Computer framework for identifying the nationality

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Abstract

Identification of a person's nationality is a legal responsibility of the respective state. In the area of image processing, face is one of the most challenging biometric traits. In recent years, gender identification, compete with age, has gained a lot of importance and it has also become one of the challenging areas in research. In addition to this, the analysis of traits also helps in identifying the nationality of a person, and this adds value to immigration-related activities. Every humans face is unique, different and diversified. Every face gives demographic information such as colour, shape, texture, range and intensity. All these details help us in identifying a person's nationality. In this paper, we try to get the shape and texture for ethnicity identification using active shape model and active appearance model. The results are based on a test database collected from the internet. The dataset comprises 250 frontal images. The test results are used to categorise the nationality of a person based on different parameters.

Keywords: Nationality, Face identification, gender, range, intensity, texture, Active shape model and Active appearance model.

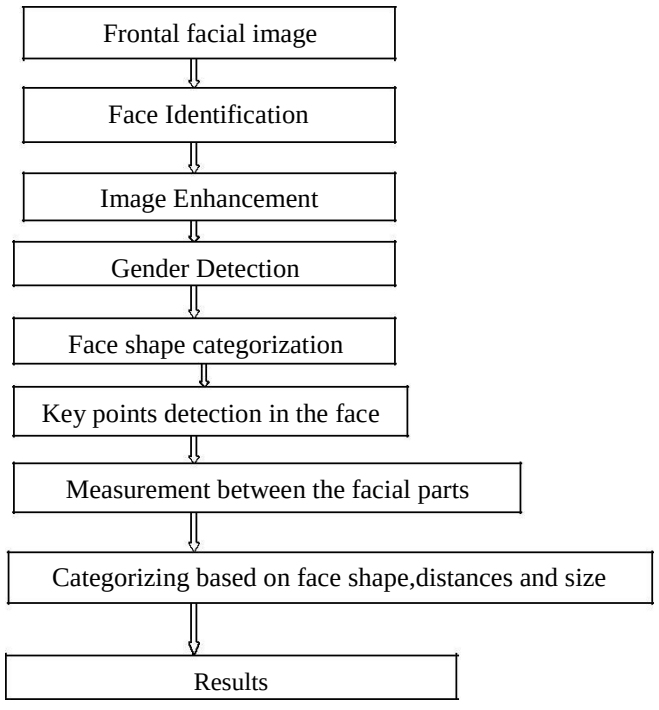
Introduction

A facial recognition system is a computer application capable of identifying a person from a digital image or from a video source. One of the ways to do this is by comparing selected facial features from the image and a facial database. it finds its application in security system and can be compared to other biometrics such as finger print or iris recognition system it also finds it application in immigration checking for the individuals nationality. In the recent past it has become popular as a commercial identification and marketing tool. Some facial recognition algorithms identify facial features by extracting features from an image of the subject face. Eg: an algorithm may analyze the relating points , size, shape, edges, nose, cheekbones and jaw. Traditionally mathematical model of face recognition represent faces in terms of geometric identification that contains distances, angles and areas between face features such as eyes, nose, chin and mouth. The demographic feature such as race and gender are involved in human face identity recognition. Humans are better at recognising faces of their own nationality than faces of other nationality. [1, 2]. They use functional Magnetic Resonance Imaging(FMRI) to examine if the same race advantage for face identification involves the Fusiform Face Area(FFA) which is very important for face identification [3]. Gutta et al[4] proposed a hybrid classifier based on RBF networks and inductive decision trees for classification of gender and nationality using a 64*92 image resolution they achieved an average accuracy rate of 92% for the nationality classification generally two categories of nationality can be classified they are Asian and Non Asian.The aim of this paper is to automatically find the landmark key features in a facial image and classify the image to be of a particular race or nationality. To give a solution to this problem we have collected around 250 facial images from different nationalities to make our sampling. Then we have measured all of them to build our measurement table database[5].

System Framework

In our experiment the system identifies the face from an input frontal image[6]. We can determine image's gender, face shape, key and mark points and facial parts. Then, we will give the results based on the comparison of sizes and distances with the samples measurement table database with Active shape model (ASM) and Active Appearance model (AAM).

Figure 1. Flow diagram of the system framework



Face Identification

Face recognition is a challenging and interesting research topic in the field of image processing which has been used widely used in many applications such as verification of credit card, Security access control and human computer interface. Thus many face identification algorithms have been proposed and survey in this area is found in [7] [8] [9]. Automatic face detection is a complex problem in image processing. Many methods exist to solve this problem such as template matching, Fisher linear Discriminant, Neural Networks, SVM. Success has been achieved with each method to varying degrees and complexities.

