

Detection of Smile At Different Pose Variation Through Image Processing

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ABSTRACT

Facial expression are the one of most important features of transferring the emotions like happiness, sad, surprise, anger, disgust, fear among people. In the last past years, Facial expression recognition has been done so much research in computer vision community but smile detection has received less attention . However, Facial expression not only reflects the emotions, but also mental activities, social activities. Smile detection is an interesting problem with many applications. On the other hand, smile can be very useful for measuring the happiness, enjoyment .To detect the problem of smile, digital image processing is used to provide same as fast and objective results .In this paper, new techniques used for solving the problem of detection of smile. The intensity differences of pixel in the grayscale faces image are used as features. Adaboost used for improve the performance of classifiers. Our approach is that the faces are correctly classified which have large pose variation. Therefore we investigate more on the detection of smile on face which having large pose variations. And at the last, SVM (Support Vector Machine) used for better classification and also recognize the pattern. By using this we find the accuracy of variations of pose using as pair of pixels.

1. INTRODUCTION

Smile is the one thing which is very important for expressing the feelings among people. It is also most common facial expression which we used in daily activities. The impression we get from a displayed expression will affect our spoken words and even our posture towards the speaker. Smile is the expression which is formed by the movement of mouth at both end. Detecting the smile can tell us about the mental state of the person. In many applications smile detection used in gaming, product rating, distance learning systems, video conferencing, and patient monitoring.

Mostly past work has done on the analyzing the facial expressions. There are two approaches to detect the smile that is features based method and appearance based method. Feature based method has variation in the face positions and angle. In Appearance based method, it does not need to find the facial parts and provides the result of smile detection. As a result, it is having very low cost for finding out variations at face angles. Overall, we can also find out variations of head pose at different angles when we smile. At different pose variations of face easily detect the smile, also find out the difference in at every variation of pose.

Smile detection has received much more interest like in digital camera smile shutters automatically shutter when smile detected .Many software come in market for finding out the happiness on the face of that person.

2. FACIAL EXPRESSION RECOGNITION

Facial expression is the one or more motion of the muscles of skin. It is the non verbal communication of facial expression. We can communicate through feelings and expression through mouth, smile, face etc. They are mean of conveying the social information through eye contact, face overall and sign languages.

Its play an important role with the human interaction with machines. We can recognize the features of face by using many applications came in market. Easily detection of face expression can be performed these day.

There are number of faces expression like neutral, anger, disgust, fear, happiness sadness, surprise. By this expression of faces we can easily know about the expression what they communicate with others. Facial expression plays an important role in communication among people.

Facial expression recognition are hard to recognize as:

Every person expresses in different ways, no pattern are available easily.

Full frontal face of the poser has to be available.

No proper database available for finding out the proper expression .

3. STEPS FOR FACIAL EXPRESSION RECOGNITION

There are four steps for recognizing the facial expression :

3.1 Facial detection

3.2 Facial extraction

3.3 Facial compression and matching

3.4 Facial expression recognition

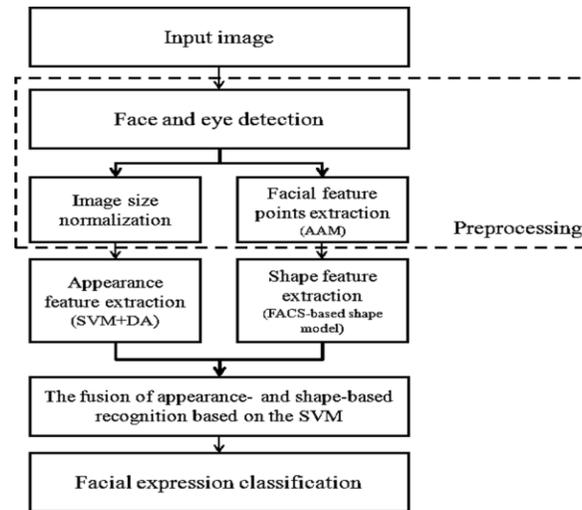


Figure1. Steps for Facial Expressions

3.1 Facial detection: In this first we detect the face ,any face you can detect in this and multiple faces .If the system consist of faces it will extract the features of faces like eyes, brows, lips, mouth.

3.2 Facial extraction: After getting facial features like mouth, eyes and lips. In this templates are stored in the databases. Also there is one rule you can easily extract the features of faces. We can also apply the rules on faces but its quiet difficult.

3.3 Facial compression: and matching: After extraction of face we can compare the face with other faces which stored in the databases. Also apply the different technologies like SVM, HMM etc.

3.4 Facial recognition: This is an optional for face recognition systems. Expression is visible on face due to the movement of face muscle. There are basic 6 expressions to recognize. That are, Happy, Angry, Disgust, Sad, Fear and Surprise.

