Pattern Recognition –HW3

About the Assignment

The main aim of the assignment is to make you familiar with the calculating PDF and classification using Bayesian Classifier, which is also called as Bayes Rule.

Step: 1

$$p(\underline{x}|\omega_i) = \frac{1}{(2\pi)^{\frac{1}{2}}|\Sigma_i|^{\frac{1}{2}}}\exp\left(-\frac{1}{2}(\underline{x}-\underline{\mu}_i)^{\mathrm{T}}\Sigma_i^{-1}(\underline{x}-\underline{\mu}_i)\right) \quad (Eq.1)$$

$\underline{\mu}_i = E[\underline{x}]$: $\ell \times 1$ vector in $\omega_i = mean\ of\ samples\ for\ classs\ \omega_i$

$\Sigma_i = E\left[(\underline{x}-\underline{\mu}_i)(\underline{x}-\underline{\mu}_i)^{\mathrm{T}}\right]$: $\ell \times \ell$ matrix in ω_i

Σ_i covariance matrix

$|\Sigma_i|$: is determinant of covariance matrix

Σ_i^{-1} : is inverse of covariance matrix

In this experiment, assume that class probabilities are equal, $p(\omega_0) = p(\omega_1) =,\ldots,= p(\omega_9)$

Therefore, we will use Maholanabis distance in place of Bayes Classifier.

For this experiment, we will make simulations on Cifar-10 dataset. Assume that you are given 10 classes named as $\omega_0, \omega_1, \ldots, \omega_9$, where each class contain 5000 samples. According to the Bayes Rule, we have to calculate the distances of the given test sample in order to check whether belongs or not to a specific class. For this purpose, we will use the Eq. 2.

Prior to test stage, you have to found below variables for each class.

$\underline{\mu}_i$ mean of samples in class ω_i

Σ_i covariance matrix

It is advised to store these variables in a python list, called models.

In case of test stage, you need to execute the following equation to compute distances. This is known as Mahalanobis distance.

$$p(w_i|\underline{x}) = \left((\underline{x} - \underline{\mu}_i)^\mathrm{T} \Sigma_i^{-1} (\underline{x} - \underline{\mu}_i) \right) \tag{Eq.2}$$

The distances must be stored in an array. Then, the minimum distance would indicate the predicted class label of processed test sample.

You have to implement code my own template, namely HW3.py

Submit the Assignment

Ex: No_Name_Surname_HW#.zip

Hint

See youtube videos on Mahalanobis distance .

Note in English:

You will graded over 5 points if you send your friend's code or any snipped code avaliable on internet.
You have to consider following 3 three rules in case of uploading the hw.
1) Send a screen shot that shows your code worked successfully without error.
2) Send a screen shot related to generated results in spyder
3) Only send **py extension file**, other file format will be graded over 5 points You have to use **spyder** when implementing any homework.
Screen shots must be related to spyder.
If one of the rule above is ignored, then your homework will be graded only over 50 points.
Take care yourself.

Note in Turkish:

Vereceğim ödevlerde internetteki **hazır kodu** benimle paylaşmanız veya kendi **arkadaşınızın kodunu** paylaşmanız. Direk bakılmadan **5 puan** olarak değerlendirilecektir.

Ödevleri yüklerken aşağıdaki 3 şeyi dikkate alarak yükleme yapınız.

1) Ödevin **hatasız** çalıştığına dair ekran çıktısı

2) Ödevin ürettiği **sonuçlara** ait ekran çıktısı

3) Ödevi yüklerken sadece **py uzantılı** dosyayı yükleyiniz. Bunun dışındaki formatta gönderenler sadece **5 puan** alır. Ödevleri **spyderda** yazmanız gerekmektedir.

Ekran çıktısı spydera ait olmalı.

Bu üç maddeden biri eksik olanların ödevleri 50 üzerinden değerlendirmeye alınacaktır