Image Enhancement

In image processing, the process of increasing the quality of a digitally stored image by manipulating the image with software is image enhancement. For example, to make an image lighter, or darker or to increase or decrease the contrast. Advanced image enhancement software also supports many filters for altering images in various ways.

The enhancement doesn't increase the inherent information content of the data, but it increases the dynamic range of the chosen features so that they can be detected easily. Enhancement can be done using different techniques such as point processing,, intensity

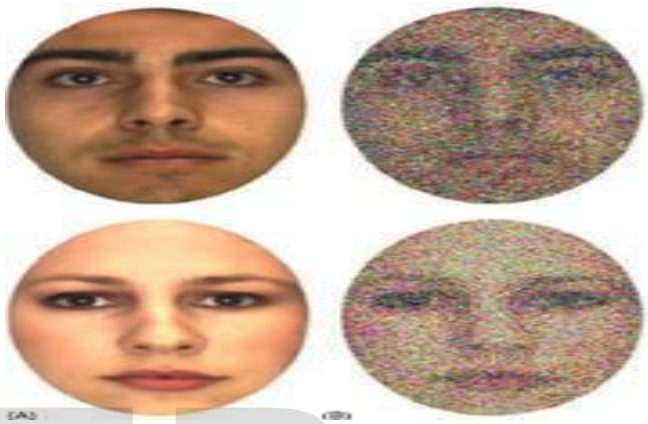
Transformation, histogram processing, spatial filtering and enhancement in the frequency domain.

Figure 2: Before and after image Enhancement

Gender Detection

As the dataset contains a mix of both the genders. Before identifying the nationality of a person it becomes very important to identify the gender. The problem of gender identification can be addressed using two different facial modalities, range and intensity. With the advances of 3D imaging technology, commercial 3d sensors provide not only the range data, but also the registered intensity information [10][11]. The facial images for gender detection can be done by normalizing the face image by taking into account the different geometrical values, illumination changes in the eyes[12] and also we can take into account the skin texture which can be analysed using Active Appearance model. In this experiment the concept of Principal component analysis and eigen vectors are used in classifying the image as a man or a woman. The components used in the eigen face technique are the eigenvector of the covariance matrix of faces, while every face is a point in n space. Where n is the number of pixels in the each image [13].

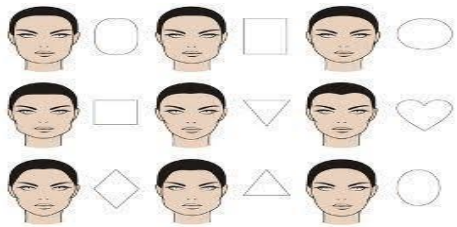
Figure 3: Gender Detection



Face Shape Classification

The human face is more complex compared to any other shapes in the world. The shape of a face can be geometrically identified based on the size, structure and geographical region. Scientists have proved that human face shapes are classified into 9 different types such as round, rectangle, oblong, square, inverted Triangle, Heart, Diamond, Triangle and Oval. This above shapes can be obtained by using the concept of Active shape model (ASM). Active Shape Models are statistical models of the shapes of objects which iteratively deform to fit to an example of the object in a new image. The shapes are constrained by a Statistical Shape Model to vary only in ways seen in a training set of labelled examples. In addition to the shape model, we require models of the image appearance around each model point. The simplest is to assume the points lie on strong edges. More complex models can be built to represent the statistical variation of the gradient along profiles through the points, normal to the boundary curve at that point.

Figure 4: Different facial shape



Key points detection in the face

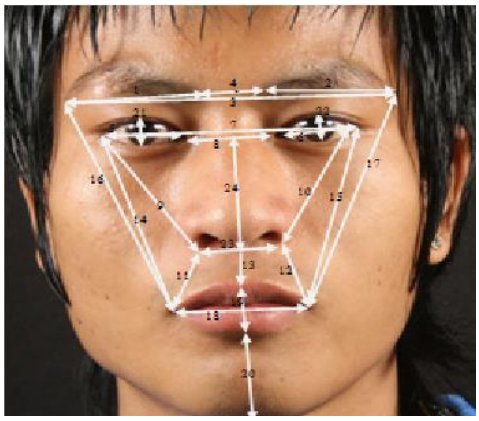
Detection of facial key points is the basic and very important task, basically it is about finding out the location of specific key points on facial images. These key points can be mouths, noses, left eyes, right eyes and so on. Each detected key point can be a (x,y) coordinate in the predicted location of the face. We can identify many such pixel coordinate in the face. Such as left_eye_center, right_eye_center, left_eye_inner_corner, left_eye_outer_corner, right_eye_inner_corner, right_eye_outer_corner, left_eyebrow_inner_end, left_eyebrow_outer_end, right_eyebrow_inner_end, right_eyebrow_outer_end, nose_tip, mouth_left_corner, mouth_right_corner, mouth_center_top_lip, mouth_center_bottom_lip. These keypoints can be tabulated in a database and can be used for analysing the nationality of an individual. The following figure shows 55 key points.

