UNIVERSITY OF SOUTH FLORIDA

Project 1

Pattern Recognition

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In this project, we were given ten classes with ten samples each. We were expected to find the central moment for each of the samples in the class. In the file proj.m , we have calculated the I mean and j mean using the formula(1):

imean = ∑∑ [X (i,j)* i] / ∑∑ [X(i,j)] formula (1)

Imean is the waited mean of the rows and jmean is the waited of the columns.

After finding imean and jmean, we calculated eight central moments using the formula (2):

Mpq = ∑∑ [($(i-imean)^p$) ($(j-jmean)^q$) X(i,j)], i=1 to I, j=1 to J Formula (2)

Central moment is the moment of the probability distribution about the variables mean and it is also a factor which can be used to classify various data points into classes.

After calculating the central moments, we had to normalize them using the Root- Mean-Square RMS value since the difference between the central moments of various classes was large. For calculating the mean and variance of the normalized central moments, we used in- built Matlab functions: { mean(), Var() } , Variance is the spread of the dataset about the mean. It's given by the formula (3):

$$Var(X) = \frac{1}{n} \sum_{i=1}^{n} (x_i - \mu)^2 \qquad \text{Formula (3)}$$

Here:

n is the number of elements

μ is the mean of the elements

In the file projc.m, we first calculate the covariance of all the matrices of the normalized moment of each dataset. Covariance indicates how one variable is dependent on other variables. That is in this case, the matrices show how the central moments are dependent on other central moments of the dataset. For calculating the covariance, we have followed the following process

1. Convert the matrix to deviation matrix by
   Xdiv = X – 11*X (Here 11 is matrix where all element are 1)
2. Calculate covariance using the deviation by
   Cov = (Xdiv'*Xdiv)./N

After the covariance, we found the inverse of the covariance of all matrices. The inverse of the covariance matrix tells us how much are the central moments independent of each other. Finally, we found the inverse of the covariance of the whole dataset A, which gives us a clear picture about the uniqueness of the central moments.

We used a website to know how to use the Matlab which is http://www.mathworks.com/

The results of our project are shown in the next page: