CIEI中国教育国际交流研修学院
国际化拔尖创新人才培养计划
INNOVATION BEYOND BOUNDARIES

国际化拔尖创新人才培养计划

课程介绍

2026 年春季学期

中国教育国际交流研修学院

“国际化拔尖创新人才培养计划”项目办公室

目 录

世界一流大学公选课程

一、 课程列表

世界一流大学公选课程					
一级学科	**二级学科**	**三级学科**	**教授**	**来自院校**	**课题名称**
工科类	计算机科学/人工智能	机器学习/深度学习	Björn Schuller	帝国理工学院	人工智能：机器学习与深度学习的多维应用
	计算机科学/人工智能	机器人学	Sen Wang	帝国理工学院	人工智能与机械工程：机器人视觉、多传感器融合与自动驾驶
	计算机科学	软件工程/游戏设计	William Nace	卡内基梅隆大学	软件工程与游戏设计：算法在游戏设计中的应用
	计算机科学/人工智能	数据科学/自然语言处理	Patrick Houlihan	哥伦比亚大学	数据科学与人工智能：深度学习在自然语言处理中的应用
	计算机科学/人工智能	机器学习/数据科学	Gunther Roland	麻省理工学院	人工智能：科学化数据分析与机器学习应用
	计算机科学/人工智能	机器学习/数据科学	Raja Sooriamurthi	卡内基梅隆大学	人工智能：机器学习在数据分析及自然语言处理中的实际运用
	计算机科学/人工智能	机器翻译/自然语言处理	Philipp Koehn	约翰斯·霍普金斯大学	人工智能：机器人学、游戏设计与机器翻译中的算法与优化
	计算机科学/人工智能	机器学习与深度学习	David Woodruff	卡内基梅隆大学	人工智能：大规模数据分析与机器学习模型中的算法优化
	计算机科学/人工智能	计算机视觉	Jens Rittscher	牛津大学	计算机视觉：基于机器学习的人脸识别、自动驾驶和图像处理
	计算机科学/人工智能	生成式 AI 与大模型	Haifeng Xu	芝加哥大学	人工智能：大模型推理、多智能体协作与智能决策算法
	计算机科学/人工智能	机器学习/计算生物学	James J. Choi	帝国理工学院	人工智能与生物医学：机器学习理论、算法与应用
	计算机科学	运筹学/系统工程	Peter Zhang	卡内基梅隆大学	人工智能与运筹学：复杂决策系统中的随机最优控制及优化理论
	计算机科学	人机交互	Lorie Loeb	达特茅斯学院	软件工程与人机交互：人工智能驱动的 UX 用户体验设计
	机械工程/结构工程	可展开结构/空间可折叠结构	Zhong You	牛津大学	机械工程与材料工程：运动结构原理与可展开机械结构
	机械工程	车辆工程	Diana Haidar	卡内基梅隆大学	机械工程与车辆工程：从汽车组件设计到车辆自动化与电气化
	电子工程/人工智能	信号处理/人工智能	Neal Bangerter	帝国理工学院	电子工程：脑机接口的人工智能、微电子学与信号处理
	电子电气工程	微电子学	Ya-Hong Xie	加州大学洛杉矶分校	电子工程：数字集成电路的设计研究及应用
	电子电气工程	智能无人系统	Danijela Cabric	加州大学洛杉矶分校	电子工程：物联网与无人机阵列网络通信系统设计
	能源工程/环境工程	能源系统/可再生能源	Aidong Yang	牛津大学	能源与环境："碳中和"低碳技术与绿色能源系统优化设计
	环境工程/环境科学	环境化学	Joe Moore	卡内基梅隆大学	环境化学：污水净化途径与水资源可持续管理系统
	材料科学	电池材料	Julia R. Greer	加州理工学院	材料科学与能源储存：化学能源与储能系统中的材料结构与性能
理科	生物	分子生物学/	Samuel Kunes	哈佛大学	生物学：阿尔茨海默症等脑神经疾

类		神经科学			病中的分子生物学研究
	生物	生物化学	Jason Sello	加州大学旧金山分校	化学与生物学：药品研发、生产及药理分析
	生物	发育生物学/细胞生物学	Aziz Aboobaker	牛津大学	生物学：基于干细胞研究的动物生长发育机理探究
	生物医学工程/化学/材料工程	生物材料/有机化学	Benjamin Almquist	帝国理工学院	生物医学工程：医用材料与生物纳米技术
	生命科学	营养学	Mary Flynn	布朗大学	生物医学：膳食营养与慢性疾病的预防
	生命科学	免疫学/分子生物学	Alexander Ploss	普林斯顿大学	免疫学：疫苗、免疫系统与抗肿瘤药物研究
	公共卫生/医学	公共卫生/全球健康	Katherine F. Smith	布朗大学	医学与公共卫生：行星健康视角下的环境变迁与人类健康研究
	物理	天体物理	Enrico Pajer	剑桥大学	物理学：从广义相对论探索宇宙起源
	数学	离散数学/代数	Dan Ciubotaru	牛津大学	数学：抽象代数中的微积分与组合数学
	应用数学	数值分析	Ming Gu	加州大学伯克利分校	应用数学：数值分析与算法优化设计
	应用数学	数值分析/算法理论	Anastasia Romanou	哥伦比亚大学	应用数学与机器学习：工程实践与社会科学中的数值计算与统计分析模型
	化学/化学工程	有机化学/化学合成	Brian Stoltz	加州理工学院	化学：有机物的结构、反应与合成
	地球科学/气候科学	地理信息/空间数据科学	George Tselioudis	哥伦比亚大学	地理信息：基于 GIS 数据的地球气候变暖模型与环境变迁
	心理学	认知心理学	Daniel Casasanto	康奈尔大学	认知心理学与神经科学：大脑思维与记忆之间的关联机制分析
	心理学	神经科学/认知心理学	Robin Murphy	牛津大学	认知心理学与神经科学：抑郁及焦虑症等病理与脑神经的关联性
	心理学	社会心理学/文化心理学	Helen Haste	巴斯大学	社会心理学：社会结构下的群体偏见与跨文化比较研究
	心理学	进化心理学/发展心理学	Max Krasnow	哈佛大学	进化与发展心理学：人类乐感演变下择偶和交友动机的发展变化
	数据科学	商业分析/供应链管理	Cosimo Arnesano	南加州大学	商业分析与数据科学：数字化转型时代的智能洞察、优化与决策
	数据科学	数据挖掘	Manuel Gonzalez Canche	宾夕法尼亚大学	数字媒体与数据科学：信息技术时代下用户行为与社会网络探析
经管类	经济学	土地经济/城市规划	Philip Allmendinger	剑桥大学	土地经济与城市规划：智慧城市解决方案与区域资源布局探究
	经济学/公共管理	数字经济/公共政策	Robert Lyon	纽约大学	数字经济与发展经济：碳减排与共享机制的可持续政策实践
	经济学/金融学	金融计量经济学	Oliver Linton	剑桥大学	金融经济学：时间序列建模、GARCH 波动率分析与数据预测方法
	金融学	金融市场|投资学	Michael Ashby	剑桥大学	金融学：金融市场与投资管理的理论、应用与实证
	金融学	公司金融|财务管理	Raghavendra Rau	剑桥大学	金融学：投资组合理论与企业项目估值实践
	金融学	投资管理/ESG	Alexei Chekhlov	哥伦比亚大学	投资学：绿色金融视角下的 ESG 因子量化模型与资产组合优化
	金融工程	金融数学	Mete Soner	普林斯顿大学	金融数学：市场优化与风险机制设计及分析

	商业分析	商业分析	Haiyuan Wang	哥伦比亚大学	商业分析与金融学：Python 数据分析在金融决策中的应用
	管理学	创业管理	Matthew Grimes	剑桥大学	管理学：创业管理中的市场机遇探寻与创新策略
	数字营销	数字营销/传播学	Freddy Nager	南加州大学	数字营销与新媒体传播：品牌策略优化与 KOL 经济在 AI 时代下的发展探究
	市场营销	品牌管理|消费者行为学	Omar Merlo	帝国理工学院	市场营销：创新营销管理与战略营销革新探究
人文及其他类	教育学	教育文化学/教育史学	Liam Francis Gearon	牛津大学	教育学与艺术史：国际视角下人文教育及文学发展的比较研究
	教育学/语言学	教育心理学/二语习得	Victoria Murphy	牛津大学	教育学与语言学：双语教育对儿童语言能力发展的影响探析
	历史	科学技术史	Richard Payne	芝加哥大学	科技史：从图灵测试到生成式浪潮的技术演进、历史拐点与未来图景
	艺术科技	电子艺术	Alejandro Borsani	罗德岛设计学院	电子艺术与交互设计：以黑客帝国为例的 VR 技术与新媒体艺术策展

类别	行业领域	企业专家	企业及职务	课题名称
企业专家实践课程	游戏影视与流媒体行业	Peng Fan	HoYoverse 创意开发与内容制作部首席制片人	游戏 IP 影视化的跨界实战：影视项目开发全流程深度解析
	人工智能与风险投资	Caitlin Cai	Rakuten 乐天产品部门负责人	生成式 AI 产品构建与创业者心智模型：理论与硅谷-亚洲实践

***备注**：本课程列表在开课前有一定的调整可能性，请具体详询项目办人员*

二、 课程介绍

1. 工科类

课程一：《人工智能：机器学习与深度学习的多维应用》

Artificial Intelligence Foundations

学科方向：机器学习/深度学习

1. 教授介绍

Björn Schuller

帝国理工学院 计算机系终身教授

- 帝国理工学院计算机系语言、音频小组负责人
- 德国 audEERING 联合创始人兼 CSO
- 世界经济论坛杰出青年科学家
- 论文被引用次数：73150；h 指数：119；i10 指数：810
- 哈尔滨工业大学计算机科学与技术学院客座教授

Bjoern Schuller 是人工智能领域的杰出人物，尤其是在情感计算以及用于音频和语音分析的机器学习领域。他因研究使用机器学习算法通过语音和其他模式分析人类情绪、个性特征和心理健康状况而闻名。Schuller 在顶级期刊和会议上发表了大量论文，并因其研究

成果而屡获殊荣。 Schuller 教授还因其在语音和情感识别应用开发方面的工作而闻名，这些应用包括医疗保健、人机交互和社交机器人。他是一位非常受欢迎的演讲者，曾在世界各地的会议和活动中发表主题演讲和受邀演讲。

除研究工作外，Schuller 教授还参与各种学术和专业活动。他是德国奥格斯堡大学的教授，也是帕绍大学和伦敦帝国学院的兼职教授。他还是 audEERING 公司的共同创始人，该公司致力于开发情感识别和音频分析软件。Bjoern Schuller 是情感计算领域的顶尖研究人员，他的工作对能够理解和响应人类情感的技术发展产生了重大影响。

Bjoern Schuller is a prominent figure in the field of artificial intelligence, particularly in the area of affective computing and machine learning for audio and speech analysis. He is known for his research on using machine learning algorithms to analyze human emotions, personality traits, and mental health conditions through speech and other modalities. Schuller has published extensively in top-tier journals and conferences, and he has received numerous awards for his work.

Schuller is also known for his work in the development of applications for speech and emotion recognition, including applications for healthcare, human-computer interaction, and social robotics. He is a highly sought-after speaker and has delivered keynote speeches and invited talks at conferences and events around the world. In addition to his research, Schuller is involved in various academic and professional activities. He is a professor at the University of Augsburg in Germany and an adjunct professor at the University of Passau and Imperial College London. He is also the co-founder of audEERING, a company that develops software for emotion recognition and audio analysis. Overall, Bjoern Schuller is a leading researcher in the field of affective computing, and his work has had a significant impact on the development of technologies that can understand and respond to human emotions.

2. 课程介绍

随着人工智能技术在医疗健康与信号处理中的快速发展,机器学习与深度学习正日益成为分析生理、神经、声学及行为信号的核心工具。本课程旨在系统介绍现代神经网络模型及其在多维信号分析中的应用。

课程内容涵盖深度前馈神经网络、卷积神经网络与循环神经网络的原理与测试方法，深入讲解连接时序分类、端到端学习、生成对抗网络（GANs）、迁移学习及弱监督学习，并探讨强化学习、绿色学习和联合学习在实际应用中的价值。课程同时结合自然语言处理与多模态信号分析的案例，帮助学生掌握如何将先进的 AI 技术应用于健康监测、情感识别及可信医疗决策支持，实现从理论到实践的全面训练

With the rapid advancement of artificial intelligence in healthcare and signal processing, machine learning and deep learning have become essential tools for analyzing physiological, neural, acoustic, and behavioral signals. This course provides a comprehensive introduction to modern neural network models and their applications in multidimensional signal analysis.

It covers deep feedforward neural networks, convolutional and recurrent neural networks, as well as methods for testing and evaluation. The course also delves into connectionist

temporal classification, end-to-end learning, generative adversarial networks (GANs), transfer learning, and weakly supervised learning, while exploring reinforcement learning, green learning, and federated learning in practical scenarios. By integrating applications in natural language processing and multimodal signal analysis, students will gain hands-on skills to apply advanced AI techniques in health monitoring, emotion recognition, and trustworthy medical decision support, bridging the gap between theory and practice.

3. 课程大纲

1.深度前馈神经网络

2.深度神经网络的测试；卷积神经网络

3.循环神经网络

4.连接时序分类用于时间序列管理

5.端到端学习（e2e）

6.生成对抗网络（GANs）

7.迁移学习；弱监督学习

8.强化学习；绿色学习和联合学习

9.在不同信号分析中的应用

10.在自然语言处理中的应用

1. Deep Feedforward Neural Networks; Training of (Deep) Neural Networks

2. Testing of Deep Neural Networks; Convolutional Neural Networks (CNNs)

3. Recurrent Neural Networks (RNNs); Memory in RNNs (Long-Short Term Memory, Gated Recurrent Units)

4. Connectionist Temporal Classification (CTC) for Time Series Management

5. End-to-End Learning (e2e)

6. Generative Adversarial Networks (GANs)

7. Transfer Learning; Weakly Supervised Learning (Active Learning, Semi-Supervised Learning)

8. Reinforced Learning (Deep Q-Learning); Recent Topics in Deep Learning (e.g., Green and Federated Learning, Explainability); Tools for Deep Learning for Pattern Recognition.

9. Applications in Audio, Video, Text, and General Signal Analysis

10. Applications in Natural Language Processing

课程二：《人工智能与机械工程：机器人视觉、多传感器融合与自动驾驶》

Robot Perception, Localization and Navigation

学科方向：机器人学

1. 教授介绍

Sen Wang

帝国理工学院 电子电气工程系终身教授

- 帝国理工学院电子电气工程系的机器人与自主系统终身教授
- 帝国理工学院 Sense Robotics 实验室主任
- 帝国理工学院人工智能与创新硕士课程创始主任
- 2024 年度机器人领域最具影响力学者奖荣誉提名

Sen Wang 教授是帝国理工学院电子电气工程系的机器人与自主系统教授，同时担任 Sense Robotics 实验室主任，领导该实验室专注于机器人、自主系统、计算机视觉和机器学习等领域的研究，致力于开发能够在复杂、动态环境中自主运行的智能机器人技术。作为帝国理工学院电子电气工程系和跨学院人工智能旗舰计划 I-X 的一部分，Sen Wang 教授的工作促进了人工智能技术在机器人领域的应用和创新。此外，他也是人工智能应用与创新硕士课程的创始主任。

他的研究涉及机器人学、计算机视觉和机器学习的交叉领域，特别关注机器人如何通过概率和学习方法理解并在未知、动态环境中自主操作。主要研究方向包括机器人定位、自动导航、SLAM（同步定位与地图构建）、机器人视觉、机器人学习等技术，并将其应用于实际机器人系统，以应对如气候变化和医疗健康等全球性挑战。Sen Wang 教授还领导团队开发了用于自主检测海上能源基础设施的水下传感和机器人技术，成功完成了 EDF Blyth 海上风电场首个自主风电基础设施检测。此外，他获得了 2024 年度机器人领域最具影响力学者奖荣誉提名，并曾担任《IEEE 自动化科学与工程学报》、《IEEE 机器人与自动化学报》、国际机器人与自动化大会（ICRA）和国际机器人与自动化系统会议（IROS）的副主编。

Prof. Sen Wang is a Senior Lecturer (Associate Professor) in Robotics and Autonomous Systems in the Department of Electrical and Electronic Engineering at Imperial College London. He is also the Director of the Sense Robotics Lab, which is part of both the Department of Electrical and Electronic Engineering and I-X, Imperial's cross-college flagship initiative in AI. Additionally, he is the Founding Director of the MSc in Artificial Intelligence Applications and Innovation. His research sits at the intersection of robotics, computer vision and machine learning, driving robots and intelligent machines to understand and operate autonomously in unstructured, dynamic environments through probabilistic and learning approaches.

His main research areas include robot localization, autonomous navigation, SLAM, robot vision, robot learning and their application on real-world robot systems to help tackle the challenges we face in our society, from climate change to healthcare. Prof. Wang has led his research team in developing underwater sensing and robotic technologies for autonomous inspection of offshore energy infrastructure, successfully carried out the first autonomous wind farm foundation inspection at EDF's Blyth Offshore Wind Farm. He was awarded the 2024 AI Most Influential Scholar Award Honorable Mention in Robotics. He has also served as Associate Editors for the IEEE Transactions on Automation Science and Engineering, IEEE Robotics and Automation Letters, ICRA and IROS.

2. 课程介绍

本课程全面介绍机器人技术，涵盖从机器人系统基础到高级导航和学习技术的核心内容。学生将学习机器人运动学、运动规划、传感与感知、多传感器融合等关键知识，同时掌握机器人操作系统（ROS）的概念与编程技能。课程深入探讨同步定位与建图（SLAM）、机器人视觉及自主导航，并结合深度学习在机器人视觉和自主系统中的最新应用，帮助学生掌握前沿技术。

This course provides a comprehensive introduction to robotics, covering key topics from robotic system fundamentals to advanced navigation and learning techniques. Students will learn about robot kinematics, motion planning, sensing, perception, and multi-sensor fusion. The course also introduces the Robot Operating System (ROS), enabling hands-on experience in robot programming. Topics such as Simultaneous Localization and Mapping (SLAM), robot vision, and autonomous navigation will be explored in depth. The course concludes with discussions on the latest advancements in robotics, including deep learning applications in robot vision and autonomous systems.

3. 课程大纲

1.机器人概述

2.机器人操作系统（ROS）

3.机器人姿态、坐标和变换

4.机器人运动学和运动

5.机器人感知和感知

6.状态估计和多传感器融合

7.SLAM：概念和应用

8.机器人视觉

9.自主导航

10.机器人学习和未来发展

1.Overview of Robotics

2.Robot Operating System (ROS)

3.Robot Pose, Coordinates and Transformation

4.Robot Kinematics and Motion

5.Robot Sensing and Perception

6.State Estimation and Multi-Sensor Fusion

7.SLAM: Concepts and Applications

8.Robot Vision

9.Autonomous Navigation

10.Robot Learning and Future Developments

课程三：《软件工程与游戏设计：算法在游戏设计中的应用》

Algorithm for Game Design

学科方向：软件工程/游戏设计

1. 教授介绍

William Nace

卡耐基梅隆大学 计算机科学教授

- 卡内基梅隆大学工程学院教学委员会创立人
- 卡内基梅隆大学信息网络研究所录取委员会
- 卡内基梅隆大学信息网络研究所课程委员会成员
- Spira 优秀教育奖获得者
- ECE 项目评估委员会主席以及优秀教员
- 曾任美国航空科研发展亚洲办公室首席科学家和技术总监

William Nace 教授，卡内基梅隆大学计算机科学领域的杰出学者，不仅作为工程学院教学委员会的奠基人，更在信息网络研究所担任多项关键职务，包括录取及课程委员会成员。Nace 教授以其卓越的教学贡献荣获 Spira 优秀教育奖，并领导 ECE 项目评估，推动计算机科学教育的前沿发展。在软件工程、游戏设计、人工智能等课题上有着深厚造诣，特别是在计算机硬件与分布式系统的研发上展现出独到的研究视野。

凭借华盛顿大学电子学硕士学位及 CMU 博士学位，Nace 教授将丰富的实战经验融入教学，曾任科研发展亚洲办公室首席科学家，热爱科研实践，利用先进设备进行创造，激发学生的创新潜能。

Professor William Nace, a distinguished scholar in computer science at Carnegie Mellon University (CMU), stands as a pivotal figure in the institution's educational landscape,

founding the Engineering College's teaching committee and holding pivotal roles in the Information Networking Institute's (INI) admissions and curriculum committees. Recognized with the prestigious Spira Award for Excellence in Teaching, Nace chairs the ECE program evaluation efforts, fostering cutting-edge advancements in computing education. Specializing in software engineering, game design, AI, and particularly in computer hardware and distributed systems,

Professor Nace enriches his teachings with a Master's from the University of Washington and a Ph.D. from CMU. His background, which includes a decorated service of five years as a Lieutenant Colonel in the U.S. Air Force overseeing development projects, secure communication systems, and serving as Chief Scientist in Asia, brings a wealth of real-world insights into the classroom. Renowned for his love of hands-on creation using technologies like laser cutters, 3D printers, and FPGA coding, Professor Nace continues to inspire innovation and creativity among his students at CMU.

2. 课程介绍

随着数字系统与分布式计算技术在互动系统和游戏设计中的快速发展，算法与硬件协同成为现代游戏开发的核心工具。《软件工程与游戏设计：算法在游戏设计中的应用》课程由 William Nace 教授主讲，旨在系统讲解数字系统设计与游戏算法在实际开发中的结合。

课程内容涵盖游戏架构设计、随机性模拟、精灵与碰撞处理、2D 物理、迷宫与导航算法、3D 渲染、碰撞检测、声音设计、多玩家联网游戏、可见性算法以及光照和阴影的实现。通过理论与实践结合，学生将掌握在嵌入式平台和分布式环境中开发高效、可靠互动系统和游戏的技能。

With the rapid development of digital systems and distributed computing in interactive systems and game design, the integration of algorithms and hardware has become a core aspect of modern game development. The course Software Engineering and Game Design: Algorithms in Game Development, taught by Professor William Nace, provides a comprehensive introduction to combining digital system design with game algorithms in practice.

Topics include game architecture, randomness, sprites and collision handling, 2D physics, maze and navigation algorithms, 3D rendering, collision detection, sound design, multiplayer networking, visibility algorithms, and lighting and shadows. By blending theory with hands-on practice, students will acquire the skills to develop efficient and reliable interactive systems and games on embedded platforms and distributed environments.

3. 课程大纲

1. 游戏架构、随机性
2. 精灵、碰撞、2D 物理
3. 迷宫算法
4. 导航算法

5. 三维渲染
6. 碰撞检测
7. 声音设计
8. 多人网络游戏
9. 可见度算法
10. 照明与阴影

1: Game Architecture, Randomness
2: Sprites, Collisions, 2d Physics
3: Maze Algorithms
4: Navigation Algorithms
5: 3d Rendering
6: Collision Detection
7: Sound Design
8: Multi-player Networked Games
9: Visibility Algorithms
10: Lighting and Shadows

课程四：《数据科学与人工智能：深度学习在自然语言处理中的应用》

Data Science: Machine Learning and Natural Language Processing

学科方向：数据科学/自然语言处理

1. 教授介绍

Patrick Houlihan

哥伦比亚大学教授

- Publicis Groupe 高级决策副总裁
- 金融数据分析公司 Sentiquant 创始人
- 美国 B2B 客户数据平台 CaliberMind 数据科学家
- 超过 14 年的半导体行业专业咨询经验
- 主导咨询工程数额超过五亿美金
- 拥有上百篇在软件系统设计和数据分析领域的论文

Patrick Houlihan 是哥伦比亚大学数据科学教授，同时他也是阳狮传媒集团高级决策副总裁，阳狮集团是法国最大及世界第三大的广告与传播集团。除此以外，他还是美国 B2B 客户数据平台 Caliber Mind 数据科学家和金融数据分析公司 Sentiquant 的联合创始人。

Patrick Houlihan 教授拥有超过 14 年半导体行业专业咨询经验，主导咨询工程数额超过五亿美金，发表过上百篇在软件系统设计和数据分析领域的论文，如《利用社交媒体预测资产价格的持续和反转》，《情绪分析和期权数量能否预测未来收益》等。

Patrick Houlihan is a professor of data science at Columbia University. He is also Senior Vice President for decision-making at Publicis Media Group, the largest advertising and communications group in France and the third largest in the world. He is also a data scientist at the US-Based B2B customer data platform Caliber Mind and the co-founder of Senti quant, a financial data analytics company.

Patrick Houlihan has more than 14 years of professional consulting experience in the semiconductor industry, led consulting projects in excess of $500 million. He has published hundreds of papers in the areas of software system design and data analysis, such as *Leveraging Social Medial to Predict Continuation and Reversal in Asset Prices*, and *Can Sentiment Analysis and Options Volume Anticipate Future Returns?*.

2. 课程介绍

机器学习和自然语言处理是两个快速发展的领域，将机器学习应用于自然语言处理，已经推动了人工智能领域的巨大进步。本课程系统介绍了机器学习与自然语言处理（NLP）的基础理论与实践方法，重点讲解如何利用 Python 语言构建高效的数据处理与文本分析系统。课程从编程基础、数据清洗、文本特征提取出发，逐步深入情感分析、文本摘要与主题建模等前沿 NLP 任务，并结合机器学习模型进行性能优化与评估。

通过课程，学生将掌握如何构建智能文本分析系统，支持信用评估、市场舆情预测、商业决策优化等关键任务。课程强调实用技能训练，帮助学生为未来的 AI、数据科学与语言技术领域打下坚实基础。

Machine learning and natural language processing are two fast-growing fields, and applying machine learning to natural language processing has driven huge advances in artificial intelligence. This course provides a systematic introduction to the foundational theories and practical applications of machine learning and natural language processing (NLP), with a focus on building efficient data handling and text analysis systems using Python. Starting from programming essentials and data preprocessing, the course advances into core NLP tasks such as sentiment analysis, text summarization, and topic modeling. Students will explore how to apply machine learning techniques to real-world language data, optimize models, and evaluate performance.

By the end of the course, students will be equipped to build intelligent text analysis systems that support credit assessment, market sentiment forecasting, and data-driven business decision-making. Emphasis is placed on hands-on skills to prepare students for careers in AI, data science, and language technologies.

3. 课程大纲

1.Python 与正则表达式基础

2.金融数据的结构化处理

3.文本数据预处理与清洗技术

4.自然语言处理基础方法

5.文本特征工程与选择方法

6.自动摘要与报告生成

7.情感分析与商业分析应用

8.网格搜索、验证与评估、性能指标

9.自然语言处理中的主题建模：LDA

10.用于情感分析的高级机器学习模型

1.Python and Regular Expressions Basics

2.Structured Processing of Financial Data

3.Text Data Preprocessing and Cleaning Techniques

4.Fundamentals of Natural Language Processing

5.Text Feature Engineering and Selection Methods

6.Automatic Summarization and Report Generation

7.Sentiment Analysis and Business Analytics Applications

8.Grid Search, Validation, Evaluation, and Performance Metrics

9.Topic Modeling in NLP: LDA

10.Advanced Machine Learning Models for Sentiment Analysis

课程五：《人工智能：科学化数据分析与机器学习应用》

Data Analysis and Machine Learning

学科方向：机器学习/数据科学

1. 教授介绍

Gunther Roland

麻省理工学院 物理系终身教授

- 麻省理工学院重离子研究组领头人
- 量子物理实验计划 sPHENIX 计划负责人之一
- CMS 重离子出版委员会主席

- MIT 重离子研究组等 7 个研究小组联合领导人
- Member, Annual Rev. Nucl. Part. Phys 编委会成员

Gunther Roland 教授从法兰克福 Kernphysik 研究所获得博士学位，于 2000 年 9 月从欧洲核子研究中心加入麻省理工学院物理系重离子小组，并担任该小组的科学助理。教授现在担任麻省理工学院重离子研究组等 7 个研究小组联合领导人。此外教授还担任 CMS 重离子出版委员会主席；量子物理实验计划 sPHENIX 计划负责人；Member, Annual Rev. Nucl. Part. Phys 编辑委员会成员等职务。

Professor Roland joined the Heavy Ion Group in the MIT Department of Physics in September 2000 from CERN, where he was a Scientific Associate. Professor Roland currently serves as the joint leader of seven research groups, including the Massachusetts Institute of Technology Heavy Ion Research Group. Additionally, he holds positions such as Chair of the CMS Heavy Ion Publications Committee, Project Leader for the quantum physics experiment sPHENIX, and Member of the Annual Review of Nuclear and Particle Physics Editorial Committee.

2. 课程介绍

人工智能与数据科学已经成为处理复杂实验数据和科学研究中不可或缺的工具。本课程系统讲解从数据采集、分析到模型应用的完整流程。内容涵盖 Python 编程基础、数据分析与统计方法、数据可视化与大规模数据处理、多元分析与机器学习基础，并深入介绍 Scikit-learn 工具库、监督学习与无监督学习的经典模型，以及强化学习（包括马尔可夫决策过程与 Q 学习）和深度学习（CNN、RNN、GAN）的应用。课程通过理论与实践结合，使学生掌握将先进 AI 技术应用于科学研究、实验数据处理及复杂系统分析的能力。

Artificial intelligence and data science have become essential tools for processing complex experimental data and scientific research. This course provides a systematic introduction to the full workflow from data collection and analysis to model deployment. Topics include Python programming, data analysis and basic statistics, data visualization and handling large datasets, multivariate analysis, and fundamentals of machine learning. The course further covers the Scikit-learn library, classical models for supervised and unsupervised learning, reinforcement learning (including Markov Decision Processes and Q-learning), and deep learning applications such as CNNs, RNNs, and GANs. By integrating theory with hands-on practice, students will develop the skills to apply advanced AI techniques to scientific research, experimental data processing, and complex system analysis.

3. 课程大纲

1.Python 编程导论

2.数据分析与基本统计

3.数据可视化与大型数据集

4.多元分析导论

5.机器学习导论

6.Scikit-learn

7.监督学习及经典模型

8.无监督学习及经典模型

9. 强化学习：马尔可夫决策过程、 Q学习

10. 深度学习：CNN、RNN、GAN

1.Introduction to Programming in Python

2.Data Analysis and Basic Statistics

3.Essential Python Libraries for Data analysis

4.Data Visualization and Working with Large Datasets

5.Introduction to Multivariate Analysis

6.Introduction to Machine Learning

7.Supervised Learning in Scikit-learn

8.Unsupervised Learning

9.Reinforcement Learning

10.Deep Learning"

课程六：《人工智能：机器学习在数据分析及自然语言处理中的实际运用》

Machine Learning and Data Analysis

学科方向：机器学习/数据科学

1. 教授介绍

Raja Sooriamurthi

卡内基梅隆大学 信息系统教授

- 卡内基梅隆大学信息系统专业主任
- 印第安纳大学学生事务副校长兼学生办公室主任
- 曾获决策科学研究所 (DSI)教学创新奖
- 曾获 Elliott Dunlap Smith 杰出教学和教育服务奖
- 曾获卡内基梅隆大学 Martcia Wade 教学奖
- 曾获印第安纳大学文理学院校友会杰出讲师奖

Raja Sooriamurthi 教授是卡内基梅隆大学信息系统教授，同时也是决策分析与系统专业项目的主任。在他的教学工作中，Sooriamurthi 强调基于项目的学习，旨在解决信息系统问题的模糊性和复杂性，同时整合各种方法。在研究方面，Raja Sooriamurthi 专注于人工智能和认知科学，尤其关注基于知识管理、分布式推理和机器学习等领域。

除了创新的教学方法之外，Sooriamurthi 教授还因其对教育的贡献而获得了无数奖项和赞誉。 其中包括决策科学研究所 (DSI) 教学创新奖、Elliott Dunlap Smith 杰出教学和教育服务奖以及 Martcia Wade 教学奖等。

Raja Sooriamurthi is a professor of Information Systems at Carnegie Mellon University and serves as the Program Director for the Decision Analytics and Systems program. In his teaching, he emphasizes project-based learning to tackle the ambiguity and complexity of information system issues while integrating various methods. In his research, Sooriamurthi focuses on artificial intelligence and cognitive science, particularly in areas such as case-based reasoning, knowledge management, distributed reasoning, and machine learning.

Apart from his innovative teaching methods, Professor Sooriamurthi has received numerous awards and accolades for his contributions to education, including the Decision Sciences Institute (DSI) Instructional Innovation Award, the Elliott Dunlap Smith Award for Distinguished Teaching and Educational Service, and the Martcia Wade Teaching Award, etc.

