

课程详述

COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	课程名称 Course Title	医学人工智能导论 Introduction to Medical Artificial Intelligence
2.	授课院系 Originating Department	医学院 School of Medicine
3.	课程编号 Course Code	MED331
4.	课程学分 Credit Value	2
5.	课程类别 Course Type	专业基础课 Major Foundational Courses
6.	授课学期 Semester	秋季/Fall
7.	授课语言 Teaching Language	中英双语 English & Chinese
8.	授课教师、所属学系、联系方式 (如属团队授课, 请列明其他授课教师) Instructor(s), Affiliation & Contact (For team teaching, please list all instructors)	 刘江, 教授, 计算机科学与工程系, liuj@sustech.edu.cn Jiang Liu, Professor, Department of Computer Science and Engineering, liuj@sustech.edu.cn
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	
10.	选课人数限额(可不填) Maximum Enrolment (Optional)	

11. 授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 Tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other (Please specify)	总学时 Total
学时数 Credit Hours	32				32
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	NA				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	无 None				
14. 其它要求修读本课程的学系 Cross-listing Dept.	无 None				

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

<p>This course provides an introduction to artificial intelligence in Medicine (AIM) . Topics talked will help students to achieve the following 4 main objectives:</p> <ol style="list-style-type: none"> 1) Highlight fundamental AI concepts and development milestones: introduce the AI development history, the formation of some key AI concepts like Agent, Learning, Reasoning and key algorithms like Perceptron, SVM, CNN algorithms, and importantly biological, psychological and medical foundations behind AI development. Teaching medical students the inherited relationship between the AI and Medicine development. 2) Introduce the AI models, algorithms and platforms behind the medicine research in terms of CAD (Computer Aided medical Diagnosis) for medical disease screening, CAI (Computer Aided Intervention) for medical operation planning/intervention/evaluation. 3) Introduce the popular deep neural network ALPHAFOLD and various popular deep learning network structures and development platform. Introduce data driven deep learning model and how it can be combined with the medicine big data to assist medical science discovery. 4) Inspire student's interest using AI for their medical career: In order to encourage students to engage AI in their medical careers and study, various AI medical applications will be introduced and discussed. Students are asked to work on AI medical application projects with the help from clinicians, group project presentation will be graded. <p>医学人工智能导论课程将介绍医学人工智能的基本概念及理论，将从以下4个方面进行展开：</p> <ol style="list-style-type: none"> 1) 重点介绍人工智能的基本概念和发展里程碑：介绍人工智能的发展历史、智能体、学习、推理等一些关键人工智能概念的形成，以及感知器、SVM、CNN 算法等关键算法。以及人工智能发展背后重要的生物学、心理学和医学基础。教导医学生掌握人工智能与医学发展之间的内在传承关系。 2) 介绍医学研究背后的人工智能模型、算法和平台，包括 CAD（计算机辅助医疗诊断）和计算机辅助医学疾病筛查、CAI（计算机辅助干预）和医疗手术规划/干预/评估。 3) 介绍流行的深度神经网络 ALPHAFOLD 和各种流行的深度学习网络结构和开发平台。介绍数据驱动的深度学习的模型，以及如何将其与医学大数据相结合，以帮助医学科学发现。 4) 激发学生在医疗职业中使用人工智能的兴趣：为了鼓励学生在医疗事业和学习中使用人工智能，将介绍和讨论各种人工智能医疗应用。学生们被要求在临床医生的帮助下从事人工智能医学应用项目，小组项目演示将被评分。
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16. 预达学习成果 Learning Outcomes

On completion of the “Introduction to Artificial Intelligence in Medicine” module, students should be able to:

- 1) Understand the AI concepts and learn the AI development milestones. Understand the biological, psychological and medical foundations behind AI development. Teaching medical students the inherited relationship between the AI and Medicine development.
- 2) Understand AI CAD (Computer Aided medical Diagnosis) algorithms for medical disease screening and diagnosis, AI CAI (Computer Aided Intervention) algorithms for medical operation planning/intervention/evaluation.
- 3) Know some popular deep neural network like ALPHAFOLD as well as some AI development platforms. Know how AI can be combined with the medicine big data to assist medical science discovery.
- 4) Inspire students to think and explore further in engaging AI for real-world medical applications in the future career and studies

完成“医学中的人工智能入门”模块后，学生应能够获得如下技能：

- 1) 理解人工智能概念，学习人工智能开发里程碑。了解人工智能开发背后的生物学、心理学和医学基础。使医学学生了解人工智能与医学发展之间的内在关系。
- 2) 了解用于医疗疾病筛查和诊断的 AI CAD（计算机辅助医疗诊断）算法，以及用于医疗手术规划/干预/评估的 AI CAI（计算机辅助干预）算法。
- 3) 了解一些流行的深层神经网络，比如 ALPHAFOLD，以及一些人工智能开发平台。了解人工智能如何与医学大数据相结合，以帮助医学科学发现。
- 4) 鼓励学生在未来的职业和研究中进一步思考和探索人工智能在现实世界中的医学应用

17. 课程内容及教学日历（如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）

Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

Week 1: Introduction of AI: Definition and Issues

Week 2: AI and Medicine

Week 3: AI Development Milestone

Week 4: Biology Neuron and Artificial Neuron

Week 5: Biological Hebb Rule and AI Learning

Week 6: Perceptron

Week 7: Perceptron Learning

Week 8: Mid-Term Examination

Week 9: Back Propagation Learning and Feed Forward Neural Networks

Week 10: Machine Learning

Week 11: Machine Learning SVM algorithm and AI Applications

Week 11: Deep Learning - Convolutional Neural Networks

Week 12: Deep Learning Algorithms and AI Application in Medicine

Week 14: Medical AI Applications and Student Project Presentations

Week 15: Medical AI Applications and Student Project Presentations

Week 16: Summary and Revision

第一周：人工智能介绍：定义和问题

第 2 周：人工智能和医学

第 3 周：人工智能发展里程碑

第 4 周：生物神经元和人工神经元

第 5 周：生物 Hebb 规则和人工智能学习

第 6 周：感知机

第 7 周：感知机学习

第 8 周：期中考试

第 9 周：反向传播学习和前馈神经网络

第 10 周：机器学习



第 11 周：机器学习 SVM 算法和人工智能应用

第 11 周：深度学习-卷积神经网络

第 12 周：深度学习算法和人工智能在医学中的应用

第 14 周：医学人工智能应用和学生项目演示

第 15 周：医学人工智能应用和学生项目演示

第 16 周：总结和修订

18. 教材及其它参考资料 **Textbook and Supplementary Readings**

1. Artificial Intelligence – A Modern Approach (AIMA) (Russell/Norvig)

Web site: <http://aima.cs.berkeley.edu/>

2. Neural Networks and Deep Learning 《神经网络与深度学习》邱锡鹏

Web site: <https://nndl.github.io/>



课程评估 **ASSESSMENT**

19. 评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance		10		
课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects		40		
平时作业 Assignments				
期中考试 Mid-Term Test		20		
期末考试		30		

Final Exam				
期末报告 Final Presentation				
其它（可根据需要 改写以上评估方式） Others (The above may be modified as necessary)				

20. 记分方式 **GRADING SYSTEM**

- A. 十三级等级制 **Letter Grading**
 B. 二级记分制（通过/不通过） **Pass/Fail Grading**

课程审批 REVIEW AND APPROVAL

21. 本课程设置已经过以下责任人/委员会审议通过
This Course has been approved by the following person or committee of authority