

ECE 662, 2020S, Mini Project 1

1. Task 1

Consider n -dimensional feature vectors coming from two classes. Assume that the distributions of the feature vectors for the two classes are (known) normal distributions and that the priors for the classes $P(w_1)$ and $P(w_2)$ are also known. You can select your own mean, (co-)variance, and prior. Put enough text, graphs, tables if necessary, to guarantee a good readability and completeness.

- Write a computer program that classifies the feature vectors according to Bayes decision rule. Generate some artificial (normally distributed) data, and test your program on the data you generated. Try feature vectors of various dimensions (at least two different dimensions, e.g., 1-dim and 3-dim).
- Quantify the accuracy of your results.
- How does the dimension of the feature vectors affect accuracy?

2. Task 2

Take the data (e.g., 1-dim feature case) you used for Question 1.

- Use maximum likelihood estimation to estimate the parameters of the feature distribution (i.e., μ and Σ of the conditional distribution for each class).
- Study the 'number of samples used for parameter estimation V.S. the parameters estimated'.
- Experiment to illustrate the accuracy of this classifier obtained with this estimate.
- Study the 'number of samples used for parameter estimation V.S. the classification accuracy'.

3. Task 3

Take the data you (e.g., 1-dim feature case) used for Question 1.

- Use Bayesian parameter estimation to estimate the parameters (μ unknown, variance known) of the feature distribution (i.e., the conditional distribution for each class). Assume $P(\theta)$ is approximately flat and known Gaussian distribution, respectively.
- Study the 'number of samples used for parameter estimation V.S. the parameter μ estimated'.
- Experiment to illustrate the accuracy of this classifier obtained with this estimate.
- Study the 'number of samples used for parameter estimation V.S. the classification accuracy'.

Notes:

- Due date March 13th, 11:59pm
- Group work (max 3 persons) is encouraged, but separate report needs to be submitted (with different parameters). Also add your team members' name
- Electronic submission to canvas
- Submission: a project report (doc, docx, or PDF), all executable code files, a readme file to introduce the code
- Matlab, or python is suggested. Other languages also acceptable.
- All codes need to have detailed comments in the file, especially close to your parameters, and subfunctions
- A readme file to introduce the codes files are required, explaining the flow and dependency