

机器学习 教学大纲

Machine Learning Subject Syllabus

一、课程信息 Subject Information

课程编号: Subject ID	3100313015	开课学期: Semester	5
课程分类: Category	专业教育 PA	所属课群: Section	专业方向类
课程学分: Credit Points	2.5	总学时/周: Total Hours/Weeks	40
理论学时: LECT. Hours	40	实验学时: EXP. Hours	0
PBL 学时: PBL Hours	0	实践学时/周: PRAC. Hours/Weeks	0
开课学院: College	东北大学 悉尼智能科技学院	适用专业: Stream	应用统计学 AS
课程属性: Pattern	选修 Elective	课程模式: Mode	自建 NEU
中方课程协调人: NEU Coordinator	张琨 Kun Zhang	成绩记载方式: Result Type	百分制 Marks
先修课程: Requisites	数理统计 Mathematical Statistics		
英文参考教材: EN Textbooks	Peter Harrington. Machine Learning in Action. Manning Publications, 2012		
中文参考教材: CN Textbooks	周志华, 《机器学习》, 清华大学出版社, 2016		
教学资源: Resources			
课程负责人(撰写人): Subject Director	张琨 Kun Zhang	提交日期: Submitted Date	单击或点击此处输入日期。
任课教师(含负责人): Taught by	张琨 Kun Zhang		
审核人: Checked by	韩鹏	批准人: Approved by	史闻博
		批准日期: Approved Date	单击或点击此处输入日期。

二、教学目标 Subject Learning Objectives (SLOs)

注：毕业要求及指标点可参照悉尼学院本科生培养方案，可根据实际情况增减行数

Note: GA and index can be referred from undergraduate program in SSTC website. Please add/reduce lines based on subject.

<p>整体目标: Overall Objective</p>	<p>通过本课程的学习，学生掌握适合在计算机上使用的概率、统计、代数、优化等方法以及与此相关的理论，掌握一些经典而且常用的机器学习方法，为专业课学习和参加工程实践打下必要的基础。</p> <p>Through the study of this course, students will master methods such as probability, statistics, algebra, optimization, and related theories suitable for use on computers. They will also master some classic and commonly used machine learning methods, laying a necessary foundation for professional courses and participating in engineering practice.</p>	
<p>(1) 专业目标: Professional Ability</p>	<p>1-1</p>	<p>掌握假设空间、经验误差与过拟合、性能度量等机器学习的基础知识</p> <p>Master the basic knowledge of machine learning such as hypothesis space, empirical error and overfitting, performance measurement, etc</p>
	<p>1-2</p>	<p>掌握对数几率回归、决策树、神经网络、支持向量机等经典而常用的机器学习算法</p> <p>Mastering classic and commonly used machine learning algorithms such as logarithmic probability regression, decision trees, neural networks, and support vector machines</p>
	<p>1-3</p>	<p>能利用相关软件实现机器学习算法，学会用计算机求解科学技术问题</p> <p>Able to use relevant software to implement machine learning algorithms and learn to use computers to solve scientific and technological problems</p>
<p>(2) 德育目标: Essential Quality</p>	<p>2-1</p>	<p>培养科学与工程应用的意识和素质</p> <p>Cultivate awareness and quality of scientific and engineering applications</p>
	<p>2-2</p>	<p>逐步培养学生的探索精神和创新能力</p> <p>Gradually cultivate students' exploratory spirit and innovative ability</p>
	<p>2-3</p>	<p>为将来从事相关研究奠定基础</p> <p>Laying the foundation for future research in related fields</p>
<p>课程教学目标与毕业要求的对应关系 Matrix of GA & SLOs</p>		
<p>毕业要求 GA</p>	<p>指标点 GA Index</p>	<p>教学目标 SLOs</p>

<p>3、设计/开发解决方案：能够设计针对复杂实际问题的解决方案，设计满足特定需求的系统、单元或流程，并能够在设计环节中体现创新意识，考虑社会、健康、安全、法律、文化以及环境等因素</p> <p>3. Design/Development of Solutions: Design solutions for complex practical problems and design systems, components or processes that meet specified needs with appropriate consideration for public health, and safety, cultural, societal and environmental considerations.</p>	<p>3-1: 能够设计针对本专业相关复杂实际问题的解决方案 3-1: Capable of designing solutions to complex practical problems related to this major</p> <p>3-2: 能够对不同设计方案进行比较和优化，在工作各环节中具有创新意识和批判意识，善于发现、分析、系统表述和解决实际问题 3-2: Capable of comparing and optimizing different design schemes, having a sense of innovation and criticism in all aspects of work, and be good at discovering, analyzing, systematically elaborating and solving practical problems</p> <p>3-3: 能够在设计和开发的各个环节中综合考虑社会、健康、安全、法律、文化以及环境等因素 3-2: Capable of comparing and optimizing different design schemes, having a sense of innovation and criticism in all aspects of work, and be good at discovering, analyzing, systematically elaborating and solving practical problems</p>	<p>1-1 到 1-3 2-1 到 2-3</p>
<p>4、研究：能够基于科学原理并采用科学方法对复杂实际问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论</p> <p>4. Investigation: Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions</p>	<p>4-1: 能够基于科学原理并采用科学方法，在本专业相关理论指导下对复杂实际问题设计实验进行研究 4-1: Capable of design experiments on complex problems with scientific knowledge and research methods of this major</p> <p>4-2: 能够结合本专业对实验数据进行分析与解释，设计并优化实验方案，并通过信息综合得到合理有效的结论 4-2: Capable of analyzing and interpreting the experimental data, designing and optimizing the experimental schemer with the knowledge of this major; reasonable and effective conclusions are obtained through information synthesis</p>	<p>1-1 到 1-3 2-1 到 2-3</p>

