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Sketching Expert System for Crime Investigation Purposes

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Abstract

The presence of police sketcher play an important role in making investigation in purpose of making arrestment to fugitive or suspect. The lacking presence of police sketcher is making a lack in investigation process, because lack of information gathered for the further process. This limitation is overcome by developing an expert system using gadget as a helping device to making sketch, with adding sketcher knowledge. Sketching method already been used since long time in process of investigation and effective making the result. The results of expert system on the case have given showing the system to real object which made sketching reach 85% of accuracy level.

Keyword: *expert system, desktop based, sketch, crime*

1. Introduction

Crime in the 21st century have increased and developed. Criminal rate as time goes by, getting more arises and yet the criminal is still cannot be put in jail. The presence of witnesses around the scene is very helpful in solving criminal cases by providing information regarding the events take place, and the people who were involved around the scene of the crime that would be a contributing factor solves a case.

Further obstacles faced by investigators is to describe the faces of people involved based on a characteristic described by witnesses to media images that can later help the investigation. Lacking of human resources as a police sketcher is also a flaw of the investigation process.

Face recognition one of the primary biometric technologies became more important owing to rapid advances in technologies such as digital cameras, Internet and mobile devices and increased demands on security. Face recognition has several advantages over other biometric technologies, it is natural, non intrusive and easy to use. But face recognition is one of the challenging problems in research, till now there is no unique solution for all face recognition applications [1-2]. The wide range of variations in human face due to view point, pose, illumination and expression deteriorate the recognition performance of the Face recognition systems. But everyone accept that the face recognition system is good, if it has less computational complexity, good recognition performance and occupies less memory.

Biometric recognition system is a system that uses the unique characteristics of each individual. This system is more reliable than the token inclusion and recognition of knowledge. Each individual has a different physiological characteristic and behavioral characteristic. Physiological characteristic is relatively stable physical characteristic like a fingerprint, iris, face, and hand geometry. While behavioral characteristics such as voice and signature are influenced by the psychological condition that easily changed. A lot of developers have developed the recognition system based on physical or physiological characteristics [3-6].

In the development process of data investigation, the process of information retrieval from witness is very important. One of those information is of the faces of whoever involved or happen to be at the crime scene, which in may be a witness or a suspect. An arrestment process would be helped if the description made by witness is easily recognizable or closely look like the suspected person. The process of making sketches of faces, require the factors of

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the sketcher, which include the expertise of a sketcher, the availability of time, and also the emotional state of the artist. In addition, it is also necessary skills of sketcher to translate the description given by witness to media images [7-8]. The reason above is why the available of police sketcher is important, and by lacking of it, will make investigation process be incomplete.

By applying simulation application as a media to processing face sketch , then the process will be completed faster, so that will help the whole process of investigation. Expert system is one outgrowth of technology developed with the aim to mimic the ability of an expert in a particular field [9].

Researches related to expert systems have been done with several research objects as follows. Max Ischenko develop web based sketching application. By that application user can make faces sketch using templates from the application. The application used to user to able to make face sketch as if been done by police sketcher. The application has been used as entertainment purpose and not been used for investigation [10].

IQ Beometrix develop model of an expert system for making face sketch based on model created by Max Ischenko application. The model is constructed consisted of windowed application with each window consist of templates. The model was tested and now currently used in mostly Law Enforcer in United States, and already making several arrestments [11].

In spring of 2003, the Fresno County Sheriff's Department faced difficult investigation of rape involving prostitutes until one of the victims agreed to work with the detective. Using a expert system for making sketch, the composite sketch was distributed to Police patrol unit, and within two days a man was apprehended and charged with several counts of kidnap and rape [11]

A 29-year-old suspect was arrested by Broward County, Florida police shortly after America's Most Wanted TV show aired a face sketch made by expert system. Prior to the Oct. 1998 AMW broadcast, several sketches of the suspect had been hand-drawn, but provided few clues for police. Deputy John McMahon of the Broward County Sheriff's Office, working closely with young victims, utilized expert system police sketch generator to compose a picture quality composite of the suspect. Soon after the sketch appeared on America's Most Wanted, a woman contacted police, saying the portrait was that of her son. A suspect was arrested within hours, and charged with sexually assaulting an 11-year-old girl and attempting to abduct 10 other girls in Florida [11].

2. Research Method

System is a implementation of both application that had been created before using buttons, as a parameter for switching object interface, a windowed figure to make the application user friendly, and templates for making the sketch. The data used for making the sketch template are sketch of parts in head gained from knowledge of a sketcher in *.png extension.

2.1. Knowledge Acquisition

The knowledge acquired from the literature and single expert, it is all including hair, head, eyes, nose, mouth, jaw, and other facial figure such as beard, mustache, freckle, and age mark. All of those placed in a windowed form and separated based in category.

2.2. Knowledge Representation

Knowledge of all sketching method from the expert represented in a sketch form divided by its category. Each of categories will be presented in windowed form, and each window will be showed according to button chosen represented on interface, so all of the buttons will representing the categories. All of categories will be placed in layer according to the placement, which mean the full output will be combination of all sketch of each categories be in one sketch in stack. Using Java programming to modeling the application, and will divide all of the templates to each layers [12-13]. The model of knowledge representation are shown below.

