**《机器学习》教学大纲**

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| 课程代码 | 155387 |
| 课程名称 | 机器学习 |
| 英文名称 | Machine Learning |
| 课程类别 | 学科基础课 |
| 课程性质 | 选修 |
| 学时 | 总学时：48；实验学时：16 |
| 学分 | 2.5 |
| 开课学期 | 5 |
| 开课单位 | 软件学院 |
| 适用专业 | 软件工程、计算机科学 |
| 授课语言 | **英语** |
| 先修课程 | 概率论、线性代数 |
| 毕业要求（专业培养能力） | （本学院开设的专业课填写；根据专业所列的毕业要求来填写） |
| 课程培养学生的能力（教学目标） | 本课程将讲授机器学习的基本概念、典型算法以及相关工业应用，学生将通过该课程了解数据分析的基本流程、基本算法，并熟练掌握相关算法求解实际问题。 |
| 课程简介 | **机器学习**主要研究基于数据的建模、分析和预测，以期从复杂数据中学习某些规律，并用以预测未来的结果和趋势，是大数据科技和人工智能的技术基础，因此是人工智能和大数据方向的方向必须课。 |
| 教学内容与学时分配 | **1.1**机器学习基础 (3)  **1.2** Linear Regression and Gradient Descent (3)  线性回归与梯度下降  **1.3** Linear Classification and Support Vector Machine and Stochastic Gradient Descent (3)  线性分类、支持向量机、随机梯度算法  **1.4** Logistic Regression, Softmax and Multiclass Classification (3)  逻辑回归与多类分类  **1.5** Overﬁtting, Underﬁtting and Cross-Validation  过拟合、欠拟合与交叉验证  **2** Scientific Reading and Writing（3）  科技文阅读与写作  **3** Ensemble methods（Adaboost）(3)  集成学习（Adaboost）  **4** Clustering and Dimension Reduction (PCA) (5)  聚类算法与维度约简  **5** Recommendation Systems (3)  推荐系统  **6** Image Processing Basics  图像处理基础  **7** Neural Networks and Deep Learning(Advanced topic) (3)  神经网络与深度学习 |
| 实验教学（包括上机学时、实验学时、实践学时） | **随堂实验**：  1 Linear Regression and Gradient Descent (4)  线性回归与梯度下降  2 Linear Classification with Stochastic Gradient Descent (4)  线性分类、支持向量机、随机梯度算法  **课程实验**：  1 Classification with Adaboost (4)  逻辑回归与集成学习算法  **2** **Face detection and recognition** (4)  人脸检测与识别基础  3 Recommendation Systems (4)  推荐系统 |
| 教学方法 | 课堂教学与实验教学 |
| 考核方式 | 考试 （50%）+平时成绩（25%）+技术报告（25%） |
| 教材及参考书 | 1 Pattern Recognition And Machine Learning By Bishop  2 Understanding Machine Learning: From Theory to Algorithms By Shai Shalev-Shwartz and Shai Ben-David  3《机器学习》by 周志华 |
| 制定人及制定时间 | 2018/9/12 |