<p>5、使用现代工具: 能够针对复杂实际问题, 开发、选择与使用恰当的技术、资源、现代信息技术工具, 包括对复杂实际问题的预测与模拟, 并能够理解其局限性</p> <p>5. Modern Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to complex practical problems, with an understanding of the limitations</p>	<p>5-2 熟悉解决本专业相关复杂实际问题所需的技术和资源, 能够运用现代信息技术进行文献检索和资料查询, 获取专业解决方案</p> <p>5-2: Familiar with the technology and resources required to solve complex practical problems related to the major, capable of using modern information technology to conduct document retrieval and data query, and obtaining professional solutions</p>	<p>1-1 到 1-3 2-1 到 2-3</p>
	<p>5-3: 能够针对本专业相关复杂实际问题, 选择与使用恰当的技术、资源、现代信息技术工具</p> <p>5-3: Capable of selecting and using appropriate technology, resources, and modern information technology tools in response to complex practical problems related to the major</p>	

三、教学内容 Content (Topics)

注: 以中英文填写, 各部分内容的表格可根据实际知识单元数量进行复制、扩展或缩减

Note: Filled in both CN and EN, extend or reduce based on the actual numbers of knowledge unit

(1) 理论教学 Lecture

知识单元序号: Knowledge Unit No.	1	支撑教学目标: SLOs Supported	1-1、2-1 到 2-3
知识单元名称 Unit Title	机器学习的基础知识 Fundamentals of Machine Learning		
知识点: Knowledge Delivery	经验误差与过拟合 Empirical error and overfitting		
	评估方法 Evaluation method		
	性能度量 Performance metrics		
	比较检验 Comparative testing		
	偏差与方差 Deviation and variance		
学习目标: Learning Objectives	了解: Recognize	机器学习的产生与发展 The emergence and development of machine learning	
	理解: Understand	比较检验 Comparative testing	
	掌握:	经验误差与过拟合、偏差与方差	

	Master	Empirical error and overfitting, deviation and variance
德育目标 Moral Objectives	培养科学与工程应用的意识和素质 Cultivate awareness and quality of scientific and engineering applications	
	逐步培养学生的探索精神和创新能力 Gradually cultivate students' exploratory spirit and innovative ability	
	为将来从事相关研究奠定基础 Laying the foundation for future research in related fields	
重点: Key Points	评估方法 Evaluation method	
	性能度量 Performance metrics	
难点: Focal Points	偏差与方差 Deviation and variance	

知识单元序号: Knowledge Unit No.	2	支撑教学目标: SLOs Supported	1-2、1-3、2-1 到 2-3
知识单元名称 Unit Title	经典而常用的机器学习方法 Classic and commonly used machine learning methods		
知识点: Knowledge Delivery	线性模型 (Linear model		
	决策树) Decision Tree		
	神经网络 Neural network		
	支持向量机 Support Vector Machine		
	贝叶斯分类器 Bayesian classifier		
	集成学习 Integrated learning		
	聚类 Clustering		
学习目标: Learning Objectives	了解: Recognize	各类算法的发展 Development of various algorithms	
	理解: Understand	机器学习方法的理论推导 Theoretical derivation of machine learning methods	
	掌握: Master	机器学习方法的应用及编程实现 Application and Programming Implementation of Machine Learning Methods	
德育目标 Moral Objectives	培养科学与工程应用的意识和素质 Cultivate awareness and quality of scientific and engineering applications		
	逐步培养学生的探索精神和创新能力 Gradually cultivate students' exploratory spirit and innovative ability		

	为将来从事相关研究奠定基础 Laying the foundation for future research in related fields
重点: Key Points	神经网络 Neural network
	支持向量机 Support Vector Machine
	贝叶斯分类器 Bayesian classifier
难点: Focal Points	集成学习 Integrated learning

