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Lie Face Recognition Use CBIR (Content Based Image Retrieval) Techniques for Otomation System

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Abstract

This reasearch undertaken to develop facial recognition system to lie expression prediction use CBIR (Content based image retrieval) techniques. this techniques intendes technique of behavior lie acts on images JPEG compressed.System can automatically detect quickly and accurately lie acts. CBIR techniques search based on similarity visual mutual image held.Mechanisms used in CBIR is using the feature vector of the image as pointer to document image. Image feature extraction is using feature vector 2D DCT (Two-Dimentional Discrete Cosine Transform). system based on analysis and face image processing with value of the performance evaluation system retrieval precision and recal**.**

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Keywords: *CBIR, lying, retrieval, 2D-DCT*

1. Introduction

There are many ways that can be used to detect lies, Handy Reader trusters Emotion and Functionality Magnetic Resonance Imaging (MRI) [1] including using a tool that is Polygraph. Polygraph made by William Marston [8]. The polygraph was originally used as a lie detector by the police department and agencies such as the FBI and CIA secret. This tool will track changes in the psychological the body if someone is lying. The trick are to see changes blood pressure,electrical resistance of skin,sweat and speed of heartbeat and breathing, which will be recorded digitally or on paper. Polygraph itself will use the technique to read and monitor the body's response when given question and answer "yes" or "no". To complete a variety of lie detector above, researcher use limitation on scope of person's face image. According to a researcher Dr. Desmond Morris concluded that someone can't hide facial and body language is part of the body most often show signal lies [3].

From the research that has been done by IBG (Interrnational Biometric Group) various types of biometrics (Zephyr Analysis), face recognition technology have advantages and disadvantages in comparison with other biometrics. The disadvantages include the level of error or level EER.(Equal Error Rate) between 1,3% – 13% [2] and the advantages is the sensor or camera can recognize the face as object without touching the object. Fields Various of research on biometric technology, research field that rapidly expanding and attracted many experts image analysis field, pattern recognition, and biometrics is face recognition and facial expressions detection [9]. Face image Condition will be tested in this research is in position straight ahead with angle of 90° facing forward without hindrance images are compressed in JPEG (Joint Photographic Experts Group) with expression and not lying. The face image is placed on the database. The system will be to generate a database containing the expression pattern of lying and no query face image with CBIR techniques. Facial similarity calculation for lie detection will be done using techniques Eigenface [7]. From This research is expected law enforcement officials will be helped in interrogate criminals suspected and person's testimony in the trial.

2. Methods

2.1 Build Facial Images Database

To build the image database with lying expression referencing expert NLP (Neuro Linguistic Programming) named Pete Casale, owner of NLP-secrets.com and Dr. Paul Seager of University of Central Lancashire[6].

Fig.1 Lying expression face example

Face Instructions can produce reliable perception and most important in recognizing personal expression among the instructions other nonverbal. Cicero, Roman Retrorika leader said, "the face is the mirror soul ". Shakespeare, English poet, wrote in Macbeth, "your face is a book where

men may read strange maters. ". Nonverbal communication expert [8] writes: The face has long been a source of information. The social psychologists have found facial perception austerity measure it is with a test called FMST (Facial Meaning Sensitivity Test) or test sensitivity meaning face. With this test we capture emotional sensitivity on the face of another person can judge his score [4]. In the book written [3] that the results of another study conducted by Morris conclude that we can not hide the body language and facial is part of the body most often shows the signal lies.

2.2 Build Algorithm Program

Query image and database image are image still consists of the background and face, to obtain image consisting only of the facial image is necessary to process face detection, the following algorithm.

