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Lying Facial Recognition Using Content Based Image Retrieval Approach In The Compressed Domain

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ABSTRACT: *In this paper we explore content based image retrieval to identify lying facial in the compressed domain. The work was conducted by constructing an application or tool which automatically detect and recognize someone dishonesty accurately based on face recognition. In this research we used more than 30,000 face images which consist of normal face expression and three lying facial categories. We wrote two face detection and face recognition algorithms to decide whether someone lies or honest. This work was carried out to bulit an automatic tool of lying facial detection and recognition fastly and accuratelly. Face detection done to separate between face area and non face area in order focus on face recognition. In this work we used face image with normal pose without obstacles and facing toward with 90 degree. In the experiments we apply more 150 queries which 50 images from each category of total of three categories (lying facial A, B and C categories). Our algoritms demonstrate good effectness of image retrieval in term of Precision and recall.*

Keywords- *recognition, matching, retrieval, lying facial,*

1. INTRODUCTION

Face recognition and *facial exspression detection* are which area interest of many researchers in the area of *image analysis*, *pattern recognition*, and *biometrics*. (Zhao et. al, 2003; Delac et al., 2004; Li dan Jain, 2005; Delac dan Grgic, 2007). In this work applied to lying facial fa*ce detection* from the more than 30.000 face images. The system can be used to detect whether one's lying or not, it helps polices in suspetced crimes interogation. Lying face expression can vary by smile face expression, angry, sad,scary, and laugh. The objectives of this work is to to verify whether one's or not in an interogation based face features, in order to do that the system generate lying facial exression pattern. Determining one's lies or not can be known by comparing trainning image to images in the database. The comparation carried out based on *i).* detection of highest value of radial and regular symetric of images, *ii).* Location of eyes and mouth, and *iii).* Detection of mid of face area, (Toure dan Beiji ,2010).

2. RELATED WORKS

2.1 Content Based Image Retrieval and JPEG.

Content-based image retrieval (CBIR) is a low-level based features based retrieval simply based on the content or existing image [1]. Some content-based image retrieval have been done up to this time,including: Blobworld [2], the system PicToSeek [3], C-BIRD [4], and MARS system [5]. Meanwhile International standard compression has now been widely introduced and is known as JPEG and MPEG. JPEG image has been very popular as a ISO / ITU-T standard and is patented in the 1990s, some models have been defined by the JPEG [6] including the baseline model, lossless, progressive and hierarchical.

2.2 Image Searching.

Traditional image searching and retrieval were carried out based on query-by-example (QBE) starting from the input image into the system (query image) are compared to the existing image in the database, several studies have been made by researchers, among them [8]. In face image based retrieval, they stated that standard query image can be a mental image. Furthermore they said that their research focus on face features, moreover all the algorithms developed can be applied to other domains, for example in clothing, home furnishings, and paintings, and mental face images. One example of effective mental image searching has been stated by Cox [9]. Image searching in the compressed domain by using many methods have been done previously and provide satisfactory and effective results compare to image searching in the pixel domain [10]. As has been proven that with a certain level of compression, then search the face to give even better results than a search on the uncompressed domain.

2.3 Face recognition

Although many automatic face recognition techniques are successfully applied in many areas of daily life, but the task of face recognition based only on the scale bias. Research topic in face recognition is still a challenge, especially in the uncontrolled environment (Adini, et.al., 1997). Meanwhile, to match with face image that is in the database or gallery we use the Euclidean distance calculation, if Euclidean distance equal to zero then the image will be exactly the same query image is in the database.

Face recognition can be done by using the chromatic color components, Hue and Saturation as was done by Zhao in Petrou (Petrou and Bosdogianni, 2005). Face can be considered as unique features ofuman, even

twins their faces still different although they are very similar. Human epertise to recgnize a face can be done easily even if face's appearances influenced by its expression, age, and obstacles (glasess, hat, hijab).

3. RESEARCH METHODS
3.1 The Ground Truth
Firstly, this work was done by creating a database of facial images with JPEG format, so that the image of the face, which mostly non-JPEG format must first be converted into JPEG format. Face image database constructed in the range of between 20,000 images and is composed of several normal face image (face looking straight ahead), the image database is also equipped with faces both perpetrators of crimes that have been or who is undergoing punishment and image faces of the perpetrators who are in search of the authorities. The three categories lying facial database constructed based on Seager (seager , 2004) works
namely: i). when eyebrows move to the middle of forehead and eye move to top right, ii). lips move hesitant and iii) when ones touch nose and mouth and close his mouth. Meanwhile, the system generated in this work done by using Visual NET platform. The output is expected to deliver a method which to provide a significant contribution to recognize suspected crimes.

The reason of in this study using JPEG images since JPEG images have several advantages compared to other formats, some of its advantages are: (i). file size is relatively small compared to other formats (image can be compressed up to reach 70% without reducing the quality of the original image), (ii). Easy and simple algorithm due to the image is divided into blocks of DCT coefficients, (iii). Most cameras today have used the JPEG format. Moreover, JPEG is an international standard format for images on the Internet and in multimedia devices today.

