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Developing a Novel Technique for Identification of Victims/Criminals of Sexual Exploitation on Women and Children using INTEL NUC

Amina Thahzeera[1], Mervyn Richard Dsouza[2], Fathima Mashitha[3], Manoj H N[4], Shailesh S Shetty[5]

[1]Computer Science and Engineering, Sahyadri, College of Engineering and Management, Adyar, VTU, India
[2]Computer Science and Engineering, Sahyadri, College of Engineering and Management, Adyar, VTU, India
[3]Computer Science and Engineering, Sahyadri, College of Engineering and Management, Adyar, VTU, India
[4]Computer Science and Engineering, Sahyadri, College of Engineering and Management, Adyar, VTU, India
[5]Assistant Professor, Computer Science and Engineering, Sahyadri, College of Engineering and Management, Adyar, VTU, India

[1] thahzee125@gmail.com; [2] mervindsouza94@gmail.com; [3] mashithafm@gmail.com; [4] manojraghu85@gmail.com; [5] shaileshshettys@gmail.com

Abstract— Identifying victims and criminals in images relating to crime-scene is challenging, particularly when not either faces or tattoos are observable. So, use of vein pattern, permanent pigment skin mark and androgenic hair patterns is common biometric trait. Therefore it is proposed in this work to carryout principal component analysis, score level fusion and skin detection algorithm making the detection/identification of criminals/victims very accurate.

Keywords— Principal component analysis, Forensic investigation, Score-level fusion, Feature extraction, Preprocessing

I. INTRODUCTION

Sexual Exploitation of women and children is a major social issue worldwide. Child pornography is against the law .It is examined officially and suppressed in most jurisdictions in the world. Out of 187, Ninety-four International police organisation had laws particularly addressing child pornography since 2008, however this does not take account of nations that ban all pornography. Of those 94 countries, 58 countries have criminalized possession of child pornography. At the present, both possession and distribution are criminal offenses in nearly all Western countries. In the United States, Protection of Children against Sexual Exploitation Act of 1977 was the first federal law to prohibit production and distribution of child pornography

for profit. Pornographers have recorded the abuse of more than one million children in the United States alone as per the estimation of US Department.

In 187 countries, the International Centre for Missing & Exploited Children (ICMEC) by the 2008 review of child pornography laws shows that 93 have no laws that particularly address child pornography. As per the estimation of U.S customers ,100,000 websites involve with child pornography [1]. Approximately 30,000 child pornography cases were reported from 2002 to 2008 in Canada alone [2]. Due to weak evidence, U.S bureau of justice has found low inspection rate of child sexual exploitation [3]. In the united states, the trafficking of child pornography by the mid-1980's was almost completely eradicated through a chain of successful groups waged by law enforcement .It is found that every year 1.2 million children are sexually exploited in India. Total of 26,694 reported cases of crimes committed against children in 2010 as per the records of National Crime Records Bureau (NCRB) . 2.3% of 100,000 people was the national average rate for crimes against children. 18.4% were responsible for all crimes against children in the state of Madhya Pradesh with 6.1% of the population ; 13.6% were responsible in Delhi, with 1.5% of the population. Unfortunately not much research work has been done to find the criminals/victims of sexual exploitation. What has been done so far mainly focused on face recognition. Governments should protect children from all forms of sexual exploitation and abuse and take necessary measures possible to make sure that they are not sold , trafficked or abducted as per the articles 34 and 35 of the United Nation Convention on the rights of the child.

II. RELATED WORK

In forensic investigation, criminal and victim identification is a necessary and challenging task. Law enforcement agencies use Biometric traits which includes DNA, face images, palmprints, fingerprints, write-prints, signatures , footprints, shoeprints, face sketches, dental records regularly for their investigation. But when faces are not observable, these biometric traits are not applicable to identify criminals and victims in images. In some cases, Tattoos are also used to identify criminals/victims but they are not always available.

Androgenic hair pattern considered as a stable biometric trait was proposed. Two common approach used to analyze androgenic hair collected from crime-scene are microscopic examination and mitochondrial DNA [4].

Color optimization scheme is used to identify blood vessel patterns and automatic intensity adjustment scheme to increase robustness which is proposed in automatic matching algorithm for vein identification. To uncover vein patterns ,Computational method was used [5].

