Assignment 1

This exercise is part of the course assignment. **Deadline for the assign ment 30.11.2022 at 23:59**

The topic of this assignment is binary classification and particularly the evaluation metrics of binary classifiers. For this assignment you should return

- The files precision.m, recall.m, pr_curve.m. Each of these files should contain your name and student number (of both students if you work in pairs).
- Your answers to the questions in the analysis part. At the end of the course, you should return a single pdf containing the answers to all questions of the assignments. The report should contain also your name and student number (of both students if you work in pairs).

Coding part (5pt)

Before you start coding, run the script main2.m, to get a taste of the final result. Your tasks are:

- Implement the function p = precision(predicted, gt) which takes as input an array of predicted labels predicted, the array of ground truths gt and computes the precision $p = \frac{TP}{TP+FP}$. Both predicted and gt are binary arrays.
- Implement the function r = recall(predicted, gt) which takes as input an array of predicted labels predicted, the array of ground truths gt and computes the precision $r = \frac{TP}{TP+FN}$. Both predicted and gt are binary arrays.
- when you are done, replace sol_precision and sol_recall in the first cell of the main script with your implementation. The result should be the same.
- Implement the function [p, r, AUC] = pr_curve(score, gt) which takes as input an array of prediction scores, the ground truth labels and computes precision and recall at different thresholds values, as well as the AUC. The output arrays p, r should have length equal to the number of unique values in the array *score*
  Hint 1: The solution of exercise 3 might be helpful, also check the matlab function sort and unique

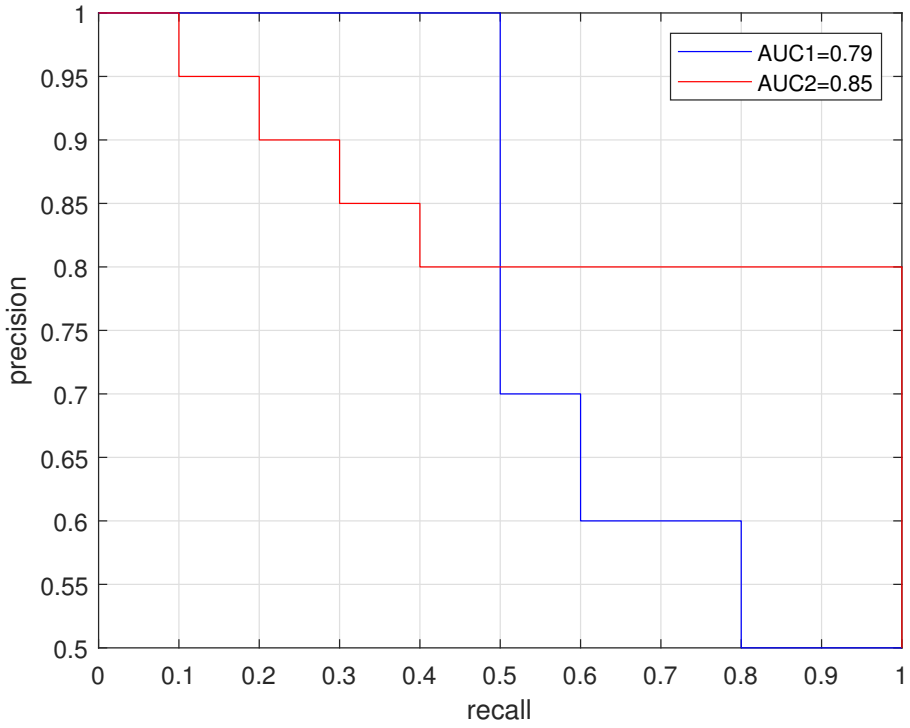
Hint 2: To compute the AUC, notice that your PR-curve is piecewise linear, the trapezoidal rule might be very handy. You are also allowed to use matlab built-in numerical integration functionalities.

- When you are done, replace `sol_pr_curve` with your implementation in the function main. Check that your PR curve is the same as with the model solution.

Analysis part (5pt)

Answer the following questions in your report

- Explain how using a higher or lower threshold affects the precision and the recall (1pt)
- If you want to minimise the number of false negatives, would you use a higher or lower threshold? why? (1pt)
- Explain why the AUC can be used to measure the performance of a binary classifier. What are the advantages of using AUC as a metric opposed to precision and recall at a fixed threshold? (2pt) **Hint:** $AUC = \int_0^1 p(r)\mathrm{d}r$.
- The following figure shows the PR-curve of two classifiers. Which one do you think its better in general? What if in your application minimising false positives is critical? Motivate your answer! (1pt)


AUC1=0.79
AUC2=0.85
precision
recall
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1