***“CourseTitle”* Syllabus**

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| --- | --- |
| Course Code | 155387 |
| Course Title | Machine Learning |
| Course Category | Disciplinary Basic Course |
| Course Nature | Compulsory Course |
| Class Hours | 48 |
| Credits | 2.5 |
| Semester | 5 |
| Institute | School of Computer Engineering |
| Program Oriented | Software Engineering, Computer Science |
| Teaching Language | English |
| Prerequisites | Linear Algebra, Probability Theory |
| Student Outcomes  (Special Training Ability) | In this course, you'll learn about some of the most widely used and successful machine learning techniques. You'll have the opportunity to implement these algorithms yourself, and gain practice with them. You will also learn some of practical hands-on tricks and techniques (rarely discussed in textbooks) that help get learning algorithms to work well. This is an "applied" machine learning class, and we emphasize the intuitions and know-how needed to get learning algorithms to work in practice, rather than the mathematical derivations. |
| Teaching Objectives | In this course, the students will learn about some of the most widely used and successful machine learning techniques. the students will have the opportunity to implement these algorithms themselves, and gain practice with them. The students will also learn some of practical hands-on tricks and techniques (rarely discussed in textbooks) that help get learning algorithms to work well. |
| Course Description | Machine learning is the subfield of computer science that, according to Arthur Samuel, gives "computers the ability to learn without being explicitly programmed." Samuel, an American pioneer in the field of computer gaming and artificial intelligence, coined the term "machine learning" in 1959 while at IBM. Evolved from the study of pattern recognition and computational learning theory in artificial intelligence, machine learning explores the study and construction of algorithms that can learn from and make predictions on data– such algorithms overcome following strictly static program instructions by making data-driven predictions or decisions through building a model from sample inputs. Machine learning is employed in a range of computing tasks where designing and programming explicit algorithms with good performance is difficult or infeasible; example applications include email filtering, detection of network intruders or malicious insiders working towards a data breach, optical character recognition (OCR), learning to rank, and computer vision. |
| Teaching Content and Class Hours Distribution | **1.1** Machine learning foundation(3)  **1.2** Linear Regression and Gradient Descent (3)  **1.3** Linear Classification and Support Vector Machine and Stochastic Gradient Descent (3)  **1.4** Logistic Regression, Softmax and Multiclass Classification (3)  **1.5** Overﬁtting, Underﬁtting and Cross-Validation  **2** Scientific Reading and Writing（3）    **3** Ensemble methods（Adaboost）(3)  **4** Clustering and Dimension Reduction (PCA) (5)  **5** Recommendation Systems (3)  **6** Image Processing Basics  **7** Neural Networks and Deep Learning(Advanced topic) (3) |
| Experimental Teaching | Quiz experiment:  1 Linear Regression and Gradient Descent (4)  2 Linear Classification with Stochastic Gradient Descent (4)  Course experiment:  1 Classification with Adaboost (4)  **2 Face detection and recognition** (4)  3 Recommendation Systems (4) |
| Teaching Method | Class Teaching and Experimental Teaching |
| Examination Method | ***Semester grades will be based 25% on class attendance and participation, 25% on the experiments performance and 50% of exams.*** |
| Teaching Materials and Reference Books | Pattern Recognition And Machine Learning By Bishop  Understanding Machine Learning: From Theory to Algorithms by Shai Shalev-Shwartz and Shai Ben-David  《机器学习》by 周志华 |
| Prepared by Whom and When | 2018/09/12 |

**《机器学习》实验教学大纲**

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| 课程代码 | 155387 |
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| 英文名称 | Machine Learning |
| 课程类别 | 学科基础课 |
| 课程性质 | 选修 |
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| 学分 | 2.5 |
| 开课学期 | 5 |
| 开课单位 | 软件学院 |
| 适用专业 | 软件工程、计算机科学 |
| 授课语言 | 英语 |
| 先修课程 | 概率论、线性代数 |
| 毕业要求（专业培养能力） | （本学院开设的专业课填写；根据专业所列的毕业要求来填写） |
| 课程培养学生的能力（教学目标） | 本课程将讲授机器学习的基本概念、典型算法以及相关工业应用，学生将通过该课程了解数据分析的基本流程、基本算法，并熟练掌握相关算法求解实际问题。 |
| 课程简介 | **机器学习**主要研究基于数据的建模、分析和预测，以期从复杂数据中学习某些规律，并用以预测未来的结果和趋势，是大数据科技和人工智能的技术基础，因此是人工智能和大数据方向的方向必须课。 |
| 主要仪器设备与软件 | 电脑、matlab以及其他开源软件 |
| 实验报告 | **随堂实验**：  1 Linear Regression and Gradient Descent (4)  线性回归与梯度下降  2 Linear Classification with Stochastic Gradient Descent (4)  线性分类、支持向量机、随机梯度算法  **课程实验**：  1 Classification with Adaboost (4)  逻辑回归与集成学习算法  **2** **Face detection and recognition** (4)  人脸检测与识别基础  3 Recommendation Systems (4)  推荐系统 |
| 考核方式 | 实验报告 |
| 教材、实验指导书及教学参考书目 | 1 Pattern Recognition And Machine Learning By Bishop  2 Understanding Machine Learning: From Theory to Algorithms By Shai Shalev-Shwartz and Shai Ben-David  3《机器学习》by 周志华 |
| 制定人及发布时间 | 2018/9/12 |