2. 课程介绍

人工智能与机器学习正日益应用于教育技术和社会决策的实际场景。本课程由系统讲解数据分析与机器学习在现实问题中的应用。课程内容包括数据分析与机器学习基础、整洁数据处理、数据可视化、监督学习基础、贝叶斯分类及分类器性能评估、聚类分析、决策树与随机森林、推荐系统，以及深度学习方法。通过理论与实践结合，学生将掌握利用人工智能技术进行教育创新、个性化学习分析和社会决策支持的能力。

Artificial intelligence and machine learning are increasingly applied in educational technology and real-world decision-making. This course provides a systematic introduction to the practical use of data analysis and machine learning. Topics include data analysis and machine learning fundamentals, tidy data processing, data visualization, supervised learning basics, Bayesian classification and classifier performance evaluation, clustering, decision trees and random forests, recommendation systems, and deep learning methods. By combining theory with hands-on practice, students will develop the skills to apply AI techniques in educational innovation, personalized learning analytics, and data-driven decision support.

3. 课程大纲

1.数据分析和机器学习入门

2.整洁数据

3.数据可视化

4.监督学习入门

5.贝叶斯分类

6.衡量分类器的性能

7.聚类

8.决策树和随机森林

9.推荐系统

10.深度学习

1.Introduction to Data Analysis and Machine Learning

2.Tidy Data

3.Visualization with the Grammar of Graphics

4.Introduction to Supervised Learning

5.Naïve Bayes Classification

6.Measuring the Performance of a Classifier

7.Clustering

8.Decision Trees and Random Forests

9.Recommender Systems

10.Deep Learning

课程七：《人工智能：机器人学、游戏设计与机器翻译中的算法与优化》

Machine Learning, Machine Translation and Large Language Models (LLM)

学科方向：机器翻译/自然语言处理

1. 教授介绍

Philipp Koehn

约翰霍普金斯大学 计算机科学终身教授

- 约翰·霍普金斯大学语言与语音处理中心（CLSP）及数据科学与人工智能研究所（DSAI）成员
- 统计机器翻译开源工具包 Moses 开发者
- 计算语言学协会（ACL）会士
- Artificial Intelligence Review 等国际顶级期刊编委
- 国际机器翻译协会（IAMT）荣誉奖获得者（2015）

Philipp Koehn 教授是计算机科学领域的世界知名学者，专注于机器翻译与机器学习，致力于利用数据驱动的方法解决长期存在的实际挑战。他在自然语言处理领域具有重要影响，特别是在机器翻译方面做出了卓越贡献。Koehn 教授现任约翰斯·霍普金斯大学怀廷工程学

院计算机科学系终身教授，同时隶属于该校语言与语音处理中心（CLSP）及数据科学与人工智能研究所（DSAI）。他撰写了该领域两本权威教材：《神经机器翻译》和《统计机器翻译》，并拥有五项相关专利。

在学术界和业界，Koehn 教授屡获殊荣。他开发的开源统计机器翻译工具包 Moses 在 2011 年欧洲多语言技术联盟卓越网络会议上荣获一等奖，并曾入围 2013 年欧洲发明家奖决赛。他曾获国际机器翻译协会（IAMT）荣誉奖，并于 2024 年当选计算语言学协会（ACL）会士。此外，他在多个国际期刊担任编辑委员，包括《Artificial Intelligence Review》和《ACM Transactions on Asian and Low-Resource Language Information Processing》，并长期组织和主持 ACL 及其他重要机器翻译学术会议。作为计算机科学领域的领军人物，Koehn 教授多次受邀在国际会议、学术论坛及知名媒体上发表演讲，包括 CNN 等主流媒体。

Philipp Koehn is recognized worldwide for his leading research in and applications for developing and understanding data-driven methods to solve long-standing, real-world challenges of machine translation and machine learning. His expertise is vital to addressing the ever-expanding need for natural language processing and machine learning. Koehn is currently a professor in the Department of Computer Science at the Whiting School of Engineering at Johns Hopkins University, and is also affiliated with the Center for Language and Speech Processing and the Data Science and Artificial Intelligence Institute. He is the author of the Neural Machine Translation and Statistical Machine Translation.

He also holds or co-holds five patents for machine translation. At the 2011 meeting of the Multilingual Europe Technology Alliance Network of Excellence, Koehn won first prize for Moses, his open-source toolkit for statistical machine translation. One of three finalists for the 2013 European Inventor Award, he won the International Association for Machine Translation's Award of Honor in 2015. He has also given numerous invited talks and has appeared on CNN and other media outlets. Additionally, he serves on the editorial boards of several international journals, including Artificial Intelligence Review and ACM Transactions on Asian and Low-Resource Language Information Processing. He has also played a key role in organizing and chairing ACL and other major academic conferences on machine translation.

2. 课程介绍

本课程全面介绍人工智能领域的前沿技术，从机器学习、深度学习的基础理论，到自然语言处理、机器翻译等具体应用，深入剖析 Transformer 架构、大语言模型等核心技术。同时，课程还探索人工智能在游戏、机器人、网络安全等多个领域的实际应用，通过理论讲解与案例分析相结合，帮助学生理解人工智能技术的运作机制，并掌握相应的技术工具，培养学生运用人工智能技术解决实际问题的能力。

This course provides a comprehensive introduction to cutting – edge technologies in the field of artificial intelligence. Starting from the fundamental theories of machine learning and deep learning, it delves into specific applications such as natural language processing and machine translation, and thoroughly analyzes core technologies like the Transformer architecture and large language models. Moreover, the course explores the

practical applications of AI in various fields including gaming, robotics, and cybersecurity.

By combining theoretical explanations with case studies, it helps students understand the operating mechanisms of AI technologies, master corresponding technical tools, and cultivate their ability to solve real - world problems using AI technologies.

3. 课程大纲

1.机器学习入门：基础与实际应用

2.深度学习：原理、应用与未来趋势

3.机器翻译技术

4.自然语言处理

5.可解释人工智能在关键领域的应用

6.Transformer 架构剖析

7.基础模型与大语言模型

8.大语言模型驱动的智能体

9.强化学习

10.跨领域应用：游戏、机器人与网络安全

1. Introduction to machine learning: basics and practical applications

2. Deep Learning: Principles, Applications and Future Trends

3. Machine translation technology

4. Natural language processing

5. Explain the application of artificial intelligence in key areas

6. Transformer architecture analysis

7. Basic model and large language model

8. Big language model-driven intelligent body

9. Reinforcement learning

10. Cross-domain applications: gaming, robots and network security"

课程八：《人工智能：大规模数据分析与机器学习模型中的算法优化》

Algorithms for Big Data

学科方向：机器学习/深度学习

1. 教授介绍

David Woodruff

卡内基梅隆大学 计算机科学终身教授

- 卡内基梅隆大学计算机系终身教授
- UCB Simons Institute 数据科学项目负责人
- IBM Almaden 研究中心资深研究员
- STOC&PODS 两届顶级会议最佳论文奖
- 曾获欧洲理论计算机科学学会 Presburger 奖

Woodruff 教授是 UCB Simons Institute 数据科学项目创建者及主席。因为其杰出的学术成果，教授获得 2020 年至今，西蒙斯研究员奖; PODS 2020 和 2010、STOC 2013 最佳学术研究论文奖。因此备受 CMU 大学的信赖，并于 2021 年担任卡内基梅隆大学博士生招生主席。教授研究领域众多，且在每个领域都有令人瞩目的成果。

Professor Woodruff is the founder and chair of the UCB Simons Institute Data Science Program. Due to his outstanding academic achievements, he has received the Simons Researcher Award from 2020 to the present, as well as the Best Paper Awards at PODS 2020 and 2010, and STOC 2013. Because of this, he is highly trusted by Carnegie Mellon University and served as the Chair of Ph.D. Admissions at Carnegie Mellon University in 2021.

2. 课程介绍

本课程聚焦于算法在大数据与人工智能时代中的核心作用，从博弈论、线性规划等优化理论出发，系统讲授在线算法、乘法权重方法、梯度下降与反向传播等关键算法机制。课程进一步引导学生深入理解机器学习经典模型与现代生成式对抗网络（GANs），掌握深度神经网络（DNN）、卷积神经网络（CNN）、递归神经网络（RNN）以及变压器（Transformer）等主流架构的原理与应用，尤其在计算机视觉领域的落地实践。

通过理论讲授与实战训练相结合的方式，学生将建立对算法与模型之间“精准匹配”机制的系统认知，理解算法如何驱动大数据分析、用户建模与智能系统设计，培养解决复杂信息环境中实际问题的能力。

This course explores the pivotal role of algorithms in the era of big data and artificial intelligence. Starting with foundational topics such as game theory and linear programming, it covers key algorithmic techniques including online computation, multiplicative weights, gradient descent, and backpropagation. The course transitions into machine learning and deep learning, introducing both classical models and modern architectures like Generative Adversarial Networks (GANs), Deep Neural Networks (DNNs),

Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and Transformers. Special emphasis is placed on practical applications in computer vision.

Through a combination of theoretical insights and hands-on implementation, students will develop a solid understanding of how algorithms facilitate accurate information-user matching, support large-scale data analysis, and power intelligent systems in complex environments.

3. 课程大纲

1.博弈论与优化基础

2.线性规划与凸优化方法

3.在线学习与流数据处理

4.乘法权重法与提升方法

5.优化方法：梯度下降机制

6.反向传播算法详解

7.机器学习模型与生成对抗网络

8.深度神经网络与卷积神经网络

9.循环神经网络与 Transformer 模型

10.计算机视觉中的深度模型应用

1.Game Theory and Optimization Fundamentals

2.Linear Programming and Convex Optimization

3.Online Learning and Streaming Data

4.Multiplicative Weights and Boosting Methods

5.Optimization Techniques: Gradient Descent

6.Backpropagation Algorithm Explained

7.Classical Machine Learning Models and GANs

8.Deep Neural Networks and Convolutional Neural Networks

9.Recurrent Neural Networks and Transformer Models

10.Deep Learning Applications in Computer Vision"

课程九：《计算机视觉：基于机器学习的人脸识别、自动驾驶和图像处理》

Machine Learning for Computer Vision

学科方向：计算机视觉

1. 教授介绍

Jens Rittscher

牛津大学 工程学终身教授

- 牛津大学生物医药工程研究所和纳菲尔德医学院首个联合任命教授
- 牛津大学 Target Discovery 研究所生物医药成像研究组主任
- 前通用电气全球研究中心资深高级研究员/项目经理
- 美国伦斯勒理工学院客座教授
- 论文引用累积 4424 次，h 指数 30，i10 指数 55

Dr Jens Rittscher 现任职于英国牛津大学，是生物医学工程学院和纳菲尔德医学院的首位联合任命教授。他同时是牛津大学工程学终身教授、牛津大学 Ludwig 癌症研究所和 Wellcome 人类基因组学中心成员，以及牛津大数据研究所的研究组组长。在加入牛津任职之前，Jens 在牛津完成其博士学位后加入了通用电气公司，并担任其全球研究中心资深高级研究员/项目经理，领导其计算机视觉实验室。

Jens 的研究兴趣主要集中在通过开发新的分析算法和新颖的计算平台来促进生物医学成像，目前他的研究重点是通过对图像数据的定量分析来改善对癌症的机制理解和患者护理。除了在生物医学成像领域的研究外，Jens 还广泛参与视频监控、视频自动标注和体积地震数据理解等领域的工作。2019 年，他与其他人共同创立了 Ground Truth Labs Ltd，将其实验室的计算病理学研究成果商业化。此前，Jens 曾担任 IEEE ISBI Steering Committee 主席。目前，他还是 EPSRC 健康数据科学博士培训中心的联合主任，并自 2021 年起加入英国 EPSRC 医疗技术战略咨询小组。

Dr Jens Rittscher was elected a Professor of Engineering Science in 2014 and is now an adjunct member of the Ludwig Institute of Cancer Research and the Wellcome Centre for Human Genomics. Since 2018 he is a group leader in the Oxford Big Data Institute where his research group is now based. Before coming to Oxford, Jens joined GE in 2001 after completing his DPhil at Oxford and led the Computer Vision Laboratory at GE Global Research in Niskayuna, NY, USA.

His research interests lie in enabling biomedical imaging through the development of new analysis algorithms and novel computational platforms, with a current focus to improve mechanistic understanding of cancer and patient care through quantitative analysis of image data. In addition to his research in the field of biomedical imaging, Jens has worked extensively in the area of video surveillance, the automatic annotation of video, and the understanding of volumetric seismic data. He co-founded Ground Truth Labs Ltd to commercialize research in computational pathology from his laboratory in 2019.

Previously, Jens was chair of the IEEE ISBI Steering Committee. At present, he is a co-director for the EPSRC Centre for Doctoral Training in Health Data Science. Since 2021 he is a member of the UK EPSRC Healthcare Technologies Strategic Advisory Team.

2. 课程介绍

本课程系统介绍计算机视觉（Computer Vision）的基础理论、关键算法与深度学习方法。学生将学习如何从图像和视频中提取有意义的信息，理解视觉感知的原理，并掌握视觉数据的处理与分析技术。课程涵盖从传统图像处理与特征提取到现代深度神经网络、图像分割与生成模型的全过程。

课程还将探讨视觉运动估计、目标跟踪以及计算机视觉在生物医学影像分析中的前沿应用。通过理论讲授与实践案例相结合，学生将具备将计算机视觉算法应用于真实世界任务的能力。

This course provides a comprehensive introduction to the principles, algorithms, and deep learning techniques underlying computer vision. Students will learn how to extract meaningful information from images and videos, understand the fundamentals of visual perception, and apply computational methods to analyze visual data. Topics include image segmentation, feature extraction and registration, object detection and classification, as well as deep learning architectures such as convolutional neural networks (CNNs) and generative models.

Advanced topics like motion analysis, visual tracking, and biomedical image interpretation will also be covered. By combining theoretical instruction with practical implementation, this course prepares students to apply computer vision methods to real-world problems across various domains.

3. 课程大纲

1.计算机视觉简介与背景

2.图像分割

3.图像特征与配准

4.机器学习概念

5.物体检测与分类

6.深度学习与对象检测简介

7.分割与图像生成

8.深度学习的高级主题

9.视觉运动与跟踪

10.生物医学图像分析

1.Introduction and background of computer vision

2.Image segmentation

3.Image Features and Alignment

4.Machine Learning Concepts

5.Object Detection and Classification

6.Introduction to Deep Learning and Object Detection

7.Segmentation and Image Generation

8.Advanced Topics in Deep Learning

9.Visual Motion and Tracking

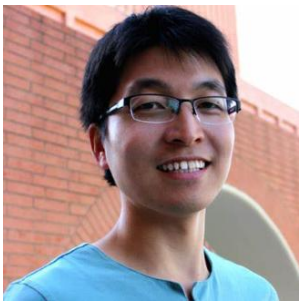
10.Biomedical Image Analysis

课程十：《人工智能：大模型推理、多智能体协作与智能决策算法》

Algorithms for Modern AI

学科方向：生成式 AI 与大模型

1. 教授介绍



Haifeng Xu

芝加哥大学 计算机科学教授

- 芝加哥大学 SIGMA 智能研究实验室负责人
- 2020 年获得谷歌学院研究奖
- 2019 年获得 ACM SIGecom 最佳论文奖，荣誉奖
- the Games journal 特邀编辑
- 2022 年 IDEAL 数据经济学特别会议组织者之一
- 中科大华罗庚精英项目成员

Haifeng Xu 是芝加哥大学计算机科学系助理教授，领导机器代理战略智能（SIGMA）实验室。他研究数据和机器学习的经济学，包括为多代理决策设计学习算法，以及为数据和 ML 算法设计市场。海峰定期在领先的机器学习和计算经济学会议上发表论文，并担任 ICML、EC、AAAI、IJCA 等顶级会议的领域主席或高级程序委员会委员。

他的研究获得了多个奖项，包括 AI2050 Early Career fellow、IJCAI Early Career Spotlight、Google Faculty Research Award、ACM SIGecom Dissertation Award（荣誉奖）、IFAAMAS Distinguished Dissertation Award（亚军）以及多个最佳论文奖；他的工作得到了多个机构的慷慨支持，包括 NSF、ARO、ONR、Schmidt Science 和 Google Research。

Haifeng Xu is an assistant professor in the Department of Computer Science at UChicago, where he directs the Strategic Intelligence for Machine Agents (SIGMA) lab . He studies the economics of data and machine learning, including designing learning algorithms for multi-agent decision making and designing markets for data and ML algorithms. Haifeng

publishes regularly at leading machine learning and computational economics conferences, and serves as area chair or senior program committee for premier venues such as ICML, EC, AAAI, IJCA, etc.

His research has been recognized by multiple awards, including the AI2050 Early Career fellow, IJCAI Early Career Spotlight, Google Faculty Research Award, ACM SIGecom Dissertation Award (honorable mention), IFAAMAS Distinguished Dissertation Award (runner-up), and multiple best paper awards; his works have been generously supported by varied agencies including NSF, ARO, ONR, Schmidt Science, and Google Research.

2. 课程介绍

本课程专注于人工智能前沿知识与核心技术。从经典机器学习基础讲起，帮助学生理解深度神经网络的架构与运行机制，深入剖析反向传播和随机梯度下降等关键算法。同时，系统讲解多智能体系统、马尔可夫决策过程，以及强化学习在大语言模型中的应用。还会介绍蒙特卡洛树搜索算法和语言模型智能体设计。最后解析 AI 平台市场算法，让学生从技术和市场两方面把握人工智能领域。

This course focuses on the cutting - edge knowledge and core technologies of artificial intelligence. Starting from the basics of classical machine learning, it helps students understand the architecture and operation mechanisms of deep neural networks, and deeply analyzes key algorithms like backpropagation and stochastic gradient descent. Meanwhile, it systematically explains multi - agent systems, Markov decision processes, and the application of reinforcement learning in large language models. It also introduces the Monte Carlo tree search algorithm and the design of language model agents. Finally, it analyzes the market algorithms of AI platforms, enabling students to grasp the field of artificial intelligence from both technical and market aspects.

3. 课程大纲

1.背景和经典机器学习

2.深度神经网络

3.反向传播和随机梯度下降

4.多智能代理系统

5.Markov 决策过程

6.强化学习和对 LLM 的应用

7. LLM 的策划问题，思想链

8. 蒙特卡洛树搜索

9.语言模型代理设计

10. AI 平台的市场算法

1.Background and Classic Machine Learning

2.Deep Neural Networks

3.Backpropagation and Stochastic Gradient Descent

4.Multi-Agent System (adversarial search + game theory)

5.Markov Decision Processes

6.Reinforcement learning and application to LLMs

7.Reasoning issue of LLMs, Chain of Thought

8.Monte Carlo Tree Search

9.Language Model Agent Design

10.Market algorithms for AI platforms

课程十一:《人工智能与生物医学:机器学习理论、算法与应用》

Machine Learning in Biomedical Sciences and Bioengineering

学科方向: 机器学习/计算生物学

1. 教授介绍

James J. Choi

帝国理工学院 生物工程终身教授

- 帝国理工学院无创手术和生物检验实验室创始人
- 美国 Zeta Surgical 外科机器人公司负责人
- 帝国理工学院智能医学影像博士培训项目负责人
- 曾任帝国理工学院癌症技术硕士研究生项目主任
- 曾获弗雷德里克·利齐奖 (国际治疗超声学学会最高的早期职业奖项之一)
- 曾获弗雷德里克·V·亨特声学博士后研究奖学金 (美国声学学会最高的博士后奖项之一)

James J. Choi 教授是伦敦帝国理工学院生物工程系的终身教授，同时担任帝国理工学院智能医学影像博士培训项目负责人。作为帝国理工学院无创手术和生物检验实验室创始人，他率领团队致力于开发微创手术设备和方法，解决了神经退行性疾病和脑肿瘤等领域的难题，为治疗阿尔茨海默病、胶质母细胞瘤和弥漫性髓母细胞瘤等疾病提供了全新的方法，并荣获多项国际知名奖项。

他的实验室在硬件、算法、物理、生物学和翻译等方面展开研究，通过跨学科合作，为将科研成果转化为实际应用提供了坚实的基础。James J. Choi 教授目前的研究兴趣主要集中在生物医学工程-非侵入性设备无创显微技术、脑部药物供给以及活体组织与病理学诊断。

James J. Choi, a professor at Imperial College London, heads the Doctoral Training Program in Intelligent Medical Imaging. He leads research on minimally invasive surgical devices and methods at the Non-Invasive Surgery and Bio-Examination Laboratory.

Utilizing ultrasound and microbubble technology, his work addresses neurodegenerative diseases and brain tumors, offering new treatments. Choi has received prestigious awards for his contributions to biomedical engineering.

2. 课程介绍

该课程的重点是学习生物医学科学和生物工程中的应用，为理论学习与实际应用之间架起桥梁，为学生提供机器学习的基础知识，包括其原理、操作和算法的执行。学生们将学习数学和编码，以开发和实施机器学习解决方案。从基础知识开始，我们将进入生物医学科学和生物工程的案例研究，展示机器学习如何解决这些领域的复杂问题。课程的目标是让学生精通机器学习——理解它、讨论它并应用它。

课程结束时，学生将能够审视生物医学和生物工程领域中的问题，并确定哪些机器学习工具可以创建有效的解决方案。如果你渴望将机器学习添加到您的工具包中，并将其应用于生物医学和生物工程的动态领域，那么本课程就是为你量身打造的。

Join our 10-week Machine Learning course focused on applications in Biomedical Sciences and Bioengineering. This practical course bridges the gap between theory and real-world application, giving you the foundational knowledge of machine learning, including its principles, operations, and the execution of algorithms. You'll engage with both mathematics and coding to develop and implement machine learning solutions. Starting with the basics, we'll then move into case studies from biomedical sciences and bioengineering, showing how machine learning can solve complex problems in these fields. Our goal is for you to become proficient in machine learning—to understand it, discuss it, and apply it.

By the end of the course, you'll be able to look at issues within the biomedical and bioengineering landscape and determine which machine learning tools can create effective solutions. If you're keen to add machine learning to your toolkit and apply it to the dynamic areas of biomedicine and bioengineering, this course is for you.

3. 课程大纲

1.人工智能模型背后的核心数学原理

2.监督学习与非监督学习

3.线性回归与逻辑回归

4.多变量回归

5.神经网络概念与生物医学案例

6.非监督学习与生物医学案例

7.深度神经网络

8.卷积神经网络

9.循环神经网络

10.Transformer 模型与案例分析

1.Mathematical Foundations: Master the essential math behind these models and code them from scratch in Python.

2.Supervised vs. Unsupervised Learning: Understand key differences and appropriate use cases.

3.Linear and Logistic Regression: Train models to predict, classify, and make decisions using labelled data.

4.Multivariable Regression: Design complex models for advanced tasks.

5.Neural Networks: Build upon regression concepts to create networks for sophisticated applications.

6.Unsupervised Learning: Analyse and model unlabelled data.

7.Deep Neural Networks: Use multi-layered architectures to improve prediction accuracy and solve complex problems.

8.Convolutional Neural Networks (CNNs): Work with image data in machine learning.

9.Recurrent Neural Networks (RNNs): Handle sequential data with temporal relationships.

10.Transformers: Discover transformative advances in machine learning and their revolutionary applications.

课程十二：《人工智能与运筹学：复杂决策系统中的随机最优控制及优化理论》

Optimal Control and Planning via Dynamic Programming and Reinforcement Learning

学科方向： 运筹学/系统工程

1. 教授介绍

Peter Zhang

卡内基梅隆大学 运筹学教授

- 卡内基梅隆大学汉斯学院信息系统与公共政策学院教授
- 获得麻省理工学院工程系统博士
- 拥有供应链全局优化器等专利
- 担任 INFORMS（国际运筹学与管理学会）、美国数学协会、美国经济协会会员
- 曾在《Journal of Mechanical Design》等期刊发表文章

Peter Zhang 教授是卡内基梅隆大学亨氏学院的助理教授，他在运筹学和信息系统管理领域享有盛誉。张教授在多伦多大学获得了工程科学应用科学学士和硕士学位，后在麻省理工学院完成了工程系统博士学位，这为他日后的学术研究和教学打下了坚实的基础。

张教授的研究领域主要集中在优化理论及其在供应链、交通、健康以及其他社会技术系统中的应用。他的研究成果不仅在学术界产生了广泛的影响，也在实际应用中展现出显著的价值。张教授拥有多项专利技术，其中包括供应链全局优化器，这是一种利用算法优化供应链流程的工具，能够有效提升供应链的效率和响应速度。

此外，他还开发了启用区块链的假设模拟器，用于评估信息共享在供应链中的影响，这在供应链管理领域具有开创性的意义。 作为国际运筹学与管理学会（INFORMS）、美国数学协会、美国经济协会的会员，张教授积极参与学术交流和合作，不断提升自己的研究水平和国际影响力。他在《Journal of Mechanical Design》等知名学术期刊上发表的文章，展示了他在计算机科学、人工智能、机器学习、强化学习等领域的深厚造诣。 张教授的主要成就还包括在卡内基梅隆大学亨氏学院的教学和指导工作。他以其严谨的学术态度、创新的教学方法和对学生的关怀，赢得了学生和同事的广泛尊重。在亨氏学院，张教授不仅传授知识，更注重培养学生的创新思维和实践能力，为学生的未来职业发展奠定了坚实的基础。

Professor Peter Zhang is an esteemed Assistant Professor at the Heinz College of Information Systems and Public Policy at Carnegie Mellon University (CMU), where he has earned a reputation for his contributions to operations research and information systems management. Professor Zhang's academic foundation was established through his Bachelor of Applied Science and Master of Applied Science degrees from the University of Toronto, followed by a Ph.D. in Engineering Systems from the Massachusetts Institute of Technology (MIT).

His research is primarily focused on optimization theory and its practical applications across various domains, including supply chain, transportation, health, and other socio-technical systems. His scholarly work has not only made a significant impact within the academic community but also demonstrated tangible value in real-world applications. Professor Zhang holds several patents, including a global optimizer for supply chains, which is a tool that uses algorithms to streamline supply chain processes and enhance efficiency and responsiveness. Additionally, he has developed a blockchain-enabled hypothetical simulator to assess the impact of information sharing within supply chains, marking an innovative contribution to the field of supply chain management. As a member of the Institute for Operations Research and the Management Sciences (INFORMS), the American Mathematical Society, and the American Economic Association, Professor Zhang actively engages in academic exchanges and collaborations, continuously enhancing his research capabilities and international influence.

His publications in renowned academic journals such as the "Journal of Mechanical Design" showcase his profound expertise in computer science, artificial intelligence, machine learning, and reinforcement learning. Among his many accomplishments, Professor Zhang is also recognized for his teaching and mentorship at Heinz College of CMU. With his rigorous academic approach, innovative teaching methods, and care for students, he has garnered widespread respect from both students and peers. At Heinz College, Professor

Zhang not only imparts knowledge but also emphasizes the cultivation of innovative thinking and practical skills in students, laying a solid foundation for their future professional development.

2. 课程介绍

随着人工智能与自动化技术的迅速发展，如何利用数据驱动的方法实现智能系统的最优控制与规划，已成为机器人学与智能决策领域的重要研究方向。本课程系统介绍动态规划（Dynamic Programming, DP）与强化学习（Reinforcement Learning, RL）在最优控制与规划中的理论基础与应用实践。课程从动态系统的建模与模拟出发，深入讲解基于模型的问题求解、无模型学习策略以及强化学习的核心算法，包括贝尔曼方程、反向归纳算法、固定点迭代和 Q 学习等。

学生将学习如何利用函数逼近技术应对高维状态空间的挑战，并理解探索与开发（Exploration–Exploitation）的平衡机制。课程还特别关注强化学习在机器人控制、路径规划与智能决策中的实际应用，帮助学生建立从理论到工程实现的系统化思维。

With the rapid advancement of artificial intelligence and automation, data-driven optimal control and planning have become central challenges in robotics and intelligent decision-making. This course provides a systematic introduction to Dynamic Programming (DP) and Reinforcement Learning (RL) for optimal control and planning. It begins with modeling and simulating dynamic systems, followed by detailed coverage of model-based problem formulation, model-free learning, and core RL algorithms, including Bellman equations, backward induction, fixed-point iteration, and Q-learning.

Students will explore function approximation techniques for handling high-dimensional state spaces and understand the balance between exploration and exploitation. The course also highlights the application of reinforcement learning in robot control, motion planning, and intelligent decision-making, bridging theoretical foundations with real-world implementation.

3. 课程大纲

1. 动态规划和强化学习简介
2. 模拟动态系统
3. 基于模型的问题和制定
4. 贝尔曼方程和反向归纳算法
5. 无模型问题和强化学习示例
6. 探索与开发：多臂赌博机
7. 贝尔曼方程和固定点迭代
8. Q 学习
9. 强化学习中的函数逼近
10. 机器人中的应用

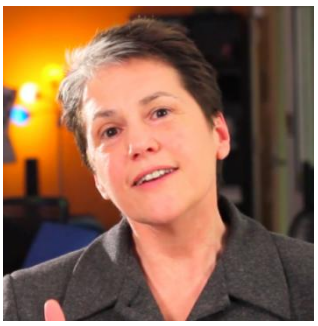
1. Introduction to Dynamic Programming and Reinforcement Learning
2. Simulating Dynamic Systems
3. Model-Based Problems and Formulations
4. Bellman Equation and Backward Induction Algorithm
5. Model-Free Problems and Reinforcement Learning Examples
6. Exploration versus Exploitation: Multi-Armed Bandits
7. Bellman Equation and Fixed-Point Iteration
8. Q-Learning
9. Function Approximation in Reinforcement Learning
10. Applications in Robotics

课程十三：《软件工程与人机交互：人工智能驱动的UX用户体验设计》

Interaction Design Foundations

学科方向：人机交互

1. 教授介绍



Lorie Loeb

达特茅斯学院教授 计算机教授

- 达特茅斯学院数字艺术项目主任（负责本科和硕士课程）
- 达特茅斯学院数字艺术领导与创新实验室（DALI Lab）联合创始人
- 达特茅斯学院技术与行为健康中心UI/UX设计负责人
- 曾任斯坦福大学计算机科学客座教授兼高级研究科学家
- 曾获得包含美国国家科学基金会（NSF）奖在内的多项著名科研项目基金

Lorie Loeb教授是达特茅斯学院计算机科学系的研究型教授，数字艺术项目主任，DALI实验室的联合创始人及执行主任，同时兼任人类中心设计辅修项目的联合创始人与技术与行为健康中心的教授。她拥有纽约大学电影与电视专业学士学位，并在亨特学院与科罗拉多大学博尔德分校深造艺术与电影学，曾在斯坦福大学、纽约大学和罗德岛设计学院任教，现致力于人机交互、UI/UX设计、数据可视化及数字工具在健康领域的应用研究。Lorie Loeb教授主导多个国家科学基金会（NSF）和美国国家卫生研究院（NIH）资助的跨学科项目，荣获富布赖特学者奖、NCWIT本科导师奖等多项殊荣，并通过技术与设计的创新实践，为教育、健康和可持续发展领域带来了深远影响。

Professor Lorie Loeb is a Research Professor in the Department of Computer Science at Dartmouth College, Director of the Digital Arts Program, Co-founder and Executive Director of the DALI Lab, and Co-founder of the Human-Centered Design minor. She also serves as an Affiliated Faculty member at the Center for Technology and Behavioral Health. Professor Loeb holds a BA in Film and Television from New York University and pursued further studies in art and film at Hunter College and the University of Colorado Boulder. She has taught at Stanford University, New York University, and the Rhode Island School of Design. Her current research focuses on human-computer interaction (HCI), UI/UX design, data visualization, and the application of digital tools in healthcare. Professor Loeb has led numerous interdisciplinary projects funded by the National Science Foundation (NSF) and the National Institutes of Health (NIH). She has received prestigious awards such as the Fulbright Scholar Award and the NCWIT Undergraduate Research Mentor Award. Through her innovative work in technology and design, Professor Loeb has made a profound impact on education, healthcare, and sustainable development.