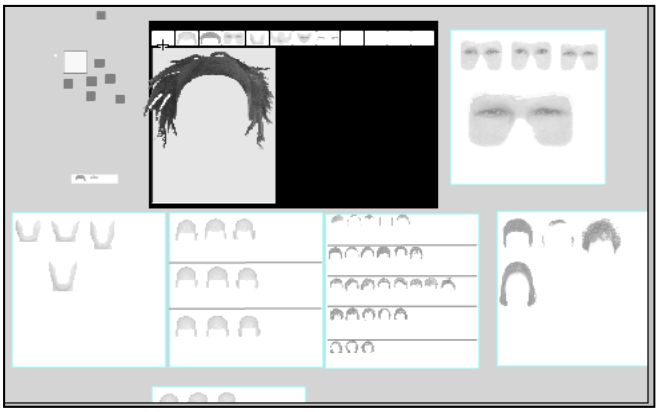

Figure 1. Window and Templates behind Main Frame

Each of the windowed form will contain a category representing on its figure, and each category will consisting some of sketch representing the sketch that will be drawn in the main canvas. Each of category will be shown as figure below.

Figure 2. Object of each Category

3. Result and Discussion

The purpose of testing these applications is to determine the effectiveness and performance of applications that have been made. This test will be able to provide a conclusion on how effective the method that allows to solve the problems that exist and how well the performance implemented.

3.1. System Platform

Expert system developed desktop based platform using some software such as Adobe Photoshop to build the knowledge base, Java Script, Adobe Flash Professional to build the application and design interface.

3.2. System Structure

3.2.1. Knowledge Acquisition

The acquisition of knowledge is the development environment used by the knowledge engineer to acquire the knowledge of single expert as the source. In this expert system development, knowledge acquisition is done through interviews with police sketcher, and supported by literature studies.

3.2.2. Knowledge Base

Knowledge base is a development environment used by the knowledge engineer to represent the knowledge that gained from the acquisition of knowledge. The fact are consisting the form of physical characteristic of head, eyes, hair, nose jaw, eyebrow and other detail such as mole, freckle, and scar mark in sketch. The rules are made by combining the facts above. Knowledge base built in the form of some window displayed, such as window of hair, window of head, window of eyes, window of nose and others.

3.2.3. User Interface

The interface is an environmental consultancy that is intended for users to choose from option available in the expert system which one the most suitable by the reference. The option will be shown in form of window, which each window will be showing figure of each category. In each window will be showing figure that resemblance of sketch which will be chosen by user.

3.2.4. Interface Engine

The inference engine uses windowed figure to create the interface which can be chosen by user, and the result of the chosen option in other window placed side by side each other. Source of that all figure have been established on the basis of knowledge above.

3.2.5. Workplace

Workplace represented in the form of 3 parts, which is buttons, sketch template window, and result window.

3.2.6. Explanation Facility

The explanation facility provided in the windowed form, first, the system will provide all the category in buttons, which each button will showing a window representing a category; second, the window appeared will be containing figures which will chosen by user to show at the result, each figure representing a sketch same to the figure itself; third, all the chosen figure from all category will be shown on a result window, and it can be changed all over. The examples for this facility are shown at Figure 3, Figure 4 and Figure 5

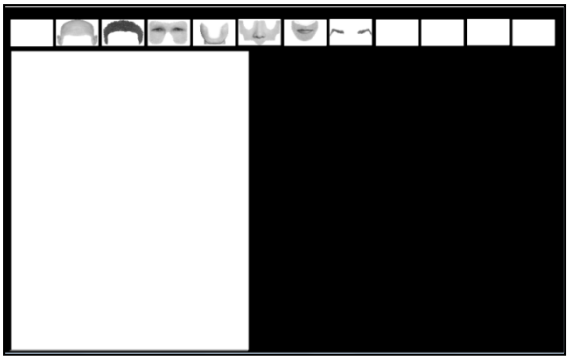

Figure 3. User Interface

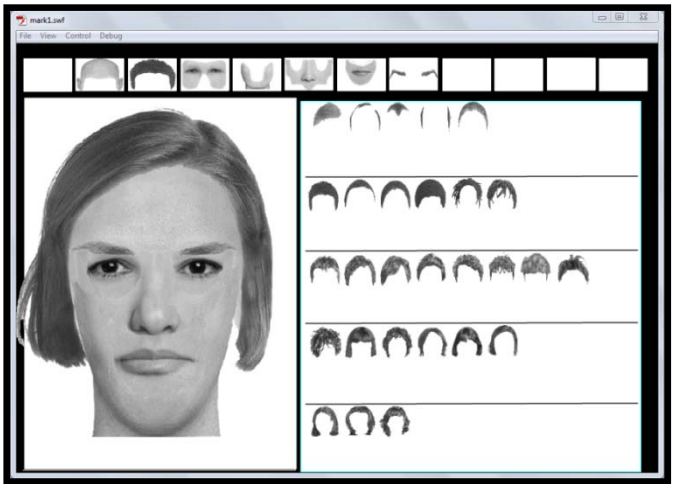

Figure 4. Windowed Figure Representing each Sketch

Figure 5. Sketch Result Compared to Real Person

3.2.7. Knowledge Improvement

Improvement of knowledge can be done if there are additions or changes to the new category, the change and addition variation, or change of method and theory to do sketching faces in term of use for police search. Based on any additions or changes, the system will do the creation of new rules of the sketching and that will be generated.

3.3. System Performance

Developed an expert system testing performed by making a sketch using the expert system based on real face, then given to respondent to guest which one of many faces in one picture is the face made by expert system. Table 4 shows that system performance as the result of the comparison.

Figure	Amunt of Audience	Correct	Wrong	Accuracy (%)
1	100	87	14	87
2	100	83	17	83
3	100	85	15	85
Average of the difference result				85

4. Conclusion

Expert system for making face sketch in purpose of police investigation has been developed on desktop based platform to receive input in the form of characteristic given by user. The inputs are physical characteristic value based on real physical characteristic from people who will be sketched. The system provides output in a form of sketch based on output given by user the process can be done repeatedly until reaching the output wanted. System testing results show that the system developed has the similarity with the real picture at 85%.

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