4. SMILE DETECTION

Smile detection is feature by which we detect the smile when person is smiling. In digital camera automatically the shutter button click and takes a photo when a smile is detected.

Smile may have different pair of facial muscles but we focused on the smile only. We received two applications that is smile shutters for digital camera and social robot that detect the human smile in everyday life. We can detect the smile at different variation by using SVM,ADABOOST techniques. At the end we get accurate result and at fast rate.

In smile detection, first we set the database of face image registration, image representation, machine algorithm.

Why do we need detection of smile on different pose variations?

We know that smile detection become an great application in todays world. Detection of smile at different pose variation is also necessary. If the head of the person is move at different angle it become an great problem for detecting the smile of face. To solve this problem we use many learning algorithm for variation of pose. It is not necessary that person is only look at same angle, also the position of face changes at different angles.

In digital camera, smile detection plays an important role. Its triggers the shutters button when smile is detected from the face. It seems that some of the faces are correctly classified when faces are taken from front, whereas faces that classified weakly when pose variations are moved. Therefore, we investigate further the impact of pose variation on smile detection.

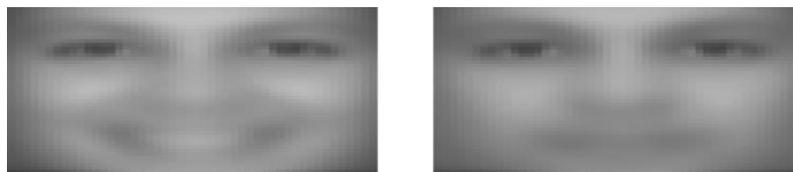


Figure2. Smile Face and Non Smile Face

The variations in facial images could be categorized as follows:

1. Camera distortion and noise

2. Complex background
3. Illumination
4. Translation, rotation, scaling, and occlusion
5. Facial expression
6. Makeup and hair style

5. WHAT IS IMAGE PROCESSING?

Image processing is a technique in which a digital image is taken as the input, and then some operations are performed on it in order to get some useful information from it. Image processing is a two dimensional signal processing in which already present set of signal processing operations is applied on the two dimensional signal of the image to extract the important information from it. Various characteristics associated with the image are studied to get useful output.

Three main steps of image processing are:

- 1 Importing digital image as input
- 2 Processing, manipulating and analyzing the image to extract important information from it.
- 3 Providing output for making decision.

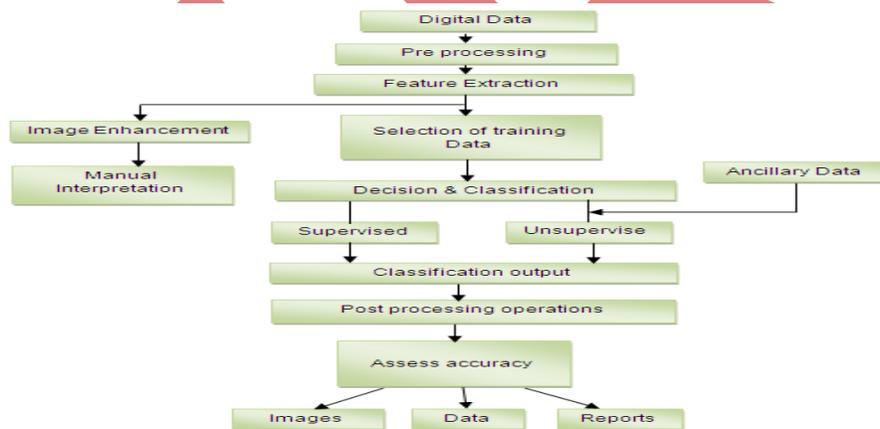


Figure3. Steps for Image Processing

5.1 Objectives of image processing

1. Image recognition: To make difference among different objects in an image
2. Pattern measurement: To measure different objects in an image
3. Visualization: To observe the objects in image that are not clearly visualized
4. Image retrieval: To extract the image of interest
5. Image sharpening and restoration: To make a better image from the current available image.

5.2 Why to use Image Processing?

To detect the smile of face at different pose variation it is very difficult. Image processing plays an important role in pattern classification ,it solve the problem of variation. There are the following drawbacks which we find out in the detection of smile at pixel differences:

1. Time consuming
2. Inaccurate
3. Subjective
4. Inconsistent
5. Inefficient

These are the various drawbacks of detection of smile when we perform this applications in phone,digital camera.

To overcome all these disadvantages image processing is used. There are the following advantages of using digital image processing:

1. Fast
2. Accurate
3. Objective

4. Consistent

5. Efficient

Hence, using digital image processing provides these advantages. Therefore digital image processing is used.

5.3. Detection of smile through image processing

The detection of smile through image processing can be done as following steps:

5.3.1 Database collection

5.3.2 Experiment design

Database collection: We collect all images that are taken by the digital camera. The new dataset GENKI used as which is consist of number of images taken from web. All faces are consists of prototyping smile. We can categorized the face, which are named as happy, non happy and not unclear.