2. 课程介绍

人机交互（HCI）是研究人类与计算机系统之间如何有效地交流和合作的领域。用户体验(UX)是人机交互的一个重要方面，侧重于用户在使用产品或系统时所感受到的整体体验。人机交互和用户体验的设计旨在创建一种用户友好的环境，以确保用户能够轻松地理解、操作和从系统中获得所需的信息或功能。在现代科技的背景下，人机交互和用户体验已经成为设计和开发过程中至关重要的因素，也是企业在信息时代成功的关键因素之一。

本课程旨在全面介绍人机交互（HCI）的基本原理、研究方法及前沿应用。课程内容涵盖用户感知与认知机制、认知模型及其在设计中的应用；探索触控、语音、手势交互以及虚拟和增强现实等多种交互技术与模式；学习软件界面设计的原则和可用性测试方法；掌握信息可视化的核心技术及复杂数据的呈现方法；通过快速原型设计，比较低保真与高保真原型的优劣，并开发交互式原型。课程还深入介绍 Figma 工具和数字设计原则，研究互动叙事案例，探讨 3D 建模在 AR/VR 中的应用及未来交互趋势。结合理论学习与实践操作，学生将通过案例研究和项目实践全面提升用户体验设计能力、创新思维与行业适应力，为从事人机交互领域的研究与实践奠定扎实基础。

Human-Computer Interaction (HCI) is the field that studies how humans and computer systems communicate and cooperate effectively. User experience (UX) is an important aspect of human-computer interaction that focuses on the overall experience that users feel when using a product or system. Human-computer interaction and user experience are designed to create a user-friendly environment to ensure that users can easily understand, operate, and get the information or functionality they need from the system. In the context of modern technology, human-computer interaction and user experience have become crucial factors in the design and development process, and have become one of the key factors for the success of enterprises in the information age.

This course provides a comprehensive introduction to the fundamental principles, research methods, and cutting-edge applications of Human-Computer Interaction (HCI). The curriculum covers user perception and cognitive mechanisms, cognitive models and their application in design; explores various interaction technologies and paradigms, including

touch, voice, gesture interactions, as well as virtual and augmented reality; delves into the principles of software interface design and usability testing methods; and equips students with core techniques for information visualization and presenting complex data. Through rapid prototyping, the course compares the advantages and disadvantages of low-fidelity and high-fidelity prototypes and guides students in creating interactive prototypes. Additionally, it offers an in-depth introduction to Figma tools and digital design principles, studies interactive storytelling cases, and examines the applications of 3D modeling in AR/VR and future interaction trends. Combining theoretical knowledge with practical exercises, students will enhance their user experience design skills, innovative thinking, and industry adaptability through case studies and project-based learning, laying a solid foundation for research and practice in the HCI field.

3. 课程大纲

1.人机交互简介

2.感知与认知

3.认知模型

4.交互技术与范式

5.软件系统的界面设计

6.基于用户行为的信息可视化

7.快速原型设计

8.Figma 和数字设计原理与技术

9.人机交互中的三维建模（AR/VR）

10.人机交互案例研究

1. Introduction to Human-Computer Interaction

2. Perception and Cognition

3. Cognitive Models

4. Interaction Technologies and Paradigms

5. Interface Design for Software Systems

6. Information Visualization Based on User Behavior

7. Rapid Prototyping

8. Figma and Digital Design Principles and Techniques

9. 3D Modeling in Human-Computer Interaction (AR/VR)

10. Case Study of HCI

课程十四：《机械工程与材料工程：运动结构原理与可展开机械结构》

Motion Structures: Deployable Assemblies of Mechanisms

学科方向：可展开结构/空间可折叠结构

1. 教授介绍

Zhong You

牛津大学 工程科学终身教授

- 牛津大学莫德林学院院士
- 曾获得 2000 年詹姆斯瓦特奖章
- 曾接受 Science 杂志人物专访
- ASME Journal of Mechanisms and Robotics 副主编
- 科研成果曾在 Financial Times, Nature, Eurika 上报道

Zhong You 教授先后在上海交通大学和大连理工大学获得工程力学学士和硕士学位。随后他加入了剑桥大学，并获得了工程系博士学位，研究航天应用中的展开式结构。毕业后他继续在剑桥大学担任研究员，专攻展开式结构的研究。在成为牛津大学工程科学系教授之前，Zhong 一直在剑桥大学工程系担任 EPSRC 高级研究员。他同时是牛津大学莫德林学院院士、ASME Journal of Mechanisms and Robotics 副主编。

他曾于 2000 年获得詹姆斯瓦特奖章，并接受过 Science 杂志人物专访。他的科研成果曾在 Financial Times, Nature, Eurika 等顶级期刊上被报道，他的作品还曾被选中参加由代表英国研究最高水平的皇家学会组织的白金汉宫科学日展览。

Dr. Zhong You obtained his Bachelor and Master degrees in engineering mechanics from Shanghai Jiaotong University and Dalian University of Technology, respectively. He then joined Cambridge University, where he completed his PhD in the Department of Engineering. He researched deployable structures for aerospace applications. Zhong continued in Cambridge as a Research Fellow at Corpus Christi College working on deployable structures. In 1997, he became an EPSRC Advanced Fellow, Department of Engineering, University of Cambridge. In 1998, he was appointed as a lecturer in the Department of Engineering Science of Oxford University and a Tutorial Fellow at Magdalen College.

He has stayed in Oxford ever since. His research has attracted attention from both the academic community and the general public and has been reported in national media such as the BBC, Financial Times, and science magazines including Eureka, Science, and Nature. Zhong's work was also selected for the Science Day Exhibition at the Buckingham Palace in 2007, organized by the Royal Society.

2. 课程介绍

作为一种新颖独特的工程结构类型，运动结构通常保留了传统结构的功能，同时还能进行较大的几何变形。在航空航天工程中，可被称作可展开结构，而在机械、医疗和土木工程中，则被称为可扩展、可折叠、可伸缩或可变形结构。运动结构早已投入使用，并且至今仍

处于科学探索的前沿。易于组装、使用和存储的运动结构一直备受需求，以解决各行各业中存在的工程问题。

Motion structures are a novel and unique type of engineering structures, which often retain the functionality of conventional structures, but are also able to undergo large geometric transformations. In aerospace engineering, they are termed deployable structures whereas in mechanical, medical and civil engineering, they are called expandable, collapsible, retractable or morphing structures.

Motion structures have long been in use, and they remain today at the forefront of scientific endeavour. Motion structures that are easy to assemble, easy to use and easy to store are in constant demand to overcome engineering problems that exist in all walks of life.

3. 课程大纲

1. 结构机制

2. 运动结构

3. 平面运动结构

4. 平面运动结构的应用：伸缩式屋顶

5. 由二维构型构建的三维运动结构

6. 三维运动结构的应用

7. 三维构型构建的三维可展开结构

8. 三维可展开结构的应用

9. 折纸结构

10. 折纸结构的设计与应用

1. Structure Mechanism

2. Motion Structures

3. Planar motion structures

4. Applications of planar motion structures: Potential applications as retractable roofs

5. 3D motion structures constructed from 2D mechanisms

6. Applications of 3D motion structures

7. 3D deployable structures constructed from 3D mechanisms

8. Applications of 3D deployable structures

9. Origami structures

10. Origami structure design and applications

课程十五：《机械工程与车辆工程：从汽车组件设计到车辆自动化与电气化》

Machine Component Design

学科方向：车辆工程

1. 教授介绍

Diana Haidar

卡内基梅隆大学 机械工程终身教授

- Maker Ecosystem 创客生态系统项目领导者
- CMU TechSpark 工程实验室导师
- 美国工程教育协会重要委员
- 曾任能源产业 Chart Energy & Chemicals 机械工程师
- 重点研究极端环境下的金属和纳米聚合物表现和测试

Diana Haidar 教授现任职于卡内基梅隆大学，担任工程学院机械工程终身教授，并领导新的创客生态系统项目 Maker Ecosystem。此外，Diana 还是卡内基梅隆大学 TechSpark 教职委员会主席/教育总监、美国工程教育协会委员，通过她在各个组织和委员会的积极参与，以及对教育和创新的执着追求，为推动科技教育和 STEM 领域的发展做出了重要贡献。Diana 的研究方向包括 3D 打印、机械工程、工程设计，并重点研究开发金属和聚合物纳米复合材料，以提高其在极端环境下的性能，为此她设计、制造和构建了各种定制的测试设备用于这些独特材料的测试。

Diana Haidar is a professor of Carnegie Mellon University in the Department of Mechanical Engineering and leads efforts in the new Maker Ecosystem. Her research interests encompass 3D printing, mechanical engineering, and engineering design, with a particular focus on developing both metal and polymer nanocomposites for advanced performance in extreme environments. To achieve this, she design, fabricate, and build various custom testing equipment for these unique materials. In instructing undergraduate and graduate student teams to make their own machinery, she developed a passion for using maker space resources to bring more hands-on design experiences to the classroom.

2. 课程介绍

本课程将通过消费者汽车的实例，教授机械零件设计的基本原理。消费类汽车是一类被广大人群广泛使用的常见机器。这些机器通过能量驱动，执行特定的动作，以施加所需的力大小和方向，从而实现受控的运动。工程师们在机械零件设计中面临着确保汽车和其所制造的产品线都安全、高效和耐用的挑战。作为实现这些目标的入门课程，本课程对动力传递、齿轮、轴承、润滑、离合器、制动器、轴、螺杆、载荷分析、疲劳和材料选择等概念进行了概览。

This course teaches the fundamentals of machine component design through examples of consumer automobiles, which are among the most common machines used by the general population. These machines are powered to perform actions, such that they apply the desired magnitude and direction of forces for controlled movement. Engineers take on the challenge of ensuring both the automobile and the product line they are made on are safe, effective, and long-lasting through machine component design.

As an introduction to achieving these goals, this course provides a survey of concepts in power transmission, gears, bearings, lubrication, clutches, breaks, shafts, screws, load analysis, fatigue, and material selection.

3. 课程大纲

1. 导论：机械部件设计入门

2. 机械部件：齿轮、轴、链接、轴承

3. 动力传输：扭矩、旋转、速度、功、功率

4. 故障模式和预防：静态、可变、疲劳

5. 连接：紧固件、耦合器、焊接、粘合剂

6. 材料选择：金属、塑料、陶瓷、木材

7. 领域前沿：复杂材料的发明应用

8. 车辆燃油经济效应

9.车辆自动化和电气化

10. 新型动力系统

1. Intro to Machine Component Design, Community Building, Gear Types

2. Rotational Motion - torque, velocity, work, power; Power Transmission - gearsets

3. Power Transmission - simple and compound geartrains

4. Vehicle Transmission - manual and automatic

5. Failure Modes and Prevention - static, dynamic, stress, strain

6. Failure Modes and Prevention - strength, deformation, shear

7. Materials - selecting for desired functionality and inventing complex materials

8. Assemblies - links, bearings, shafts

9. Joinery - fasteners, couplers, welds, adhesives

10. New Powertrain Technology - vehicle automation and electrification"

课程十六：《脑机接口的人工智能、微电子学与信号处理》

Brain/Machine Interfaces: Artificial Intelligence, Signals, & Circuits

学科方向：信号处理/人工智能

1. 教授介绍

Neal Bangerter

帝国理工学院 生物工程教授

- 博伊西州立大学电气与计算机工程系主任
- 伦敦超高场磁共振成像项目帝国理工学院负责人
- 欧洲工商管理学院 AI 与数字转型教授
- 犹他大学放射科系教授
- 曾任微软战略业务发展经理、麦肯锡高级顾问

Neal Bangerter 于 2018 年加入帝国理工学院，担任生物工程教授，专注于医学成像（特别是 MRI）、人工智能与机器学习、大数据/数据分析以及信号处理。作为伦敦协作超高场扫描仪（LOCUS）项目的帝国理工学院负责人，他领导着由伦敦国王学院、帝国理工学院、伦敦大学学院和癌症研究所共同参与的超高场磁共振成像联合项目。他还是伦敦 EFG 资产管理公司未来领袖小组的人工智能专家，并与帝国人工智能网络和计算、认知与临床神经影像实验室有密切联系。

Bangerter 教授在加州大学伯克利分校获得物理学学士学位，随后在斯坦福大学获得电气工程硕士和博士学位。他曾在威尔科克斯公司担任软件开发工程师，并共同创立了数据可视化软件公司 Visualize。毕业后，他在麦肯锡公司工作，随后在微软担任高级业务开发和战略业务发展经理，其后又在广告技术公司 Reactrix 担任产品管理副总裁。2006 年，他重返学术界，成为斯坦福大学放射学实验室的研究员。目前，Bangerter 教授 的研究兴趣包括开发用于超高磁场强度下的磁共振成像的新型脉冲序列，机器学习在医疗影像和健康护理中的应用，以及数据、人工智能和相关技术在生物科学和其他行业中的前景与局限性。他在设立英国生物银行神经影像研究（一个大规模健康研究项目）方面发挥了重要作用，并与斯坦福大学、牛津大学、剑桥大学、癌症研究所、犹他大学、布莱根杨大学、伦敦国王学院和西门子医疗等机构有积极的研究合作。

Neal Bangerter joined Imperial in February 2018 as Associate Professor of Bioengineering, where he specializes in medical imaging (with a focus on MRI), artificial intelligence and machine learning, big data/data analytics, and signal processing. He is also the Imperial lead of the London Collaborative Ultra-High Field Scanner (LOCUS) project, a joint venture for ultra-high field MR imaging between King's College London, Imperial, University College London, and the Institute for Cancer Research. He serves on the Future Leaders Panel for EFG Asset Management in London as their Artificial Intelligence expert, and is affiliated with the Imperial Artificial Intelligence Network and the Computation, Cognitive, and Clinical Neuroimaging Laboratory.

Dr. Bangerter received a Bachelor's degree in Physics from U.C. Berkeley, and received his Master's and Ph.D. degrees in Electrical Engineering from Stanford University. He spent several years as a software developer for metrology company Wilcox Associates prior to graduate school, and co-founded data visualization software company Visualize. He returned to academia in 2006 as a researcher in Stanford's Radiological Sciences Laboratory. His current academic interests include the development of novel pulse sequences for magnetic resonance imaging at ultra-high magnetic field strengths, the application of machine learning to a variety of problems in medical imaging and healthcare, and the promises and limitations of data, artificial intelligence, and related technologies in the biosciences, healthcare, and other industries.

He was instrumental in setting up the U.K. Biobank Neuroimaging study (a massive big-data health research effort), and has active research collaborations with groups at Stanford University, Oxford, Cambridge, the Institute for Cancer Research, University of Utah, Brigham Young University, Kings College London, and Siemens Healthcare.

2. 课程介绍

在本课程中，学生将被引入脑机接口（Brain/Machine Interfaces）领域，并学习人工智能（AI）和机器学习（ML）如何革新我们解读大脑信号的能力。课程首先将讲解实现人脑与电子、机械系统交互的基础技术，随后深入探讨各类人工智能、机器学习及信号处理方法如何帮助我们理解来自大脑的信号。前几次课程将介绍学生理解该领域所需的基础概念，主题包括：信号处理入门、脑机接口中的人工智能技术基础系列讲座、基础电子电路、微电子学与集成电路。

此外，学生还将学习人脑与神经系统的基本原理，了解神经系统如何利用电信号在体内的感觉与运动通路上传递信息。随后，课程将回顾脑机接口中涉及的各种技术，包括：非侵入式技术（EEG 脑电图、EMG 肌电图、MEG 脑磁图以及基于成像的方法）；半侵入式技术（ECoG 皮层电图）；侵入式技术（植入式电极系统）。在这些部分中，我们将重点讲解用于分析不同类型神经信号的各种人工智能/机器学习算法与信号处理方法。最后，课程将概述脑机接口领域的前沿研究与最新应用，介绍这些技术目前正在探索的广泛应用场景。

In this course, students will be introduced to the exciting field of Brain/Machine Interfaces and will learn how the fields of Artificial Intelligence and Machine Learning are revolutionizing our ability to interpret signals from the brain. We will first study the basic technologies that make interfacing the human brain with electronic and mechanical systems possible, and will then delve into how various artificial intelligence/machine learning and other signal processing techniques are allowing us to interpret signals we receive from the brain. The first several lectures will cover basic foundational concepts that the students will require to understand the field. Topics will include an introduction to signal processing, an in-depth series of lectures on the basics of artificial intelligence techniques for brain/machine interfaces, basic electronic circuits, microelectronics and integrated circuits. Students will also learn fundamentals of the human brain and nervous system, and how the nervous system uses electrical signals to communicate over the sensory and motor pathways in the body.

We will then review the various technologies involved in brain/machine interfaces. These will include lecture material and readings on the non-invasive technologies (EEG, EMG, MEG, and imaging-based techniques), semi-invasive technologies (ECoG), and invasive technologies (implanted electrode systems). We will focus heavily in all of these lectures on the various artificial intelligence/machine learning and other signal processing techniques used to analyze neurological signals of different types. Finally, we will review the current state-of-the-art in brain/machine interfaces, introduce the broad set of applications being explored for these technologies.

3. 课程大纲

1. 脑机接口概述
2. 人工智能与机器学习导论
3. 脑机接口中的信号处理导论
4. 脑机接口的神经科学基础导论
5. 脑机接口的高级人工智能与机器学习
6. 基于成像与代谢的脑机接口类型
7. 基于电位的脑机接口技术
8. 脑机接口的硬件、电路与系统
9. 有效科研计划书写作与论文结构
10. 脑机接口的未来展望与人工智能的作用

1. Applications of brain/machine interfaces
2. Introduction to basic signals, systems, and signal processing
3. Basic electronic circuits, microelectronics, and integrated circuits
4. Basics of the human brain and human nervous system
5. Neurological signals and Non-invasive brain/machine interfaces
6. Measuring electrical signals from the brain: electroencephalography (EEG), magnetoencephalography (MEG)
7. Measuring electrical signals from skeletal muscle: electromyography (EMG)
8. Semi-invasive brain/machine interfaces: electrocorticography (ECoG)
9. Invasive brain/machine interfaces: implanted electrodes
10. Signal processing and machine learning techniques for biomedical signals

课程十七：《电子工程：数字集成电路的设计研究及应用》

Introduction to Very Large Scale Integration

学科方向：微电子学

1. 教授介绍

Ya-Hong Xie

加州大学洛杉矶分校 材料科学与工程终身教授

- 贝尔实验室物理科学和工程研究部的技术人员
- 电气与电子工程师协会 IEEE 的会员
- 2012 年德国洪堡基金会研究奖得主
- 美国半导体研究公司发明人表彰奖得主
- 德国莱布尼茨协会研究所访问科学家
- 拥有美国以及韩国、日本和中国等国家的 38 多项专利

Ya-Hong Xie 教授是加州大学洛杉矶分校（UCLA）材料科学与工程系的终身教授，并兼任本科教育副主席。UCLA 是美国申请人数最多的大学之一，Samueli 工程学院在 2022 年 U.S. News 排名中位于全美工程学院第 16 位，公立大学第 8 位。

他的研究覆盖电子工程、电气工程、微电子学、凝聚态物理学、半导体和集成电路芯片等领域。Xie 教授发表了 190 多篇技术文章，持有 38 项美国专利和多项国际专利。2012 年，他获得亚历山大·冯·洪堡基金会的研究奖，该奖项由全球顶尖科学家评选，历史上有 57 位诺贝尔奖得主曾获得资助。作为 IEEE 会士，Xie 教授曾连续三年担任 IEEE 电子器件学会电子材料委员会主席，IEEE 是全球最大的专业技术组织之一。

Professor Ya-Hong Xie is a tenured professor in the Department of Materials Science and Engineering at the University of California, Los Angeles (UCLA), also serving as Vice Chair for Undergraduate Education. UCLA is one of the most applied-to universities in the U.S., with the Samueli School of Engineering ranked 16th among all engineering schools and 8th among public universities in the 2022 U.S. News rankings.

His research covers fields such as electronic engineering, electrical engineering, microelectronics, condensed matter physics, semiconductors, and integrated circuit chips. Professor Xie has published over 190 technical papers and holds 38 U.S. patents along with several international patents. In 2012, he received the prestigious Alexander von Humboldt Foundation Research Award, selected by a committee of approximately 100 renowned scientists; 57 Nobel laureates have been funded by the Humboldt Foundation throughout its 150-year history. A Fellow of IEEE, Professor Xie has served as the Chair of the IEEE Electron Devices Society's Electronic Materials Committee for three consecutive years, with IEEE being one of the world's largest professional technical organizations.

2. 课程介绍

本课程系统介绍微电子学与集成电路的基本原理，帮助学生理解从电荷与电路基础到现代集成电路设计与制造的完整知识体系。课程从电荷性质与电路概念入手，逐步深入至半导体物理、pn 结与 MOS 电容器结构、以及 MOSFET 的工作机理。学生将学习集成电路的制造工艺流程，并了解短沟道效应的物理本质及其在技术演进中的解决方案。

在数字逻辑部分，课程介绍布尔代数与 CMOS 逻辑电路设计，帮助学生建立从物理器件到逻辑功能的系统性理解。最后，课程将探讨寄生效应及其对电路性能的影响，从电阻与电容的角度分析电路中不可忽视的真实特性。本课程为学习电子工程、微电子设计与脑机接口硬件等前沿领域打下坚实的基础。

This course provides a systematic introduction to the fundamentals of microelectronics and integrated circuits, guiding students through the complete knowledge framework from basic charge and circuit concepts to modern IC design and fabrication. Starting with the nature of electric charge and circuit fundamentals, students will explore solid-state physics, intrinsic and extrinsic semiconductors, pn junctions, and MOS capacitors, leading to a detailed understanding of MOSFET operation.The course also introduces integrated circuit fabrication processes and examines the short-channel effect—its underlying physics and the historical development of mitigation techniques.

In the digital logic section, students will learn Boolean algebra and CMOS circuit design, bridging the gap between physical device behavior and logical computation. Finally, the course discusses parasitic effects from the perspective of resistance and capacitance, highlighting their practical impact on circuit performance.This course serves as a solid foundation for advanced study in electronic engineering, microelectronic design, and hardware for brain-machine interfaces.

3. 课程大纲

1.电荷的性质、电路基础概念；

2.集成电路（IC）本质；流行的集成电路逻辑

3.固态物理；本征半导体与外征半导体

4.pn 结和 MOS 电容器

5. MOSFET：pn 结+MOS 电容器

6.集成电路制造工艺流程

7.短沟道效应的本质和补救措施的历史发展

8.布尔代数

9.CMOS 电路

10.从电阻和电容的角度看寄生效应

1. The properties of electrical charge, basic electrical circuit, resistors, inductors, capacitors, current source and voltage source; mention the omission of the all-important quantum mechanics and thermodynamics;

2. The essence of the integrated circuits (ICs): voltages at each circuit nodes;The prevalent IC logic: Boolean logic, etc.

3. Solid state physics: atomic bonding, energy bands, CB & VB; intrinsic and extrinsic semiconductors; the temperature effect of extrinsic semiconductors

4. pn junction & MOS capacitor: construction, charge distribution, I-V; the difference between MOS and MOM capacitors: the density of states;

5. MOSFET:pn-junctions + MOS capacitors with emphasis on the Si electrode; the necessary involvement of two separate circuits & the meaning of "transistor";Output and transfer characteristics;

6. Integrated circuit fabrication process flow: key process modules: the involvement of other field of sciences;

7. The essence of short-channel effects and historic development of remedies: strained Si, metal-hi k gate stacks, 3-D structures;

8. Boolean algebra: the emphasis of universal gates;

9. CMOS circuits: inverter, NAND and NOR gates from 2 to n-inputs; Vdd-power;

10. Parasitic effects from the perspective of resistance and capacitance;

课程十八:《电子工程:物联网与无人机阵列网络通信系统设计》

Wireless Communications System Design

学科方向: 智能无人系统

1. 教授介绍

Danijela Cabric

加州大学洛杉矶分校 电子工程终身教授

- 加州大学洛杉矶分校电路和嵌入式系统项目主任
- 2018-2019 IEEE Com Soc 美国电气和电子工程师协会通讯领域杰出科学家
- 美国 IEEE 网络信号和信息处理期刊副主编
- 著名通讯硬件制造商 MaxLinear 公司首席科学顾问

Danijela Cabric 教授是加州大学洛杉矶分校电子与计算机工程系的教授。她于 2001 年获得加州大学洛杉矶分校的电子工程专业硕士学位，随后于 2007 年获得加州大学伯克利分校的电子工程专业博士学位。她的研究方向是无线通信系统设计，无线通信的机器学习，传感与安全与性能分析，嵌入式平台和软件定义无线电的实验。2020 年，Cabric 教授因其"对频谱感知和认知无线电系统的理论和实践的贡献"而当选电气和电子工程师协会(IEEE)院士。教授的学术成就闻名国际，在顶级学术期刊所发表论文的总引用量近两万次。

Danijela Cabric is a Professor in the Department of Electrical Engineering, University of California, Los Angeles. She gained her master degree in University of California, Los Angeles in 2001 and her PhD in University of California, Berkeley in 2007. Her research interests are wireless communications system design, machine learning for wireless communications, sensing and security and performance analysis and experiments on embedded platforms and software defined radios.

In 2020, Professor Cabric was elected a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) for her "contributions to theory and practice of spectrum sensing and cognitive radio systems." Her academic achievements are internationally renowned, with an astounding total citation count of 20,000.

2. 课程介绍

课程将重点介绍一种自上而下的无线通信系统设计方法，从分析和实践的角度建立对核心物理和网络层功能的基本理解。学生们将学习无线系统数字通信和信号处理的知识;实用的检测和估计算法应用于发射机-接收机线路设计中;研究基于 OFDM、扩频和多天线的现代无线电设计以及无线协议和网络技术。同时学生们将研究现有和新出现的无线系统，包括 2G 到 6G 网络、WiFi 和物联网。

The course will focus on a top-down approach to the design of wireless communication systems to build a fundamental understanding of core physics and network layer functions from an analytical and practical perspective. Students will learn about digital communication and signal processing in wireless systems; Practical detection and estimation algorithms are used in transmitter - receiver circuit design. Modern radio design based on OFDM, spread spectrum and multi-antenna as well as wireless protocols and network technologies are studied. Students will also study existing and emerging wireless systems, including 2G to 6G networks, WiFi and the Internet of Things.

3. 课程大纲

1.数字通信：信号空间、发射器和接收器结构

2.无线信号处理：调制/解调、估计/检测

3.无线信道建模、链路预算

4.多载波调制（OFDM）

5.信道估计、均衡、同步

6.多天线通信、MIMO

7.波束成形、大规模多输入多输出

8.无线传感和定位

9.设计实例：物联网、WiFi、超宽带通信

10.设计实例 5G 蜂窝和毫米波网络

1. Digital Communications Fundamentals: Signal Space, Transmitter and Receiver Structure
2. Signal Processing Fundamentals for Wireless:
3. Modulation and Demodulation, Estimation and Detection
4. Wireless Channel Modeling, Link Budget
5. Multicarrier Modulation (OFDM)
6. Channel Estimation, Equalization, Synchronization
7. Multiple Antenna Communications, Beamforming, Massive MIMO
8. Wireless Sensing and Localization
9. Design examples: Internet of Things, WiFi
10. Design Examples: 5G Cellular, Cognitive Radio Communications

课程十九：《能源与环境：“碳中和”低碳技术与绿色能源系统优化设计》

Low-carbon Technology and Future Energy Systems

学科方向：能源系统/可再生能源

1. 教授介绍

Aidong Yang

牛津大学 终身教授

- 牛津大学格林邓普顿学院工程科学系终身教授
- 牛津大学系统工程小组研究负责人
- 牛津大学格林邓普顿学院学术委员会成员兼高级研究员
- NERC 环境研究小组首席研究员
- 2017-2021“通过改善气候条件去除温室气体”会议领导人

Aidong Yang 教授于 2014 年加入牛津大学，担任格林邓普顿学院工程科学系终身教授，同时还担任牛津大学系统工程小组研究的负责人。教授曾就读于大连理工大学化学工程专业，于 1997 年获得博士学位。在加入牛津大学之前，Yang 教授是萨里大学化学与过程工程系的高级讲师。他曾在中国科学院、路易斯安那州立大学、亚琛工业大学、纽卡斯尔大学等多家学术机构从事博士后研究工作。

Yang 教授的研究兴趣在于开发化学/生物化学过程及相关系统的建模方法和工具，以及应用模型和其他系统工程方法支持可持续能源、工程和制造系统的开发。特别是，他的研究小组目前活跃在三个领域：生物系统工程、食品-能源-水关系和负排放技术。Yang 教授还曾连续五年作为会议领导人组织领导了 “通过改善气候条件去除温室气体”国际会议。

Aidong Yang joined Oxford in 2014 as an Associate Professor in the Department of Engineering Science, and as a Research Fellow of Green Templeton College. He is also

currently head of research for the Systems Engineering Group at the University of Oxford. Aidong studied Chemical Engineering in Dalian University of Technology and received a PhD in 1997. Before moving to Oxford, Aidong was a Senior Lecturer in the Department of Chemical and Process Engineering at University of Surrey, where he started as a Lecturer in 2007 after working as a postdoctoral researcher in a number of academic organizations, including Chinese Academy of Science, Louisiana State University, RWTH Aachen, and University of Newcastle Upon Tyne.

Aidong's research interests lie in developing methods and tools for modelling chemical/biochemical processes and related systems, and in applying models and other systems engineering approaches to support the development of sustainable energy, engineering and manufacturing systems. In particular, his group is currently active in three areas: biological systems engineering, food–energy–water nexus, and negative emission technology. Professor Yang served as the conference leader for five consecutive years, organizing the International Conference on "Removing Greenhouse Gases by Improving Climate Conditions."

2. 课程介绍

本课程将讨论人类目前面临的主要环境和能源挑战，并介绍可用于评估和开发有效解决方案的系统工程方法。这些方法基于数学建模，并且包括数值（计算机编程）仿真和优化。在课题研究中，学生将有机会学习和研究关键的能源和环境技术，包括化学、生物化学(如生物反应器)和电化学(如电解、燃料电池)系统知识。课程内容覆盖范围广泛，跨度为能源和环境科学工程、系统工程和化学工程。

This course will discuss key energy and environmental challenges and introduce systems engineering approaches that can be used to evaluate and develop effective solutions. These approaches are based on mathematical modelling and include numerical (computer) simulation and optimization. During the research projects, the students will also have an opportunity to learn and research key energy and environmental technologies, including chemical, biochemical (e.g., bioreactors) and electrochemical (e.g., electrolysis, fuel cells) systems. The course will start with a set of lectures to introduce the theoretical foundation of these approaches, which will be followed by undertaking research projects.

3. 课程大纲

1. 低碳经济简介；能源系统原理
2. 能源转换和储存技术
3. 电化学系统和绿色氢能
4. 技术经济分析：能源成本与效益
5. 生命周期评估和碳足迹
6. 生物能源和生物燃料
7. 碳捕获、封存与利用
8. 未来能源系统：计算机建模优化

9. 未来能源系统：计算机建模模拟

10. 技术到系统：循环经济与资源关系

1. Introduction to low-carbon economy, energy system principles

2. Techno-economic assessment

3. Renewable energy technologies

4. Green hydrogen and energy storage

5. Life-cycle assessment and carbon foot-printing

6. Bioenergy and biofuel

7. Carbon capture, storage and utilization

8. Computer modelling of future energy systems: simulation

9. Computer modelling of future energy systems: optimization

10. From technologies to systems: Circular economy and resource nexus"

课程二十:《环境化学：污水净化途径与水资源可持续管理系统》

Water Treatment and Sustainable System for Water Resource Recovery

学科方向：环境化学

1. 教授介绍

Joe Moore

卡内基梅隆大学 土木与环境工程教授

- 卡内基梅隆大学土木与环境工程学院教授
- 美国化学学会第 252 届全国会议环境化学分会优异奖
- 美国国家科学院与工程院科学与工程大使
- 美国国家科学基金会科研基金得主

Joe Dallas Moore 博士于 2006 年获得 Wabash 学院生物学（法语）学士学位，并在 2012 年和 2017 年分别获得卡内基梅隆大学土木（及环境）工程硕士和博士学位。他的研究主要关注微生物和纳米技术的交互作用，尤其是纳米粒子对微生物群落的影响。Moore 博士的研究方法结合了环境微生物学和纳米科技。他目前的研究重点是开发和应用新技术来评估和解决环境问题，特别是在水和废物处理方面。Moore 博士的研究兴趣包括环境工程、纳米技术在环境中的应用。

Dr. Joe Dallas Moore received his B.S. in Biology (in French) from Wabash College in 2006 and his M.S. and Ph.D. in Civil (and environmental) Engineering from Carnegie Mellon University in 2012 and 2017, respectively. His research focuses on the interaction of

microbes and nanotechnology, particularly the effects of nanoparticles on microbial communities. Dr Moore's approach combines environmental microbiology and nanotechnology. His current research focuses on the development and application of new technologies to assess and solve environmental problems, particularly in water and waste treatment. Dr. Moore's research interests include environmental engineering, the use of nanotechnology in the environment, and the mechanisms by which microbial communities respond.

