Age Detection using Face Images

Introduction

- Estimating facial attributes plays a crucial role in vast potential applications of multimedia communication and human machine interaction.
- The age progression displayed on faces is uncontrollable and personalized.
- Manifold learning methods are used to find a sufficient low-dimensional embedding space.
- One of the methods of feature extraction is using LPP, in which facial features are extracted from an appearance-based shape-texture model.
- SVM is applied on an input face image represented by a set of fitted model parameters to estimate classification vector.
- A large size data set should have a significant trend for underlying sequential patterns, since each face image has a unique age label.
- Learned feature and classified features are used to estimate age of a new image.

Problem Statement

- Human age detection using facial images as input data.

Literature Review

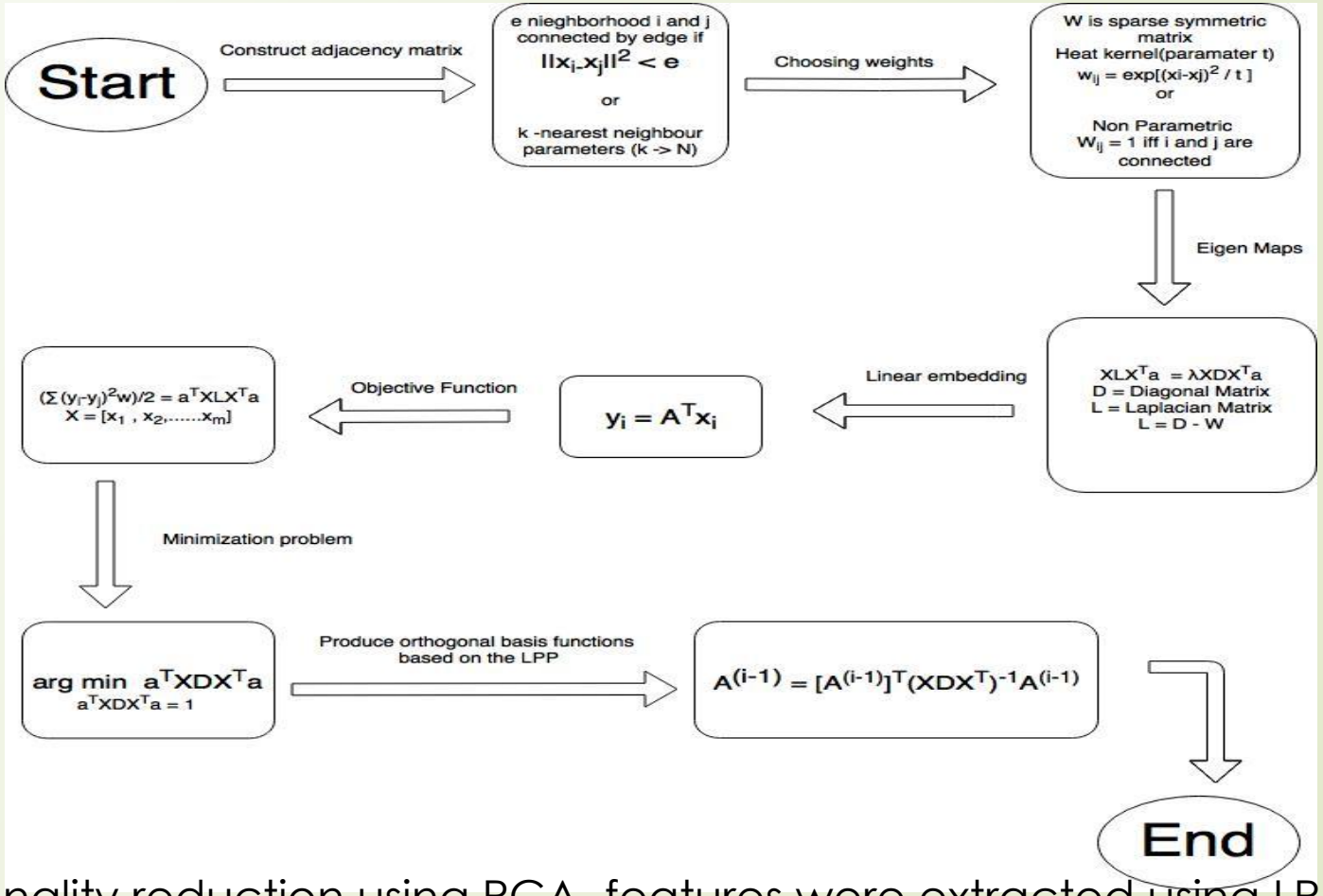
- It was necessary to reduce the dimensionality of a data set consisting of many variables correlated with each other, either heavily or lightly, while retaining the variation present in the dataset, up to the maximum extent.
- The same is done by transforming the variables to a new set of variables, which are known as the principal components.
- Existing age estimation techniques used face, appearance model, aging pattern subspaces, age manifolds, age classification/regression.
- We studied 2 cases: [1]
  - How much can age estimation performance be affected by gender ?
    - Case 1: age estimation is performed on all faces without discriminating between males and females
    - Case 2: age estimation is performed for males and females separately, with the assumption that gender is known.
  - How significantly can age estimation errors be reduced if the estimations are performed on smaller gender and age groups ?