1. Insert image (as the query image)
2. Change RGB images to YCbCr space (query image and database image)
3. Perform edge detection to get face image.
4. Convert images to DCT (Two-Dimentional Discrete Cosine Transform)
5. Back to step 2 until all the images in the database unreadable
6. Calculate eigenface
7. Calculate precision and recall

Faces in an image has its own characteristics compared with parts other than the face. With these characteristics in the image is determined whether or not there is a face. characteristic effective can be used in face detection. Human skin has color Different and the YCbCr color space or also called CCIR 601(International Radio Consultative Committee) color of the skin can RAS classified as shown in Table 1 below

Table 1 Classification Range of color face human RAS [5]

Min Cb	Max Cb	Min Cr	Max Cr	Name of RAS
110	130	80	120	Negroid
130	150	120	140	Mongolid
150	200	140	170	Kaukasoid

In RGB space, each component of the image (red, green, and blue) has a brightness level of different. Thus in YCbCr space all the information about the brightness level is given by Y component, because the component blue (Cb) and components red (Cr) are not depending on luminance. Here is a step conversion of RGB image into component Y, Cb, and Cr [7][15]

$$Y = ((0.257 \times R) - (0.504 \times G) + (0.098 \times B)) + 16$$
$$Cb = ((0.148 \times R) - (0.291 \times G) + (0.439 \times B)) + 128$$
$$Cr = ((0.439 \times R) - (0.368 \times G) - (0.071 \times B)) - 128$$

R : Red color components of a color image
G : Green color components of the color image
B : Blue color components of the color image

value used to determine the face is the value of Cr and Cb. Generate feature DCT coefficients query image and the image database to construct a two-dimensional matrix image of face with the equation.

$$f(x,y) = -\frac{2}{\sqrt{MN}} a(u)\, a(v) \sum_{X=0}^{N-1} \sum_{y=0}^{M-1} C(u,v) \cos\left[\frac{\pi(2x+1)u}{2N}\right] \cos\left[\frac{\pi(2y+1)v}{2M}\right]$$

Whre u : 0,1,2,.... N-1 and V : 0,1,2....M-1 with N : 8 and M : 8 and then will get matrix 8 x 8 like figure

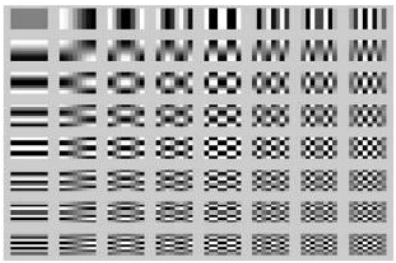


Fig.2 2 DCT 8 x 8

To calculate eigenface can use equation

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

retrieval system to evaluate the performance of the image retrieval precision and retrieval namely recall. Precision is closely related to the accuracy of system in finding images relevant, while the recall is related to speed system-retrive me all documents releval. Both of these measurements can be expressed in the following equation

$$Precision = \frac{|\{relevant\ documents\} \cap \{retrieved\ documents\}|}{|\{retieved\ document\}|}$$

$$Recall = \frac{|\{relevant\ documents\} \cap \{retrieved\ documents\}|}{|\{retieved\ document\ from\ database\}|}$$

3. Result and Discussion

3.1 Face image database

In this research using 3117 image of face with different expressions and 6% are lying face image with expression. then the image in the database is categorized into two: lying face image with expression 6 % and 94% normal (no lie) in order to simplify the calculation precision and recall.

3.2 Face Detection

To obtain image (image query and image database) consisting only of facial image is necessary to the process face detection cropping prosses .

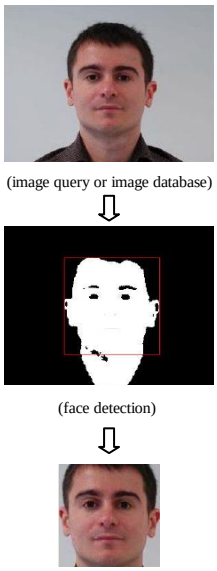


Fig.3 Cropping Image

Table 2 Average cropping percentage

No. Image	Cropping Percentage (%)
1	100
2	100
3	90
4	80
5	98
6	95
7	98
8	80
9	100
10	98
11	90
12	95
13	100
14	100
515	100
Average	94.93

The next step is Consine Discrete Transform (DCT) produces 8 x 8 matrix , following Marik data for an example of a query image and image database.