2. 课程介绍

如何高效、经济和环保地处理各类废水,已成为全球范围内亟待解决的问题。生物法、膜法以及其他高新技术以其高效、节能和自动化等优点,被广泛应用于城市与工业水处理。生物技术、纳米技术与信息技术等高新技术的发展,为水污染治理开辟了新的途径。与此同时,膜分离技术、生物接触氧化等工艺的使用,也使污水与废水处理的自动化、无人值守运转成为可能。

How to efficiently, economically and environmentally friendly treat various types of waste water has become an urgent problem to be solved worldwide. Biological method, membrane method and other high-tech are widely used in urban and industrial water treatment due to their advantages of high efficiency, energy saving and automation. The development of high and new technologies such as biotechnology, nanotechnology and information technology has opened up new ways for water pollution control. "

3. 课程大纲

1. 水化学、水质
2. 饮用水处理
3. 吸附和氧化技术
4. 电化学技术
5. 反渗透和膜过滤
6. 废水生化处理
7. 浮游生物和生物膜处理
8. 污泥处理与回收
9. 生物技术应用
10. 其他先进技术

1. Water Chemistry. Water Quality
2. Drinking Water Treatment
3. Adsorption and Oxidation Technology
4. Electrochemical Technology
5. Reverse Osmosis and Membrane Filtration

6. Biochemical Wastewater Treatment

7. Planktonic and Biofilm-based Treatment

8. Sludge Treatment and Recycling

9. Biotech applications

10. Other Advanced Technologies

课程二十一：《材料科学与能源储存：化学能源与储能系统中的材料结构与性能》

Materials and Energy Storage: Why Materials Matter

学科方向：材料科学

1. 教授介绍

Julia R. Greer

加州理工学院 材料科学、力学和医学工程学教授

- 加州理工 KNI 实验室负责人
- 首届 AAAFM-希格奖（2019）
- 范内瓦·布什教师奖（Vannevar Bush Faculty Fellow）
- 《Extreme Mechanics Letters》《 Nano Letters》副主编

Julia R. Greer 教授的研究聚焦于创制与表征具有多尺度微结构层次的材料体系。其带领的研究团队通过三维光刻、纳米制造及增材制造等技术，开发微纳米架构材料的制备与合成方法，并系统研究其力学、电化学、机电、生化及光子学性质与材料架构、组成成分及微结构特征的关联规律。

Julia R. Greer 教授获得了首届 AAAFM-希格奖（2019），并被授予范尼瓦-布什教学奖（2016）及 CNN 的 20/20 远见者（2016）。研究成果被麻省理工学院《Technology Review》（2015）评为十大突破性技术之一，被《Fast Company》评为“100 位最具创造力人物”之一，并被世界经济论坛评为“全球青年领袖”（2014），并获得了多项职业奖项：Kavli（2014）、Nano Letters、SES 和 TMS（2013）；NASA、美国机械工程师学会（ASME，2012）、大众机械突破奖（2012）、能源部（DOE，2011）、DARPA（2009）以及技术评论的 TR-35（2008）。自 2007 年起担任加州理工学院教授，同时也是《Extreme Mechanics Letters》和《 Nano Letters》期刊副主编。

Dr Julia R. Greer's research focuses on creating and characterizing material systems with multi-scale microstructural levels. Her team has developed methods for the preparation and synthesis of micro-nano-structured materials through technologies such as three-dimensional lithography, nanofabrication, and additive manufacturing. They have systematically studied the mechanical, electrochemical, electromechanical, biochemical,

and photonic properties of these materials and their correlations with the material architecture, composition, and microstructure characteristics.

Professor Julia R. Greer received the inaugural AAAFM-Sig Award (2019) and was awarded the Vannevar Bush Faculty Researcher Title (2016) and CNN's 20/20 Visionary (2016). Her research was recognized as one of the top ten breakthrough technologies by MIT's Technology Review (2015), was named one of the "100 Most Creative People" by Fast Company, and was recognized as a "Global Young Leader" by the World Economic Forum (2014). She has received several professional awards: Kavli (2014), Nano Letters, SES, and TMS (2013); NASA, the American Society of Mechanical Engineers (ASME, 2012), the Breakthrough Award in Mechanical Engineering by Volkswagen (2012), the Department of Energy (DOE, 2011), DARPA (2009), and the TR-35 by Technology Review (2008). Since 2007, she has served as a professor at the California Institute of Technology and is also the deputy editor of "Extreme Mechanics Letters" and "Nano Letters".

2. 课程介绍

材料科学致力于提升电池的安全性、降低成本、延长使用寿命，并寻找更加环保的材料解决方案，以促进绿色能源的普及。本课程聚焦于聚焦于电池与能量存储材料的基本原理与材料行为。课程从材料科学的基础概念出发，介绍材料的基本力学性质，并将这些知识应用于电池材料体系中。帮助学生理解材料在能量存储过程中的作用。课程以锂离子电池和固态电池为主要案例，更强调材料的结构–性能关系以及材料视角下的电池工作机理，为后续材料、能源或电池相关课程奠定基础。

Materials science is dedicated to enhancing the safety of batteries, reducing costs, extending their lifespan, and seeking more environmentally friendly material solutions, in order to promote the widespread adoption of green energy. This course focuses on the fundamental principles and material behaviors of batteries and energy storage materials. Starting from the basic concepts of materials science, the course introduces the basic mechanical properties of materials and applies this knowledge to battery material systems. It helps students understand the role of materials in the energy storage process. The course mainly uses lithium-ion batteries and solid-state batteries as case studies, emphasizing the relationship between material structure and performance as well as the battery working mechanism from a material perspective, laying the foundation for subsequent courses related to materials, energy, or batteries.

3. 课程课纲

1.储能技术导论：材料科学视角下的电池

2.材料科学基础

3.化学势作为一种材料概念

4.离子运输

5. 表面与界面

6.电池简介

7.锂离子电池材料

8.固态电池

9.电池中的材料力学

10.电池系统与材料展望

1.Energy storage technologies: batteries as materials systems

2.Fundamentals of Materials Science

3.Chemical potential as a materials concept

4.Ion Transport

5. Surfaces and Interfaces

6.Introduction to Batteries

7.Lithium-ion Battery Materials

8.Solid-state Batteries

9.Mechanics of Materials in Batteries

10.Battery Systems and Materials Outlook

2. 理科类

课程一:《生物学:阿尔茨海默症等脑神经疾病中的分子生物学研究》

Molecular Biology of Memory and Memory Diseases

学科方向:分子生物学/神经科学

1. 教授介绍

Samuel Kunes

哈佛大学 分子与细胞生物学终身教授

- 哈佛大学神经生物学学位课程委员会副主任
- 哈佛大学生化科学导师委员会副主任
- Pew 生物医学科学基金学者项目获得者
- Damon Runyon-Walter Winchell 基金会专项资金获得者
- 荣获专利“调节记忆的成分和方法” (60/726, 318) 26,318

Samuel Kunes 教授是哈佛大学分子与细胞生物学终身教授。他于 1988 年毕业于麻省理

工学院，获得遗传学博士学位。教授目前的研究包括成人视觉系统的功能和可塑性，这个项目的目的是确定这些记忆被编码的位置和方式。另一项研究着眼于参与突触可塑性的蛋白质是如何在局部合成的，以应对产生记忆的环境输入。教授的学术成就闻名国际，在生物学领域深耕四十多年，已在多个顶级学术期刊发表论文并拥有一项专利：调节记忆的成分和方法（专利号：60/726,318）。教授还曾获得过 Damon Runyon-Walter Winchell 基金会专项资金并且在哈佛拥有以自己名字命名的实验室（Kunes Laboratory)。

Samuel Kunes is a Professor of Molecular and Cellular Biology at Harvard University. He earned a PhD in Genetics in M.I.T. in 1988. His laboratory uses the Drosophila melanogaster as a system of choice to examine how behavior is modulated by the nervous system's functional plasticity, and to illuminate the relationship between genetic control and the evolutionary divergence of behavior. With respect to the function and plasticity of the adult visual system, the aim of this project is to determine where and how such memories are encoded. Another study looks at how a protein involved in synaptic plasticity is synthesized locally in response to environmental inputs that produce a memory. He won the Damon Runyon-Walter Winchell Cancer Fellowship, and he has his own named Laboratory at Harvard (Kunes Laboratory).

2. 课程介绍

记忆（Memory）是人类大脑的核心功能之一，也是构成我们自我身份的关键。想一想：当人类失去记忆时（如阿尔茨海默症患者），他们也会逐渐失去自我认同。从进化的角度看，记忆使动物能够从经验中获益——无论这些经验是好是坏——从而更好地生存并将遗传信息传递给下一代。在本课程中，我们将探讨“记忆”这一主题——什么是记忆、大脑如何学习并储存记忆，以及大脑如何利用记忆来指导行为。那么，什么是记忆？

记忆并不是我们经历的完整记录，而是大脑对经验的片段化选择：例如一个面孔的特征、一段事件的快照，或是一种伴随的情绪（毕竟，记忆既可以是愉快的，也可能是痛苦的）。我们以细胞与分子层面的变化形式，将记忆储存在大脑的“神经回路”中。神经回路的改变——尤其是在突触（即神经元之间的连接）处——会影响神经元之间的通讯方式，从而改变我们的思想与行为。事实上，基于神经生物系统的计算模型构成了目前最成功的人工智能算法的理论基础。本课程将以整体性的视角研究记忆科学。我们将从大脑的分子与细胞生物学基础知识入手，接着探讨神经可塑性（neural plasticity）的概念，以及信息与经验在大脑结构中的储存机制，即记忆的生物学本质。

Memory is a central capability of our brains and critical to who we are as people. Consider: as humans lose their memories, as happens in Alzheimer's Disease, they also suffer a progressive loss of self-identity. From an evolutionary perspective, memory allows animals to benefit from experience, whether the experiences are good or bad, and thus be better able to survive and pass on their genetic information to the next generation. In this course we will study memory - what it is, how the brain learns and stores memory, and how the brain uses memory to direct behavior.

So, what is memory? Rather than a complete record of experience, our brains select fragments of experiences, like specific features of a face, a snapshot of an event and, often, an associated emotion (memories, after all, can be pleasant or painful). We store

memory as a cellular and molecular change in the ‘neural circuits’ of our brains. An alteration in neural circuits, specifically at synapses (the connections between neurons), changes communication between neurons and thus alters our thoughts and behavior. Computations modeled on neurobiological systems underlie the most successful artificial intelligence algorithms.

This course will take a holistic approach to the science of memory. We begin with basic knowledge of the molecular and cellular biology of the brain. The course then turns to the concepts of neural plasticity and the storage of information and experience as ‘memory’ within the context of the brain’s anatomy.

3. 课程大纲

1.记忆的行为定义

2.神经元、突触和神经回路

3.记忆与大脑

4.记忆器官:海马体

5.Hebbian 理论，可塑性

6.突触可塑性的机制

7.记忆的分子生物学

8.预测错误记忆与基于记忆的算法

9.成年神经发生;干细胞与类器官

10.跨代记忆;阿尔茨海默病

1. Behavioral Definitions of Memory – Memory is a Multifaceted Phenomenon Studied in Humans and Animal Models. We begin by learning how memory is defined and measured.

2. Neurons, Synapses and Circuits – Nuts and Bolts of the Brain: Here’s what you need to know.

3. Memory and the Brain – Where Do We Find Memory in the Brain? A first look at brain structure and finding the ‘engram’.

4. Hippocampus, a Memory Organ – Spatial and Other Representations in the Hippocampus: Place Cells and Grid Cells – How we Find Memory Neurons

5. Hebbian Plasticity – Measuring Synaptic Change for Long-Term and Short-Term Memory – Hebb’s Molecule

6. Synaptic Mechanisms of Plasticity – Molecular Basis of Fast Local Changes in Synaptic Function

7. The Molecular Biology of Memory – Signaling Between Synapse and Nucleus – Memory and the Genome – Cell Biological Correlates of Memory

8. Prediction Error Memory and Memory-Based Algorithms – Brain Networks that Update Memory by Measuring the Difference Between Expectation and Reality. – Neural Networks for Reinforcement Learning

9. Special Topic Lectures: Adult Neurogenesis; Stem Cells and Organoids – New Neurons in Old Brains; Their roles in memory and psychiatric disorders – Making Brains in Dish

10. Special Topic Lectures: Trans-Generational Memory; Alzheimer's Disease – Memory Transfer Between Generations; The role of small RNA molecules – Possible Causes and Treatments for Alzheimer's Disease

课程二：《化学与生物学：药品研发、生产及药理分析》

Chemistry and Biology of Drug Discovery, Production, and Action

学科方向：生物化学

1. 教授介绍

Jason Sello

加州大学旧金山分校/布朗大学 终身教授

- 布朗大学化学系教授
- 加州大学旧金山分校药物化学终身教授
- 曾任布朗大学化学系录委会及奖学金办公室委员
- 2010 年《有机与生物分子化学》杂志评选十大最重要生化课题领导人
- 美国化学学会，美国微生物学会等学会会员
- 荣获美国国家科学基金会职业成就奖

Jason Sello 是加州大学旧金山分校 (UCSF) 药物化学系教授。他还是该系执行委员会成员。Sello 博士的研究重点是细菌蛋白质，尤其是与链霉菌和结核分枝杆菌等细菌的耐药性有关的蛋白质。他还对蛋白酶体抑制剂及其作为抗菌剂的潜力感兴趣。

Jason Sello 还担任布朗大学的化学教授。他的研究兴趣包括开发新的合成方法及其在天然产物全合成中的应用。塞洛博士在哈佛大学获得化学博士学位，并在麻省理工学院完成博士后研究。他的研究成果曾多次获奖，包括美国国家科学基金会（NSF）"CAREER 奖 "和 Eli Lilly"资助者奖"。

他的研究成果发表在各种科学杂志上，研究课题包括开发小分子来恢复药物对耐药性念珠菌分离株的活性，以及研究用于治疗利什曼病感染的热共聚纳米载体。Sello 教授还因其研究工作获得 2012 年的能源部早期职业研究奖。

Dr. Jason Sello is a Professor in the Department of Pharmaceutical Chemistry at the University of California, San Francisco (UCSF). He is also a member of the Executive Committee in the same department. Dr. Sello's research focuses on bacterial proteins, particularly those related to drug resistance in bacteria such as Streptomyces and Mycobacterium tuberculosis. He is also interested in proteasome inhibitors and their

potential as antibacterial agents.

Dr. Jason Sello is a professor of chemistry at Brown University. His research interests include the development of new synthetic methodologies and their application to the total synthesis of natural products. Dr. Sello received his Ph.D. in chemistry from Harvard University and completed postdoctoral research at the Massachusetts Institute of Technology. He has been recognized with several awards for his research, including the NSF CAREER Award and the Eli Lilly Grantee Award.

His research has been published in various scientific journals, with topics ranging from the development of small molecules to restore drug activity against resistant Candida isolates to the study of thermoresponsive copolymer nanovectors for the treatment of Leishmania infections. Dr. Sello has also received awards for his work, such as the DOE's Early Career Research Award in 2012.

2. 课程介绍

我们很多最重要的药物都是抗生素。抗生素的定义是一种微生物产生的小分子，杀死或损害另一种微生物的生长。这些分子很可能在自然界中被用于化学防御，但它们长期以来一直被用于生物研究、生物技术和医学。医学上最著名的抗生素之一是被称为青霉素的抗菌药物。本课程旨在突出化学与生物学之间的联系。本课程将涵盖化学和生物的广泛主题。本课程面向生物和/或化学科学背景的学生。具有化学背景的学生将学习生物学的基本概念;生物学知识扎实的学生将学习化学的基本概念。在本课程中，我们将以多种抗生素为例，讲解抗生素药物在生物化学、分子生物学、细胞生物学与遗传学的角度，探索各种药物的药理、合成生产等要素。

Many of our most important medicines are antibiotics. An antibiotic is defined as a small molecule produced by one microorganism that kills or inhibits the growth of another. In nature, these molecules are likely used for chemical defense, but they have long been essential tools in biological research, biotechnology, and medicine. One of the most famous antibiotics in medicine is penicillin.

This course aims to highlight the connection between chemistry and biology by covering a broad range of topics in both disciplines. It is designed for students with backgrounds in biological and/or chemical sciences. Students with a chemistry background will gain an understanding of fundamental biological concepts, while students with a strong biology background will learn essential chemical principles.

Throughout the course, various antibiotics will serve as examples to illustrate the biochemical, molecular, cellular, and genetic perspectives of drug action. Students will explore key aspects of pharmacology, synthesis, and production of these drugs, gaining a deeper appreciation for how chemistry and biology intersect in the development of modern medicine.

3. 课程大纲

1.抗生素和微生物基本概念

2.链霉素;结核病和结核分枝杆菌;灰葡萄球菌

3.氨基糖苷的结构和定义;链霉素的作用机制

4.红霉素;红细胞酵母菌;大环内酯和苷元

5.红霉素的作用机制;红霉素的抗药性机制

6.酪氨霉素;芽孢杆菌;酪氨酸酶;抗生素多肽

7.酪氨酸的特殊性;酪氨苷与苎麻素的合成

8.非核糖体多肽合成;酪脒的生物合成;功能域

9.生物化学和遗传学：抗生素的生产途径

10.基因工程生产已知抗生素及其衍生物

1. Intro to antibiotics and microorganism

Explanations for antibiosis

Exploitation of antibiotic production in nature

The structure and action of antibiotics Central Dogma of Molecular Biology

2. Discovery of streptomycin

Tuberculosis and the taxonomy, phylogeny, and morphology of Mycobacterium tuberculosis. Taxonomy, phylogeny, and morphology of Streptomyces griseus.

3. Structure and definition of aminoglycoside. Mechanism of action of streptomycin.

Chemistry of Protein Synthesis Ribosome Amino acid structure

4.Discovery of erythromycin

Taxonomy, phylogeny, and morphology of Saccharopolyspora erythrae Structure elucidation of erythromycin Definitions of macrolide and aglycone.

5. Mechanism of action of erythromycin. Mechanism of erythromycin resistance Semi-synthetic erythromycins

6. Discovery of Tyrothricin Taxonomy, phylogeny, and morphology of Bacillus brevis Gram Staining Chemical Properties of Tyrothricin Antibiotic polypeptides

7. Peculiarities of Tyrothricin Biosynthesis of Tyrocidine A Biosynthesis of Gramicidin A Peculiarities of Tyrothricin

8.Non-Ribosomal Peptide Synthesis Tyrocidine Biosynthesis Domain and Domain Functions

9.The strategies that biochemists and geneticists use to elucidate the metabolic pathways that yield antibiotics. The strategies that organic chemists use to chemically synthesize peptide antibiotics, lactams, polyketides, and aminoglycosides.

10.The use of genetic engineering to produce known antibiotics and derivatives thereof.

课程三：《生物学：基于干细胞研究的动物生长发育机理探究》

Molecular and cellular biology in development and diseases

学科方向：发育生物学 / 细胞生物学

1. 教授介绍

Aziz Aboobaker

牛津大学 生物学终身教授

- 牛津大学玛格丽特夫人学堂院长
- 牛津大学基因组监督委员会副主席
- 牛津大学 BBSRC DTP（跨学科生物科学博士培训项目）评审委员会
- 英国遗传学学会委员会成员及事务副主席
- 生物学 SCI 期刊《PloS Genetics》副主编
- 曾任牛津大学动物学院终身教授
- 曾获英国研究理事会（RCUK）奖学金

Aziz Aboobaker 教授在分子生物学和寄生虫学领域拥有超过二十年的学术研究经历。他博士毕业于爱丁堡大学细胞、动物与种群生物学研究所，其研究成果，尤其在线虫的 Hox 基因和真涡虫 RNAi 方面的突破性贡献引人瞩目。Aziz Aboobaker 教授曾在 2016–2019 年期间担任牛津大学玛格丽特夫人学堂院长与牛津大学动物学系终身教授，现任牛津大学生物学系的比较与功能基因组学终身教授。同时，他也是生物学领域著名的 SCI 期刊《PloS Genetics》的主编之一。Aziz Aboobaker 教授目前的研究主要关注动物再生以及推动该过程的干细胞以探究再生、干细胞与癌症和衰老这些现象之间的多种联系与可能。

Aziz Aboobaker, with over twenty years of research experience in molecular biology and parasitology, earned his Ph.D. from the University of Edinburgh. He has made significant contributions to areas such as nematode Hox genes and RNAi in planarians. Formerly a Warden at Lady Margaret Hall and a professor at the University of Oxford, he now holds a professorship in Comparative and Functional Genomics at Oxford's Department of Biology. Aboobaker also serves as an editor for "PloS Genetics" and focuses his current research on animal regeneration, exploring connections between regeneration, stem cells, cancer, and aging.

2. 课程介绍

这门课程的目标是深入探讨生物学的关键领域，致力于学生对分子生物学、遗传学、发育生物学以及生物医学研究的理解。首先，学生将全面了解分子生物学的基础知识和中心法则，揭示 DNA 到 RNA 到蛋白质的生物合成过程。其次，课程将深入探讨遗传学的基本原理，包括基因与遗传的关系，以及分子遗传学和基因组学的相关内容。发育生物学部分将介绍动物发育的分子和细胞基础，探索发育系统的多样性。

此外，课程将深入研究疾病的分子基础，重点关注遗传性疾病和癌症。最后，学生将接触到最新的功能基因组学方法，包括基于测序的研究和基因组操控方法，为学生提供在生物医学研究领域迈出重要一步的基础。通过学习这些内容，学生将具备解决生物学问题和应用

相关知识的能力，为未来从事生物医学研究或相关领域的职业发展奠定坚实基础。

The objective of this course is to delve into key areas of biology, aiming to enhance students' understanding of molecular biology, genetics, developmental biology, and biomedical research. Firstly, students will gain a comprehensive understanding of the fundamentals of molecular biology and the central dogma, unraveling the biological synthesis process from DNA to RNA to proteins. Secondly, the course will explore the fundamental principles of genetics, including the relationship between genes and inheritance, as well as molecular genetics and genomics. The section on developmental biology will introduce the molecular and cellular basis of animal development, exploring the diversity of developmental systems.

Additionally, the course will extensively examine the molecular basis of diseases, with a focus on genetic disorders and cancer. Finally, students will be introduced to state-of-the-art functional genomic approaches, including sequencing-based studies and genome manipulation techniques, providing them with a foundational step into the field of biomedical research. Through these studies, students will acquire the skills to address biological questions and apply relevant knowledge, laying a solid foundation for future careers in biomedical research or related fields.

3. 课程大纲

1.分子生物学基础及中心法则

2.遗传学基础:基因和遗传；基因组学基础

3.发育生物学 I：动物发育和多样性概述

4.发育生物学 II：发育系统的具体实例

5.疾病的分子基础：遗传性疾病和癌症

6.前沿功能基因组学方法：基因组功能

7.前沿功能基因组学方法：基因组表达

8.干细胞与潜能

9.动物再生

10.再生生物学：世界级研究实例

1.Fundamentals of Molecular biology and the Central Dogma, DNA to RNA to Protein

2.Fundamentals of Genetics- Genes and Inheritance; Molecular Genetics and Genomics

3.Developmental Biology- molecular and cellular basis I: an overview of animals development and diversity

4.Developmental biology - molecular and cellular basis II: specific examples of developmental systems

5.The molecular basis of disease: Genetic disorders and cancer

6.An introduction to state-of-the-art functional genomic approaches I: sequencing based approaches to studying genome function

7.An introduction to state-of-the-art functional genomic approaches II: genome and expression manipulation approaches to studying gene function.

8.Stem cells and potency

9.Animal Regeneration

10.Regenerative Biology: examples of world class research

课程四：《生物医学工程：医用材料与生物纳米技术》

Intro to Biomaterials and Bionanotechnology

学科方向：生物材料/有机化学

1. 教授介绍

Benjamin Almquist

帝国理工学院终身教授

- 帝国理工学院生物工程系终身教授
- 麻省理工学院科赫综合癌症研究所博士后
- 曾获 2017 年欧洲生物材料学会新兴研究者称号
- 数次获得帝国理工学院最佳教学提名
- 在生物医药领域拥有 3 项重要专利
- Advanced Materials 等 14 家期刊审稿人

Benjamin Almquist 教授在斯坦福大学获得了材料科学硕士和博士学位。教授在 2017 年欧洲生物材料学会新兴研究者称号；数次获得帝国理工学院最佳教学提名；此外还是 Advanced Materials 等 14 家专业期刊审稿人。

Professor Benjamin Almquist received his M.S. and Ph.D. in Materials Science from Stanford University. The professor was named Emerging Researcher at the European Society for Biomaterials in 2017; has been nominated for Best Teaching at Imperial College several times; and is additionally a reviewer for 14 professional journals, including Advanced Materials.

2. 课程介绍

本课程旨在介绍化学、材料科学与生命科学的交叉领域，重点探讨原子与分子层面的相互作用如何决定材料的性质，并进一步延伸至生物材料与生物纳米技术的应用。课程从原子结构、化学键与电子构型等基本化学概念入手，帮助学生理解分子间相互作用（如范德华力、氢键、偶极–偶极作用等）对材料性质的影响。

随后，课程将深入讨论材料的机械性能（包括应力、应变、弹性与塑性）以及生物材料的生化特性，并介绍用于药物递送系统的材料类型与生物相容性原理。通过案例分析，学生

将了解药物配方设计与控释系统的科学基础。

课程的后半部分将聚焦于仿生与纳米技术在医学中的创新应用，包括纳米颗粒、纳米传感器与愈伤纳米材料等前沿主题。通过学习，学生将理解纳米尺度下材料如何与生物体系相互作用，并探索其在药物递送、组织修复与生物检测中的潜在应用。

This course provides an interdisciplinary introduction to the interface of chemistry, materials science, and life sciences, focusing on how atomic and molecular interactions determine material properties and their applications in biomaterials and bio nanotechnology.

The course begins with the fundamentals of atomic structure, subatomic particles, chemical bonding, and electronic configuration, followed by an exploration of intermolecular forces —including van der Waals forces, hydrogen bonding, dipole - dipole interactions, and ionic - covalent character—and their influence on the mechanical and chemical properties of materials.

Students will then study the mechanical behavior of materials (stress, strain, elasticity, and plasticity) and the biochemical properties of biomaterials, emphasizing materials used in drug delivery systems, their biocompatibility, and their functional performance. Through applied examples, the course will cover drug formulation principles and controlled release mechanisms.

In the latter part of the course, attention will shift to biomimetic technologies and nanotechnology, including nanoparticles, nanoscale drug carriers, microsensors, and wound-healing nanomaterials. Students will gain insight into how nanoscale materials interact with biological systems and how such interactions drive innovation in therapeutics, diagnostics, and regenerative medicine.

3. 课程大纲

1.原子结构和化学键；亚原子粒子；原子模型

2.电子构型；化学键

3.材料中的分子间相互作用；范德华力；氢键

4.偶极-偶极相互作用；极性；离子共价特性

5.材料的机械特性：应力和应变；弹性和塑性

6.生物材料的生化特性

7.给药系统材料：生物材料类型；生物相容性

8.生物材料的应用；药物配方；控释系统

9.仿生技术：纳米颗粒；纳米技术与给药系统

10.生物纳米技术：微传感器；愈伤纳米材料

1. atomic structure and chemical bonding; subatomic particles; atomic models

2. Electronic configurations; chemical bonding

3. intermolecular interactions in materials; van der Waals forces; hydrogen bonding

4. dipole–dipole interactions; polarity; ionic covalent properties

5. mechanical properties of materials: stress and strain; elasticity and plasticity

6. biochemical properties of biological materials

7. materials for drug delivery systems: types of biomaterials; biocompatibility

8. Applications of biomaterials; drug formulation; controlled release systems

9. biomimetic technologies: nanoparticles; nanotechnology and drug delivery systems

10. Bio–nanotechnology: microsensors; healing nanomaterials

课程五：《生物医学：膳食营养与慢性疾病的预防》

Nutrition – Fundamentals and How Food Influences Health

学科方向：营养学

1. 教授介绍

Mary Flynn

布朗大学 医学终身教授

- 曾获得布朗大学教学优秀荣誉奖
- 罗德岛大学神经科学教授
- 知名营养学家及米里亚姆医院首席营养师
- 布朗大学临床医学终身教授
- 曾担任布朗大学营养科学委员会主席
- 代表著作《降低膳食脂肪对健康状况的影响》

Mary Flynn 教授是一位在营养学领域内成就卓著的专业人士，拥有广泛的教育背景和丰富的学术及临床经验。她于 1994 年获得罗德岛大学营养学博士学位。Flynn 教授自 2012 年至今在布朗大学担任医学副教授（临床）。此外，自 2017 年以来，她还担任罗德岛大学的兼职 Ryan 神经科学研究副教授。因其在教学和公共服务方面的卓越表现而受到表彰，曾获得 2005 年院长教学优秀奖、2007 年美国银行地方英雄奖（因在食品储藏室的志愿工作），以及 2010 年罗德岛营养师协会的 24 克拉公共服务奖。

Prof. Mary Flynn is a highly accomplished professional in the field of nutrition with an extensive educational background and a wealth of experience in both academic and clinical settings. She holds a PhD in Nutrition from the University of Rhode Island in 1994. She is the Associate Professor of Medicine (Clinical) in Brown University since 2012.

Additionally, she has been an Adjunct Ryan Associate Research Professor of Neuroscience at the University of Rhode Island since 2017. Prof.

Flynn has been recognized for her excellence in teaching and public service, receiving the Dean’s Teaching Excellence Award (2005), the Bank of America Local Hero Award for Volunteer Work at Food Pantries (2007), and the Rhode Island Dietetic Association’s 24 Carat Award for public service (2010).

2. 课程介绍

本课程系统介绍营养科学的基本原理，探讨食物中的营养成分如何影响人体健康、代谢与疾病风险。课程从营养学研究的概述入手，引导学生理解碳水化合物、脂质与蛋白质等三大能量营养素在人体中的功能及其与常见疾病（如糖尿病、冠心病、肥胖）之间的关系。在学习能量平衡与体重管理的过程中，学生将分析饮食模式与慢性疾病风险因素的关联。课程还将深入讲解微量营养素（维生素与矿物质）在维持生理功能与预防疾病中的关键作用，以及营养补充剂的科学原理与实际效果。

课程后半部分聚焦于细胞层面的营养吸收与代谢机制，帮助学生从分子与细胞生物学的角度理解营养物质如何被消化、吸收、转运与转化为能量。通过理论讲授与案例分析相结合的方式，学生将建立对饮食与健康关系的科学认知，为进一步学习生物医学、公共健康或食品科学奠定基础。

This course provides a comprehensive introduction to the fundamentals of nutrition and examines how food influences human health, metabolism, and disease risk. Beginning with an overview of nutrition science and research, the course explores the functions of the three major macronutrients—carbohydrates, lipids, and proteins—and their connections to common health conditions such as diabetes, coronary heart disease, and obesity.

Students will analyze energy balance, diet, and weight management, as well as the role of nutrition in the development and prevention of chronic diseases. The course also covers micronutrients, including essential vitamins and minerals, highlighting their importance in maintaining physiological functions and preventing deficiencies. The topic of nutritional supplements will be discussed critically in relation to their efficacy and biological impact.

In the final part of the course, students will explore nutrient absorption and metabolism at the cellular level, gaining insight into how nutrients are digested, transported, and converted into energy within the body.

By integrating biochemical theory with real-world examples, this course equips students with a solid scientific understanding of how diet shapes health—laying the groundwork for further study in biomedical science, public health, or food and nutritional sciences.

3. 课程大纲

1.营养和营养研究概述

2.碳水化合物；糖尿病和碳水化合物

3.脂质；脂蛋白、脂质和冠心病

4.蛋白质；低蛋白和高蛋白膳食摄入的影响

5.能量管理；饮食与体重；肥胖的健康影响

6.饮食与慢性疾病；风险因素

7.微量营养素；必需维生素和矿物质

8.营养补充剂及其作用

9.细胞水平的营养吸收和代谢 I

10.细胞水平的营养吸收和代谢 II

1. Introduction to nutrition topics and terminology. An overview of nutrition and nutrition research.

2. Carbohydrate

–Defined, types, food sources, function in the human body. Introduction to diabetes and the role of carbohydrate.

3. Lipids

–Defined, food sources, function in human body. Lipoproteins, role of lipids in coronary heart disease.

4. Protein

–Defined, food sources, function in bod, effect of low and high dietary protein intake.

5. Micronutrients

–Essential Vitamins and Minerals–Exploration of essential vitamins and minerals required for proper bodily functions. Food Sources, functions, and deficiencies of key micronutrients in the human diet. Toxicities.

6. Energy management

–The role of diet/ food in body weight. Health consequences of overweight/ obesity.

7. Diet and chronic disease development and treatment

–What foods to eat to decrease the risk of and to treat coronary heart disease, type 2 diabetes, and to maintain a healthy body weight. Examine risk factors.

