1 Report

1.1 Linear Discriminant Analysis(LDA)

1.1.1 fit

In LDA, the parameters we estimate are class priors(π_k) ,mean(μ_k) for each class and covariance matrix(Σ) from the training data.

- **Class Priors(π_k)**

$$\pi_k = \frac{N_k}{N} \tag{1}$$

where N_k is the number of samples in class k, and N is the total number of samples.

- **class mean(μ_k)**

$$\mu_k = \frac{1}{N_k} \sum_{i=1}^{N_k} x_i \tag{2}$$

where N_k is the number of samples in class k, and x_i is the i^{th} sample in class k.

- **Covariance Matrix(Σ)**

$$\Sigma = \frac{1}{N} \sum_{i=1}^{N} (X_i - \mu)(X_i - \mu)^T \tag{3}$$

where N is the number of samples, X_i is the i^{th} sample, and μ is the mean of the samples.

1.1.2 predict

We predict of the test data by these estimates and get the accuracy of LDA in RGB and Grayscale versions of dataset.

- Accuracy of test data in RGB : **0.3713**
- Accuracy of test data in Grayscale : **0.2739**

1.2 (Quadratic Discriminant Analysis)QDA

1.2.1 fit

In QDA, the parameters we estimate are class priors(π_k) ,mean(μ_k) and covariance matrix(Σ_K) for each class from the training data.

- **Class Priors(π_k)**

$$\pi_k = \frac{N_k}{N} \tag{4}$$

where N_k is the number of samples in class k, and N is the total number of samples.

- **class mean(μ_k)**

$$\mu_k = \frac{1}{N_k} \sum_{i=1}^{N_k} x_i \tag{5}$$

where N_k is the number of samples in class k, and x_i is the i^{th} sample in class k.

- **Covariance Matrix(Σ)**

$$\Sigma_k = \frac{1}{N_k} \sum_{i=1}^{N_k} (X_i - \mu_k)(X_i - \mu_k)^T \tag{6}$$

where N_k is the number of samples in class k, X_i is the i^{th} sample in class k, and μ_k is the mean of the samples in class k.

1.2.2 predict

We predict of the test data by these estimates and get the accuracy of QDA in RGB and Grayscale versions of dataset.

- Accuracy of test data in RGB : **0.2364**
- Accuracy of test data in Grayscale : **0.2602**

1.3 (Gaussian Naive Bayes)GNB

1.3.1 fit

In Gaussian Naive Baye, the parameters we estimate are class priors(π_k) ,mean(μ_k) and variance(σ_k^2) for each class from the training data.

- **Class Priors(π_k)**

$$\pi_k = \frac{N_k}{N} \tag{7}$$

where N_k is the number of samples in class k, and N is the total number of samples.

- **class mean(μ_k)**

$$\mu_k = \frac{1}{N_k} \sum_{i=1}^{N_k} x_i \tag{8}$$

where N_k is the number of samples in class k, and x_i is the i^{th} sample in class k.

- **class variance(σ_k^2)**

$$\sigma_k^2 = \frac{1}{N_k} \sum_{i=1}^{N} (X_i - \mu_k)^2 \tag{9}$$

where N_k is the number of samples in class k, X_i is the i^{th} sample in class k, and μ_k is the mean of the samples in class k.

1.3.2 predict

We predict of the test data by these estimates and get the accuracy of QDA in RGB and Grayscale versions of dataset.

- Accuracy of test data in RGB : **0.2976**
- Accuracy of test data in Grayscale : **0.2662**