Report Lab 1 Preparation

Pattern Recognition NTUA

9th Semester

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Introduction

In this work we prepared steps 1 till 9 from the Laboratory Exercise 1. The main purpose of this Exercise includes the implementation of an automatic visual recognition of hand - written digits 0-9. The steps below are presented with a given explanation for each one and images wherever it is necessary for a better view.

Step 1

In figure 1 it is demonstrated digit 131 from the train data. We used **imagesc()** for the exhibition of the
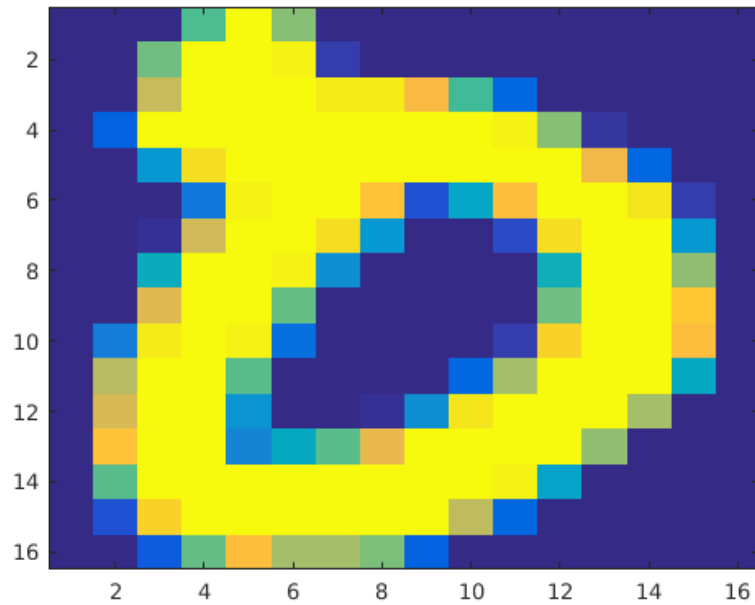

Figure 1: Digit 131

Step 2

By running through the whole train set we computed the classical mean value of pixel(10,10) for the digit "0" (the process is actually straightforward and does not require any other explanation) and the value is: $\mu = -0.9273$

Step 3

By running through the whole train set we computed the classical variance of pixel(10,10) for the digit "0" (the process is actually straightforward and does

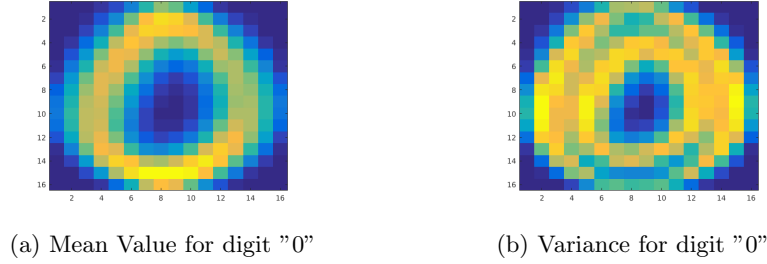(a) Mean Value for digit "0"   (b) Variance for digit "0"

Figure 2

not require any other explanation) and the value is: $\sigma = 0.084$

Step 4

We repeat the same process as in the previous Steps 2-3 to compute the mean value and the variance for all the pixels as shown in our matlab workspace **m** and **s** respectively.

Step 5

In figure 3 the reader can see the image of digit "0" as has been created using the mean values of Step 4.

Step 6

In figure 3 the reader can see the image of digit "0" as has been created using the variance of Step 4. Obviously, the image corresponding to mean value is recreating an average zero if we concentrate in the active regions (active region is yellow). On the other hand, image corresponding to the variance of digit zero resembles the explicit limits of the average zero digit. This is because, the average writer differs from each writer in writing a specific digit. As it is demonstrated, the area inside and outside the curve of zero is constructing the variance of digit "0".

Step 7

a) By following the same procedure as this in step 4 we computed the mean value and the variance for all the digits.

b) The results of the aforementioned method are demonstrated in figure 2.

Step 8

Now that we have trained our model with the appropriate features we take advantage of it and we try to classify the 101th digit of the test set. In respect

(a) Digit "1" (b) Digit "2" (c) Digit "3"

(d) Digit "4" (e) Digit "5" (f) Digit "6"
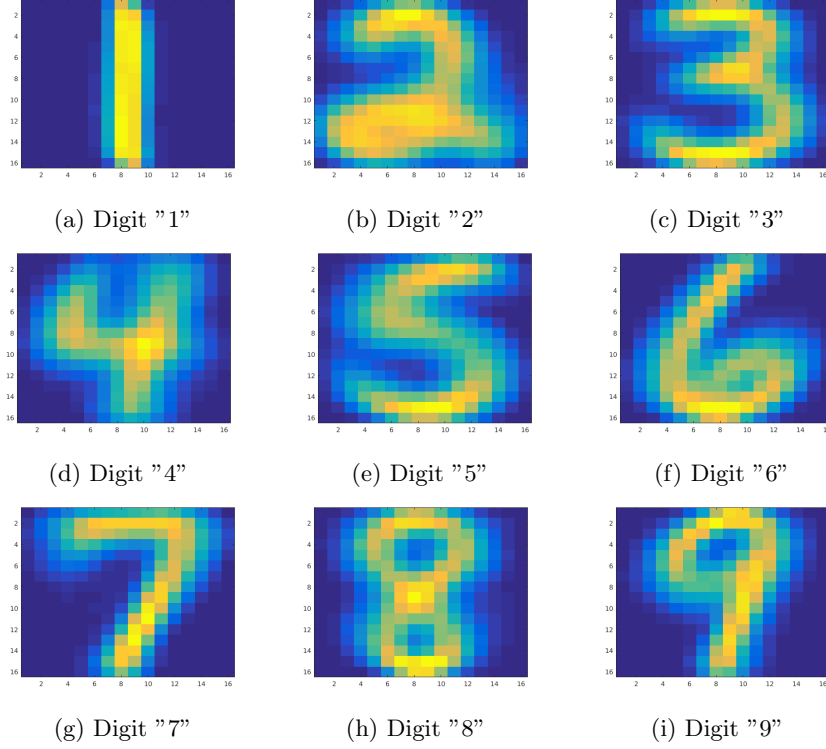
(g) Digit "7" (h) Digit "8" (i) Digit "9"

Figure 3: Mean Values for each digit

to our classification model we compute the Euclidean distance of the test data digit from all the vectors created by our model. These vectors contain the mean feature values for each digit, so in total we have 10 vectors. Consequently, the classifier conducts as a result, the digit whose respective vector has the minimum distance from the test vector. From this results it is obvious that the classification was correct for this test.

Step 9

a) The repetition of this process gives us the classification for the whole test data according to the euclidean distance.

b) By taking into consideration the former classification process the total Recall of our system is demonstrated below:

$$TotalRecall = 0.8142$$

*Important Note: For the purpose of the demonstration of images we rotated the images in order the exposition of the digits to be vertical aligned we rotated all the images properly. Although, for avoiding further misconceptions all the other values asked to be computed were computed upon the given pixels.