Table 3 matrix data image query dan image database

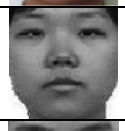
image query		image database	
coordinate	value	coordinate	value
0,0	71	0,0	100
1,0	69	1,0	107
2,0	66	2,0	120
3,0	73	3,0	128
4,0	81	4,0	121
5,0	83	5,0	117
6,0	84	6,0	124
7,0	72	7,0	120
0,1	79	0,1	107
1,1	74	1,1	110
2,1	74	2,1	118
3,1	80	3,1	116
4,1	85	4,1	126
5,1	82	5,1	132
6,1	76	6,1	128
7,1	66	7,1	122
0,2	86	0,2	107
1,2	84	1,2	111
2,2	88	2,2	119
3,2	90	3,2	117
4,2	88	4,2	126
5,2	83	5,2	132
6,2	73	6,2	127
7,2	64	7,2	122
0,3	92	0,3	109
1,3	96	1,3	111
2,3	106	2,3	120
3,3	101	3,3	117
4,3	87	4,3	125
5,3	77	5,3	130
6,3	63	6,3	125
7,3	57	7,3	121
0,4	95	0,4	113
1,4	105	1,4	110
2,4	116	2,4	119
3,4	102	3,4	116
4,4	78	4,4	123
5,4	65	5,4	125
6,4	53	6,4	120

7,4	57	7,4	118
0,5	98	0,5	116
1,5	109	1,5	108
2,5	113	2,5	118
3,5	95	3,5	115
4,5	68	4,5	119
5,5	57	5,5	120
6,5	57	6,5	115
7,5	75	7,5	115
0,6	75	0,6	115
1,6	104	1,6	107
2,6	112	2,6	117
3,6	86	3,6	114
4,6	65	4,6	117
5,6	56	5,6	115
6,6	70	6,6	110
7,6	102	7,6	112
0,7	109	0,7	110
1,7	119	1,7	107
2,7	98	2,7	118
3,7	82	3,7	114
4,7	68	4,7	116
5,7	57	5,7	113
6,7	80	6,7	108
7,7	119	7,7	111

Results of vector D is stored in variable , after wholeprocess of face recognition completed the next step is the process of indexing . This process is carried out to display the face most similar to the nearest ten calculation 0.001 . Here is example of result face recognition process.

Fig.4 Image query

Table 3 Result Face Recognition Process

number	Image	image category
1		lying
2		lying
3		normal
4		normal
5		lying
6		normal
7		normal
8		normal
9		normal
10		normal

next fifteen images called computed value effectiveness recognition by determining the value of precision and recall use precision and recall equation.

Table 4 Value Recall and Precision

Image Query	Precision	Recall
1	0,3	0,2
2	0,2	0,13
3	0,4	0,27
4	0,2	0,13
5	0,3	0,2
6	0,3	0,2
7	0,2	0,13
8	0,2	0,13
9	0,3	0,2
10	0,4	0,27
11	0,4	0,27
12	0,2	0,13
13	0,2	0,13
14	0,3	0,2
15	0,3	0,2

amount	4,2	2,79
average	0,28	0,186

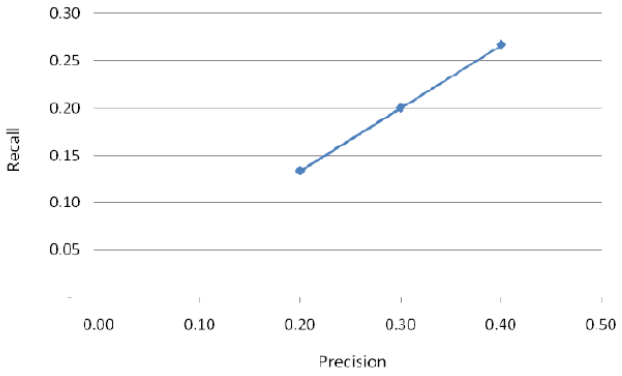


Fig.4 Precision and Recall Graph

Precision value of 0,28 and recall 0,186 or in other words the value ekfektifitas accuracy of techniques to recognize the image of the face with facial expressions lie able to reach 28 %

4. Conclusions

Face recognition specifically for predictions lie face that do have effective retrieval precision of 0.28 and 0.186 with katalain recall system is able to recognize the face of the image lying tested with values up to 28%.

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