山东大学 计算机科学与技术 学院

机器学习与模式识别 课程实验报告

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| 实验题目：Linear Discriminant Analysis | | | |
| 实验学时：2 | | 实验日期：2025/3/11 | |
| 实验环境：  软件环境：  系统：Windows 11 家庭中文版23H2 22631.4317  计算软件：MATLAB 版本: 9.8.0.1323502 (R2020a)  Java 版本: Java 1.8.0\_202-b08 with Oracle Corporation Java HotSpot(TM) 64-Bit Server VM mixed mode  硬件环境：  CPU：13th Gen Intel(R) Core(TM) i9-13980HX 2.20 GHz  内存：32.0 GB (31.6 GB 可用)  磁盘驱动器：NVMe WD\_BLACKSN850X2000GB  显示适配器：NVIDIA GeForce RTX 4080 Laptop GPU | | | |
| 1. 实验内容   In this exercise, you need to implement Linear Discriminant Analysis(LDA)   1. 实验步骤 2. 获取实验使用的数据。      1. 构造二分类LDA模型：        1. 用matlab代码实现并进行计算。 2. 完成结果的可视化。 3. 构造多分类的LDA模型：          1. 用matlab代码实现并进行计算。 2. 完成结果的可视化。 3. 测试结果        1. 附录：实现源代码  |  | | --- | | %% 清空环境变量  clear;  clc;  %% 加载数据  redPoints = load('ex3Data/ex3red.dat');    % 红色点  bluePoints = load('ex3Data/ex3blue.dat');  % 蓝色点  greenPoints = load('ex3Data/ex3green.dat');% 绿色点  %% 绘制数据点  figure;  plot(redPoints(:, 1), redPoints(:, 2), 'r.', 'MarkerSize', 15);  axis equal;  hold on;  plot(bluePoints(:, 1), bluePoints(:, 2), 'b.', 'MarkerSize', 15);  % plot(greenPoints(:, 1), greenPoints(:, 2), 'g.', 'MarkerSize', 15);  xlabel('x');  ylabel('y');  %% 二分类LDA  % disp(redPoints);  mu0 = mean(redPoints);  mu1 = mean(bluePoints);  sum0 = cov(redPoints - mu0);  sum1 = cov(bluePoints - mu1);  sum\_w = sum0+sum1;  w = inv(sum\_w)\*(mu0-mu1)';  % disp(w);  x = linspace(-5,15);  y = x \* (w(2)/w(1));  plot(x,y,'k-');  for i = 1:size(redPoints, 1)      m = w(2) / w(1);      b = 0;      x0 = redPoints(i, 1);      y0 = redPoints(i, 2);      x1 = (m \* (y0 - b) + x0) / (m^2 + 1);      y2 = (m^2 \* y0 + m \* x0 + b) / (m^2 + 1);      plot([x0 x1], [y0 y2], 'r-');  end  for i = 1:size(bluePoints, 1)      m = w(2) / w(1);      b = 0;      x0 = bluePoints(i, 1);      y0 = bluePoints(i, 2);      x1 = (m \* (y0 - b) + x0) / (m^2 + 1);      y2 = (m^2 \* y0 + m \* x0 + b) / (m^2 + 1);      plot([x0 x1], [y0 y2], 'b-');  end  %% 多分类LDA  figure;  plot(redPoints(:, 1), redPoints(:, 2), 'r.', 'MarkerSize', 15);  axis equal;  hold on;  plot(bluePoints(:, 1), bluePoints(:, 2), 'b.', 'MarkerSize', 15);  plot(greenPoints(:, 1), greenPoints(:, 2), 'g.', 'MarkerSize', 15);  xlabel('x');  ylabel('y');  mu = mean([bluePoints;redPoints;greenPoints]);  disp(mu);  sb = size(bluePoints, 1) \* cov(mean(bluePoints) - mu) + size(greenPoints, 1) \* cov(mean(greenPoints) - mu) + size(redPoints, 1) \* cov(mean(redPoints) - mu);  sw = cov(bluePoints - mean(bluePoints)) + cov(greenPoints - mean(greenPoints)) + cov(redPoints - mean(redPoints));  S = inv(sw) \* sb;  [eigvecs, eigvals] = eig(S);  disp(eigvecs);  disp(eigvals);  max\_eigval = max(diag(eigvals));  [~, idx] = max(diag(eigvals));  max\_eigvec = eigvecs(:, idx);  disp(max\_eigval);  disp(max\_eigvec);  unit\_max\_eigvec = max\_eigvec / norm(max\_eigvec);  x = linspace(-5,15);  y = x \* (unit\_max\_eigvec(2)/unit\_max\_eigvec(1));  plot(x,y,'k-');  for i = 1:size(redPoints, 1)      m = unit\_max\_eigvec(2) / unit\_max\_eigvec(1);      b = 0;      x0 = redPoints(i, 1);      y0 = redPoints(i, 2);      x1 = (m \* (y0 - b) + x0) / (m^2 + 1);      y2 = (m^2 \* y0 + m \* x0 + b) / (m^2 + 1);      plot([x0 x1], [y0 y2], 'r-');  end  for i = 1:size(bluePoints, 1)      m = unit\_max\_eigvec(2) / unit\_max\_eigvec(1);      b = 0;      x0 = bluePoints(i, 1);      y0 = bluePoints(i, 2);      x1 = (m \* (y0 - b) + x0) / (m^2 + 1);      y2 = (m^2 \* y0 + m \* x0 + b) / (m^2 + 1);      plot([x0 x1], [y0 y2], 'b-');  end  for i = 1:size(greenPoints, 1)      m = unit\_max\_eigvec(2) / unit\_max\_eigvec(1);      b = 0;      x0 = greenPoints(i, 1);      y0 = greenPoints(i, 2);      x1 = (m \* (y0 - b) + x0) / (m^2 + 1);      y2 = (m^2 \* y0 + m \* x0 + b) / (m^2 + 1);      plot([x0 x1], [y0 y2], 'g-');  end | | | | |