

# 课程大纲

## COURSE SYLLABUS

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                              |
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| 1.  | 课程名称(中英文)<br><b>Course Title(Chinese and English)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 模式识别 <b>Pattern Recognition</b>                              |
| m2. | 课程类别 <b>Course Type</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 专业课                                                          |
| 3.  | 授课院系<br><b>Originating Department</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 电子与电气工程系 Department of Electronic and Electrical Engineering |
| 4.  | 可选课学生所属院系<br><b>Open to Which Majors</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 本专业                                                          |
| 5.  | 课程学时 <b>Credit Hours</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 64                                                           |
| 6.  | 课程学分 <b>Credit Value</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 3                                                            |
| 7.  | 授课语言<br><b>Teaching Language</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 中英文                                                          |
| 8.  | 授课教师 <b>Instructor(s)</b><br>(如果是一个课题组共同讲授的, 请标明 MI 以及其他构成成员。)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 时红建                                                          |
| 9.  | 先修课程、其它学习要求<br><b>Pre-requisites or Other Academic Requirements</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 信号与系统(Signal and System)                                     |
| 10. | <b>教学目标 Course Objectives</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                              |
|     | <p>课程学习目标: 到课程结束, 学生能做如下:</p> <ul style="list-style-type: none"> <li>● 推导与程序执行贝页斯理论</li> <li>● 进行参数与非参数密度分布估计</li> <li>● 对分离与不可分离的模式, 涉及分类器</li> <li>● 使用神经网络进行分类</li> </ul> <p>Course Learning Objectives: By the end of this class, students would:</p> <ul style="list-style-type: none"> <li>● Derive and implement Bayes Decision Theory.</li> <li>● Perform Parametric and Non Parametric Density Estimation.</li> <li>● Design Linear Classifiers for separable and non-separable patterns. Implement classifiers using neural networks.</li> </ul> |                                                              |

| 11.                                                          | <b>教学方法及授课创新点 Teaching Methods and Innovations</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
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|                                                              | Fundamentals of Statistical, Structural, and Neural Pattern Recognition Approaches: Parametric and Nonparametric Classification, Feature Extraction, Clustering, Self-organizing Nets for Pattern Recognition, and Formal Languages Representation, Current medical and industrial applications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 12.                                                          | <b>教学内容及学时分配 Course Contents and Course Schedule</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
|                                                              | <table border="0" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: none;">COURSE OUTLINE</th> <th style="text-align: right; border-bottom: none;">WEEKS</th> </tr> </thead> <tbody> <tr> <td style="border-top: none;">1. INTRODUCTION .....</td> <td style="text-align: right; border-top: none;">1</td> </tr> <tr> <td style="border-top: none;">    1.1 MATHEMATICAL FOUNDATION</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">2. BAYES DECISION THEORY.....</td> <td style="text-align: right; border-top: none;">2</td> </tr> <tr> <td style="border-top: none;">    2.1 Bayes Classifier for Continuous Case</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">    2.2 The Gaussian Two-class classifier</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">    2.3 Bayes Classifier for Discrete Case</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">    2.4 Error Probability and Receiver Operating Characteristics</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">3. MAXIMUM-LIKELIHOOD AND BAYESIAN PARAMETER ESTIMATION.....</td> <td style="text-align: right; border-top: none;">2</td> </tr> <tr> <td style="border-top: none;">    3.1 Maximum Likelihood Estimation</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">    3.2 Application to Bayesian Classification</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">    3.3 Learning the Mean of Gaussian Density Function</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">4. NONPARAMETRIC TECHNIQUES .....</td> <td style="text-align: right; border-top: none;">3</td> </tr> <tr> <td style="border-top: none;">    4.1 Probability Density Estimation</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">    4.2 Parzen Windows Estimation</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">    4.3 k Nearest Neighbor Estimation</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">    4.4 Nearest Neighbor Rule</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">    4.5 k Nearest Neighbor Rule</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">5. LINEAR DISCRIMINANT FUNCTIONS.....</td> <td style="text-align: right; border-top: none;">2</td> </tr> <tr> <td style="border-top: none;">    5.1 Linear Discriminant Functions and Decision Surfaces</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">    5.2 The Two-Category Case</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">    5.3 Generalized Linear Discriminant Functions</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">    5.4 Relaxation Procedure</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">    5.5 Minimum Square Error Procedure</td> <td style="border-top: none;"></td> </tr> <tr> <td style="border-top: none;">    5.6 Linear Programming Procedure</td> <td style="border-top: none;"></td> </tr> </tbody> </table> | COURSE OUTLINE | WEEKS | 1. INTRODUCTION ..... | 1 | 1.1 MATHEMATICAL FOUNDATION |  | 2. BAYES DECISION THEORY..... | 2 | 2.1 Bayes Classifier for Continuous Case |  | 2.2 The Gaussian Two-class classifier |  | 2.3 Bayes Classifier for Discrete Case |  | 2.4 Error Probability and Receiver Operating Characteristics |  | 3. MAXIMUM-LIKELIHOOD AND BAYESIAN PARAMETER ESTIMATION..... | 2 | 3.1 Maximum Likelihood Estimation |  | 3.2 Application to Bayesian Classification |  | 3.3 Learning the Mean of Gaussian Density Function |  | 4. NONPARAMETRIC TECHNIQUES ..... | 3 | 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..... | 2 | 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 |  |
| COURSE OUTLINE                                               | WEEKS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 1. INTRODUCTION .....                                        | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 1.1 MATHEMATICAL FOUNDATION                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 2. BAYES DECISION THEORY.....                                | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 2.1 Bayes Classifier for Continuous Case                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 2.2 The Gaussian Two-class classifier                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 2.3 Bayes Classifier for Discrete Case                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 2.4 Error Probability and Receiver Operating Characteristics |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 3. MAXIMUM-LIKELIHOOD AND BAYESIAN PARAMETER ESTIMATION..... | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 3.1 Maximum Likelihood Estimation                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 3.2 Application to Bayesian Classification                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 3.3 Learning the Mean of Gaussian Density Function           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 4. NONPARAMETRIC TECHNIQUES .....                            | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 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.....                        | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 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                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 13.                                                          | <b>课程考核 Course Assessment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
|                                                              | Homework (30%), Projects (40 %), and three Exams (30%).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
| 14.                                                          | <b>教材及其它参考资料 Textbook and Supplementary Readings</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |
|                                                              | R. O. Duda, P. E. Hart and Stork, Pattern Classification and Scene Analysis, Wiley, New York, 2nd Edition 2001.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |       |                       |   |                             |  |                               |   |                                          |  |                                       |  |                                        |  |                                                              |  |                                                              |   |                                   |  |                                            |  |                                                    |  |                                   |   |                                    |  |                               |  |                                   |  |                           |  |                             |  |                                       |   |                                                         |  |                           |  |                                               |  |                          |  |                                    |  |                                  |  |