8. Nutrition and Physical Activity

–Overview of the relationship between nutrition and physical activity in maintaining overall health and well–being.

–Exploration of nutrient needs for individuals engaged in different levels of physical activity.

–Role of nutrition in optimizing exercise performance and recovery.

9. Nutrient Absorption and Metabolism at the Cellular Level-I

-Understanding the process of nutrient absorption and metabolism in the human body.

-Exploring the role of cellular biology and biochemistry in nutrient utilization.

10. Nutrient Absorption and Metabolism at the Cellular Level-II

-Investigating how different nutrients are broken down, stored, and utilized by cells.

课程六：《免疫学：疫苗、免疫系统与抗肿瘤药物研究》

Molecular & Cellular Immunology

学科方向：免疫学/分子生物学

1. 教授介绍

Alexander Ploss

普林斯顿大学 分子生物终身教授

- 拥有个人命名实验室 Ploss Lab
- 曾获普林斯顿大学知识产权突出贡献奖
- 美国科学促进会（AAAS），美国传染病协会（IDSA）等权威协会专家成员
- Virus 等著名期刊副主编及编委会成员
- 博士学位师从 2020 诺奖得主 Charles M. Rice

Alexander Ploss 目前为普林斯顿大学分子生物系终身教授，拥有个人命名实验室 Ploss Lab。Ploss 教授在德国图宾根大学（University of Tübingen）获得了生物化学学士和硕士学位，并在西雅图华盛顿大学霍华德-休斯医学研究所（Howard Hughes Medical Institute）和德国海德堡德国癌症研究中心（German Cancer Research Center）接受了培训，在康奈尔大学获得免疫学博士学位。他的研究重点是人类传染病的免疫反应和发病机制，包括肝炎病毒、相关黄病毒和疟疾。他的研究小组将组织工程学、分子病毒学/发病机理和动物构造相结合，创造并应用创新技术，包括人源化小鼠模型，用于研究和干预人类肝病感染。

Ploss 教授获得了金伯利-劳伦斯癌症研究发现基金奖（Kimberly Lawrence Cancer Research Discovery Fund Award）、美国传染病学会颁发的阿斯特拉青年研究员奖（Astella's Young Investigator Award）、美国肝脏基金会颁发的肝脏学者奖（Liver Scholar Award）、美国微生物学会颁发的默克-欧文-西格尔纪念奖（Merck Irving Sigal Memorial Award）、德国病毒学学会洛夫勒-弗洛什奖、西奥博尔德-史密斯学会青年研究员奖、美国癌症学会研究学者奖以及伯勒斯威康基金会发病机制研究员奖。另外，Ploss 教授是新泽西州癌症研究所基因组不稳定性和肿瘤进展项目的成员

Alexander Ploss is currently a tenured professor in the Department of Molecular Biology at Princeton University, where he leads the Ploss Lab. He completed his Bachelor's and Master's degree in biochemistry at the University of Tübingen, Germany including additional training the Howard Hughes Medical Institute at the University of Washington,

Seattle, and at the German Cancer Research Center in Heidelberg, Germany. Dr. Ploss completed his Ph.D. in Immunology at Memorial Sloan-Kettering Cancer Center/Cornell University and postdoctoral training at the Rockefeller University. Prior to joining the Department of Molecular Biology at Princeton University in 2013 he was a research associate professor at the Center for the Study of Hepatitis C at the Rockefeller University. His research focuses on immune responses and pathogenesis to human infectious diseases, including hepatitis viruses, related flaviviruses, and malaria. His group combines tissue engineering, molecular virology/pathogenesis, and animal construction, to create and apply innovative technologies including humanized mouse models for the study and intervention of human hepatotropic infections.

In recognition of his work he received the Kimberly Lawrence Cancer Research Discovery Fund Award, an Astella's Young Investigator Award from the Infectious Disease Society of America, a Liver Scholar Award from the American Liver Foundation, the Merck Irving Sigal Memorial Award from the American Society of Microbiology, the Löffler-Frosch Prize from the German Society of Virology, the Young Investigator Award from the Theobald Smith Society, the Research Scholar Award from the American Cancer Society, and an Investigator in Pathogenesis Award from the Burroughs Wellcome Fund. Professor Ploss is a member of the Genomic Instability and Tumor Progression Program at the Cancer Institute of NJ

2. 课程介绍

在医学领域，免疫学作为一个关键的领域，致力于研究人体免疫系统的功能、调节机制以及免疫应答对于疾病的影响。随着科学技术的发展，免疫学逐渐融合于许多医学领域，特别是在疫苗研发、免疫治疗和抗肿瘤药物方面取得了显著进展。

这门课程涉及了哺乳动物免疫系统的基本方面，包括其组成和功能。涵盖的主题包括先天免疫系统和获得性免疫系统的基本免疫系统特征，免疫系统的多样性，抗原呈递，T 细胞、B 细胞以及免疫效应功能，并在课程结束时对健康与疾病中的免疫功能和失调进行了概述。学生应积极参与课堂，并提出基于免疫学的临床案例研究，随后讨论案例及其中涉及的一般概念。

In the field of medicine, immunology plays a pivotal role in studying the functionality, regulatory mechanisms, and immunological responses of the human immune system in relation to diseases. With the advancement of scientific technologies, immunology has integrated into various medical disciplines, particularly making significant strides in vaccine development, immunotherapy, and anti-tumor drugs.

This course deals with the basic aspects of the mammalian immune system in terms of components and their function. Topics covered included basic immune system features of both the innate and acquired immune system, immune system diversification, antigen presentation, T cell, B cell and immune effector function and concluded with an overview of immune function and dysfunction in health and disease. Students are expected to actively participate in class and to present an immunology-based clinical case studies, followed by discussion of both the case and the general concepts covered in the case.

3. 课程大纲

1.免疫学导论；先天免疫：第一道防线

2.先天免疫及其诱导反应：补体系统

3.B/T 细胞受体的抗原识别；抗原受体

4.T 淋巴细胞的抗原呈递

5.MHC 及其功能,免疫系统受体信号传递

6.B/T 细胞的发育

7.胸腺选择；淋巴细胞归巢和启动

8.T 细胞效应功能；B 细胞活化

9.Ig 的分布和功能；Fc 受体；免疫记忆

10.适应性免疫的动态；癌症免疫

1. Intro into immunology; Innate immunity: first lines of defense

2. Innate immunity: the complement system; Induced responses of innate immunity: Pattern recognition by cells of the innate IS; Induced innate responses to infection

3. Antigen recognition by B cell and T cell receptors; The generation of lymphocyte antigen receptors: Ig and TCR gene rearrangement

4. The generation of lymphocyte antigen receptors: Ab subclasses & diversification of the antibody repertoire; Antigen presentation to T lymphocytes

5. MHC and its function; Signaling through immune system receptors – part I

6. Signaling through immune system receptors – part II; B&T cell development

7. Thymic selection; survival and maturation of lymphocytes in the periphery; Lymphocyte homing and priming

8. T cell effector functions; B cell activation

9. The distribution and functions of Ig classes; Fc receptors; Immunological Memory

10. Dynamics of adaptive immunity; Immunity to cancer

课程七:《医学与公共卫生：行星健康视角下的环境变迁与人类健康研究》

Planetary Health

学科方向：医学/公共卫生

1. **教授介绍**

Katherine F. Smith

布朗大学 医学科学教授

- 布朗大学医学科学教授
- 生物教育高级副院长
- 生物与医学学院领导委员会成员
- 拥有传染病生态学与生物地理学背景，负责本科、硕士及博士教育的统筹管理

Katherine F. Smith 是医学科学副教授，也是生物学教育高级副院长。她是生物与医学学院院长领导委员会成员，也是该学院本科、硕士和博士教育的行政负责人。史密斯院长在传染病生态学和生物地理学方面接受过培训，于 2008 年加入该大学。她的学术研究重点是地球健康和 STEMM 教育。她的研究成果发表在《科学》、《生态学快报》、《一个健康》和《保护生物学》等同行评审期刊上。

史密斯院长为本科生和医学生讲授地球健康课程，并担任沃伦·阿尔珀特医学院地球健康课程整合委员会的联合主席。她获得了生物科学学院院长颁发的本科教学、指导和辅导卓越奖。她拥有新墨西哥大学的生物学学士学位，以及加州大学圣巴巴拉分校生态学、进化与海洋生物学系的博士学位。

Kate Smith PhD is Associate Professor of Medical Science and Senior Associate Dean of Biology Education. She is a member of the Division of Biology and Medicine Dean's leadership council and administrative leader of undergraduate, master's and doctoral education in the Division. With training in infectious disease ecology and biogeography, Dean Smith joined the University in 2008. Her scholarship focuses on planetary health and STEMM education. Her work has been published in peer-reviewed journals such as Science, Ecology Letters, One Health and Conservation Biology.

Dean Smith teaches courses on planetary health to undergraduate and medical students and co-chairs the Planetary Health Curriculum Integration Committee at The Warren Alpert Medical School. She is recipient of the Dean's Award for Excellence in Undergraduate Teaching, Advising and Mentoring in the Biological Sciences. She earned her BS in biology from The University of New Mexico and a PhD from the Department of Ecology, Evolution and Marine Biology from The University of California Santa Barbara.

2. 课程介绍

一个更温暖的世界会是一个更病态的世界吗？生物多样性对我们的健康有益吗？我们如何养活不断增长的人口？我们如何将城市转变为健康和可持续发展的城市？这些问题构成了本次课程的基础。行星健康是一个新的跨学科领域，研究人类活动对地球自然系统造成的干扰对人类健康的影响。本课程通过 10 次课程向学生介绍行星健康的历史、概念和应用，其中融合了行星健康联盟案例集锦中的案例研究，以及《行星健康：人类世中保护人类健康和环境》中的课程内容。

学生们将探讨气候变化、生物多样性丧失、食品系统、传染病、非传染病、污染、能源转型以及通向更健康、更可持续未来的途径等关键主题。案例研究将通过全球各地的实际案例来阐释理论概念。到课程结束时，学生们将能够批判性地评估环境变化对人类健康的影响，并阐述在 21 世纪保护福祉的方法。

Will a warmer world be a sicker world? Is biodiversity good for our health? How will we feed a growing population? How do we transform cities for health and sustainability? These and related questions form the foundation of Introduction to Planetary Health. Planetary health is a new interdisciplinary field that examines the human health implications of human-caused disruptions to Earth's natural systems.

This course introduces students to the history, concepts, and applications of planetary health through 10 lectures that incorporate case studies from the Planetary Health Alliance Case Study Anthology, and lessons from Planetary Health: Safeguarding Human Health and the Environment in the Anthropocene. Students will explore key themes such as climate change, biodiversity loss, food systems, infectious disease, noncommunicable diseases, pollution, energy transitions, and pathways toward healthier, more sustainable futures. Case studies will ground theoretical concepts in real-world examples from around the globe. By the end of the course, students will be able to critically assess how environmental change impacts human health and articulate approaches for safeguarding wellbeing in the 21st century.

3. 课程大纲

1.气候变化与人类健康

2.气候变化与人类健康

3.土地利用变化与人类健康

4.入侵物种与人类健康

5.环境毒素与人类健康

6.传染病与人类健康

7.快速变化星球上的粮食与营养

8.能源系统与行星健康

9. 海洋健康

10. 健康星球上的心理健康与幸福感

1. An Introduction to Planetary Health

2. Climate Change and Human Health

3. Land-Use Change and Human Health

4. Invasive Species and Human Health

5. Environmental Toxins and Human Health

6. Infectious Disease and Planetary Health

7. Food and Nutrition on a Rapidly Changing Planet

8. Energy and Planetary Health

9. Ocean Health

10.Mental Health and Happiness on a Healthier Plane

课程八：《物理学：从广义相对论探索宇宙起源》

An introduction to Exoplanets and Cosmology

学科方向：天体物理

1. 教授介绍

Enrico Pajer

剑桥大学 教授

- 剑桥大学应用数学和理论物理系教授
- 剑桥大学卡弗里宇宙学研究所研究员
- 康奈尔大学高能物理专业博士后
- 曾任乌得勒支大学理论物理系教授、高级研究员
- 曾任普林斯顿大学研究员
- 曾获荷兰研究委员会 (NWO) 授予的最佳科研奖 (Vidi grant)

Enrico Pajer 教授任职于剑桥大学应用数学和理论物理系、剑桥大学广义相对论研究中心，主要从事宇宙学、量子场论、弦理论和广义相对论等领域的研究，包括通货膨胀、大尺度结构、宇宙微波背景等。在此之前，他曾是康奈尔大学高能物理专业博士后、普林斯顿大学研究员、乌得勒支大学理论物理系教授及高级研究员。他的研究成果在理论物理领域具有重要意义，被广泛发表在学术期刊上，并在国际学术界产生了广泛影响。

Enrico Pajer is a professor of the theoretical physicist at the Department of Applied Mathematics and Theoretical Physics and part of the General Relativity research group at the University of Cambridge. He primarily engages in research in fields such as cosmology, quantum field theory, string theory, and general relativity, covering topics like inflation, large scale structures, and the cosmic microwave background. Previously, he served as a postdoctoral fellow in high-energy physics at Cornell University, a research associate at Princeton University, and a professor and senior researcher at Utrecht University's Department of Theoretical Physics.

2. 课程介绍

该课程从弗里德曼-勒梅特-罗伯逊-沃克的膨胀宇宙学模型开始，简单介绍宇宙历史上的主要时代和重要发现、重点回顾大爆炸模型及其粒子内容、探讨当前宇宙的主要组成部分，包括可见（重子）物质、暗物质和暗能量。学生们将通过该课程更好地理解宇宙膨胀、加速度原理以及红移现象等，进而能够预测宇宙未来的演变趋势和命运。

The course begins with the Friedman-Lemait-Robertson-Walker inflationary cosmology model, a brief introduction to the major epochs and discoveries in the history of the

universe, a review of the Big Bang model and its particle content, and a discussion of the main components of the current universe, including visible (baryonic) matter, dark matter, and dark energy. Students will be able to better understand the expansion, acceleration and redshift of the universe, so that they can predict the future evolution and fate of the universe.

3. 课程大纲

1. 太阳系与系外行星理论
2. 系外行星探测方法
3. 宇宙膨胀与行星诞生 ；行星探测历史
4. 宇宙组成；宇宙学红移；弗里德曼方程
5. 流体与状态方程；单组分与多组分宇宙
6. 暗物质模型；宇宙学距离
7. 暗物质、暗能量、加速膨胀
8. 星系团、旋转曲线、引力透镜
9. 宇宙微波背景；热历史
10. 事件视界与曲率；暴胀；原始扰动

1. Theory of the Solar System and Exoplanets
2. Methods for Exoplanet Detection
3. Cosmic Expansion and Planet Formation; History of Planet Detection
4. Composition of the Universe; Cosmological Redshift; Friedmann Equations
5. Fluids and Equations of State; Single-component and Multi-component Universes
6. Dark Matter Models; Cosmological Distances
7. Dark Matter, Dark Energy, and Accelerated Expansion
8. Galaxy Clusters, Rotation Curves, Gravitational Lensing
9. Cosmic Microwave Background; Thermal History
10. Event Horizons and Curvature; Inflation; Primordial Perturbations

课程九：《数学：抽象代数中的微积分与组合数学》

From Combinatorics to Calculus

学科方向：离散数学/代数

1. 教授介绍

Dan Ciubotaru

牛津大学 数学终身教授

- 牛津大学萨默维尔学院招生官
- 牛津大学萨默维尔学院数学导师
- 曾在 MIT、香港科技大学等高校任教
- 曾担任魏茨曼科学研究所访问学者
- 多项研究受英国工程和美国国家科学基金会资助
- 美国数学学会（AMS）及伦敦数学学会（LMS）成员

Dan Ciubotaru 教授于 2014 年在学术氛围而闻名于世的康奈尔大学数学系完成了自己的博士学位的学习，之后开始了长达数十年的研究和教学工作。Dan Ciubotaru 教授同时拥有中英美顶尖院校的教学经验。目前教授担任牛津大学数学系终身教授，同时担任牛津大学萨默维尔学院数学导师，负责考前辅导和纯数学理论辅导。自 2014 年以来，教授一直负责牛津大学萨默维尔学院招生官工作。

Dan Ciubotaru 教授的研究领域是表示论 representation theory，这是一个研究对称性的数额学领域，同时教授还对局部朗兰兹对应关系框架下的还原李群和赫克代数的单元感兴趣。教授的研究最近得到了英国工程与物理学研究中心（EPSRC）"新视野的资助。

Prof. Dan Ciubotaru completed his studies at Cornell University's Mathematics Department in 2014, earning his doctoral degree. Following this, he embarked on decades-long research and teaching endeavors. Professor Ciubotaru possesses teaching experience from leading institutions in China, the UK, and the USA. Currently, he holds the position of tenured professor in the Mathematics Department at the University of Oxford, while also serving as a mathematics tutor at Somerville College, Oxford University, responsible for pre-examination coaching and tutoring in mathematics. Since 2014, Professor Ciubotaru has been in charge of the admissions work at Somerville College, Oxford University.

His research area is in representation theory, an area of mathematics concerned with the study of symmetries, and also particularly interested in unitary representations of reductive Lie groups and Hecke algebras in the framework of the local Langlands correspondence. Prof. Ciubotaru’s research has been recently supported by the EPSRC grants “New Horizons”.

2. 课程介绍

通过本课程，学生将全面掌握组合数学、微积分和概率论的核心概念，并能灵活运用于商业和科学领域。课程旨在培养学生的数学建模和问题解决能力，使其能够利用幂和、排列、概率分布等工具分析实际业务和科学挑战。

This course aims to provide students with a comprehensive understanding of core concepts

in combinatorics, calculus, and probability theory, and to equip them with the ability to apply these concepts flexibly in business and scientific contexts. The course is designed to cultivate students' skills in mathematical modeling and problem-solving, enabling them to analyze real-world business and scientific challenges using tools such as power sums, permutations, and probability distributions.

3. 课程大纲

1. 组合数学

2. 无穷级数与生成函数

3. Zeta 函数与伯努利多项式

4. 微积分

5. 概率积分、Gamma(1/2)、双重积分

6. 伽玛函数：功能方程、贝塔函数、椭圆积分及应用

7. 离散概率、条件概率、组合应用

8. 微积分与概率的高级主题

9. 微积分概念在伽玛函数中的扩展

10.组合数学在机器学习中的应用

1. Combinatorics: power sums, permutations, Bernoulli polynomials, combinations, the Binomial Theorem

2. Infinite series, generating functions

3. Zeta functions and Bernoulli polynomials

4. Calculus: the Gamma function $\Gamma(s)$ (integral definition, basic properties)

5. The probability integral, $\Gamma(1/2)$, Double Integrals

6. More advanced properties of Γ, Functional equation, Beta function, elliptic integrals and applications

7. Discrete probability, conditional probability, combinatorial applications

8. Advanced Topics in Calculus and Probability

Extension of calculus concepts related to the Gamma function.

Probabilistic interpretations of the Gamma function, Central Limit Theorem.

Applications in Statistics and stochastic processes.

9. The role of symmetries

Groups: geometric symmetries, permutations

10. Applications of Combinatorics in Machine Learning; Introduction to combinatorial concepts in machine learning. Combinatorial aspects of algorithm design; Real-world case studies showcasing the interdisciplinary nature of the material; Overview of the course journey from combinatorics to calculus.

课程十：《应用数学：数值分析与算法优化设计》

Numerical Analysis

学科方向：数值分析

1. 教授介绍

Ming Gu

加州大学伯克利分校 终身教授

- 加州大学伯克利分校数学系终身教授
- 耶鲁大学计算机科学博士
- 研究方向：应用数学，数值线性代数，科学计算
- 2017 机器学习国际大会论文发表
- 2017 年 Hipc 最佳论文奖

Ming Gu 教授现任加州大学伯克利分校数学系教授。他于 1993 年在享有盛誉的耶鲁大学计算机科学系获得博士学位，并于 2000 年加入伯克利分校任教，拥有长达数十年的研究与教学经验。教授的研究专注于快速算法，其应用领域涵盖数值线性代数、数据分析、优化及机器学习（包括深度学习）。他的研究成果曾荣获多项国际奖项肯定，其中包括 2017 年国际高性能计算大会的最佳论文奖。

2. 课程介绍

数值分析是研究分析用计算机求解数学计算问题的数值计算方法及其理论的学科，涉及领域广泛，其中包含的最优化问题通常可以表示为数学规划形式的问题。线性规划是运筹学中研究较早、发展较快、应用广泛、方法较成熟的一个重要分支，是辅助人们进行科学管理的一种数学方法，是研究线性约束条件下线性目标函数的极值问题的数学理论和方法。线性规划广泛应用于军事作战、经济分析、经营管理和工程技术等方面，为合理地利用有限的人力、物力、财力等资源作出最优决策，提供科学的依据。

Numerical analysis is a discipline that studies numerical computation methods and their theories for solving mathematical problems using computers. It encompasses a wide range of fields, with many optimization problems often being formulable as mathematical programming problems. Linear programming is an important subfield in operations research that has been studied early, developed rapidly, widely applied, and has matured methods.

It is a mathematical theory and method for addressing optimization problems involving linear objective functions subject to linear constraints. Linear programming finds extensive applications in areas such as military operations, economic analysis, business management, and engineering technology. It provides a scientific basis for making optimal decisions in utilizing limited resources such as manpower, materials, and finances rationally.

3. 课程大纲

1.课程导论与简介

2.线性规划及其应用

3.线性规划及其对偶；单纯形法

4.最优性和对偶性

5.饮食规划应用

6.多目标线性规划

7.城市交通应用

8.零和博弈

9.非零和两人博弈

10.总结和结论

1. Introduction

2. Introduction: Linear Programs and applications

3. Linear Programs and their duals; the simplex method

4. Optimality and duality

5. Applications: Diet problems

6. Applications: Multi-Objective Linear Programming

7. Applications: Transportation problems

8. Zero-sum Two-person games

9. Non Zero-sum Two-person games

10. Summary and conclusions

课程十一：《应用数学与机器学习：工程实践与社会科学中的数值计算与统计分析模型》

Numerical Models, AI and Machine Learning, and their Applications

学科方向：数值分析/算法理论

1. 教授介绍

Anastasia Romanou

哥伦比亚大学教授

- 哥伦比亚大学应用物理与应用数学系教授
- NASA 戈达德太空研究所研究员
- 曾任美国大西洋 AMOC 研究组成员
- 美国地球物理学会 NASA 会议重要嘉宾
- 参与撰写空间地球科学与应用的年代际调查

Anastasia Romanou 教授是哥伦比亚大学应用数学与应用物理系教授。她在 1999 年获得佛罗里达州立大学物理海洋学博士学位。同时她也是美国国家航空航天局（NASA）戈达德太空研究所（GISS）的研究学者。GISS 是 NASA 的地球太阳探险分支的部门实验所，是哥伦比亚大学地球机构的一个单位。教授目前的研究内容包括全球碳循环与气候、海洋大尺度环流、气候变率。教授参与了关于地球科学与空间应用的十年调查，提供了海洋生物学和生物地球化学社区对国家研究委员会为下一个环境监测和地球科学及应用的十年调查发布的 RFI 的初步投入。NASA 及其合作伙伴要求国家研究委员会(NRC)每十年一次展望未来 10 年或更长时间，并优先考虑研究领域、观测和进行这些观测的名义任务。

NASA Goddard Institute for Space Studies. She earned a Ph.D. in Physical Oceanography, Florida State University in 1999. Her research interests are in Global carbon cycle and climate, large-scale circulation of the oceans, and climate variability. She also participated in the Decadal Survey for Earth Science and Applications from Space to research the Ocean Biology and Biogeochemistry community's initial input to the RFI issued by the National Research Council towards the next Decadal Survey for environmental monitoring and Earth science and applications. NASA and its partners ask the NRC once each decade to look out 10 or more years into the future and prioritize research areas, observations, and notional missions to make those observations.

2. 课程介绍

本课程提供了可以在计算机上使用 Python/Matlab 解决的数值建模和机器学习的例子。具体来说，教学主题包括介绍数值模型的本质和它们与分析模型的区别，数值方法和模型的历史，关键概念如离散化，插值和曲线拟合，数值微分和积分以及基本稳定性分析。我们简要介绍了人工智能模型，特别是机器学习，神经网络，聚类和决策树。

This course provides examples in Numerical Modeling and Machine Learning that can be solved using Python/Matlab on a computer. Specifically, instruction topics include an introduction into the nature of numerical models and their difference from analytical models, the history of numerical methods and modeling, key concepts such as discretization, interpolation and curve fitting, numerical differentiation and integration and basic

stability analysis. We offer a brief introduction in Artificial Intelligence models and in particular Machine Learning, neural networks, clustering and decision trees.

3. 课程大纲

1 概述与定义

2 线性方程与矩阵代数

3 数值优化

4 数值分析基础概念（一）

5 数值分析基础概念（二）

6 机器学习与人工智能

7 人工智能高级主题

8 数值建模中的统计方法

9 时间序列分析与预测

10 数值方法的应用：社会科学与工程科学

1 Overview and Definitions:

2 Linear Equations and Matrix Algebra:

3 Numerical Optimization:

4 Basic concepts of Numerical Analysis Part 1

5 Basic concepts of Numerical Analysis Part 2

6 Machine Learning and Artificial Intelligence

7 Advanced Topics in AI

8 Statistical Methods in Numerical Modeling

9 Time Series Analysis and Forecasting

10 Applications of Numerical Methods: Astronomy and astrophysics

课程十二：《化学：有机物的结构、反应与合成》

Introduction to Organic Chemistry Structure, Reactivity and Synthesis

学科方向：有机化学/化学合成

1. 教授介绍

Brian Stoltz

加州理工学院 化学终身教授

- Stoltz 实验室负责人
- 论文引用次数：29093; h 指数：87; i10 指数：276
- 美国化学学会会员
- 曾获得 2018 美国化学会合成有机化学创造性工作奖
- 曾获国家科学基金会科学家和工程师总统早期职业奖
- Tetrahedron 和 Beilstein Journal of Organic Chemistry 杂志主要编委

Brian Stoltz 教授于耶鲁大学（Yale University）获得有机化学博士学位，现任职加州理工学院化学系的终身教授，以其在有机合成化学领域的深厚造诣享誉学界。Stoltz 实验室，以其名命名的研究基地，聚焦于开发创新策略，致力于合成具有独特结构与生物物理性质的复杂分子。Stoltz 教授团队不断突破合成科学的界限，致力于高效合成生物活性化合物及开拓新材料合成技术，其研究方法广泛影响着能源、纳米科技等多个前沿领域。

做为美国化学学会会员，Stoltz 教授曾荣获 2018 年美国化学会的合成有机化学创造性工作奖，并持有国家科学基金会科学家和工程师总统早期职业奖。他同时担任《Tetrahedron》与《Beilstein Journal of Organic Chemistry》的编委，持续推动有机化学的前沿发展。

Professor Brian Stoltz obtained a Ph.D. in Organic Chemistry from Yale University. Now he is a tenured Professor at the California Institute of Technology (Caltech), serving as a Professor in the Department of Chemistry. Professor Stoltz stands out for his profound contributions to organic synthesis. Heading the Stoltz Laboratory, named in his honor, his team focuses on devising innovative strategies for synthesizing complex molecules with unique structures and biological–physical properties. Pushing the frontiers of synthetic science, Professor Stoltz’s research yields novel biologically active compounds and new methodologies for material synthesis, significantly impacting fields like energy and nanotechnology.

An esteemed member of the American Chemical Society, he garnered the ACS 2018 Award for Creative Work in Synthetic Organic Chemistry and the NSF's Presidential Early Career Award for Scientists and Engineers. Also serving as an editorial board member for Tetrahedron and Beilstein Journal of Organic Chemistry, Stoltz perpetuates the advancement of the discipline.

2. 课程介绍

有机化学作为化学领域的一个重要分支，关注于研究碳基化合物的结构、性质、反应和合成方法。有机分子的多样性和复杂性使得这个领域充满了挑战与机遇。有机化学不仅在生命科学、药物研发和材料科学等领域具有重要地位，还是现代合成化学的基础，推动了许多技术和创新的发展。有机化学的研究不仅深化了我们对自然界中分子结构和反应机理的理解，还为解决全球性问题如可再生能源、环境污染等提供了有力支持。

Organic chemistry, as a significant branch of chemistry, focuses on the study of the

structure, properties, reactions, and synthesis methods of carbon-based compounds. The diversity and complexity of organic molecules make this field both challenging and full of opportunities. Organic chemistry holds a crucial position not only in fields like life sciences, pharmaceutical research, and materials science but also serves as the foundation of modern synthetic chemistry, driving the development of various technologies and innovations. Research in organic chemistry not only deepens our understanding of molecular structures and reaction mechanisms in the natural world but also provides strong support for addressing global issues such as renewable energy and environmental pollution.

3. 课程大纲

1. 有机结构简介
2. 官能团、成键、立体化学导论
3. 酸度、氧化程度与反应机理
4. 一般反应性 烯烃 I
5. 烯烃 II
6. 羰基化合物 I
7. 羰基化合物 II
8. 立体化学分析
9. 逆合成分析基础
10. 复杂多环分子合成过程

1. Introduction to organic structure
2. Functional groups. Bonding. Stereochemistry.
3. Acidity. Oxidation levels. Mechanism.
4. General reactivity. Olefins I
5. Olefins II
6. Carbonyls I
7. Carbonyls II
8. Stereochemical Analysis
9. Basics of Retrosynthetic Analysis
10. Complex polycyclic molecule synthesis process

课程十三：《地理信息：基于GIS数据的地球气候变暖模型与环境变迁》

Observing Earth's Environment from Space

学科方向：地理信息/空间数据科学

1. 教授介绍

George Tselioudis

哥伦比亚大学 教授

- 哥伦比亚大学应用物理与应用数学系教授
- NASA 戈达德太空研究所物理科学研究员
- GEWEX 中纬度层状云云系统研究工作组主席
- WGCM 云反馈模型对比项目协调员
- 曾获美国地球物理学会 Charles Falkenberg 奖
- Nature、Journal of Geophysical Research-Atmospheres、Journal of Climate 等知名期刊审稿人

George Tselioudis 教授是哥伦比亚大学应用数学与应用物理系教授。他在 1999 年获得哥伦比亚大学大气科学博士学位。同时他也是美国国家航空航天局（NASA）戈达德太空研究所（GISS）的研究学者。Tselioudis 博士领导了一个研究团队，分析观测结果和模型模拟，以调查云、辐射和降水随气候的变化以及由此产生的辐射反馈。Tselioudis 博士于 2004 年获得美国地球物理学会（AGU）查尔斯·法尔肯伯格奖。AGU 作为美国国家科学院全国研究理事会下属的分支机构，出版的学术期刊共有 19 种，包括著名的《地球物理学研究杂志》（Journal of Geophysical Research）系列。在地球科学（Geosciences, Multidisciplinary）影响因子排名前 10 位的刊物中，美国地球物理学会的学术期刊占有两席。

George Tselioudis is an Adjunct Professor of Applied Physics and Applied Mathematics in Columbia University, and a Research Scientist of NASA Goddard Institute for Space Studies. He earned a Ph.D. in Atmospheric Sciences, Columbia University in 1992. Dr. Tselioudis heads a research team that analyzes observations and model simulations to investigate cloud, radiation, and precipitation changes with climate and the resulting radiative feedbacks. Dr. Tselioudis received the American Geophysical Union Charles Falkenberg Award in 2004. AGU publishes a total of 19 academic journals. Among the top 10 journals ranked by impact factor in the field of Geosciences, two publications from the American Geophysical Union hold positions.

2. 课程介绍

本课程的主题是研究获取和分析卫星观测数据的方法，目的是研究影响地球环境的物理过程的运行。本课程涵盖了卫星遥感技术的基础知识，并探索了不同类型的地球观测卫星及其传感器。该课程随后探讨了卫星观测在环境科学中的应用，包括气候变化、自然资源管理和灾害响应。

The subject of this course is the study of the methods used to obtain and analyze satellite observations, with the objective to examine the operation of physical processes that shape the Earth's environment. The course covers the basics of satellite remote sensing

techniques, and explores the different types of Earth observation satellites and their sensors. The course then examines the applications of satellite observations in environmental science.