**《机器学习》实验教学内容与学时分配**

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| 实验项目编号 | 实验项目名称 | 实验学时 | 实验内容提要 | 实验类型 | 实验要求 | 每组人数 | 主要仪器设备与软件 |
| 1 | 线性回归与梯度下降 | 4 | 掌握线性回归概念，掌握梯度算法解决实践问题 | 验证性 | 必做 | 3 | 个人电脑 |
| 2 | 线性分类,支持向量机与随机梯度算法 | 4 | 掌握线性分类概念，利用随机梯度优化算法解决大规模线性分类问题 | 验证性 | 必做 | 3 | 个人电脑 |
| 3 | Adaboost分类算法实践 | 4 | 利用Adboost解决人脸检测问题 | 综合性 | 必做 | 3 | 个人电脑 |
| 4 | 推荐系统实践 | 4 | 实现一个基于内容或者基于用户评分的用户推荐系统 | 探索性 | 必做 | 3 | 个人电脑 |
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***“Machine Learning”* Syllabus**

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| --- | --- |
| Course Code | 155387 |
| Course Title | Machine Learning |
| Course Category | Disciplinary Basic Course |
| Course Nature | Elective Course |
| Class Hours | 48 |
| Credits | 2.5 |
| Semester | 5 |
| Institute | School of Computer Engineering |
| Program Oriented | Software Engineering, Computer Science |
| Teaching Language | English |
| Prerequisites | Linear Algebra, Probability Theory |
| Student Outcomes (Special Training Ability) | In this course, you'll learn about some of the most widely used and successful machine learning techniques. You'll have the opportunity to implement these algorithms yourself, and gain practice with them. You will also learn some of practical hands-on tricks and techniques (rarely discussed in textbooks) that help get learning algorithms to work well. This is an "applied" machine learning class, and we emphasize the intuitions and know-how needed to get learning algorithms to work in practice, rather than the mathematical derivations. |
| Teaching Objectives | In this course, the students will learn about some of the most widely used and successful machine learning techniques. the students will have the opportunity to implement these algorithms themselves, and gain practice with them. The students will also learn some of practical hands-on tricks and techniques (rarely discussed in textbooks) that help get learning algorithms to work well. |
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| Instruments and Equipments | Quiz experiment:  1 Linear Regression and Gradient Descent (4)  2 Linear Classification with Stochastic Gradient Descent (4)  Course experiment:  1 Classification with Adaboost (4)  **2 Face detection and recognition** (4)  3 Recommendation Systems (4) |
| Experiment Report | Required |
| Assessment | Experimental Report |
| Teaching Materials and Reference Books | 1 Pattern Recognition And Machine Learning By Bishop  2 Understanding Machine Learning: From Theory to Algorithms By Shai Shalev-Shwartz and Shai Ben-David  3《机器学习》by 周志华 |
| Prepared by Whom and When | 2018/9/12 |

***“CourseTitle”* Experimental Teaching Arrangements**

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| No. | Experiment Item | Class Hours | Content Summary | Category | Requirements | Number of StudentsEach Group | Instruments, Equipments and Software |
| 1 | Linear Regression and Gradient Descent (4) | 4 | Understand linear regression and implement based on gradient descent method | Verification | Compulsory | 3 | Personal Computer |
| 2 | Linear Classification with Stochastic Gradient Descent (4) | 4 | Understand linear classification and implement based on stochastic gradient descent method | Verification | Compulsory | 3 | Personal Computer |
| 3 | Classification with Adaboost (4) | 4 | Implement face detection based on Adaboost method | Comprehensive | Compulsory | 3 | Personal Computer |
| 4 | Recommendation Systems (4) | 4 | Implement and complete a recommendation system based on content or user preference | Exploratory | Compulsory | 3 | Personal Computer |
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