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Automated Identification System Using Discrete Wavelet Transform

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Abstract - *In numerical analysis and functional analysis, a discrete wavelet transform (DWT) is any wavelet transform for which the wavelets are discretely sampled. As with other wavelet transforms, a key advantage it has over Fourier transforms is temporal resolution: it captures both frequency and location information (location in time). Computer vision is an interdisciplinary scientific field that deals with how computers can gain high-level understanding from digital images or videos. Due to a vital role in law enforcement Face sketch recognition has received significant attention. The only suspect in crime scenes is the verbal information or description provide by the eye witness which can be later be used to draw sketch which is used to identify the suspect. Later this face sketch can be used as query for matching the sketch against the gallery of face photo with the known identities .However, many crimes occur where none of this information is present, but instead an eyewitness account of the crime is available. In these circumstances, a forensic artist is often used to work with the witness in order to draw a sketch that depicts the facial appearance of the culprit according to the verbal description. The major challenge of face sketch recognition is matching images of different modalities. We have used Matlab to design the system based on DWT.*

Key Words: Sketch Identification; SOM; DWT; Simulink; Face Sketch; Automated Identification;

1. INTRODUCTION

Due to a vital role in law enforcement Face sketch recognition has received significant attention. The only suspect in crime scenes is the verbal information or description provide by the eye witness which can be later be used to draw sketch which is used to identify the suspect. Later this face sketch can be used as query for matching the sketch against the gallery of face photo with the known identities.However, many crimes occur where none of this information is present, but instead an eyewitness account of the crime is available. In these circumstances, a forensic artist is often used to work with the witness in order to draw a sketch that depicts the facial appearance of the culprit according to the verbal description. The major challenge of face sketch recognition is matching images of different modalities

Both forensic sketches and viewed sketches pose challenges to face recognition due to the fact that probe sketch images contain different textures compared to the gallery photographs they are being matched against. However, forensic sketches pose additional challenges due to the inability of a witness to exactly remember the appearance of a suspect and her subjective account of the description, which often results in inaccurate and incomplete forensic sketches.

The SOM (Self Organizing Maps) neural network algorithm is designed for training of image data. This project is based on general architecture of facial recognition systems. Program source code and simulation is executed in MATLAB.

Face recognition focuses on still images, which can be broadly grouped into image-based and feature-based approaches. Face recognition is commonly used in applications such as human-machine interfaces, automatic access control systems and forensic investigations etc. which involves comparing a face image with a database of stored faces in order to identify the face in the image. This project involves the design and development of a forensic face sketch identification system. The DWT image compression technique is used to compress the cropped facial features of the image database like frontal face, left eye, right eye, nose and lips. After compression the image pixels reshaping is used for preparing the image classes as an input for the neural network. The SOM (Self Organizing Maps) neural network algorithm is designed for training of image data. The un-supervised weight is assigned during the training and learning in simulink for different number of epochs to classify and inputted face sketch. This project is based on general architecture of facial recognition systems. Program source code and simulation is executed in MATLAB and Simulink.

1.1. Problem Statement

Face recognition focuses on still images, which can be broadly grouped into image-based and feature-based approaches. Face recognition is commonly used in applications such as human- machine interfaces, automatic access control systems and forensic investigations etc. which involves comparing a face image with a database of stored faces in order to identify the face in the image. This project involves the design and

development of a forensic face sketch identification system. The 2D-DCT image compression technique is used to compress the cropped facial features of the image database like frontal face, left eye, right eye, nose and lips. After compression the image pixels reshaping is used for preparing the image classes as an input for the neural network. The SOM (Self Organizing Maps) neural network algorithm is designed for training of image data. The un-supervised weight is assigned during the training and learning in Simulink for different number of epochs to classify and inputted face sketch. This project is based on general architecture of facial recognition systems. Program source code and simulation is executed in MATLAB and Simulink.

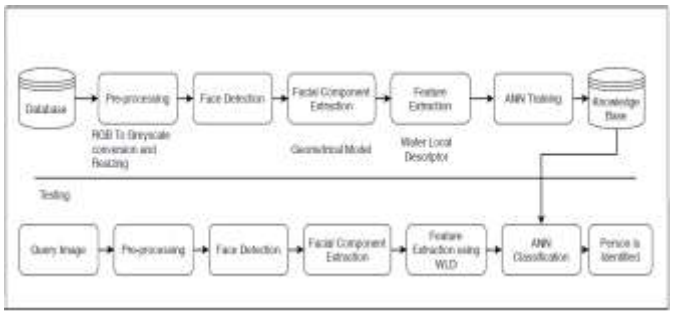


Figure 1: Flowchart for forensic face sketch recognition system.

Figure 2 illustrates the flowchart proposed for the design of the forensic face sketch recognition system, based on the methodology.

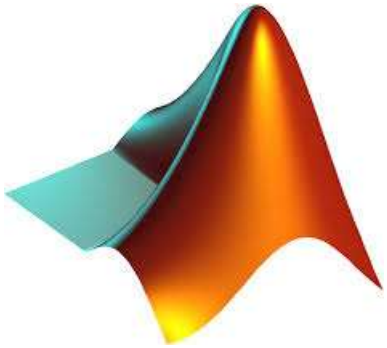
2. SKETCH DETECTION WORKING

Firstly, we already have a database which contains the details of face images and other details of the individuals. When an eyewitness sees a crime he reports it to the concerned authority which in this case is the Police.

The eyewitness is asked to draw sketch of the criminal. This sketch of criminal is matched with the images in the database. If the match is found we have the details of the criminal like his address, contact number based on which he can be caught.

If the sketch is not matched with the images in the database then this sketch is forwarded to all the branch. The branch has live CCTV camera feeds where the match is run. If the CCTV camera detects a face then it gives alarm to the nearby Police station. Thus the criminal can be caught.

3. MATLAB



MATLAB is a high-performance language for technical computing created by *The Math Works* in 1984. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include:

- Math and computation
- Algorithm development
- Data acquisition
- Modeling, simulation, and prototyping
- Data analysis, exploration, and visualization
- Scientific and engineering graphics
- Application development, including graphical user interface building

MATLAB has evolved over a period of years with input from many users. In university environments, it is the standard instructional tool for introductory and advanced courses in mathematics, engineering, and science. In industry, MATLAB is the tool of choice for high-productivity research, development, and analysis.

Simulink is software bundled with MATLAB for modeling, simulating, and analyzing dynamic systems. It supports linear and nonlinear systems, modeled in continuous time, sampled time, or a hybrid of the two. Systems can also be multi-rate, i.e., have different parts that are sampled or updated at different rates. Simulink enables users to pose a question about a system, model it, and see what happens. With Simulink, models can be built easily from scratch, existing models can be taken and be added to it. Thousands of engineers around the world use Simulink to model and solve real problems in a variety of industries.

4. SELF ORGANISING MAP (SOM)

A self-organizing map is a type of artificial neural network (ANN) that is trained using unsupervised learning to produce a low-dimensional (typically two-dimensional), discretized representation of the input space of the training samples, called a map, and is therefore a method to do

dimensionality reduction. Self-organizing maps differ from other artificial neural networks as they apply competitive learning as opposed to error-correction learning and in the sense that they use a neighborhood function to preserve the topological properties of the input space. This makes SOMs useful for visualization by creating low-dimensional views of high-dimensional data, akin to multidimensional scaling.

5. CONCLUSIONS

We have used DWT in this system which leads to lesser processing time. Selecting the optimal number of input neurons for neural network simulation, which is the size of the input image and training database images in pixels. We have used smallest amount of image pixels which increased accuracy.

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