CS6690: Pattern Recognition Assignment #2

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1 Bayesian Classifiers

According to Bayes Theorem, for a dataset x with classes ω_i,
Probability of a datapoint belonging to class ω_i is defined as:

$$P(\omega_i|x) = \frac{(P(x|\omega_i)P((\omega_i))}{P(x)} \tag{1}$$

- Here, $P(x|\omega_i)$ is known as the class likelihood.
  To estimate this value, we require the distribution of ω_i. Based on the central limit theorem, we can assume that this would be Gaussian distribution for large datasets.
- The value $P(\omega_i)$ is the class prior and is calculated using:
  $$P(\omega_i) = N_i/N \tag{2}$$
  This term becomes irrelevant if the classes have equal probabilities.
- P(x) is termed as 'evidence' and can be calculated as:
  $$P(x) = \sum_i P(x|\omega_i)P(\omega_i) \tag{3}$$

2 Gaussian Likelihood Distribution

For multi-dimensional data, the Gaussian Distribution is:

$$P(x; \mu, \Sigma) = \frac{1}{2\pi^{k/2}|\Sigma|^{1/2}} e^{-(x-m)^T \Sigma^{-1} (x-m)} \tag{4}$$

where

- μ is the mean
- Σ is the covariance matrix

The above parameters are calculated for the following cases

3 Bayes Classification

If $P(\omega_1|x) > P(\omega_2|x)$ then x belongs to class ω_1
If $P(\omega_1|x) < P(\omega_2|x)$ then x belongs to class ω_2

Using equation (1), this can be written as:

$$P(x|\omega_1)P(\omega_1) \gtrless P(x|\omega_2)P(\omega_2) \tag{5}$$

This classification rules minimizes number of misclassifications.

Figure 1: Simulation Results

3.1 Parameters

3.2 DET Curves

3.3 Decision Boundaries

3.4 Confusion Matrices

4 Cases

4.1 Subsection Heading Here

Write your subsection text here.

5 Conclusion

Write your conclusion here.