[1] Guo, G., Mu, G., Fu, Y., Dyer, C. and Huang, T., 2009, September. A study on automatic age estimation using a large database. In *Computer Vision, 2009 IEEE 12th International Conference on* (pp. 1986-1991). IEEE.

- Approaches and accuracies we studied: [2]
  (i)OLPP (ii)BIF+OLPP (iii) BIF+PCA (iv) BIF+LSDA (v) BIF+MFA
- Age Estimation error was lower in BIF+LSDA i.e. 2.95
  - Automatic age estimation can have better results than the corresponding mixed age estimation for all four representations, although the gender classifications are not perfect.
  - BIF+LSDA for age estimation, which has the highest gender classification accuracy.
  - BIF+MFA representation performs the worst for gender classification, thus raising the MAE, although it has the smallest MAE for age estimation with mixed gender.
  - All representations have larger errors than other when gender is known.

[2] Fu, Y., Xu, Y. and Huang, T.S., 2007, July. Estimating human age by manifold analysis of face pictures and regression on aging features. In *Multimedia and Expo, 2007 IEEE International Conference on* (pp. 1383-1386). IEEE.

APPROACH [3][4]



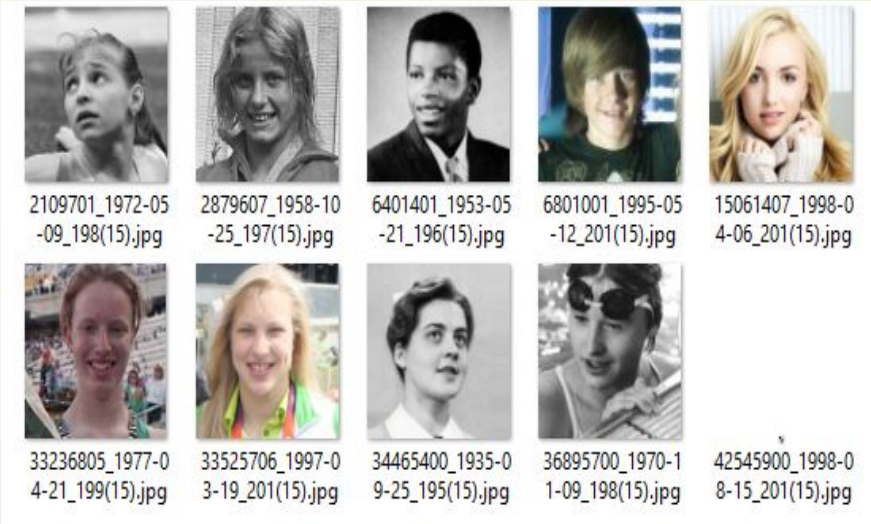
1) After dimensionality reduction using PCA, features were extracted using LPP.

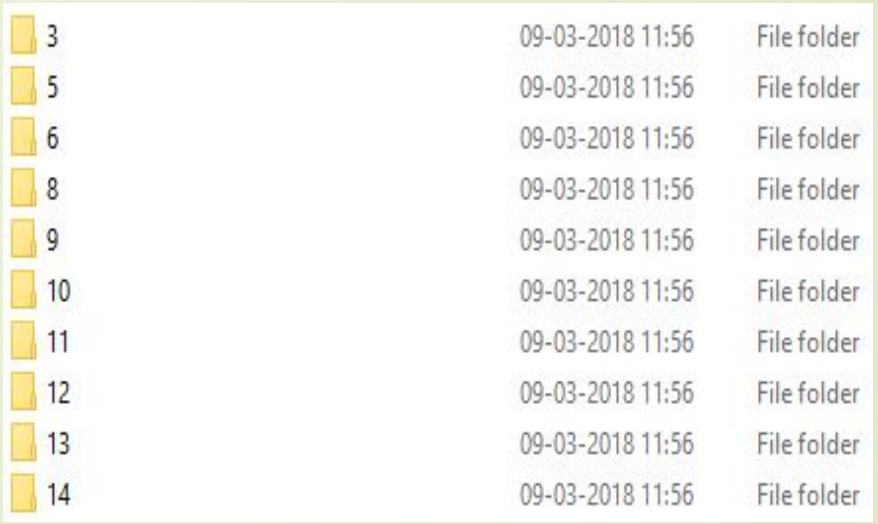
2) SVM was implemented on this extracted features to classify into three classes.

[3] VAISHNAVI, M. and VIJAYALAkSHMI, A., 2017. Age Estimation using OLPP Features.
[4] Wang, R., Nie, F., Hong, R., Chang, X., Yang, X. and Yu, W., 2017. Fast and orthogonal locality preserving projections for dimensionality reduction. *IEEE Transactions on Image Processing*, 26(10), pp.5019-5030.