3.2 Research steps
Research is conducted in two phases, first phase involves the collection of facial image of more than 30,000 facial images. In this first phase, activities will be focused on activities and face features extraction. Figure 1. describes the flow of activities which constitute the face extraction. To stage face recognition , this works use to implement image retrieval by image query into the system, which a imple implementation of image retrieval based on face detection feature. Database used in this study is a combination or mixture of some facial expressions such as facial was mediocre, angry face, smiling,

shouting, and laughing, while also used illumination (some variation of radiation from the left side, right side, and radiation from both sides).
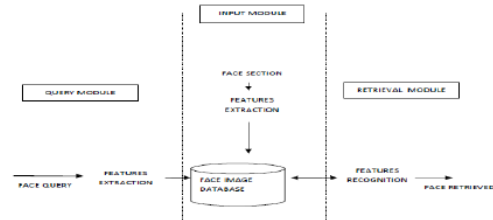

Figure 1. Diagram of face recognition retrieval system

Database used in this study is a combination or mixture of some facial expressions such as facial was mediocre, angry face, smiling, shouting, and laughing, while also used illumination (some variation of radiation from the left side, right side, and radiation from both sides).

3.3 Evaluation of Effectiveness of Face Image Search
To measure the similarity or degree of similarity between the query face image (the reference face) with facial image is in the database, then used the Euclidean distance formula which can be defined as follows:

$$d(Q,I) = \frac{\sum_{i=0}^{M}(Q_i - I_i)^2}{M}$$

Where Q is the query face image and I is a vector of image features that exist in the database, while M represents the number of elements present in the image features. As for calculating effectiveness (effectives) of facial images used search precision and recall parameters that can be written as follows

$$\text{Precision} = \frac{\sum \text{relevant images retrieved}}{\sum \text{images retrieved}}$$

$$\text{Precision} = \frac{\sum \text{relevant image retrieved}}{\sum \text{relevant image in category in the database}}$$

The greater the value of precision and recall, the more effective methods or techniques used by search, Precision has a maximum value 1 and minimum 0.

3.4 Faces Searching Algorithm
The algorithm of the method applied in this study is to explore the features available in the DCT coefficients, where each coefficient is a vector containing the energy to build a histogram in the process of matching during the search process and the introduction of facial images from the database. Sequence or algorithm of this technique can be explained as follows:

1. Input face image
2. Convert RGB Image into YCbCr and HVS component, get face candidate
a. Generate Key Indexing from DCT coefficient of 2D matrix image calculate I(query Image) as follow:
H(i)= {h0,h1,…,h63), and hi=
Q(u,v) is DCT coefficient at row u, and column v
Similar step 3 for iamge in the database.
H(i) = { h0,h1,h2,…,h63},andn
hi =
d(u,v) is DCT coefficient at row u and column v.
3. Calculate similarity between image query and image in the database using this formula:

$$D(Iq,Id)Minimum - \frac{\sqrt{\sum_{i=0}^{N}(Iqi - Idi).(Iqi - Idi)}}{N}$$

Where D is distance between Iq vector Id vector (face in the database). Whilst N is number of block of related face image. D value has range 0 and 1, if D=0 then image query is exactly the sane to image retrieved from the database.
4. Range face image retrieved based D value calculated as ascending order.
For Number_of_block = 1 to N
For u = 0 to 63
For v = 0 to 63
D((Iq(u,v),Id(u,v)));
End
End
End
5. Display 20 images similar retrieved
6. For next image query, repeat steps 1 to 6.

4. RESULT AND DISCUSSION
4.1 Effectiveness of Face Criminal Search
More than 100 query (reference face) was deployed as test taken from no less than 500 training images (training face images) in this work, showing that the effectiveness is quite good because most of the Precision gained greater than 0.65 or 65%. The algorithms built for this tool, is DCT features algorithm coefficient features extraction using color *luminance,* arguing that the color *luminace* widely accepted and considered to represent than the colorchrominance. By using algorithms that match facial images with the JPEG format, then the effectiveness calculated and the result has average precision and recall of more than 0.65, as can be seen in figure 1.

4.2 Facial detection and recognition Algorithms
In this work algorithm used to explore DCT coefficients features which the coefficients is considered as vector. The vector consists of energy to build a hsitogram in matching process of face recogniton into image database. From figure 1, it can be concluded that the greater precision, it will be followed also by increasing the value of Recall. Rate of facial images retrieval from the directory depends on the computer, the faster the processor, then the process will also be faster. Figure 4.4 and 4.5 display results of the face detection and face recognition of our algorithm.
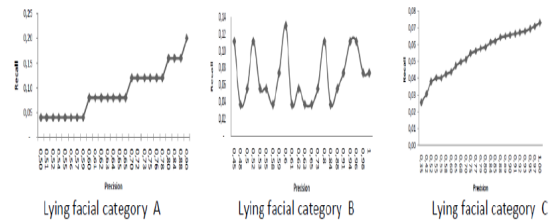

Figure 1. The effectiveness of three categories faces

5. CONCLUSION AND FUTURE WORKS
5.1 Conclusion
Several conclusions can be drawn from the results of the study face recognition that is the JPEG image file sizes are much smaller, does not reduce the information displayed. This is evidenced by the retrieval effectiveness of which is still quite high (about 0.65) by using the method of DCT feature extraction. In the algorithm used in the study, features - and not face facial features are also applied to produce accurate results. Even though, GUI of the tool has not been considered ready as a commercial application, our algorithms show fair effectiveness in term of Precision and Recall.

5.2 Future works
Existing and future research needs to be worked to improved the effectiveness of the algorithm by using larger database both in terms of both quantity and variety. We will try to apply other methods such as segmentation, neural network, and fuzzy logic for face detection and recognition.

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