3. 课程大纲

1.电磁辐射与卫星传感器

2.卫星遥感简介

3.被动遥感

4.主动遥感

5.地球观测卫星

6.气候科学应用案例-1

7.气候科学应用案例-2

8.自然资源管理中的应用

9. 灾害响应中的应用

10.从太空观测地球

1. Electromagnetic Radiation and Satellite Sensors

2. Introduction to Satellite Remote Sensing

3. Passive Remote Sensing

4. Active Remote Sensing

5. Earth Observation Satellites

6. Climate Science Application Case-1

7. Climate Science Application Case-2

8. Applications in Natural Resource Management

9. Applications in Disaster Response

10. Observing Earth from Space

课程十四：《认知心理学与神经科学：大脑思维与记忆之间的关联机制分析》

Human Brain & Mind: An introduction to cognitive neuroscience

学科方向：认知心理学

1. 教授介绍

Daniel Casasanto

康奈尔大学 心理学终身教授

- 曾获得心理科学期刊实验心理学领域年度最佳文章奖
- 美国心理学科协会 2015 年度杰出研究贡献奖
- 美国心理学会 2015 年度杰出心理师荣誉获得者
- Frontiers in Neuroscience 副主编,Frontiers in Psychology 副主编,PLoS ONE 学术编辑

Daniel Casasanto 教授在 Oberlin College 完成了英语文学和声乐表演的学士学位，后继续在 University of Pennsylvania 深造神经科学，并在 Massachusetts Institute of Technology 获得了脑与认知科学的博士学位。现任 Cornell University 人类发展系的副教授。他同时在 Cornell 大学的心理学系和芝加哥大学的心理学系担任研究副教授职务。Casasanto 教授曾在 Max Planck 语言心理学研究所担任高级科学研究员，并在 Stanford 大学心理学系担任博士后研究员。

他的研究涉及语言、文化以及身体如何共同塑造心理过程，其成果广泛发表于《心理科学》,《认知科学》,《语言和认知》，以及《日常心理学报》等高影响力学术期刊。Casasanto 教授还是多个国际认知科学和心理学会议的常客，并在多个科学期刊上担任编辑工作。

Professor Daniel Casasanto completed his Bachelor's degree in English Literature and Vocal Performance at Oberlin College, continued his studies in Neuroscience at the University of Pennsylvania, and received his PhD in Brain and Cognitive Sciences at the Massachusetts Institute of Technology. D. in Brain and Cognitive Sciences from the Massachusetts Institute of Technology. He is currently an Associate Professor in the Department of Human Development at Cornell University. He holds research associate professorships in the Departments of Psychology at Cornell University and the University of Chicago, where he was a Senior Scientific Fellow at the Max Planck Institute for the Psychology of Language and a Postdoctoral Fellow in the Department of Psychology at Stanford University.

His research on how language, culture, and the body work together to shape mental processes has been widely published in high-impact journals such as Psychological Science, Cognitive Science, Language and Cognition, and the Journal of Everyday Psychology, and he has been a regular contributor to several international conferences on cognitive science and psychology, as well as serving as an editor for several scientific journals.

2. 课程介绍

认知能力是人们成功的完成活动最重要的心理条件。知觉、记忆、注意、思维和想象的能力都被认为是认知能力。认知能力，是人脑加工、储存和提取信息的能力，即人们对事物的构成、性能、与他物关系、发展动力、发展方向以及基本规律的把握能力。人们的认知特点对于社会经济状况都有显着的影响,增强认知能力也已经被发现与财富增长和预期寿命的增加有关。而一直以来，人们普遍认为，像数学和阅读这样的能力，是具有家族性的，但影响这些性状基因的复杂系统在很大程度上却不为人们所了解。

Cognitive ability is the most critical psychological condition for successfully carrying out activities. Abilities such as perception, memory, attention, thinking, and imagination are all considered cognitive abilities. Cognitive ability refers to the brain's capacity to process, store, and extract information, allowing individuals to comprehend the composition, properties, relationships with other things, driving forces, developmental directions, and fundamental principles of things. People's cognitive characteristics significantly impact their socioeconomic status, and enhancing cognitive abilities has been found to be associated with increased wealth and life expectancy. However, it has long been believed that abilities like mathematics and reading are hereditary traits, yet the complex systems of genes influencing these traits are not well understood by people to a large extent.

3. 课程大纲

1. 我们大脑到底是不是一台数字计算机
2. 特定模式模拟的思维模型 I
3. 特定模式模拟的思维模型 II
4. 语言、行为与思维的抽象概念与理论 I
5. 语言、行为与思维的抽象概念与理论 II
6. 不同身体特质对认知与语言思维的影响 I
7. 不同身体特质对认知与语言思维的影响 II
8. 情境模型与特定模态模拟模型的关联性
9. 身体与思维的相互影响
10. 身体与情绪的关系：手语交流形式研究

1. The mind as a digital computer
2. Thinking as modality-specific simulation, part one
3. Thinking as modality-specific simulation, part two
4. In what sense are abstract concepts embodied, part one
5. In what sense are abstract concepts embodied, part two
6. Body-specificity of language and thought, part one
7. Body-specificity of language and thought, part two
8. Situation models with or without simulation
9. Bodies and minds affect each other
10. Expressing thoughts with the hands

课程十五：《认知心理学与神经科学：抑郁及焦虑症等病理与脑神经的关联性》

Behavioural and Cognitive Neuroscience for Human Psychopathology

学科方向：神经科学/认知心理学

1. 教授介绍

Robin Murphy

牛津大学终身教授

- 牛津大学实验心理学终身教授
- 牛津大学基督圣体学院院士和招生导师
- 牛津大学计算精神病理实验室负责人
- 曾任英国实验心理学协会成员
- 担任《实验心理学期刊：动物学习与认知》顾问编辑

Robin Murphy 教授是牛津大学实验心理学终身教授，也是牛津大学基督圣体学院招生办成员。除了获得终身教职外，Robin Murphy 教授还是牛津大学计算精神病理实验室（The Computational Psychopathology Research Group）的负责人，该实验室获得英国经济与社会研究理事会（ESRC）和英国生物技术与生物科学研究委员会（BBSRC）等国家级机构的资金支持。以了解大脑和心理过程如何产生行为为目标，研究人类和动物模型中的联想学习过程，致力于研究健康人群和弱势群体的注意力、学习和行为，以便更好地了解风险和病因，并为预防和干预提供信息。Robin Murphy 教授担任《实验心理学期刊：动物学习与认知》顾问编辑，自身也发表过多篇心理学论文，如《心理病态中无受损的整合研究：来自错觉结合范式实验的证据》，《对称性“超级学习”：使用双向概率结果来增强学习效果》。

Professor Robin Murphy is a tenured professor of Experimental Psychology at the University of Oxford and a member of the Admissions Office at Corpus Christi College, Oxford. In addition to his tenure at The University of Oxford, Professor Robin Murphy is the director of The Computational Psychopathology Research Group, The lab is funded by national institutions such as the Economic and Social Research Council (ESRC) and the Biotechnology and Biological Sciences Research Council (BBSRC). With the goal of understanding how the brain and mental processes produce behavior, the lab studies associative learning processes in human and animal models, and is dedicated to studying attention, learning, and behavior in healthy and vulnerable populations to better understand risk and etiology, and to inform prevention and intervention. Professor Robin Murphy is on the editorial board for Journal of Experimental Psychology: Animal Learning and Cognition. He has published many papers in psychology, such as No impaired integration in psychopathy: Evidence from an illusory conjunction paradigm, Symmetrical ‘Super Learning’: Enhancing learning using a bidirectional probabilistic outcome.

2. 课程介绍

心理病理学是一门研究心理疾病以及引发心理疾病行为的学科。它的研究范围包括各种

心理疾病的起因、发展、症状以及治疗等方面，并且对各种心理疾病进行划分与归类。需要特别指出的一点是心理病理学并不是仅仅研究精神病性心理障碍如精神分裂症等不同类型精神病的一门学科，而是涵盖了所有类型的心理疾病，如我们所熟知的焦虑症、抑郁症、强迫症等都心理病理学的研究范围内。

本课程从行为（学习和动机）和认知（记忆和注意力）的生物学基础开始，从计算的角度发展你对心理障碍的理解。我们涵盖了心理学的基本理论（学习和行为的动物模型），以了解计算理论（纠错和自由能原理）。这些与神经生物学的基础知识一起应用于基于人类心理的病理学。同时该课程也强调科学方法论和对技术和理论的理解。

Psychopathology is the study of mental illness and the behaviors that trigger it. Its research scope includes the causes, development, symptoms and treatment of various mental diseases, and divides and classifies various mental diseases. It should be pointed out that psychopathology is not only a discipline that studies different types of psychosis such as psychotic psychological disorders such as schizophrenia, but covers all types of mental diseases, such as anxiety, depression, obsessive-compulsive disorder, etc.

A course of fundamental psychological research and knowledge designed to support your understanding of human psychopathology from a mechanistic perspective. My course starts with the biological bases of behaviour (learning and motivation) and cognition (memory and attention) to develop your understanding of psychological disorders from a computational perspective. We cover fundamental theories of psychology (animal models of learning and behaviour) to understand computational theory (error correction and free energy principles). These along with fundamentals of neurobiology are applied to human psychological-based pathology. The course places an emphasis on scientific methodology and comprehension of technique and theory.

3. 课程大纲

1. 实验心理学与人类行为的联想分析
2. 预测误差和学习的神经生物学
3. 如何通过工具性学习达到行为控制
4. 人类心理病理学和个体差异
5. 抑郁症
6. 恐惧与恐惧症
7. 安慰剂和诅咒剂，厌食症和进食障碍
8. 精神分裂症和注意力障碍
9. 法医心理学
10. 犯罪心理学

1. Part I-Experimental Psychology and the associative analysis of human behaviour

2. Prediction Error and the neurobiology of learning

3. Instrumental learning

4. Part II—Human psychopathology and individual differences

5. Depression

6. Fear & Phobia

7. Placebo and nocebo, Anorexia and disorders of eating

8. Schizophrenia and disorders of attention

9. Forensic psychology: Psychopathy

10. Criminal psychology

课程十六：《社会心理学：社会结构下的群体偏见与跨文化比较研究》

Foundations of Social Psychology

学科方向：心理学

1. 教授介绍

Helen Haste

巴斯大学终身荣誉教授

- 巴斯大学心理学终身荣誉教授
- 曾连续 20 余年在哈佛大学担任特聘教授
- 巴斯心理系创系人之一，社会心理学鼻祖
- 英国科学促进会心理学分会主席
- 国际社会心理学理事会主席

Helen Haste 教授曾在哈佛大学心理学研究生院担任客座教授，同时主导英国巴斯大学的心理学教育，在英国巴斯大学担任心理学系主任，直至 2008 年成为名誉教授。Helen 的学术成就和贡献曾受到国际政治心理学会以及道德教育协会的高度认可，曾获得 Knutson 和 Sanford 奖以及 Kuhmerker 奖。作为学界泰斗，她曾执掌国际政治心理学会主席、英国科学进步协会理事会主席和副主席等重要职务。

Professor Helen Haste previously held the position of visiting professor at Harvard University's Graduate School, concurrently leading the psychology education at the University of Bath in the United Kingdom, where she served as head of the psychology department until 2008, upon assuming the title of emeritus professor. Helen has received recognition for her career and contributions from the International Society of Political Psychology (the Knutson and Sanford Awards) and from the Association for Moral Education (the Kuhmerker Award). Her significant leadership positions include President of the International Society of Political Psychology, Chair of Council and Vice President of the British Association for the Advancement of Science, and President of the Psychology

Section.

2. 课程介绍

社会心理学是研究人类与他人互动的学科。它探讨了人们在信仰与行动中如何受到他人影响，以及我们的态度和信念如何影响我们对经历的解读和对他人的回应，这些态度和信念从何而来，以及在何种条件下会发生变化。

本课程将向学生介绍社会心理学的核心理念和最新研究成果。课程内容包括精彩的讲座、深度阅读和研讨、精心挑选的电影或视频并展开讨论、课堂实践练习，以及通过社交媒体或面对面与朋友和同学收集数据。学生将通过这门课程了解社会心理学研究的多种方法，探究何种信息可以被称为“数据”，以及如何进行科学管理。此外，学生们还将分组合作，开展一项研究项目，包括数据收集、数据分析和研究报告撰写。通过这一过程，学生们将获得实践社会心理学、培养合作能力和批判性思维的宝贵经验。

Social psychology is the study of humans in interaction with others. This includes how we are influenced by others in what we believe and how we act, what attitudes and beliefs affect how we interpret our experiences and how we respond to others, where these attitudes and beliefs come from and under what conditions they change.

This course will introduce students to core ideas and research in social psychology. The Program includes lectures, readings and discussion of them, films or videos plus discussion, class exercises, and the collection of data from friends and fellow students via social media or face to face. The course will introduce students to methods of research in social psychology; what counts as ‘data’ and how is it managed. Additionally students will work in groups to conduct, analyse and write up a research project.

3. 课程大纲

1. 社会心理学的概念
2. 判断与信息处理过程
3. 集体判断与解决问题
4. 态度及其测量方法
5. 我们如何受他人影响
6. 我们的身份为何以及如何具有“社会”属性
7. 文化差异
8. 价值观与当代的中国
9. 群体过程与效能
10. 群体中的问题或挑战

1. The concept of social psychology
2. Judgments & Information processing

3. Judgments & problem solving

4. Attitudes and how to measure them

5. How are we affected by others

6. Why, and how is our identity "social"

7. Cultural differences

8. Values and contemporary China

9. Group processes and effectiveness

10. What problems and challenges emerge

课程十七：《进化与发展心理学：人类乐感演变下择偶和交友动机的发展变化》

Evolutionary Psychology

学科方向：心理学

1. 教授介绍

Max Krasnow

哈佛大学教授

- 哈佛大学心理学教授
- 哈佛大学本科教学委员会委员
- 哈佛大学认知，大脑，行为研究所联合创办人
- 2019 年荣获哈佛校长基金的新晋学术研究奖
- 2017 年荣获哈佛大学脑神经科学系卓越教学奖

Max Krasnow 教授是哈佛大学心理学系教授，同时也是哈佛学院课程委员会成员和认知、脑与行为科学研究所的联合创始人。他曾获得哈佛大学总统学术研究基金奖和哈佛大学脑与认知科学系的教学卓越奖。此外，他还是《人格与社会心理学杂志》的审稿人。Krasnow 教授的研究重点是人类合作和社会行为机制的进化起源和计算设计。他的研究涉及合作、惩罚、音乐和认知适应等多个方面的进化心理学，深入探讨了第三方惩罚、婴儿定向歌曲中的父母后代冲突以及基因组印记在音乐心理学中的作用等主题。他最具影响力的论文之一《诚实的重要性？：证据表明欺骗不会污染实验对象群》，该论文预见性地提出了对研究环境中不诚实行为影响的常见假设。在哈佛大学心理学系，Krasnow 教授教授多门课程，包括进化心理学、行为科学统计学、心理测量学和应用教育心理学。

Prof. Max Krasnow is a professor at Harvard University's Department of Psychology, co-founder of the Institute for Cognitive, Brain, and Behavioral Sciences, and a member of the Harvard College Curriculum Committee. He has received recognition such as the Harvard President's Fund for Academic Research Award and the Excellence in Teaching Award from Harvard University's Department of Brain and Cognitive Sciences. His research focuses

on the evolutionary origins of human cooperation and social behavioral mechanisms, spanning topics like third-party punishment and parent-offspring conflict in infant-directed song. One of his notable papers, "The Importance of Being Honest? : Evidence that Deception Does Not Pollute the Subject Pool," challenges assumptions about the impact of dishonesty in research settings. At Harvard, he teaches courses like Evolutionary Psychology and Applied Educational Psychology.

2. 课程介绍

进化与发展心理学的交叉研究将为我们提供独特的视角，帮助解释为什么人们在选择伴侣和朋友时会表现出特定的偏好和行为。通过探究乐感、择偶和交友之间的关联，学生将更好地理解人类行为的深层次动机，以及这些动机如何在不同环境中塑造了我们的社交互动。这将为心理学和社会学领域提供新的洞见，同时也有助于我们更好地理解人类文化和社会的发展变化。

The interdisciplinary exploration of evolutionary and developmental psychology offers a unique perspective to elucidate why individuals exhibit specific preferences and behaviors when selecting partners and friends. By examining the interplay between aesthetic appreciation, mate selection, and friendship, we can enhance our understanding of the intrinsic motivations that underlie human behavior and how these motivations shape our social interactions across various environments. This endeavor will provide novel insights for the fields of psychology and sociology, contributing to a better comprehension of the development and changes in human culture and society.

3. 课程大纲

1. 什么是自然选择，为什么我们应该关注
2. 进化心理学如何融入科学企业
3. 为什么存在普遍的人类本性，它如何变异
4. 为什么人类本性具有特定领域的先天性
5. 环境适应、适应与适应主义计划。
6. 大脑是如何计划和控制我们进食的
7. 心理如何影响性伴侣的选择和约会行为
8. 心理与亲属关系、亲密关系的关联性
9. 心理如何影响我们的社交行为（一）
10. 心理如何影响我们的社交行为（二）

1. What is natural selection and why should we care?
2. How does Evolutionary Psychology fit into the scientific enterprise?
3. Why a universal human nature, and how does it vary?

4. Why is human nature domain specific & innate?
5. The EEA, adaptations & the adaptationist program
6. How is the mind prepared for navigating and eating?
7. How is the mind prepared for mating and dating?
8. How is the mind prepared for a world with kin?
9. How is the mind prepared to be social (I)?
10. How is the mind pre prepared to be social (II)?

课程十八:《商业分析与数据科学:数字化转型时代的智能洞察、优化与决策》

Data Science and AI for Business

学科方向：商业分析/供应链管理

1. 教授介绍

Cosimo Arnesano

南加州大学 教授

- 南加州大学马歇尔商学院教授
- 南加州大学成像服务研究中心副主任
- Thermo Fisher Scientific 战略投资经理
- 卡尔蔡司公司客户与学术关系前负责人
- 南加州大学生物医学工程博士、生物医学工程硕士
- 罗马大学能源与环境工程博士、医学工程硕士

Cosimo Arnesano 教授是一位博学多才的多学科科学家和学者，知识广博，涉及生物学和生物化学、物理学和光学、统计学和数据科学、电子学、生物医学成像以及商业、项目和运营管理等领域。他拥有能源与环境工程博士学位、生物医学工程博士学位以及工商管理硕士学位，教授曾在 ThermoFisher Scientific、Zeiss Microscopy 等公司担任要职，拥有非常丰富的行业经验。

Professor Cosimo Arnesano is a versatile and knowledgeable interdisciplinary scientist and scholar, with expertise spanning various fields such as biology, biochemistry, physics, optics, statistics, data science, electronics, biomedical imaging, as well as business, project, and operations management. He holds a Ph.D. in Energy and Environmental Engineering, a Ph.D. in Biomedical Engineering, and a Master of Business Administration (MBA) degree. Professor Arnesano has held key positions at companies like ThermoFisher Scientific and Zeiss Microscopy, bringing with him a wealth of industry experience.

2. 课程介绍

分析是使用数据洞察力和其他量化方法来增强决策的实践。从业务的角度来看，对于成熟的公司来说，不断优化业务操作是非常重要的。公司可以使用分析来系统地评估资产、产品和运营团队的性能，以保持一条健康的提高盈利能力的道路。一般来说，商业分析领域为决策者和分析师提供了分析和改进公司运营的工具。本课程将为学生提供数据科学技术和优化模型的基础知识与工具，帮助他们在商业中进行战略决策。学生将通过 Python、Excel 和 Google Colab 进行实际操作，重点关注回归分析、优化、不确定性下的决策建模以及基础机器学习概念等真实案例的应用。通过本课程的学习，学生将掌握如何运用数据和模型在复杂的商业环境中做出明智的决策。

Analysis is the practice of using data insights and other quantitative methods to enhance decision-making. From a business perspective, continuous optimization of operational processes is crucial for mature companies. Analytics can be employed to systematically assess the performance of assets, products, and operational teams, ensuring a path of sustainable profitability. In general, the field of business analysis provides decision-makers and analysts with tools to analyze and enhance company operations.

This course will provide students with the foundational knowledge and tools to apply data science techniques and optimization models for strategic decision-making in business. Students will use Python, Excel, and Google Colab for practical implementations, with a focus on real-world applications such as regression analysis, optimization, decision modeling under uncertainty, and basic machine learning concepts. By the end of this course, students will be able to leverage data and models to make informed decisions in complex business environments.

3. 课程大纲

1.统计学知识回顾：数据类型、假设检验

2.相关性分析和回归分析

3.高级回归分析：多元线性回归分析、虚拟变量

4.线性优化：线性规划图解法

5.高级优化

6.决策分析：决策树方法

7.蒙特卡罗模拟：风险分析

8.大数据及数据科学概览

9.机器学习与人工智能概览：分类模型、逻辑回归、神经网络

10.机器学习与人工智能在商业领域的应用

1.Introduction to Basic Statistics

2.Correlation and Regression Analysis

3.Advanced Regression Analysis

4.Introduction to Linear Optimization

5.Advanced Optimization

6.Decision Analysis

7.Monte Carlo Simulation

8.Introduction to Big Data and Data Science

9.Introduction to Machine Learning and Artificial Intelligence

10.Application of ML and AI in Business

课程十九：《数字媒体与数据科学：信息技术时代下用户行为与社会网络探析》

Social Media Data Mining and Analytics

学科方向：数据挖掘

1. 教授介绍

Manuel González Canché

宾夕法尼亚大学终身教授

- 2024 年度机器人领域最具影响力学者奖荣誉提名
- 宾夕法尼亚大学终身教授
- 宾夕法尼亚大学教育发展双项目联合导师
- 亚利桑大学访问学者奖得主
- 高等教育社交媒体研究学者导师
- 著有《高等教育中的社交媒体：文献综述和研究方向》等传媒论文

Manuel González Canché教授任职于宾夕法尼亚大学高等教育部门。此外他还是宾大教育学院人类发展与定量方法学院和国际教育发展项目的联合导师；高等教育与民主联盟的高级研究员。Manuel 的研究主要集中在代表性不足的少数群体的途径、教育和移民问题、社会不平等、社会心理学和文化研究、社会网络和社交资本和数据可视化，尤其对理解影响少数族裔和风险学生教育与职业成功可能性的结构因素特别感兴趣。Manuel 曾凭借《社区学院如何利用社交媒体提高学生成功率》荣获亚利桑大学访问学者奖；著有《高等教育中的社交媒体：文献综述和研究方向》等传媒论文。

此外，González Canché还是是 2016 年高等教育研究协会杰出学者/初级职业奖的获得者。并曾获得斯宾塞基金会、美国教育研究协会/国家科学基金会、机构研究协会和教育科学研究所的研究资金。目前，González Canché是关键定量、计算和混合方法研究项目的研究导师。

Manuel González Canché joined the Higher Education division as an associate professor in 2017. At Penn GSE he also serves as affiliated faculty with the Human Development and

Quantitative Methods division and the International Educational Development Program. In addition, he is a senior scholar in the Alliance for Higher Education and Democracy. Manuel's research primarily focuses on pathways for underrepresented minorities, education and immigration, social inequalities, social psychology and cultural studies, social networks and social capital, and data visualization. He has a special interest in understanding structural factors that influence minority and at-risk students' likelihood of educational and occupational success. Manuel received the Visiting Scholar Award from the University of Arizona for his work on "How Community Colleges Use Social Media to Increase Student Success" and has authored media papers such as "Social Media in Higher Education: Literature Review and Research Directions".

González Canché is the 2016 recipient of the Association for the Study of Higher Education's Promising Scholar/Early Career Award. He has secured funding for research from the Spencer Foundation, the American Education Research Association/National Science Foundation, the Association for Institutional Research, and the Institute of Education Sciences. González Canché is currently a Fellow in the Institute in Critical Quantitative, Computational, & Mixed Methodologies Fellows Program where he serves as a mentor.

2. 课程介绍

近年来，随着互联网、移动互联网和物联网等平台汇聚的海量数据不断涌现，为科学研究带来了前所未有的机遇。对科研人员和大型企业管理者来说，他们更迫切地需要了解如何在大数据背景下充分利用海量信息进行数据分析，并从中提取出有价值的信息。这种需求的增加也催生了新媒体和计算机领域的交叉学科。

In recent years, the exponential growth of data gathered from platforms such as the Internet, mobile Internet, and Internet of Things has presented an unparalleled opportunity for scientific research. This data deluge has created a pressing need for researchers and enterprise managers to understand how to leverage the vast amount of information available in order to conduct comprehensive data analysis and extract valuable insights, all within the context of big data. Consequently, this increasing demand has given rise to the emergence of cross-disciplinary fields that bridge the gap between new media and computer science.

3. 课程大纲

1. 什么是社交媒体数据挖掘?
2. 数据挖掘技术是如何运作的?
3. 社交媒体数据挖掘是否遵从道德?
4. 如何判断传媒的道德标准?
5. 如何利用统计技术从社媒平台中提取数据?
6. 从社交媒体平台收集数据的问题
7. 探究相关的研究问题和假设
8. 分析和计划研究报告/案例研究

9. 探讨数据挖掘的应用与挑战

10. 社交媒体数据挖掘中的社交网络分析（SNA）

1. What is Social Media Data Mining?

2. How Does It Work?

3. Is Social Media Data Mining Ethical?

4. How to Judge the Ethical Standards of the Media?

5.How to Use Statistical Techniques to Extract Data From Social Media Platforms?

6. Explore Relevant Research Question and Hypothesis

7. Analysis and Planning the Research Paper/case Study

8. Exploring the Applications and Challenges of Data Mining

9. Text mining and machine learning to analyze social media data

10. Social Network Analysis (SNA) in Social Media Data Mining

3. 经管类

课程一：《土地经济与城市规划：智慧城市解决方案与区域资源布局探究》

Urban Planning and Land Economy

学科方向：土地经济/城市规划

1. 教授介绍

Philip Allmendinger

剑桥大学终身教授

- 剑桥大学土地经济学终身教授
- 剑桥大学人文社会科学学院院长
- 伦敦大学副校长
- 伦敦大学土地经济学教授
- 欧洲知名院校巴黎 Forward College 首席学术官
- 论文引用次数超过 10000 次，谷歌学术因子高达 h-index 45 & i10-index 86!

Philip Michael Allmendinger 教授是国际知名的土地经济与城市规划专家，现任伦敦大学土地经济学教授兼副校长。他曾在剑桥大学担任多个高级管理职位，包括土地经济学教授、该系主任和人文学科与社会科学学院副院长以及副校长顾问，推动了学院的学术卓越与行政发展。

他还是巴黎 Forward College 的首席学术官和巴斯大学副校长，展现了其在国际学术界的领导力和影响力。Allmendinger 教授出版了多部重要学术著作，并发表了大量研究论文，为空间规划与土地政策领域做出了深远贡献。他在剑桥大学克莱尔学院担任院士多年，积极

指导学生，并作为副校长顾问致力于提升大学的区域事务与影响力。

Philip Michael Allmendinger is an internationally renowned expert in land economy and urban planning. He currently serves as Professor of Land Economy as well as the Pro Vice Chancellor at the University of London. During his 28 years in higher education Professor Allmendinger has held a host of senior leadership positions, including as a Deputy Vice-Chancellor and a Head of School (Dean) of the Humanities and Social Sciences at the University of Cambridge and Deputy Vice-Chancellor at the University of Bath.

He has most recently been the Chief Academic Officer at Forward College, Paris, one of the University's Recognised Teaching Centres. He has most recently been the Chief Academic Officer at Forward College, Paris, one of the University's Recognised Teaching Centres. He has published numerous significant academic works and research papers, making profound contributions to the fields of urban planning and land theory.

2. 课程介绍

世界有一半以上的人口居住在城市，我们希望城市是清洁、公平、绿色、可持续、安全、健康和宜居的。“智慧城市”会帮助我们实现这些愿望，还是破坏这些愿望？

本课程深入探讨全球城市面临的关键挑战，涵盖从可持续发展到智慧科技的应用等多个方面，旨在探索如何在快速变化的世界中实现城市的平衡发展与经济韧性。鉴于全球已有超过一半的人口居住在城市，掌握有效规划与管理城市空间的方法变得尤为重要，这直接关系到促进经济与社会的长远健康发展。

通过本课程，学生将学习城市规划与土地经济的核心理论及实践技巧，深入了解住房供给、环境保护、城市更新等现实议题。此外，课程还将提供构建可持续且充满活力的城市发展策略所需的专业知识与实践能力，使学生能够在未来的城市规划与管理中发挥关键作用，应对气候变化、技术创新等带来的新挑战，为创造更加宜居、繁荣的城市环境贡献力量。

This course offers an in-depth exploration of the critical challenges facing cities globally, spanning topics from sustainable development to the implementation of smart technologies. We aim to investigate how to foster balanced development and economic resilience in a rapidly changing world. Given that more than half of the global population resides in urban areas, it has become essential to master effective planning and management of urban spaces to support the long-term economic and social well-being of societies.

Through this course, students will engage with the core theories and practical skills in urban planning and land economy, with a focus on pressing issues such as housing provision, environmental protection, and urban renewal. Additionally, the course provides the expertise and practical abilities needed to formulate sustainable and vibrant urban development strategies, equipping students to play a key role in future urban planning and management. Students will learn to address emerging challenges posed by climate change and technological innovation, ultimately contributing to the creation of more livable and prosperous urban environments.

3. 课程大纲

1.概述:城市发展框架和资源配置

2.规划理论及其演变

3.土地利用与管理路径

4.住房管理与城市发展

5.软性空间与区域治理

6.智慧城市与新兴技术

7.可持续土地利用与环境政策

8.城市复兴与经济多元化

9.城市规划的全球调整

10.未来城市规划:应对气候与技术变革

1. Overview of urban planning and land economy

2. Planning theory and its evolution

3. Land use and management

4. Housing and urban development

5. Soft space and regional governance

6. Smart cities and technological impact on planning

7. Sustainable land use and environmental policy

8. Urban regeneration and economic impacts

9. Global challenges in urban planning

10. Planning the future city

课程二:《数字经济与发展经济:碳减排与共享机制的可持续政策实践》

Next Generation Economic Modalities: How emerging economic modalities shape contemporary society

学科方向: 数字经济/公共政策

1. 教授介绍

Robert Lyon

纽约大学 斯特恩商学院教授

- 曾任纽约大学 Stern 商学院 SSP 实验室负责人

- 曾任纽约大学 Stern 本科课程设计负责人
- 曾任纽约大学人文科学学院创意写作主导师
- 曾任芝加哥大学出版社资深经理
- 曾担任明尼苏达狼队 (NBA 球队) 沟通训练顾问
- 曾任青少年国际公益创新挑战赛 (PBIC) 评委

Robert Lyon 教授的研究和教学重点集中在商业与社会的交叉领域。在担任纽约大学 Stern 商学院教授的 15 年中，他主导并设计了该校本科学生的必修专业课程《商业与公众》和《文化与商业》。同时，他创立并指导了 Stern 社会解决方案项目实验室（SSP），这是一个为本科生设计的创新型研究项目，该项目旨在解决重要的社会经济问题以及新兴企业规划。

近年来，Robert Lyon 教授设计并教授了关于共享经济、循环经济、下一代世界经济模式、社会企业和现代全球经济中的强迫劳动和奴役等课程。2021 年新增的课程包括《金融文化》和《美国职业联赛体育管理》。Robert Lyon 教授的研究兴趣主要集中在商业及其公众关系、文化与商业发展、新世界经济模式的利与弊、公益企业（NGO）的运营模式等等。

Robert Lyon, a professor at NYU's Stern School of Business, specializes in the intersection of business and society. Over 15 years, he's developed core undergraduate courses like "Business and Society" and founded the Stern Social Solutions Project Lab (SSP) for social entrepreneurship. Lyon teaches on topics such as the sharing economy, social entrepreneurship, and modern global economics. His research focuses on business and public relations, cultural and business development, and NGO operational models.

2. 课程介绍

本课程探讨在科技创新、环境约束与社会变革的共同作用下，21 世纪全球经济体系如何被重新塑造。课程将重点分析新兴经济范式，如平台经济、共享经济、循环经济与注意力经济，并探讨它们对劳动形态、可持续发展与公共政策的影响。

同时，课程还将讨论社会目的型组织（Social Purpose Organizations）等新型商业形态，如何在市场、社会与环境之间重构关系，推动经济体系的可持续转型。

通过案例研究与研究导向式讨论，学生将获得跨学科的理解，掌握经济系统演变的逻辑，以及可持续商业实践在现代管理与政策制定中的应用。

This course explores how the global economy is being reshaped in the 21st century by technological innovation, environmental imperatives, and social transformation. Students will examine emerging economic paradigms such as the platform economy, sharing economy, circular economy, and attention economy, and analyze their implications for labor, sustainability, and policy.

The course also discusses how new forms of organizations—such as social-purpose enterprises—are redefining the relationship between markets, society, and the environment.