Figure 5: Face showing 55 keypoints.

Measurement between facial Parts

After detecting the facial key points. The faces from the image database can be compared by tabulating the distance between the facial parts and size of the facial parts. We can use anthropometric and morphological measurement techniques [14][15].

Figure 6: Distance and size measures



Measurement Metrics

1. Head height
2. Head width
3. Forehead width
4. Forehead height
5. Face height
6. Face width
7. Nose width
8. Nose Height
9. Mouth width
10. Mouth Height
11. Chin Height
12. Distance between Eyes

13 Distance Between Nose and mouth
14 Distance between ears
15 Distance between eyebrows

By using the above values we predict the nationality of an individual.

Conclusion

In this paper we have represented a computer based framework to identify the nationality from the frontal facial images. The image samples should be collected before the process. One has to have frontal images of different countries. The images collected should have normal light illuminations and should not have rotations. We can recognize nationality from frontal image candidate automatically. There are some challenges in using nationality detection to create high qualified applications for the military, police, defence, security control and immigration. The future work can be done by collecting faces from all countries in the world which is a very complex and challenging problem in research.

References

[1]. R. Malpass & J.Kravitz, "Recognition for faces of own and other race" PP.330-334 1969.

[2]. J. Brigham & P. Barkowitz "Do they all look alike? The effect of race, sex, expression and attitudes on the ability to recognize faces", J.Appl.Soc.Phychol 8pp, 306-318 1978.

[3]. A. Golby, J.Gabrieli, J.chiao & J.Ebehardl, "Differential responses in fusiform region to same race and other race faces", Naure Neuroscience 4(8), pp.845-850, 2001.

[4]. S.Gutta, J. Huang, P.Phillips & H.Wechsler, "Mixture of experts for classification of gender, Ethnic origion and pose of human faces", IEEE international conference on automatic face and gesture recognition , 2002.

[5]. Bastanfard, A;Nik, M.A; Deshibi, M.M., "Iranian face database with age, pose , expression, "Machine vision,

2007. ICMV 2007. International conference on, Vol, no, pp:50,55, 28-29 Dec 2007.

[6]. Neeraj kumar, Alexander C.Berg Attribute and smile classifier for face verification. ICCV 2009.

[7] W. Zhao, R. Chellappa, A. Rosenfeld and P. J. Phillips, "Face Recognition: A Literature Survey", ACM Computing Surveys, vol. 35, No. 4, 2003, pp.399 - 458.

[8] Ashok Samal and Prasana A.Iyengar, "Automatic recognition and analysis of human faces and facial expressions: A survey", Pattern Recognition, vol. 25, 1992, pp.65-77.

[9] R. Chellappa, C.L. Wilson, and S. Sirohey, "Human and machine recognition of faces: A survey", Proceedings of the IEEE, vol. 83, 1995, pp.705-740.

[10] Minolta Vivid 910 non-contact 3D laser scanner, < http://www.minoltausa.com/>.

[11] Cyberware Inc., < http://www.cyberware.com/>.

[12] R. Brunelli and T. Poggio, "Hyberbf Networks for Gender Classification", *DARPA Image Understanding Workshop*, pp. 311-314, 1992.

[13] P. Belhumeur, J. Hespanha, and D. Kriegman, "Eigenfaces vs. Fisherfaces:Recognition using class specific linear projection," IEEE Pattern Analysis and Machine Intelligence, vol. 19, pp.711-720, June 1997.

[14] Vallois, H. V. (1965) "Anthropometric Techniques", Current Anthropology 6(2): 127-143.

[15]L.G. Farkas et al., International Anthropometric Study of Facial Morphology in Various Ethnic Groups/Races. Journal of Craniofacial Surgery. 16(4):615-646, July 2005.