A. Experiment design



Figure4. GENKI Database

B. Image Registration: In this all images were first converted to gray-scale and then normalized face at different pixels by rotating, cropping, and scaling. We compared the performance when the eyes were automatically detected, using the eye detection system. If the image which we registered has been identified not correctly, inaccurate performance we get .

C. Image Representation: We compared the performance of widely used image representations:

1) Gabor Energy Filters (GEF): It is the model of complex cells of the primate's visual cortex. In this energy filter is consists of two linear filters that is real and imaginary parts filters. The real and imaginary pairs share the same envelope but the gratings are out the out of the phase. The outputs of these two real and imaginary components are squared and obtain an estimate of energy at a particular location and frequency band. This filters are mostly used in various applications of face recognition and expression recognition.

2) ADABOOST: Adaptive Boosting is a machine learning algorithm. It is a meta-algorithm, and can be used to improve the performance of classifiers.

3) GABOR FILTERS: These filters are used for edge detection of facial expressions.

4) Box Filters (BF): These are filters which is consists of rectangular input. These filters are particularly used for applications on digital computers.

5) Edge Orientation Histograms (EOH): These features become popular for a object recognition and face detection .They are assumed to be more tolerant to image variation and provide better performance than Box Filters.

6) BF+EOH: Combining of these two feature, its show face detection highly effective. Same experiment are performed for smile detection.

7) SVM: This model associated with learning algorithms that analyze the data and recognize pattern for classification and regression analysis. This machine take the data and assume the input which we take, two possible classes forms the output making its a non-probabilistic binary linear classifier

8) Local Binary Patterns(LBP):We also assumed the features with LBP for smile detection. Using LBP we perform preprocessing or as features directly.

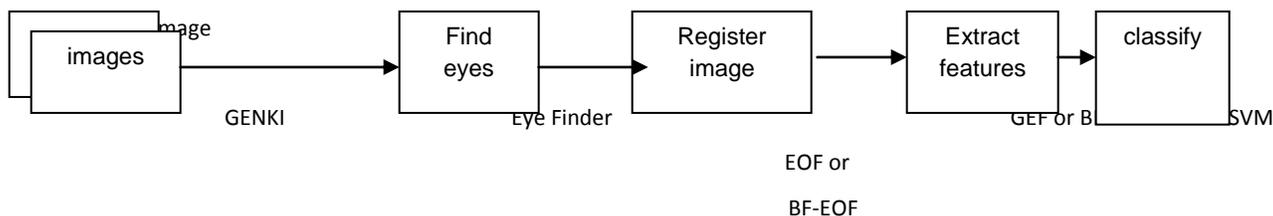


Figure5. Steps for Detection of Smile (Jacob Whitehill et al.)

6. WHAT IS SUPPORT VECTOR MACHINE?

SVM is a kind of Artificial Neural Network architecture, which is used to find out the optimal hyper plane for the classification and the generalization. It means it is used to find out the hyper plane in which the distance to the one side of hyper plane is equal to the other side of the hyper plane. SVM maximizes the margin between the two classes. We get very high level of classification and generalization using the SVM and can make very accurate decisions.

The SVM can be described the basic ideas: first, the input are formulated as feature vectors. Second, these features vectors mapped into the features space by using kernel functions. Thirdly, a division is computed into the feature space to optimally separate the class training vectors. This property of SVM is superior in comparison to the machine learning

7. WHY TO USE SUPPORT VECTOR MACHINE FOR CLASSIFICATION?

In this technique, SVM is going to be used for the classification. Because SVM provides highest degree of accuracy among all the other methods available. That is why SVM will be used in this technique for the calculation of the rusted area in the given iron material and it will provide highest accuracy.

7.1 Present Problem

There are number of techniques which are developed for the detection of smile at different pose variation of face. But there is no technique which can provide 100% accuracy in minimum time. As we move to achieve accuracy and fastness, complexity also increases. Therefore, I propose a technique which is simple, fast and can provide high accuracy using ADABOOST and Support-Vector-Machine for the detection of smile in its early stage.

Following are the objectives to develop a technique that can detect the smile:

Make a database of images of faces.

To acquire digital images of faces whose detection is to be done

To use AdaBoost learning algorithm for making strong classifiers. This algorithm help in classifications.

Various filters are also used for facial expression recognitions. Then use SVM to calculation the pattern classifications

Therefore, to make automatic system that can detect the smile.

7.2 Objectives

There are the following objectives of the automatic detection of smile through image processing:

1. To achieve high accuracy
2. Fastness
3. Simplicity
4. To detect the smile at different pose variations
5. To save money
6. Easily detect the smile when shutter triggered.

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