Through case studies and research-based discussions, students will gain an interdisciplinary understanding of how economic systems evolve and how sustainable business practices can be integrated into modern management and policymaking.

3. 课程大纲

1.21 世纪经济体系的分析

2.平台经济的崛起

3.循环经济

4.共享经济

5.注意力经济

6.不断演进的经济模式下的工作未来

7.社会目的组织

8.自然资本与环境经济学

9.全球变暖与碳减排

10.可持续商业实践

1.Analysis of Economic Systems of 21st Century

2.The Rise of Platform Economy

3.Circular Economy

4.Sharing Economy

5.Attention Economy

6.Future of Work in Evolving Economic Modalities

7. Social Purpose Organizations

8.Natural Capitalism & Environmental Economics

9.Global Warming & Carbon Mitigation

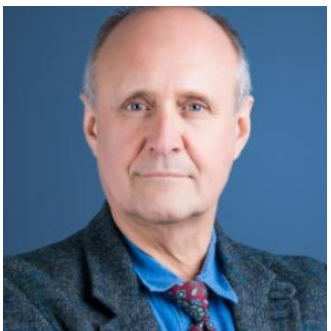
10. Sustainable Business Practices

课程三：《金融经济学：时间序列建模、GARCH 波动率分析与数据预测方法》

Financial Econometrics

学科方向：金融计量经济学

1. 教授介绍



Oliver Linton

剑桥大学 经济学终身教授

- 剑桥大学经济系系主任
- 世界金融计量学会主席
- 英格兰银行计量经济学顾问
- 国际统计学会会士，计量经济学学会会士
- 中国人民大学特聘教授
- 曾就职于伦敦政经学院，耶鲁大学，牛津大学
- 三次获得 Econometric Theory 奖
- 学术论文总引用次数过万次

Oliver Linton 教授是一位杰出的经济学家，因其在计量经济学和实证金融学方面贡献而闻名。他目前是剑桥大学政治经济学教授和剑桥大学三一学院院士。1983 年获得伦敦政治经济学院数学学士学位（一等）；于 1991 年获得加州大学伯克利分校经济学博士学位，1988 年获得耶鲁大学硕士学位,1986 年获得伦敦政治经济学院计量经济学和数理经济学硕士学位。1991 年至 1993 年，他以牛津大学纳菲尔德学院初级研究员的身份开始其学术生涯。之后，Oliver Linton 教授在耶鲁大学伦敦政治经济学院担任过多个职位，包括经济学、统计学和计量经济学教授。

Oliver Linton 教授的研究涉及计量经济学的多个领域，包括时间序列分析、非参数和半参数方法以及金融计量经济学。他开发了创新的统计技术来分析经济和金融数据，他的工作对该领域产生了重大影响。

在他的职业生涯中，Oliver Linton 教授在顶级学术期刊上发表了大量论文，为计量经济学和实证金融学领域做出了重大贡献。他的研究重点是开发用于分析经济和金融数据的统计方法，尤其侧重于非参数和半参数技术。

Oliver Linton is a Professor of Political Economy at the University of Cambridge and a Fellow of Trinity College since 2011. Previously, he was a Professor of Econometrics at the London School of Economics and Political Science from 1999 to 2011. He held various positions at Yale University, including Professor in the Department of Economics and the Department of Statistics, from 1993 to 2000. He started his academic career as a Junior Research Fellow at Nuffield College, Oxford University, from 1991 to 1993. He earned his PhD in Economics from UC Berkeley in 1991, an MA from Yale University in 1988, an MSc in Econometrics and Mathematical Economics from LSE in 1986, and a BSc (1st Class) in Mathematics from LSE in 1983. Prof.

Linton is known for his research in econometrics and empirical finance, focusing on developing statistical methods for analyzing economic and financial data. He has published extensively in top academic journals and has received several awards for his research contributions.

2. 课程介绍

本课程系统介绍金融经济学的核心理论与实证方法，旨在帮助学生通过数据驱动的分析理解金融市场的运行机制与行为规律。课程内容涵盖从有效市场假说、事件研究、资产定价模型到波动性与时间序列分析等关键主题，强调利用统计与计量工具对市场数据进行实证检验与模型构建。

学生将学习如何应用 CAPM 模型、GARCH 模型及其他实证方法分析资产回报、风险溢价

与市场效率。通过案例研究与实际数据操作，课程培养学生在投资决策、风险管理及政策分析中的数据分析能力和批判性思维，为未来从事金融研究与实务工作奠定坚实基础。

This course provides a systematic introduction to the core theories and empirical methods of financial econometrics, enabling students to understand the mechanisms and behavioral patterns of financial markets through data-driven analysis. Covering key topics such as the Efficient Market Hypothesis, event studies, asset pricing models, and volatility and time-series analysis, the course emphasizes the use of statistical and econometric tools for empirical testing and model construction.

Students will learn to apply models such as CAPM and GARCH to analyze asset returns, risk premiums, and market efficiency. Through case studies and hands-on data projects, the course develops students' analytical and critical thinking skills for investment decision-making, risk management, and policy analysis, building a solid foundation for both academic research and professional practice in finance.

3. 课程大纲

1.金融与统计的计量经济学基础

2.金融市场与计量经济分析

3.有效市场假说与资产回报可预测性

4.实证市场微观结构

5.事件研究分析与统计检验

6.投资组合选择与 CAPM 应用

7.固定收益市场与折现

8.股票风险溢价

9.基本面与泡沫的计量分析

10.波动性与时间序列 GARCH 模型

1.Econometric Foundations of Finance and Statistics

2.Financial Markets and Econometric Analysis

3.Efficient Markets Hypothesis and Predictability of Asset Returns

4.Empirical Market Microstructure

5.Event Study Analysis

6.Portfolio Choice and CAPM

7.Fixed Income Markets and Discounting

8.Equity Risk Premium

9.Econometric Analysis of Present Value Relations

10.Volatility and Time-Series GARCH Model

课程四：《金融学：金融市场与投资管理的理论、应用与实证》

Empirical Finance: Capital markets, investment and asset pricing

学科方向：金融市场|投资学

1. 教授介绍

Michael Ashby

剑桥大学 经济学教授

- 剑桥大学 Downing 学院经济学教授
- 剑桥大学 Judge 商学院荣誉任职
- 担任 Management Science 评审专家
- 曾任爱尔兰首席国家律师办公室顾问
- 曾任 BlackRock 公司投资研究所研究员

Michael Ashby 教授是剑桥大学 Downing 商学院的经济学教授。他在 2015 年、2016 年分别获得剑桥大学经济学学士和硕士学位，随后在 2020 年获得剑桥大学经济学博士学位。Michael Ashby 教授的研究方向涉及资产价格的可预测性，以及如何使用可预测性为资产定价，测试资产定价模型，并构建优化风险回报权衡的投资组合。

他积极参与《Management Science》期刊的评审工作，为推动学术研究质量做出了重大贡献。除了在学术界的成就，Ashby 教授也在公共和私人部门发挥了重要作用。他曾在爱尔兰首席国家律师办公室担任咨询顾问，利用他的专业知识为政府政策和法律事务提供支持和建议，帮助解决复杂的经济和法律问题。在金融行业，Michael 教授在 BlackRock 公司投资研究所担任研究员期间，专注于投资策略和市场分析。他的研究成果为公司的投资决策提供了关键洞见，助力 BlackRock 在全球金融市场中的稳健表现。

Michael Ashby is a College Associate Professor in Downing College in the University of Cambridge. He graduated from the University of Cambridge in 2015 with bachelor's degree in economics, 2016 with master’s degree in economics and 2020 with a Ph.D. in economics. Michael’s research interests relate to predictability in asset prices and how this can be used to price assets, test asset pricing models and construct portfolios which optimize the risk-return trade-off.

He actively participated in the review work of the journal Management Science and made significant contributions to promoting the quality of academic research. His research has provided key insights into the firm's investment decisions and contributed to BlackRock's robust performance in global financial markets.

2. 课程介绍

本课程旨在培养学生对金融市场和投资管理领域的深入理解，使其具备综合的理论知识和实践技能。学生将深入研究金融市场的基础概念，学会有效进行资本的配置和构建风险平衡的投资组合。通过深入了解资本资产定价模型（CAPM）和多因素资产定价模型，学生将能够进行资产估值和风险评估。

课程还聚焦于市场效率假说（EMH）和行为金融理论，使学生能够理解市场行为背后的心理学和行为科学因素。通过学习 ESG 原则的应用、期权市场与估值技能、预测建模以及因子模型和实证测试，学生将全面提升在投资和金融决策中的能力。通过这门课程，学生将发展为具备深厚金融知识、注重实际应用的专业人士，为未来在金融领域取得成功奠定坚实基础。

This course aims to cultivate students' in-depth understanding of the financial markets and investment management, equipping them with comprehensive theoretical knowledge and practical skills. Students will delve into fundamental concepts of financial markets, learning to effectively allocate capital and construct portfolios with balanced risk. Through a thorough exploration of the Capital Asset Pricing Model (CAPM) and multi-factor asset pricing models, students will be capable of asset valuation and risk assessment.

The course also focuses on the Efficient Market Hypothesis (EMH) and behavioral finance theory, enabling students to comprehend the psychological and behavioral science factors underlying market behavior. By studying the application of ESG principles, options markets and valuation skills, forecasting modeling, as well as factor models and empirical testing, students will significantly enhance their capabilities in investment and financial decision-making. Through this course, students will develop into professionals with profound financial knowledge, emphasizing practical applications and laying a solid foundation for future success in the financial field.

3. 课程大纲

1.金融市场与银行概论

2.资本配置与投资组合管理

3.资本资产定价模型

4.资产定价的多因子模型

5.有效市场假说

6.事件研究分析

7.行为金融理论

8.ESG 中的实证金融应用

9.期权市场与估值

10.金融领域的预测建模

1. Introduction to Financial Markets and Banking

2. Capital Allocation and Portfolio Management

3. Capital Asset Pricing Model (CAPM)

4. Multifactor Models in Asset Pricing

5. Efficient Market Hypothesis (EMH)

6. Event study analysis

7. Behavioral Finance Theories

8. Empirical Finance Applications in ESG

9. Option Markets and Valuation

10. Predictive Modeling in Finance

课程五：《金融学：投资组合理论与企业项目估值实践》

Financial Valuation

学科方向：公司金融|财务管理

1. 教授介绍

Raghavendra Rau

剑桥大学终身教授

- 剑桥大学金融系终身教授
- 剑桥大学替代金融中心（CCAF）创始人及董事
- 欧洲金融协会前任主席
- 财务学权威期刊 Financial Management 前任编辑
- 担任 10 多家国际知名金融期刊担任副主编、顾问编辑
- 论文总引用 8300 多次，h 指数 30，i10 指数 56

Raghavendra Rau 教授是剑桥大学 Judge 商学院的金融系终身教授，也是剑桥替代金融中心(CCAF) 的创始人兼学术主任。在加入剑桥大学之前，Rau 曾在多所国际知名院校任教，包括加州大学伯克利分校、加州大学洛杉矶分校和普渡大学等。他的研究兴趣重点在投资者和企业如何获取和利用信息。他曾担任欧洲金融协会主席、2023 年金融管理协会在芝加哥的年会程序主席；曾任旧金山全球最大的资产管理公司巴克莱全球投资者(BGI)主管；是《企业金融杂志》等专业期刊的副编辑。

Rau 教授在金融和经济学领域具有深远的影响力，其研究和论文被《纽约时报》、《华尔街日报》、《经济学人》和《金融时报》等顶级金融媒体多次引用和转载。他也被频繁受邀在全球各大研讨会和学术会议上发表主题演讲。

Raghavendra Rau is a Professor of Finance at the Judge Business School at the University of Cambridge and a founding director of the Cambridge Centre for Alternative Finance. Before joining the University of Cambridge, Rau was an academic in the US teaching at

universities such as the University of California at Berkeley, the University of California at Los Angeles and Purdue University. His research interests include how investors and firms acquire and use information. He's a past president of the European Finance Association and was previously Principal at Barclays Global Investors, then the largest asset manager in the world, in San Francisco. He's also an Associate Editor of the Journal of Corporate Finance, among others.

He is known for his research on market efficiency. Professor Rau has a profound influence in the field of finance and economics. His research has frequently been covered by the popular press including the New York Times, the Financial Times, the Wall Street Journal, and the Economist, among others. He is also frequently invited to deliver keynote speeches at major workshops and academic conferences around the world.

2. 课程介绍

财务估值是指对一个企业的价值进行定量估计的过程。投资者可以根据企业的估值来判断是否值得投资，以及投资的风险和回报预期直接影响融资的规模和条件。在并购和兼并交易中，财务估值是决定交易价格的关键因素。

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This course serves as a foundational introduction to financial valuation. The course aims to establish a connection between the financial markets and the economy, as well as how companies are organized and developed. This leads to the core content of the course: identifying the key challenges in corporate finance and understanding how to address them. Specifically, the course will educate students on interest rates, investment portfolios, methods of valuing companies and projects. Ultimately, students will be encouraged to adopt the perspective of corporate decision-makers and apply the acquired knowledge to solve real-world business issues.

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3. 课程大纲

1.金融市场与公司经营目标

2.货币的时间价值

3.利率与债务工具与股票和指数的价值评估

4.计算投资组合的回报和风险

5.公司和项目估值

6.项目决策规则

7.类比公司估值

8.资本结构理论

9.资本成本计算

10.金融衍生品定价

1. Financial Market

2. Time Value of Money

3. Interest Rate & Debt Instruments & Valuing Stocks and Indices

4. Computing the Returns and Risk of Portfolios

5. Company and Project Valuation

6. Decision Rules for Projects

7. Capital Structure Theory

8. Advanced Capital Budgeting Techniques

9. Merger and Acquisition Valuation

10. Option Pricing and Financial Derivatives

课程六:《投资学:绿色金融视角下的 ESG 因子量化模型与资产组合优化》

ESG Investing

学科方向: 投资管理/ESG

1. 教授介绍

Alexei Chekhlov

哥伦比亚大学 数学系教授

- 知名科技软件公司达索系统高级研究员
- 曾任阿尔法基金某资产管理公司合伙人兼研究部负责人
- 曾任北岸资产管理公司研究总监

Alexei Chekhlov 教授现任职于哥伦比亚大学数学系。他于普林斯顿大学获得应用与计算数学博士学位,并在普林斯顿大学担任研究员期间从事流体湍流理论的研究。他发现了产生精确的科尔莫哥洛夫能量谱解的最简单非线

性随机模型；解释了间歇性效应及其与代数尾部分布函数的关系；他还发现了各向异性通用能谱；并多次发表有关流体力学、气体动力学理论、湍流以及应用数学和定量金融领域的文章。

此外他还曾担任阿尔法基金某资产管理公司合伙人兼研究部负责人。该公司是一家位于纽约的 CTA（商品交易顾问）公司，管理着多个短期系统化管理的期货投资项目，其管理的基金以卓越的绝对收益和风险调整后的表现而备受瞩目。Alexei 还曾就职于北岸资产管理公司，担任研究总监。Alexei 的主要研究方向集中在计算数学、应用数学、定量金融、投资组合管理与优化和风险管理。

Alexei Chekhlov is currently affiliated with the Department of Mathematics at Columbia University. Chekhlov earned his Ph.D. in Applied and Computational Mathematics from Princeton University, where he also served as a researcher conducting research on the theory of fluid turbulence. During his time at Princeton, he made significant contributions to the field, including the discovery of the simplest nonlinear random model that produce the exact Kolmogorov energy spectrum solution. He provided explanations for intermittency effects and their relationship to algebraically-tailed distribution functions and discovered the anisotropic universal energy spectrum. He has published repeatedly on fluid mechanics, the kinetic theory of gases, turbulence, and within the fields of applied mathematics and quantitative finance.

Additionally, Chekhlov serves as the Head of Research and Partner at Systematic Alpha Management, LLC, a New York-based CTA firm managing several short-term systematic managed futures investment programs. The fund managed by Systematic Alpha was noted for its top absolute and risk-adjusted performance. In both 2009 and 2012 it has won HFMWeek US Performance awards in the Managed Futures (CTA) category. It has also received the CTA Intelligence US Performance awards in 2014 and 2016 as best short-term trader. Alexei's primary research interests lie in computational mathematics, applied mathematics, quantitative finance, investment portfolio management and optimization, and risk management. His extensive professional experience and research achievements across multiple domains also enrich his teaching endeavors.

2. 课程介绍

本课程旨在引导学生系统掌握现代投资管理方法及 ESG（环境、社会与公司治理）投资理念与实践技能，使学生能够应对不断增长的 ESG 投资需求。通过课程学习，学生将深入理解自由竞争金融市场中证券价格的有效性及其在证券估值与投资策略选择中的应用，掌握风险与收益的权衡、分散化以及资产配置在现代投资组合理论中的关键作用。

课程不仅致力于提升现有及未来投资从业者的专业能力，使投资机构能够展示其在可持续投资领域的实力与承诺，同时还强调实证数据与量化方法的运用，帮助学生将经典理论与实际投资实践紧密结合，实现理论与实务的全面提升。

This course is designed to provide students with a systematic understanding of modern investment management as well as ESG (Environmental, Social, and Governance) investment concepts and practical skills, enabling them to meet the growing demand for ESG expertise. Through the course, students will gain a deep understanding of the efficiency of

securities prices in competitive financial markets and its application in valuation and investment strategy selection. They will also master the trade-offs between risk and return, as well as the role of diversification and asset allocation in modern portfolio theory.

The course aims not only to enhance the professional capabilities of current and future investment practitioners and demonstrate the commitment of investment firms to sustainable investing, but also to emphasize the use of empirical financial data and quantitative methods, helping students bridge classical investment theory with real-world practice for comprehensive skill development.

3. 课程大纲

1.资产类别与金融工具基础

2.利率与时间价值

3.风险资产的资本配置

4.多元化与投资组合风险

5.指数模型与量化投资组合优化

6.资本资产定价模型与套利定价理论

7.有效市场假说与行为金融学

8.ESG 概论与可持续投资方法

9.ESG 市场分析与行业趋势

10.环境因素与投资机会

1.Fundamentals of Asset Classes and Financial Instruments

2.Interest Rates and Time Value of Money

3.Capital Allocation to Risky Assets

4.Diversification and Portfolio Risk

5.Index Models and Quantitative Portfolio Optimization

6.Capital Asset Pricing Model and Arbitrage Pricing Theory

7.Efficient Market Hypothesis and Behavioral Finance

8.Introduction to ESG and Sustainable Investment Approaches

9.ESG Market Analysis and Industry Trends

10.Environmental Factors and Investment Opportunities

课程七：《金融数学：市场优化与风险机制设计及分析》

Introduction to Financial Mathematics

学科方向：金融数学

1. 教授介绍

Mete Soner

普林斯顿大学 金融工程终身教授

- 普林斯顿大学运筹学和金融工程终身教授
- 普林斯顿大学运筹学和金融工程学院院长
- 曾担任苏黎世联邦理工学院数学系主任
- 普林斯顿大学 Bendheim 金融中心项目成员
- 前苏黎世联邦理工学院数学系终身教授
- 曾任职于美国和欧洲多所知名大学，包括 CMU, ETH 等
- SIAM Journal of Financial Mathematics 主编
- 《数学与金融经济学》联合主编
- 2014 年荣获“洪堡研究奖”
- 专业期刊论文引用次数 18763 次; h 指数: 58; i10: 119

Mete Soner 教授是控制论、几何测度论大师 Wendell Helms Fleming 的学生，当然自己也是控制论的权威代表，因其优异的表现，获得美国国防部资助读博，并于 1985 获得布朗大学博士学位。目前担任普林斯顿大学运筹学和金融工程系主任和终身教授，普林斯顿大学 Bendheim 金融中心和应用与计算数学项目成员，教授曾是运筹学和金融工程系建系以来第一个 Wythes' 55 Professor. 他的教学生涯已近 40 年，足迹遍布欧美大陆，桃李满天下。Soner 教授的研究方向主要是关于不确定性下的决策，包括关于随机最优控制、马尔科夫决策过程、非线性偏微分方程、概率论、数学金融和金融经济学的相关问题。

Professor Mete Soner was a student of the master of control theory and geometric measure theory, Wendell Helms Fleming. He himself is an authoritative representative in control theory. Due to his outstanding performance, he received funding from the US Department of Defense to pursue his Ph.D. and obtained his doctoral degree from Brown University in 1985.

Currently, he serves as the director and a tenured professor of the Department of Operations Research and Financial Engineering at Princeton University. He is also a member of the Bendheim Financial Center and the Program in Applied and Computational Mathematics at Princeton University. He was the first Wythes' 55 Professor since the establishment of Department of Operations Research and Financial Engineering. With nearly 40 years of teaching experience, his influence spans across Europe and the Americas.Professor Soner's research primarily focuses on decision-making under uncertainty, including topics such as stochastic optimal control, Markov decision processes, nonlinear partial differential equations, probability theory, mathematical finance, and financial economics.

2. 课程介绍

本课程旨在培养学生在金融数学与量化分析方面的核心能力，帮助学生理解金融产品设计、风险管理及市场效率的定量方法。课程核心内容涵盖套利原理、风险中性定价、Black-Scholes 模型、利率期限结构、以及经典的均值-方差投资组合理论，并结合实际市场数据进行计算与分析。

在计算技能方面，课程将引导学生掌握 Python 编程及模拟技术，通过问题课和项目练习，学习如何对金融衍生品进行定价和风险分析。课程安排包括从基础的时间价值与债券、利率，到期望收益、期货与套利，再到二项式模型、多步动态规划、随机游走、Black-Scholes 定价公式，以及均值-方差与资本资产定价模型（CAPM）的系统学习。

This course is designed to equip students with core skills in financial mathematics and quantitative analysis, enabling them to understand financial product design, risk management, and market efficiency through quantitative methods. The course covers arbitrage principles, risk-neutral pricing, the Black-Scholes model, term structure of interest rates, and the classical mean-variance portfolio theory, with practical applications using real market data.

In terms of computational skills, students will learn basic Python programming and simulation techniques. Problem sessions and projects will guide students step by step, from setting up Python on a laptop to simulating and computing prices for financial derivatives. Sample Python codes will be provided to enhance hands-on experience.

Topics include: the time value of money, bonds and interest rates, internal rate of return, futures and arbitrage, binomial models, multi-step models, probability and Python-based pricing computations, dynamic programming, random walk simulations, Black-Scholes pricing and volatility, and the mean-variance problem and CAPM.

3. 课程大纲

1.货币的时间价值、债券和利率

2.远期合约、期货和套利策略

3.二项式模型：一步与二步案例

4.多步二项式模型

5.基于 Python 的定价计算方法

6.动态规划

7.连续时间的 Black-Scholes 模型

8.Black-Scholes 公式

9.基于蒙特卡洛模拟的定价计算

10.债券分析：久期、凸性和免疫策略

1. Time Value of Money, Bonds, Interest Rates

2. Forwards, Futures, Arbitrage

3. Binomial Model, One and Two Step Cases

4. Multi-step Model

5. Python Based Pricing Computations

6. Dynamic Programming

7. Continuous Time Black & Scholes Model

8. Black & Scholes Formula

9. Computations Based on Monte-carlo Simulations

10. Bonds: Duration, Convexity and Immunization

课程八：《商业分析与金融学：Python 数据分析在金融决策中的应用》

Data Science and Applications in Finance

学科方向：商业分析

1. 教授介绍

Haiyuan Wang

哥伦比亚大学教授

- 哥伦比亚大学实践副教授
- 曾任 BlackRock 贝莱德集团副总裁
- 曾任纽约罗斯福管理公司执行董事
- 曾任全球大西洋金融集团高管
- 曾任摩根士丹利数据挖掘策略师
- 曾任 CitationShares LLC 运筹分析师

Haiyuan Wang 教授在数据科学与金融量化分析领域成果显著，研究方向涵盖预测指标与长寿风险管理。他在哥伦比亚大学教授多门数据科学与应用分析课程，致力于培养金融领域的数据驱动型人才。教授拥有 14 年以上建模与开发经验，对统计学、机器学习和优化有深刻理解，曾在多家顶尖金融机构担任重要职务，包括在 BlackRock 贝莱德集团担任副总裁，领导投资建模与分析；在纽约罗斯福管理公司出任执行董事，专注固定收益量化研究；以及在全球大西洋金融集团和摩根士丹利负责贷款建模、算法交易与数据分析工作。

Professor Haiyuan Wang has achieved remarkable accomplishments in the fields of data science and financial quantitative analysis, with research focusing on predictive indicators and longevity risk management. He teaches multiple courses on data science and applied analytics at Columbia University, dedicating himself to cultivating data-driven talent for the financial industry.

With over 14 years of experience in modeling and development, Professor Wang has a profound understanding of statistics, machine learning, and optimization. He has held prominent roles at leading financial institutions, including Vice President at BlackRock,

where he led investment modeling and analytics; Executive Director at Roosevelt Management Company, specializing in fixed-income quantitative research; and senior positions at Global Atlantic Financial Group and Morgan Stanley, focusing on loan modeling, algorithmic trading, and data analysis.

2. 课程介绍

数据分析是现代社会中不可或缺的一项技能，因为我们生活在一个数据驱动的世界。无论是商业、医疗、金融、教育、公共政策，都需要数据来指导决策。通过对数据的收集、处理、分析和解释，数据分析可以帮助人们发现趋势、规律，挖掘出潜在的商业机会，并为各个行业提供科学决策支持。数据分析技术可以应用于多个领域，如市场研究、财务分析、客户关系管理、人力资源管理等等。

本课程是一门实践导向的机器学习与数据科学课程，专注于Python在金融数据分析中的应用。学生将学习从数据采集、可视化到建模和预测等关键步骤，掌握数据科学家在金融分析中所需的技能。课程内容涵盖数据来源与实验、概率论、回归方法、决策树、随机森林等数据科学方法，并应用于金融市场数据的真实案例。通过实践案例、动手实验和项目，学生将学习如何利用Python分析和解决金融领域中的数据科学问题，从而深入理解数据分析和统计学在金融决策中的作用，为进入数据驱动的金融行业做好准备。

Data analysis is an essential skill in today's data-driven world, underpinning decision-making across industries such as business, healthcare, finance, education, and public policy. Through the processes of data collection, processing, analysis, and interpretation, it empowers individuals and organizations to uncover trends, recognize patterns, and identify hidden opportunities, enabling informed and strategic decisions. With its wide-ranging applications, data analysis is integral to areas such as market research, financial forecasting, customer relationship management, and human resource optimization, serving as a cornerstone for evidence-based decision-making in a variety of sectors.

This course is a hands-on exploration of machine learning and data science, emphasizing the application of Python in financial data analysis. Students will engage with essential processes, including data collection, visualization, modeling, and prediction, while acquiring the critical skills required by data scientists in the context of financial analysis.

The curriculum encompasses data sources and experimental methods, probability theory, regression techniques, decision trees, random forests, and other key data science methodologies, all applied to real-world financial market scenarios. Through practical case studies, interactive experiments, and project-based learning, students will develop the ability to leverage Python for analyzing and addressing complex data science challenges in finance. By the end of the course, participants will gain a deep understanding of the pivotal role data analysis and statistical methods play in informed financial decision-making.

3. 课程大纲

1.数据科学与金融市场概论

2.数据、图表与统计学基础

3.数据来源：实验与模拟

4.概率论：高斯分布与二项分布

5.置信区间

6.假设检验

7.回归方法

8.决策树与随机森林

9.数据科学中的其他方法与工具

10.数据分析在金融领域的高级应用

1.Introduction to data science and financial markets

2.Data, graph, and statistics

3.Where data comes from—experiments and simulation

4.Probability

5.Confidence intervals

6.Hypothesis testing

7.Regression methods

8.Decision trees and random forest

9.Other methods in data science and relevant tools

10.Connecting dots, potential application

课程九：《管理学：创业管理中的市场机遇探寻与创新策略》

Entrepreneurship: Evaluating Market Opportunities

学科方向：创业管理

1. 教授介绍

Matthew Grimes

剑桥大学 终身教授

- 剑桥大学 Judge 商学院终身教授
- 剑桥大学商学院创业中心联合主任
- 曾获第 13 届社会企业家年度会议最佳论文奖

- Academy of Management Journal 最佳评审奖
- 曾任加拿大企业社会责任中心研究员

Matthew Grimes 教授任职于剑桥大学 Judge 商学院。教授的研究方向是创业和可持续发展，着重研究个人和组织通过创业创新方式、引入和维持积极的社会变革的方法，通过研究促进创新和创新管理的背景和个体因素。Grimes 教授曾荣获第 13 届社会企业家年度会议最佳论文奖，这一奖项表彰了他在社会企业家精神方面的杰出研究贡献。此外，他还获得了 Academy of Management Journal 的最佳评审奖，体现了他在学术评审和研究指导方面的卓越能力和公正性。在剑桥大学，他通过教学和研究，培养了大批未来的企业家和学者，并推动了创业教育的发展。作为创业中心的联合主任，Grimes 教授领导了一系列创新项目和研究计划，旨在支持和发展新兴企业，促进创业生态系统的健康成长。他的多领域成就和跨界影响力，使他成为学术界和企业界备受尊敬的领袖人物。

Matthew Grimes is a Professor in Judge Business School, University of Cambridge. His research interests include entrepreneurship and sustainable development. He examines how individuals and organizations create, introduce, and sustain positive social change by way of entrepreneurship by studying both the contextual and individual factors that contribute to innovation and the governance of innovation. He is a member of the Organizational Theory and Information Systems subject group at Cambridge Judge Business School, Academic Co-Director of the Cambridge Judge Entrepreneurship Centre, and current Associate Editor at the Academy of Management Journal.

2. 课程介绍

在一个团队中，学生们将产生一个想法，使用商业建模技术来”充实”这个想法，并定义一个新的创业机会，对他们的新创业概念是否可行和值得追求进行基于研究的评估，并”推销”他们的想法。本课程的主题将包括:创意的产生、商业模式的发展、市场定义、客户发现、竞争分析、资源开发和风险分析。这门课程是为有兴趣学习如何研究一个新市场机会的想法的学生开设的，这个想法可能会形成一个新的创业企业的基础。本课程旨在培养研究和分析新企业潜力所需的分析和概念技能。研究过程包括识别、评估和决定是否追求特定的市场机会。此外，该过程涉及分析与相关新企业相关的可取性、可行性和可行性风险。

Working on a team, students will generate an idea, use business modeling techniques to “flesh out” that idea and define a new venture opportunity, perform are search-based assessment of whether their new venture concept is viable and worth pursuing, and “pitch” their idea. Topics covered in this course will include: idea generation, business-model development, market definition, customer discovery, competitive analysis, resource development, and risk analysis.

This is a course for students interested in learning how to research an idea for a new market opportunity that is likely to form the basis for a new entrepreneurial venture. This course is about developing the analytical and conceptual skills required to research and analyze the potential for a new venture. The research process involves identifying, evaluating and determining whether or not to pursue a particular market opportunity. In addition, the process involves analyzing the desirability, feasibility, and viability risks associated with the associated new venture.

3. 课程大纲

1. 商业模式画布与市场机会识别
2. 市场营销中的价值主张与客户关系管理
3. 客户细分与市场定位
4. 客户调研、市场研究与 MVP 开发
5. 销售管理与获客渠道优化
6. 竞争与外部环境分析策略
7. 创业融资渠道与资本获取
8. 利用创新解决社会和环境问题
9. 社会创新的商业模式探索
10. 企业社会责任与问责机制

1. Idea generation and evaluation for first-time entrepreneurs
2. Developing value propositions
3.Profiling customers
4.Creating minimum viable products (MVP) to enable customer and market research
5.Exploring customer channels
6.Managing customer relationships
7.Analyzing competitive and external environment
8.How to pitch ideas
9.How to raise capital
10.Using entrepreneurship to address social and environmental problems

课程十：《数字营销与新媒体传播：品牌策略优化与 KOL 经济在 AI 时代下的发展探究》

Social Media Influence: Strategies for Amplifying Online Identity and Impact

学科方向：数字营销/新媒体传媒

1. 教授介绍

Freddy Nager

南加州大学 教授

- 南加州大学安纳伯格传播学院传播学教授
- 安纳伯格传播机构（The Annenberg Agency）创始主任
- 美国知名唱片公司 MCA Records，作为全球最早一批娱乐网站的编辑
- 国际广告公司萨奇广告公司 Saatchi & Saatchi 高级文案
- 创意策略与营销咨询公司 Atomic Tango LLC 创始人

Freddy Tran Nager 是来自南加州大学安纳伯格传播学院（USC Annenberg）的传播学教授，同时也是数字社交媒体硕士项目（MS in Digital Social Media）的副主任。Freddy Nager 教授自 2012 年起在安纳伯格学院任教，主要教授“网红/意见领袖营销”（influencer marketing）、“网站开发”（website development）以及“创业传播”（entrepreneurial communication）等课程。此外，他还是“安纳伯格传播机构”The Annenberg Agency 的创始主任——这是一个由学生组成、为非营利组织提供咨询服务的机构。Nager 教授在数字媒体与市场营销领域有着 30 多年的行业专业经验。

他曾在任职于美国知名唱片公司 MCA Records，担任全球最早的娱乐网站之一的编辑。他还曾为世界顶级的国际广告公司萨奇广告公司 Saatchi & Saatchi 担任高级文案，为丰田（Toyota）等客户策划线上营销活动。目前，他创立并经营了一家创意策略与营销咨询公司 Atomic Tango LLC，服务对象包括知名品牌、科技初创企业以及业界专家和意见领袖等知名人士。

Dr Merlo is Associate Dean (External Relations) and Academic Director of the MSc Strategic Marketing programs at Imperial College Business School. Previously he was Lecturer in Marketing at Cambridge University Judge Business School. He has been the recipient of numerous awards for his teaching and research, including teaching prizes from several universities, a European Union Award for Excellence, a Fellowship from the Swiss Research Fund, and a Best Paper award from the American Marketing Association. Dr Merlo's research has appeared in many academic and professional journals, including MIT Sloan Management Review. As a consultant and executive educator, he has worked with many organizations around the world, such as McKinsey & Co., Samsung, Airbus.

