南方科技大学 SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

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	**模式识别 Pattern Recognition**
2.	授课院系 Originating Department	电子与电气工程系 Department of Electronic and Electrical Engineering
3.	课程编号 Course Code	EE423-14
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	通识必修课程 General Education (GE)Required Courses 专业核心课 Major Core Courses 专业选修课 Major Elective Courses
6.	授课学期 Semester	春季 Spring
7.	授课语言 Teaching Language	英文 English
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）	时红建 Hongjian Shi 电子与电气工程系 Electrical and Electronic Engineering shihj@sustech.edu.cn
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	无 NA / 待公布 To be announced
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		64

12.	**先修课程、其它学习要求 Pre-requisites or Other Academic Requirements**	MA103A 线性代数 I-A MA212 概率与数理统计 MA103A Linear Algebra I-A MA212 Probability and Statistics
13.	**后续课程、其它学习规划 Courses for which this course is a pre-requisite**	机器学习，人工智能， 图像处理 Machine Learning, Artificial Intelligence, Image Processing
14.	**其它要求修读本课程的学系 Cross-listing Dept.**	数学系，计算机系，生物医学工程系 Departments of Computer Science, Biomedical Engineering， Mathematics

教学大纲及教学日历 SYLLABUS

15. **教学目标 Course Objectives**

课程学习目标：到课程结束，学生能做如下：

- 推导与程序执行贝叶斯理论
- 进行参数与非参数密度分布估计
- 对分离与不可分离的模式，涉及分类器
- 使用神经网络进行分类

Course Learning Objectives: By the end of this class, students would:

- Derive and implement Bayes Decision Theory.
- Perform Parametric and Non Parametric Density Estimation.
- Design Linear Classifiers for separable and non-separable patterns.
- Implement classifiers using neural networks.

16. **预达学习成果 Learning Outcomes**

- 理解贝叶斯决策理论
- 推导与程序执行贝叶斯理论
- 进行参数与非参数密度分布估计
- 对分离与不可分离的模式，涉及分类器
- 使用神经网络进行分类
- 应用模式识别技术到各个领域与实际工作中

- Understand Bayes decision theory
- Derive and implement Bayes Decision Theory.
- Perform Parametric and Non-Parametric Density Estimation.
- Design Linear Classifiers for separable and non-separable patterns.
- Implement classifiers using neural networks.
- Apply the techniques in Pattern Recognition in various fields and practical works

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.)

教学大纲： 周

1. 课程介绍 1-2
   - 1.1 数学基础
   - 1.2 信号与系统

2. 贝叶斯决策论..... 3-5
   - 2.1 连续情况的贝叶斯分类
   - 2.2 高斯二分法
   - 2.3 离散情况的贝叶斯分类
   - 2.4 误差概率与接受端操作刻画

3. 最大可能性与贝叶斯参数估计 6-8
   - 3.1 最大可能性估计
   - 3.2 贝叶斯分类应用
   - 3.3 高斯密度函数的期望值

4. 非参数技术..... 9-12
   - 4.1 概率密度函数
   - 4.2 帕仁窗口估计
   - 4.3 k 最邻估计
   - 4.4 最邻规则
   - 4.5 k 最邻规则

5. 线性判别函数.....12-16
   - 5.1 线性判别函数与决策面
   - 5.2 两类情况
   - 5.3 一般线性判别函数
   - 5.4 缓和步骤
   - 5.5 最小平方误差方法
   - 5.6 线性规划程序

SYLLABUS

COURSE OUTLINE Week

1. INTRODUCTION 1-2
   - 1.1 MATHEMATICAL FOUNDATION
   - 1.2 Signal and System

2. BAYES DECISION THEORY..... 3-5
   - 2.1 Bayes Classier for Continuous Case
   - 2.2 The Gaussian Two-class classifier
   - 2.3 Bayes Classier for Discrete Case
   - 2.4 Error Probability and Receiver Operating Characteristics

3. MAXIMUM-LIKELIHOOD AND BAYESIAN PARAMETER ESTIMATION..... 6-8
   - 3.1 Maximum Likelihood Estimation
   - 3.2 Application to Bayesian Classification
   - 3.3 Mean of Gaussian Density Function

4. NONPARAMETRIC TECHNIQUES 9-12
   - 4.1 Probability Density Estimation
   - 4.2 Parzen Windows Estimation
   - 4.3 k Nearest Neighbor Estimation
   - 4.4 Nearest Neighbor Rule
   - 4.5 k Nearest Neighbor Rule

5. LINEAR DISCRIMINANT FUNCTIONS.....12-16
   - 5.1 Linear Discriminant Functions and Decision Surfaces
   - 5.2 The Two-Category Case
   - 5.3 Generalized Linear Discriminant Functions
   - 5.4 Relaxation Procedure
   - 5.5 Minimum Square Error Procedure
   - 5.6 Linear Programming Procedure

实验课内容：	小时数
1. 必须数学与信号知识补充 （根据需要）	2
2. MATAB 基本编程语使用 （实验操作）	3
3. C/C++语言编程基本原理 （实验操作）	6
4. 基本图像输入输出	2
5. 类别分布模拟	2
6. 图像亮度分布分析	2
7. 贝叶斯分类设计	3
8. 贝叶斯分类在图像处理中的应用	2
9. 最邻规则应用	3
10. 图像中的目标检测	2
11. 聚集分类	3
12. 聚集分类应用与分析	2
Laboratory class outline:	hours
1. Supplementary math and signal background	2
2. Basic usage of MATAB	3
3. Principle of C/C++ language	6
4. Image input and output	2
5. Simulation of class distribution	2
6. Analysis of Image intensity	2
7. Design of Bayes classifier	3
8. Application of Bayes classification in image processing	2
9. Application nearest neighbour rule	3
10. Target detection in images	2
11. Clustering	3
12. Clustering classification and its application and analysis	2

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

参考书：R. O. Duda, P. E. Hart and Stork, Pattern Classification and Scene Analysis, Wiley, New York, 2nd Edition 2001.
其他类似书可以做参考，我们将主要依靠讲课内容与所提及的参考书
Reference book: R. O. Duda, P. E. Hart and Stork, Pattern Classification and Scene Analysis, Wiley, New York, 2nd Edition 2001.

Other reference books are also possible, we will mainly base on our lecture contents and the mentioned reference book.

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		5 至 0% -5 to 0%	缺课一次减 1 分，迟到或早退减 0.5 分 1% credits off for one absence, and 0.5% for early or late attendance	
课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects	10 至 12 个课堂项目 10 to 12 class projects 1 个课程项目 1 course project	40 25	项目 60%通过为课程通过必须 60% of projects is required for the course pass	
平时作业 Assignments	12 次作业 12 assignments	30		
期中考试 Mid-Term Test				
期末考试 Final Exam				
期末报告 Final Presentation		5		
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