知识单元序号: Knowledge Unit No.	3	支撑教学目标: SLOs Supported	1-2、1-3、2-1 到 2-3
知识单元名称 Unit Title	进阶知识 Advanced knowledge		
知识点: Knowledge Delivery	卷积神经网络 Convolutional neural network		
	迁移学习 Transfer learning		
	元学习 Meta learning		
学习目标: Learning Objectives	了解: Recognize	元学习 Meta learning	
	理解: Understand	迁移学习 Transfer learning	
	掌握: Master	卷积神经网络 Convolutional neural network	
德育目标 Moral Objectives	培养科学与工程应用的意识和素质 Cultivate awareness and quality of scientific and engineering applications		
	逐步培养学生的探索精神和创新能力 Gradually cultivate students' exploratory spirit and innovative ability		
	为将来从事相关研究奠定基础 Laying the foundation for future research in related fields		
重点: Key Points	卷积神经网络 Convolutional neural network		
难点: Focal Points	迁移学习 Transfer learning		

(2) 实验教学 Experiments

注：可根据实际情况增减行数。实验类型可分为验证性、设计性、综合性，实验性质可分为选做、必做。

Note: Please add/reduce lines based on subject. The Type contains Verify, Design, and Comprehensive, while the Pattern contains Required and Elective

无

None

四、教学安排 Teaching Schedule

注：可根据实际情况增减行数

Note: Please add/reduce lines based on subject.

教学内容 Teaching Content	学时(周) Hour(Week)			
	理论 LECT.	实验 EXP.	课外实践 PBL	集中实践 PRAC.
机器学习的基础知识 Fundamentals of Machine Learning	4			
线性模型 (Linear model	4			
决策树) Decision Tree	4			
神经网络 Neural network	4			
支持向量机 Support Vector Machine	4			
贝叶斯分类器 Bayesian classifier	4			
集成学习 Integrated learning	4			
聚类 Clustering	4			
卷积神经网络 Convolutional neural network	4			
迁移学习 Transfer learning	2			
元学习 Meta learning	2			
总计 Total	40		0	0

五、教学方法 Teaching Methodology

注：可根据实际情况增减行数或修改内容

Note: Please add/reduce lines or revise content based on subject.

勾选 Check	教学方法与特色 Teaching Methodology & Characters
<input checked="" type="checkbox"/>	多媒体教学：基于信息化设备的课堂教学 Multi-media-based lecturing
<input checked="" type="checkbox"/>	实践能力传授：理论与行业、实际案例相结合

	Combining theory with industrial practical problems
<input checked="" type="checkbox"/>	课程思政建设：知识讲授与德育相结合 Knowledge delivery with ethic education
<input checked="" type="checkbox"/>	PBL 教学：问题驱动的分组学习与交流 Problem-based learning
<input type="checkbox"/>	其他:单击或点击此处输入文字。 Other:单击或点击此处输入文字。

六、成绩评定 Assessment

注：可根据实际情况增减行数或修改内容

Note: Please add/reduce lines or revise content based on subject.

考核环节: Assessment Content	平时 Behavior	环节负责人: Director	张琨 Kun Zhang
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	30
考核方式: Measures	满分 100 分，出勤，50 分；作业，50 分。 Full score of 100 points, attendance, 50 points; Homework, 50 points.		

考核环节: Assessment Content	期末 Final	环节负责人: Director	张琨 Kun Zhang
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	70
考核方式: Measures	满分 100 分，通过批阅结课论文给出学生成绩。 Full score of 100 points, providing student grades through reviewing the final thesis		

七、改进机制 Improvement Mechanism

注：未尽事宜以教学团队以及学院教学指导委员会商定为准。

Note: Matters not covered in this file shall be determined by TAB of SSTC, NEU.

教学大纲改进机制 Subject Syllabus Improvement Mechanism			
考核周期(年): Check Period (YR)	4	修订周期(年): Revise Period (YR)	4
改进措施: Measures	课程负责人根据课程教学内容与人才培养目标组织课程团队讨论并修改教学大纲，报分管教学工作副院长审核后由执行院长批准。 The subject coordinator shall be responsible for the syllabus discussion and improvement, and the revised version shall be submitted to deputy dean (teaching affairs) for reviewing then to executive dean for approval		

成绩评定改进机制 Assessment Improvement Mechanism			
考核周期(年): Check Period (YR)	1	修订周期(年): Revise Period (YR)	1
改进措施: Measures	<p>课程负责人根据课程教学内容、课堂教学效果以及成绩分布，对课程教学方法和成绩评定环节进行改进，并同步优化评定办法。</p> <p>The subject coordinator shall revise the syllabus based on the teaching content, effect and result distribution while optimize the assessment measures.</p>		