2. 课程介绍

在数字时代，影响力即是新的“社会货币”。本课程将带领学生探索社交媒体影响力的原理、策略与伦理，从品牌定位、内容设计到受众分析，系统学习如何构建和扩大个人或机构的线上身份。课程以营销学与传播学为基础，结合实践案例与平台分析，帮助学生理解“影响力”背后的心理机制与算法逻辑。学生将学习如何评估真实影响（而非虚假数据），制定目标、选择平台、构建社群并通过协作扩大影响力。同时课程还将探讨人工智能对创意与传播未来的影响。

In the digital era, influence has become the new social currency. This course guides students through the principles, strategies, and ethics of social media influence — from

brand positioning and content creation to audience analysis. Drawing on frameworks from marketing and communication, students will explore the psychology of influence and the algorithmic forces that shape digital culture. They will learn to measure authentic impact (beyond vanity metrics), identify opportunities for growth, and design campaigns that enhance both visibility and credibility. The course also examines the evolving role of artificial intelligence as both a tool and a challenger in online influence.

3. 课程大纲

1.认识“影响力”：流量、欺诈与真实影响

2.寻找个人定位：激情、专长与机会

3.目标设定：真实 KPI 与可衡量成果

4.识别受众：兴趣社群与网络结构

5.平台选择：舒适度、竞争与资源

6.自我表达：个性、视角与说服力

7.扩展影响：算法与协作的力量

8.传播策划：从认知到行动（AIDA 模型）

9.影响者营销实践：管理与合作

10.未来展望：人工智能的助力与挑战

1.Defining “Influence”: Popularity, fraud, and true impact

2.Finding Your Niche: Passion, expertise, and opportunity

3.Setting Goals: Real KPIs

4.Identifying Your Audience: Networks and communities of interest

5.Selecting Your Medium and Platform: Comfort, competition, and resources

6.Expressing Yourself: Personality, perspective, and persuasion

7.Expanding Your Influence: Gaming the system, the power of collaboration

8.Planning Campaigns: Awareness, interest, desire, and action

9.Working in Influencer Marketing: Managing influencers and agencies

10.Predicting the Future: Artificial Intelligence — Assistant or Competitor

课程十一：《市场营销：创新营销管理与战略营销革新探究》

Marketing Management

学科方向：品牌管理|消费者行为学

1. 教授介绍

Omar Merlo

帝国理工学院 市场战略终身教授

- 帝国理工学院商学院教授|副院长
- 帝国理工学院商学院战略营销项目主任
- 曾任剑桥大学贾奇商学院及圣埃德蒙学院院士
- 曾任 Oxford、LSE、UCL 等高校访问教授
- 曾在麦肯锡、三星、安永等 15 家世界 500 强公司担任高管及顾问
- 曾任墨尔本大学企业学院执行董事

Omar Merlo 教授现任帝国理工学院商学院副院长，并兼任战略营销硕士项目的学术主任。在此之前，他曾在剑桥大学 Judge 商学院担任市场营销学教授。Omar 教授凭借其杰出的教学和研究成果屡获殊荣，包括来自多所大学的教学奖、欧盟卓越奖、瑞士研究基金会奖学金，以及美国营销协会的最佳论文奖。他的研究成果发表在诸多学术和专业期刊上，包括麻省理工学院斯隆管理评论等期刊。作为顾问和高管教育者，Omar 教授曾与全球众多组织合作，如麦肯锡公司、三星、Airbus 等等。

Dr Merlo is Associate Dean (External Relations) and Academic Director of the MSc Strategic Marketing programs at Imperial College Business School. Previously he was Lecturer in Marketing at Cambridge University Judge Business School. He has been the recipient of numerous awards for his teaching and research, including teaching prizes from several universities, a European Union Award for Excellence, a Fellowship from the Swiss Research Fund, and a Best Paper award from the American Marketing Association. Dr Merlo's research has appeared in many academic and professional journals, including MIT Sloan Management Review. As a consultant and executive educator, he has worked with many organizations around the world, such as McKinsey & Co., Samsung, Airbus.

2. 课程介绍

这门课程的目标是帮助学生全面了解市场与客户管理的重要概念、原则和理论。它强调了有效市场与客户管理在塑造商业战略和提高盈利能力方面的关键作用。学生将培养在市场管理、创造客户价值以及制定营销计划、战略和策略方面的实用技能。

此外，课程还探讨了营销与组织其他职能之间的紧密关联，以及营销与创新之间的重要联系。课程内容涵盖了适用于不同环境下的各种营销策略，包括大众市场、奢侈品牌和艺术娱乐行业。通过学习，学生将提高批判性思维和沟通能力，提升在营销领域的专业水平。

This course is designed to provide students with a comprehensive understanding of key market and customer management concepts, principles, and theories. It emphasizes the critical role of effective market and customer management in shaping business strategy and driving profitability. Students will develop practical skills in managing markets,

creating customer value, and developing marketing plans, strategies, and tactics.

The course also explores the interrelationship between marketing and other organizational functions, as well as the important connection between marketing and innovation. Various marketing strategies will be examined, including those applicable to mass markets, luxury brands, and the arts and entertainment industry. Throughout the course, students will enhance their critical thinking and communication abilities, thereby increasing their level of professional expertise in the field of marketing.

3. 课程大纲

1. 市场营销基本原理
2. 战略营销规划流程
3. 市场细分，目标市场选择和定位
4. 消费者行为
5. 市场营销组合 I：产品与分销
6. 市场营销组合 II：定价策略
7. 营销传播
8. 品牌管理
9. 服务管理
10. 客户关系管理

1. Marketing fundamentals
2. Strategic marketing planning process
3. Market segmentation, target market selection and positioning
4. Consumer Behavior
5. Marketing Mix I: Product and Distribution
6. Marketing Mix II: Pricing Strategies
7. Marketing Communication
8. Brand Management
9. Service Management
10. Customer Relationship Management

4. 人文及其他类

课程一：《教育学与艺术史：国际视角下人文教育及文学发展的比较研究》

Researching the Arts, Humanities and Education: Comparative and International Perspectives

学科方向：教育文化学/教育史学

1. 教授介绍

Liam Francis Gearon

牛津大学 终身教授

- 牛津大学哈里斯曼切斯特学院高级研究员
- 牛津大学哲学、宗教、教育小组创始人兼负责人
- 剑桥大学教育学院外部特邀评论专家
- 伯明翰大学教育学院高级荣誉研究员
- 澳大利亚纽卡斯尔大学联合教授

Liam Francis Gearon 教授是牛津大学教育系终身教授，牛津大学哲学、宗教、教育研究小组的创始人兼负责人，还担任哈里斯曼彻斯特学院，英国伯明翰大学教育学院荣誉等多个研究机构的主席和领导人。在哲学、宗教和教育这一共同焦点下，他通过艺术、人文、哲学和社会科学的理论和实证相互联系，为研究政策和影响的理论、艺术和人文研究的文化价值、研究伦理、认识论和伦理领域的交叉点、极端主义和反恐、以及教育安全等领域的研究做出了卓越的贡献。他的著作“On Holy Ground”荣获 2016 年教育研究学会图书奖。

Professor Liam Francis Gearon is a tenured professor in the Department of Education at the University of Oxford. He is also the founder and head of the Philosophy, Religion, and Education Research Group at Oxford University. Additionally, he holds positions as chair or member in various research institutions, including Harris Manchester College, the School of Education at the University of Birmingham. With a focus on philosophy, religion, and education, he connects theories and empirical evidence from art, humanities, philosophy, and social sciences. His contributions span various areas, including theoretical research on policy and its impact, the cultural value of arts and humanities studies, research ethics, intersections of epistemology and ethics, extremism, counter-terrorism, and education security. His work "On Holy Ground" was honored with the 2016 Book Prize by the Educational Research Society.

2. 课程介绍

古今中外，艺术、文学、教育和宗教始终是深植在历史场合中的关键元素，它们交织在人类社会发展的重要线索中。随着社会的不断演进，哲学思想和文学在各个文化和时代中持续发展，并随着社会的步伐而沉淀和升华。西方人文发展源远流长，可以追溯至古希腊，那时人文学科成为市民哲学启蒙的基石。在古罗马时期，三学四科的概念开始形成，这些学科成为中世纪的主导，强调艺术、文学、教育和宗教犹如技术或者做事的方法。西方哲学领域的发展轨迹经历了早期萌芽、初步成型、扩展与繁荣以及多元与深化四个阶段，具有两百余年的历史，包括了古希腊罗马、文艺复兴和近代艺术、文学、教育、宗教的历史研究，形成

了综合领域扩展与繁荣的态势、多元与深化的趋势。

Across different times and cultures, art, literature, education, and religion have always been crucial elements deeply embedded in historical contexts, intertwining as vital threads in the development of human society. With the continuous evolution of societies, philosophical thoughts and literature have persistently developed across various cultures and epochs, evolving and transcending in step with the progress of society. The roots of Western humanities can be traced back to ancient Greece, where the humanities became the cornerstone of civic philosophical enlightenment.

During the Roman period, the concept of three studies and four disciplines began to take shape, becoming the predominant subjects in the Middle Ages, emphasizing that art, literature, education, and religion are akin to methods and techniques. The developmental trajectory of Western philosophy has undergone four stages: early germination, preliminary formation, expansion and prosperity, as well as diversification and deepening, spanning over two centuries. It encompasses studies of ancient Greece and Rome, the Renaissance, and the modern history of art, literature, education, and religion, forming a trend of expansion and prosperity, as well as diversification and deepening in the field.

3. 课程大纲

1. 艺术、人文和教育研究：比较和国际视角 I
2. 艺术、人文和教育研究：比较和国际视角 II
3. 欧洲启蒙运动：学术学科的形成 I
4. 欧洲启蒙运动：学术学科的形成 II
5. 如何阅读和解释：文学、哲学和视觉艺术 I
6. 如何阅读和解释：文学、哲学和视觉艺术 II
7. 书籍如何影响政治：知识和权力 I
8. 书籍如何影响政治：知识和权力 II
9. 重审艺术、人文、教育：推动知识前沿 I
10. 重审艺术、人文、教育：推动知识前沿 II

1. Researching the Arts, Humanities and Education: Comparative and International Perspectives I
2. Researching the Arts, Humanities and Education: Comparative and International Perspectives II
3. The European Enlightenment I
4. The European Enlightenment II
5. How to Read and Interpret I

6. How to Read and Interpret II

7. How Books Influence Politics I

8. How Books Influence Politics II

9. Revisiting Arts, Humanities and Educational Research I

10. Revisiting Arts, Humanities and Educational Research II

课程二:《教育学与语言学:双语教育对儿童语言能力发展的影响探析》

Child Language Development and Bilingualism

学科方向: 教育心理学/二语习得

1. 教授介绍

Victoria Murphy

牛津大学终身教授

- 牛津大学应用语言学终身教授
- 牛津大学教育学院院长
- 牛津大学凯洛格学院招生办成员
- 曾任英国全国课程语言发展协会(NALDIC)主席
- 著有《外语者的英语幼儿教育》,《学龄早期的第二语言学习:趋势和背景》
- 担任多家语言学领域顶尖期刊审稿人(International Journal of Bilingualism and Bilingual Education, Studies in Second Language Acquisition, System, TESOL Quarterly)

Victoria Murphy 教授是牛津大学应用语言学教授和牛津大学教育学院院长,同时也负责牛津大学凯洛格学院的招生工作。Victoria Murphy 教授的研究重点是了解儿童二语/外语学习、词汇和读写能力发展之间的相互关系。她的工作研究了新兴双语儿童中跨语言系统的跨语言关系,以及小学外语学习如何影响第一语言读写能力的发展。她的工作得到了 ESRC、Leverhulme 信托基金、纳菲尔德基金会和教育捐赠基金会等机构的资助,她出版了两本关于年轻语言学习者的书(《外语者的英语幼儿教育》,《学龄早期的第二语言学习:趋势和背景》),以及许多被评审的期刊文章和书籍章节。

Victoria Murphy is Professor of Applied Linguistics and Director of the Department of Education, University of Oxford. She is also responsible for admissions at Kellogg College, Oxford. Victoria's research focuses on understanding the inter-relationships between child L2/FL learning, vocabulary and literacy development. Her work examines cross-linguistic relationships across linguistic systems in the emergent bilingual child and how foreign language learning in primary school can influence developing first language literacy. Her work has been funded by ESRC, The Leverhulme Trust, The Nuffield Foundation and the Educational Endowment Foundation, among others, and she has published

two books on the topic of young language learners (Early Childhood Education in English for Speakers of other Languages, Second Language Learning in the Early School Years Trends and Contexts), as well as numerous refereed journal articles and book chapters.

2. 课程介绍

双语教育并不是一个新奇的概念。欧洲绝大多数国家的孩子，从 9 岁开始都要学习第二门语言（比利时的孩子们从 3 岁开始就学第二门语言）。在绝大多数的欧洲国家中，他们学习的第二门语言是英语，相似的情况也在中国发生。越来越多的国家和家庭注重双语教育。

本课程以语言发展的认知基础为核心，融合心理语言学、发展心理学与认知心理学理论，旨在带学生探索语言如何塑造认知，以及认知如何支撑语言的底层逻辑。课程不局限于教育场景，而是从心理学视角拆解儿童语言发展的关键科学问题。主要分为两大模块：语言发展的核心认知机制、特殊场景下的语言认知交互。

Bilingual education is not a novel concept. Children in most European countries learn a second language from the age of 9 (children in Belgium learn a second language from the age of 3). In the vast majority of European countries, the second language they learn is English, and a similar situation is happening in China. More and more countries and families are focusing on bilingual education.

This course centers on the cognitive foundations of language development, integrating theories from psycholinguistics, developmental psychology, and cognitive psychology. It aims to guide students in exploring how language shapes cognition and how cognition underpins the underlying logic of language. Moving beyond educational contexts, the course deconstructs key scientific questions in children's language development from a psychological perspective. It is structured into two main modules: Core Cognitive Mechanisms of Language Development (Psychological Foundations) and Language–Cognition Interaction in Specific Contexts (Psychological Applications).

3. 课程大纲

1. 言语感知和表达能力的发展
2. 词汇能力发展
3. 语法能力发展
4. 交际能力的发展
5. 特殊人群的语言能力发展
6. 双语学者的母语习得
7. 语码混合和语言选择
8. 早期第二语言习得
9. 针对幼儿的外语教学
10. 双语教育项目

1. Development of Speech Perception and Production
2. Lexical Development
3. Grammatical Development
4. Development of Communicative Competence
5. Language Development in Special Populations
6. Bilingual First Language Acquisition
7. Code-mixing and Language Choice
8. Early L2
9. Instructed Foreign Language Learning for Young Learners
10. Bilingual Education Programmes

课程三：《科技史：从图灵测试到生成式浪潮的技术演进、历史拐点与未来图景》

Artificial Intelligence: Technology, History, and the Future

学科方向：科学技术史

1. 教授介绍

Richard Payne

芝加哥大学终身教授

- 芝加哥大学历史系终身教授
- 芝加哥大学古典历史研究项目负责人
- 曾获伊朗伊斯兰共和国文化和伊斯兰指导部颁发的伊朗伊斯兰共和国年度书籍世界奖
- 曾获得美国哲学学会颁发的 Jacques Barzun Prize 的历史研究领域最高奖项
- 曾获得国际伊朗研究学会 Ehsan Yarshater 奖

Richard Payne 教授目前是芝加哥大学历史学院终身教授，研究东亚历史文化领域最杰出的学者，毕业于普林斯顿大学并获得历史学博士学位。Richard Payne 教授是美国文化历史研究领域最高奖项雅克·巴尔赞奖（Jacques Barzun Prize ）的获得者，他的著作“A State of Mixture: Christians, Zoroastrians, and Iranian Political Culture in Late Antiquity”获得了历史学界的广泛赞誉，他还曾获如美国大学优等生荣誉学会、德国 DAAD 等机协会颁发的多项重要文化、历史类奖项。

Richard Payne 教授教授的突出之处在于他的跨学科方法，他将历史分析、宗教研究和文化人类学研究相结合。他精心研究原始资料和数据，揭示了不同宗教和民族群体之间复杂的文化融合，为理解古帝国社会和社会政治动态提供了更深层次的理解。

Professor Richard Payne is currently a tenured professor at the University of Chicago's

Department of History, renowned as one of the foremost scholars in the fields of East Asian and Iranian cultures. He holds a doctoral degree in history from Princeton University. Professor Payne is a recipient of the prestigious Jacques Barzun Prize, the highest honor in the field of cultural history. His book "A State of Mixture: Christians, Zoroastrians, and Iranian Political Culture in Late Antiquity" has garnered widespread acclaim in the historical community. Additionally, he has been awarded multiple significant cultural and historical accolades, including the Phi Beta Kappa Society and the German Academic Exchange Service (DAAD).

A hallmark of Professor Payne's scholarship lies in his interdisciplinary approach, integrating historical analysis with insights from religious studies and cultural anthropology. His meticulous examination of primary sources reveals intricate interactions among diverse religious and ethnic groups, offering deeper insights into the social and political dynamics of ancient empires.

2. 课程介绍

本课程通过跨学科视角探讨技术尤其是人工智能的发展历程、社会影响与未来趋势。课程内容涵盖技术定义与意识形态、技术发展史、技术乌托邦思想、超人类主义，以及人工智能在经济与社会体系中的不同应用模式。学生将通过经典文献、案例分析和当代研究，理解技术如何塑造社会结构、经济模式与文化认知，并思考人工智能时代的伦理、治理与社会挑战。

课程强调历史纵深与未来前瞻的结合，既关注技术自身的演化，也关注技术与政治、经济、文化及人类未来的互动关系，帮助学生建立系统化的技术与社会认知框架。

This course explores the development, societal impact, and future trajectories of technology, with a particular focus on artificial intelligence, from an interdisciplinary perspective. The curriculum covers the definition of technology and its ideological dimensions, the history of technological development, techno-utopian thought, transhumanism, and the various applications of AI within economic and social systems. Through classical literature, case studies, and contemporary research, students will examine how technology shapes social structures, economic models, and cultural perceptions, while critically reflecting on the ethical, governance, and societal challenges posed by the AI era.

The course emphasizes both historical depth and future-oriented perspectives, addressing not only the evolution of technology itself but also its interaction with politics, economics, culture, and the future of humanity. It aims to help students develop a systematic framework for understanding the complex relationships between technology and society.

3. 课程大纲

1.技术是什么？科学与意识形态

2.技术的深层历史（一）

3.技术的深层历史（二）

4.技术乌托邦主义（一）

5.技术乌托邦主义（二）

6.超人类主义

7.人工智能与协作经济（一）

8.人工智能与协作经济（二）

9.人工智能与资本主义（一）

10.人工智能与资本主义（二）

1.What is Technology?

2.A Deep History of Technology, I

3.A Deep History of Technology, II

4.Techno-Utopianism, I

5.Techno-Utopianism, II

6.Transhumanism

7.AI Communism, I

8.AI Communism, II

9.AI Capitalism, I

10.AI capitalism, II

课程四：《电子艺术与交互设计：以黑客帝国为例的 VR 技术与新媒体艺术策展》

Exploring the Intersection of Art, Science, and Technology in Contemporary and New Media Art

学科方向：电子艺术

1. 教授介绍

Alejandro Borsani

罗德岛设计学院 终身教授

- 罗德岛设计学院（RISD）实验与基础研究系终身教授
- 计算、技术与文化专业课程授课教授
- 电子艺术与计算机艺术领域的艺术家、教育学者
- 作品曾在全球多个著名场馆展出，包括开罗电子艺术节 Cairotronica、全球计算机图形与互动技术顶级会议 ACM

SIGGRAPH、Aesthetica 短片电影节、Videobrasil 国际展和 BIENALSUR 国际双年展等

Alejandro Borsani 教授是罗德岛设计学院的终身教授，主要负责教授实验与基础学科以及计算技术与文化研究方向的课程。他的研究和创作探索艺术、科学和技术的交汇，通过雕塑、电子学和计算方法的结合，创造出融合事实与虚构的叙事作品，常常聚焦于那些具有争议历史和不确定未来的地点。Borsani 教授的作品曾在其全球个人展、团体展和各大节庆活动及学术会议等重要活动及场所展出，包括开罗电子艺术节 Cairotronica、全球计算机图形与互动技术顶级会议 ACM SIGGRAPH、Aesthetica 短片电影节、BIENALSUR 国际双年展、Artech 国际会议、Videobrasil 国际展、Story of Light 艺术文化节、国际影像艺术节、墨尔本 Channels 视频艺术节和拉合尔设计峰会等。

Prof. Alejandro Borsani currently serves as Associate Professor at the Rhode Island School of Design, where he teaches in the Experimental and Foundation Studies division and the Computation, Technology and Culture concentration. He is an artist who explores the intersections of art, science and technology through his work with sculpture, electronics and computational methods. He utilizes video and animation to create narratives that blend fact and fiction around sites with contested histories and uncertain futures.

His works have been presented in solo shows, group exhibitions, festivals and conferences around the world in such venues as Cairotronica (Cairo), ACM SIGGRAPH (LA), Aesthetica Short Film Festival (York), BIENALSUR (Buenos Aires), Artech (Braga), Videobrasil (São Paulo), Story of Light (Goa), Festival Internacional de la Imagen (Manizales), Channels (Melbourne) and Lahore Design Summit (Lahore).

2. 课程介绍

本课程深度探索当代艺术、科学与技术的跨界融合，以新媒体艺术为载体，追溯从文艺复兴时期到人工智能时代艺术表达与技术革新的历史脉络。学生将通过分析批判性介入科学研究的先锋艺术作品（如生物艺术、数据雕塑、生成式 AI 创作），探讨新兴技术引发的哲学命题（如机器创造力、虚拟身份伦理、环境数据叙事），并研究艺术家如何以创新手段回应气候变化、数字隐私等社会挑战。

课程结合案例研究、技术工作坊（Processing 创意编程、Arduino 互动装置、Unreal 引擎虚拟叙事）与跨学科理论，培养学生在艺术科技前沿领域的批判思维与实践能力，最终完成融合科技批判性与美学深度的研究提案或艺术创作方案。

This seminar explores the dynamic intersection of art, science, and technology in contemporary and new media art, tracing historical connections between artistic expression and technological innovation. Students will analyze groundbreaking artworks that critically engage with scientific research, investigating the philosophical questions raised by emergent technologies while examining artists' creative responses to societal challenges. Through in-depth case studies and demos, participants will gain profound insights into cutting-edge artistic methodologies, technological research in creative contexts, and the emerging possibilities at the frontier of interdisciplinary practice.

The course provides a comprehensive journey through the traditions and future potential of art that bridges personal expression with technological discovery, offering a nuanced

understanding of how artists transform scientific and technological developments into powerful, critically reflective creative experiences.

3. 课程大纲

1. 艺术与科技的概念碰撞与策展
2. 视觉：光学原理、色彩理论与视觉错觉
3. 听觉：声音作为艺术的特点、技术与空间
4. 自然现象中的数学规律与其美学潜质
5. 如何将科学数据转化为视觉叙事的艺术
6. 电子艺术及物理计算在互动装置中的应用
7. 如何以自然现象为基础构建艺术概念
8. 生物艺术、非有机生命与后人类美学
9. 虚拟现实如何构建交互艺术与沉浸式体验
10. 网络与集体智能在艺术策展中的应用

1. Introduction – Art at the Intersection of Science and Technology
2. Light and Color – Optics and Visual Perception
3. Sound, Technology, and Space – Sound as Art
4. Nature as artist – From Fractals to Generative Art
5. Data Visualization and Art – Bridging Science and Aesthetics
6. Interactive Art – Custom Electronics and Physical Computing
7. Natural Systems and Environmental Narratives
8. BioArt, non-organic life and post human aesthetics
9. Embodiment and Virtual Reality
10. Networks and Collective Intelligence

5. 企业专家实践课程

课程一：《游戏 IP 影视化的跨界实战：影视项目开发全流程深度解析》

Cross-Media Entertainment - From Game IP to Global Content

行业方向：游戏影视与流媒体行业

1. 专家介绍

Peng Fan

HoYoverse 创意开发与内容制作部首席制片人

- 曾任 Netflix 全球原创动漫制作财务经理
- 曾任派拉蒙影业公司 企业规划高级财务分析师
- 曾任普华永道娱乐行业管理顾问

2. 任职企业介绍

HoYoverse（米哈游）是一家全球知名的中国游戏开发与发行公司，以制作高品质的二次元风格游戏和开放世界 RPG 著称。2011 年(总部位于中国上海).代表作品《原神》(Genshin Impact),《崩坏》系列 HoYoverse 凭借技术创新与全球化策略，成为中国游戏出海的标杆企业之一。

Netflix 从 DVD 租赁商蜕变为流媒体巨头，凭借数据算法+原创内容重塑娱乐行业，未来将持续探索游戏、广告、AI 等新增长点，巩固其“全球内容帝国”地位。关键数据（2023）：全球付费用户超 2.3 亿（覆盖 190+国家）；年营收超 330 亿美元；市值约 2000 亿美元（好莱坞市值最高媒体公司）。代表作品：剧集：《怪奇物语》《王冠》《鱿鱼游戏》（首个全球爆款非英语剧）。

3. 课程介绍

在内容为王的时代，将顶级游戏 IP 转化为成功的影视作品，已成为全球娱乐产业的核心增长点。然而，这一跨界过程充满了叙事重构、技术实现与全球协作的复杂挑战。

本课程由 HoYoverse 创意开发首席制片人、前 Netflix 亚太内容战略师主导设计。课程将深度结合其在 《赛博朋克：边缘行者》 等成功案例中的实战经验，并融入其对《原神》等顶级 IP 进行影视化开发的前沿工作，系统性地解析游戏 IP 跨界影视的完整流程。

学生将通过本课程，掌握从 IP 评估、跨媒介叙事、多国团队管理到商业模型构建的全套方法论，获得驾驭未来超级 IP 项目的核心能力，为进入全球顶级内容开发赛道奠定坚实基础。

As content becomes king, transforming top-tier game IP into successful film and television projects has emerged as a core growth driver in global entertainment. Yet this cross-media journey presents complex challenges in narrative reconstruction, technical execution, and global collaboration.

Developed by HoYoverse's Creative Development Chief Producer and former Netflix APAC Content Strategist, this course builds on proven successes like ""Cyberpunk: Edgerunners"" while incorporating cutting-edge work on titles like ""Genshin Impact."" It systematically deconstructs the complete game-to-screen adaptation pipeline.

Participants will gain comprehensive methodology spanning IP evaluation, transmedia storytelling, multinational team management, and business model construction—equipping them with the core competencies to navigate future super-IP projects and establish themselves in the global content development arena.

4. 课程大纲

开篇

1.娱乐产业变革与未来格局

模块一：游戏 IP 开发与战略布局

2. 游戏 IP 的跨媒介开发潜力评估

3. 跨媒介叙事与世界观构建策略

4. 全球 IP 本土化运营框架

模块二：影视制作与全球发行

5. 从游戏到影视的完整改编流程

6. 跨界制片管理与多团队协作

7. 全球内容战略：亚太市场与全球拓展

模块三：商业战略与前沿视野

8. 娱乐产业投资模型解析

9. 数据驱动的内容决策方法论

10. 娱乐领域前沿技术洞察"

1.The Evolving Entertainment Landscape

MODULE 1: GAME IP DEVELOPMENT & STRATEGY

2.Evaluating Game IP for Cross-Media Adaptation

3.Transmedia Worldbuilding Strategies

4.Global IP Localization Frameworks

MODULE 2: FILM & TV PRODUCTION

5.The Adaptation Process: Games to Screen

6.Managing Cross-Media Productions

7.Global Content Strategy: APAC and Beyond

MODULE 3: BUSINESS STRATEGY & FINANCE

8.Entertainment Investment Models

9.Data-Driven Content Decisions

10.Emerging Technologies in Entertainment

课程二：《生成式 AI 产品构建与创业者心智模型：理论与硅谷-亚洲实践》

ASCEND|Inner Power & Leadership Lab & AI Future Builders Launchpad

行业方向：人工智能与风险投资

1. 专家介绍

Caitlin Cai

Rakuten 乐天产品部门负责人

- 合著畅销书《重构：用生成式 AI 打造产品》
- 曾任元象 XVERSE 执行董事
- 曾任 MetaX Ventures 执行董事

2. 任职企业介绍

乐天株式会社（Rakuten），是日本最大电子商店街“乐天市场”经营者，日本乐天市场是 B2B2C 购物平台，是日本最大电子商店街。其所属的乐天株式会社 JASDAQ 上市公司，创立于 1997 年，是日本经团会员，日本 Rakuten 通过一系列积极并购，目前旗下产业包含乐天银行、证券公司、职业棒球队、旅游网站等。

元象 XVERSE 是一家成立于 2021 年初、总部位于深圳的科技公司，专注于人工智能（AI）与 3D 技术的融合，致力于打造 AI 驱动的 3D 内容生产与消费一站式平台，愿景是“定义你的世界”。创始人：姚星，前腾讯副总裁、腾讯 AI Lab 和 RoboticsX Lab 创始人，现为国家科技部新一代人工智能战略咨询委员会成员。融资情况：截至目前，元象已完成累计超过 2 亿美元的融资，投资方包括腾讯、高榕资本、五源资本、高瓴创投、红杉中国、淡马锡和 CPE 源峰等知名机构。

3. 课程介绍

ASCEND 是一门培养未来 AI 领袖的先锋课程，创造性融合 “内在领导力” 与 “前沿科技创业” 。课程旨在应对核心挑战：帮助学习者在技术巨变中确立清晰的自我认知与目标感，并掌握将愿景转化为现实的硬技能。通过 AI 产品、创业融资等硬核知识，结合心理学与设计思维工作坊，引导学员完成内在成长，最终制定出兼具雄心与可行性的个人发展蓝图，成为技术与人文兼备的变革者。

ASCEND is a pioneering program cultivating future leaders for the AI era, uniquely blending “Inner Leadership” with “Frontier Tech Entrepreneurship”. It addresses the

core challenge of maintaining self-awareness and purpose amidst technological disruption, while mastering the hard skills to turn vision into reality. Through rigorous modules on AI product strategy, startup financing, and immersive psychology and design thinking workshops, the course guides participants through profound inner development. They will emerge with a concrete, ambitious career or startup roadmap, equipped to become changemakers who unite technical mastery with human-centric leadership.

4. 课程大纲

1.自我意识与个人能动性基础

2.情绪掌控与关系智力

3.目标感与巅峰状态激活

4.愿景、目标与身份整合

5.解密 AI 世界：生态、趋势与机遇

6.AI 产品思维与创新框架

7.设计思维与创意实验室

8.组建初创公司：团队、模式与早期增长

9.风险投资、私募股权与创业融资

10.最终路演：你的职业与创业蓝图

1.Foundations of Self-Awareness & Personal Agency

2.Emotional Mastery & Relational Intelligence

3.Intentionality & Activating Peak States

4.Vision, Purpose, and Identity Alignment

5.Demystifying the World of AI: Ecosystem, Trends & Opportunities

6.Product Thinking & Innovation in AI

7.Design Thinking Creative Lab

8.Building a Startup: Team, Model & Early Go-to-Market

9.Venture Capital, Private Equity & Startup Finance

10.Your Career & Startup Roadmap