Implementation & Results

- We first found the age of the person in the image from the name of the image. Then image was renamed by appending the age to the name of the image.
- Next, the images representing same age were added to a same folder named as the age digits. Like the images whose subject has age 15 are added to the folder named "15".
- The images were processed to extract features using LPP. On applying LPP, we found L, D and W vectors and eventually found out eigen vector A.
- SVM is applied on these features to classify them into 3 classes i.e. yound, adult and old.
- Whenever new image is given as an input, it will be classified based on this SVM classifier.





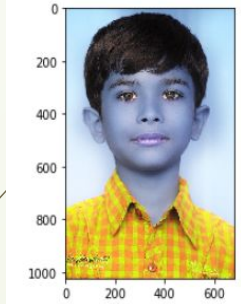
Discussions

[6]

[7]

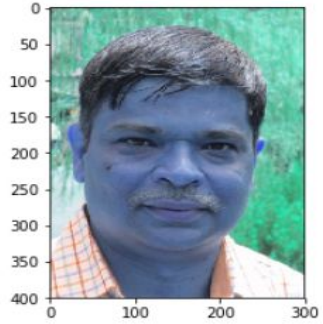
```
%matplotlib inline
img = cv2.imread('kid.jpg')
plt.imshow(img)
print('Age Class :1 - Young \nAge Range :0-17')
```

```
Age Class :1 - Young
Age Range :0-17
```



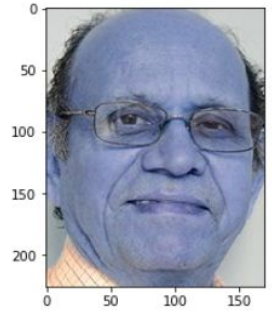
```
%matplotlib inline
img = cv2.imread('image1.jpg')
plt.imshow(img)
print('Age Class :2 - Adult \nAge Range :18-46')
```

```
Age Class :2 - Adult
Age Range :18-46
```



```
%matplotlib inline
img = cv2.imread('image2.jpg')
plt.imshow(img)
print('Age Class :3 - Old \nAge Range :46 nd above')
```

```
Age Class :3 - Old
Age Range :46 nd above
```



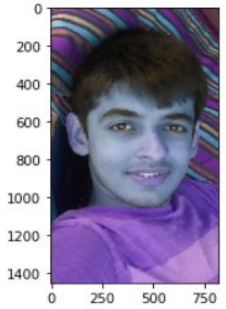
```
In [150]: pred
Out[150]: array([2])
```

```
%matplotlib inline
img = cv2.imread('kid.jpg')
plt.imshow(img)
print('Age Class :2 - Adult \nAge Range :18-46')
```

```
Age Class :2 - Adult
Age Range :18-46
```

```
%matplotlib inline
img = cv2.imread('jeet.jpg')
plt.imshow(img)
print('Age Class :2 - Adult \nAge Range :18-46')
```

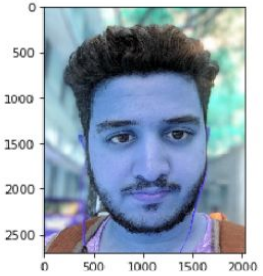
```
Age Class :2 - Adult
Age Range :18-46
```



```
array([3])
```

```
%matplotlib inline
img = cv2.imread('sharvil.jpg')
plt.imshow(img)
print('Age Class :3 - Old \nAge Range :46 and above')
```

```
Age Class :3 - Old
Age Range :46 and above
```



[6] https://ahduni.edu.in/seas/assets/faculty_image/77830IMG_0181.JPG
[7] https://ahduni.edu.in/seas/assets/faculty_image/50703Ashok_Formal_photo.jpg

Conclusion & Future Work

- While dealing with the facial variations in the context of machine learning, age estimation has been an explored domain. Age variations present several unique which make age recognition a challenging task to be studied.
- Our basic idea is to model an aging pattern defined by individual's face images such that the dimensionality and hence the cost of computation is reduced.
- We are motivated in performing the dimensionality reduction through PCA approach but the differentiating ground being the consideration of underlying data manifold structure as well.
- After performing dimensionality reduction (which is indeed a crucial part), we used LPP to extract the features from those images.
- We implemented Support Vector Machine to draw a hyperplane separating the features of young and adult and to compute the age range of an inputted image.
- We would like to base our approach in defining more ranges for precise age classification and detection problem.

References

[1] Guo, G., Mu, G., Fu, Y., Dyer, C. and Huang, T., 2009, September. A study on automatic age estimation using a large database. In *Computer Vision, 2009 IEEE 12th International Conference on* (pp. 1986-1991). IEEE.

[2] Fu, Y., Xu, Y. and Huang, T.S., 2007, July. Estimating human age by manifold analysis of face pictures and regression on aging features. In *Multimedia and Expo, 2007 IEEE International Conference on* (pp. 1383-1386). IEEE.

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[5] Fu, Y., Guo, G. and Huang, T.S., 2010. Age synthesis and estimation via faces: A survey. *IEEE transactions on pattern analysis and machine intelligence*, *32*(11), pp.1955-1976.

Thank You !