Gender Classification from Facial Images

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Methods (plan):

1)Identifying Gender from Unaligned Facial Images by Set Classification
2)Identifying Gender using Eigenface method
3)Identifying Gender from facial images using FisherFaces Method

Method 1 : Identifying Gender from Unaligned Facial Images using Set Classification

-> Step 1 : Random cropping of facial image patches
Image set Xi is generated from each training subject. N subjects are taken and {X1, X2, … , Xn} - > Image sets
-> Step 2 : we resize and reshape each image patch to n-dimensional column vector.
-> Step 3 : We describe each Xi as it's own linear subspace Si spanned by a set of bases.
->Step 4 : We then extract the top-d largest eigen value for corresponding Pi eigenvector. We measure similarity btw a pair of subspaces Si and Sj by canonical correlation. With this we get that the correlation btw transformed subspaces of same gender are maximised and those of different genders are minimised.
**We use MORPH database and by this correlation and convolution of transforme subspaces we identify the gender in test image with the maximum correlated gender in other subspaces.

Dataset : (for other/below methods)

Facial Images are taken from the MCUT database. Planning to use with 400 female and 400 male faces. All images are face frontal view.
Variations will be in : Lighting, Age, Ethnicity, facial expression, hair and face accessories and position of the face in the image. So, images will be uncentered. Training will be done with 200 images of each gender. For testing, there are about 180 images of each gender available. This dataset will be used for the methods below.

Method 2 : Identifying Genders using Eigenface Method

Step 1 : In this a PCA is applied to reduce the dimensionality of the image.

Step 2 : This algorithm identifying almost every new face to be male , contributing large error to females., When a male face is projected onto male eigen face the resultant reduced dimension matches with others very well but not when female faces are projected .

Step 3: the number of principal components was chosen to be 200. We obtained this result by eliminating all eigen values whose value is zero.
Step 4: A k-fold cross validation was performed to decide the number of dimensions in the reduced space more precisely. This resulted in a reduced dimension of 170

Step 5: female subjects who have short hair, hair tied back or in a scarf were almost always labeled male. This was the problem with PCA
Step 6: In the paper by Abhimanyu Bannerjee, he used holistic approach by processing the entire face and coming up with an eigen bases.

Errors and Risk Factors :
When database 3 images are used,
Male faces error : 0.6 for training and 0.14 for test
Female faces error : 0.11 for training and 0.16 for test

When database 4 images are used,
Male faces error : 0.8 for training and 0.03 for test
Female faces error : 0.14 for training and 0.28 for test

Method 3 : Identifying Gender from facial images using FisherFaces Method

Step 1 : Similar to the method before, K-fold cross validation is done on the data to find the number of dimensions needed for the most representative space.
Step 2 : PCA is done on the data and the representative reduced space is obtained.
Step 3 : The objective of this algorithm is to find those features in the reduced space which are the most salient differences between male and female features and give them highest priority while classifying.
Step 4 : The variance between the classes is maximised rather than variance within each class.
**This method gives high error on uncentered data
Error and risks
When B/W images are used,
Male faces : 0.9
Female faces : 0.1
When RGB images are used,
Male face : 0.25
Female face : 0.4

Tools and Libraries we may use :

->MATLAB
->OpenCV
->Face++(library)
->Luxand(library)

->FERRET dataset
->MCUT dataset
->MORPH dataset