An automated RPPVSM identification system proposes a technique named Relatively Permanent Pigmented or Vascular Skin Marks (RPPVSM) which is of high potential and high identification accuracy[6] .

Since Lower legs contain quality information which are usually large and often visible in evidence images even when they put on face mask to avoid recognition. To obtain geometric information , an algorithm is been proposed with alignment scheme and matching scheme[7].

To uncover vein patterns from the skin uncovered in color images, an algorithm is proposed based on the principles of skin biophysics and optics.Transparency of the vein patterns in resulting images is far better than that in near infrared images [8].

Kulbeka –Munk model and OBVU method was proposed to visualize the patterns of vein transforming color images to NIR images [9].

Generalized EM Algorithm for retinal angiograms(x-ray test) is proposed that exploits the network arrangement of patterns of blood vessel[10].

Leg geometry which makes use of androgenic hair follicles was proposed for low resolution androgenic hair patterns.[11].

These are various techniques which meets few of the features, but each algorithm had some drawbacks and performance was far from perfect.

III.PROPOSED SYSTEM

a)ARCHITECTURE

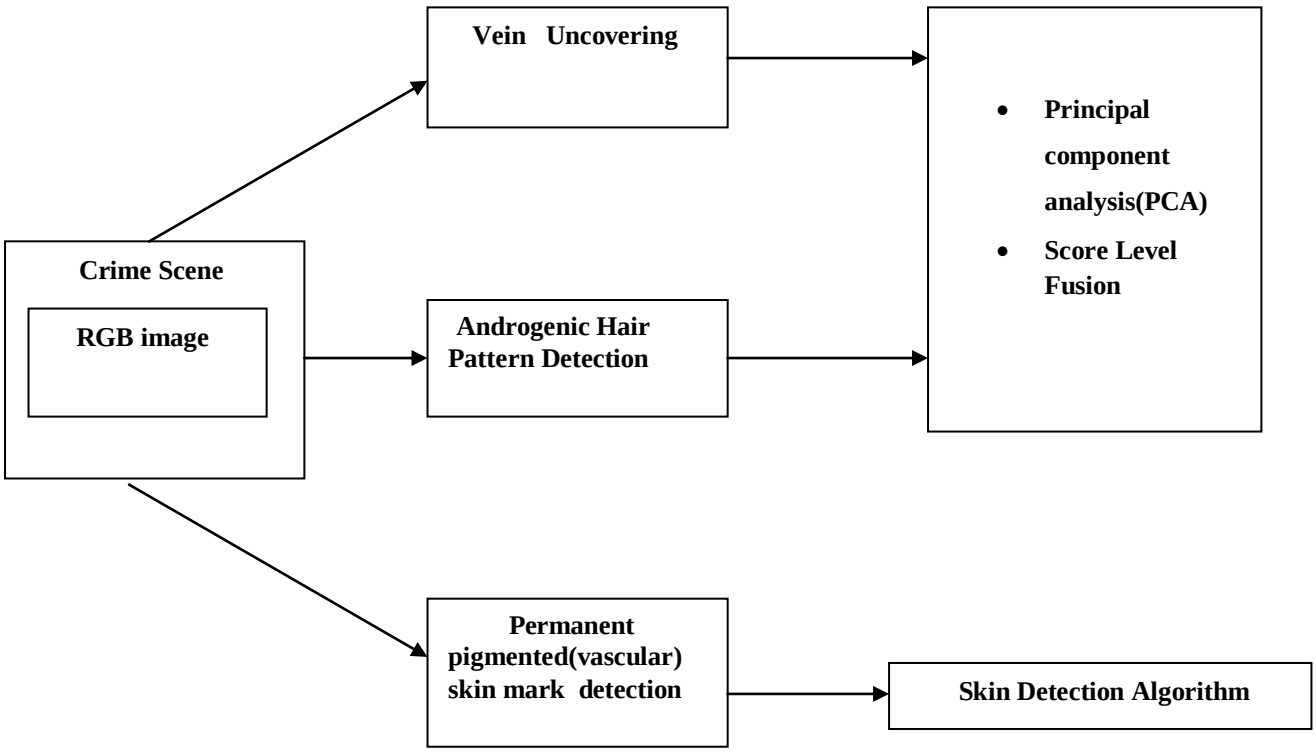
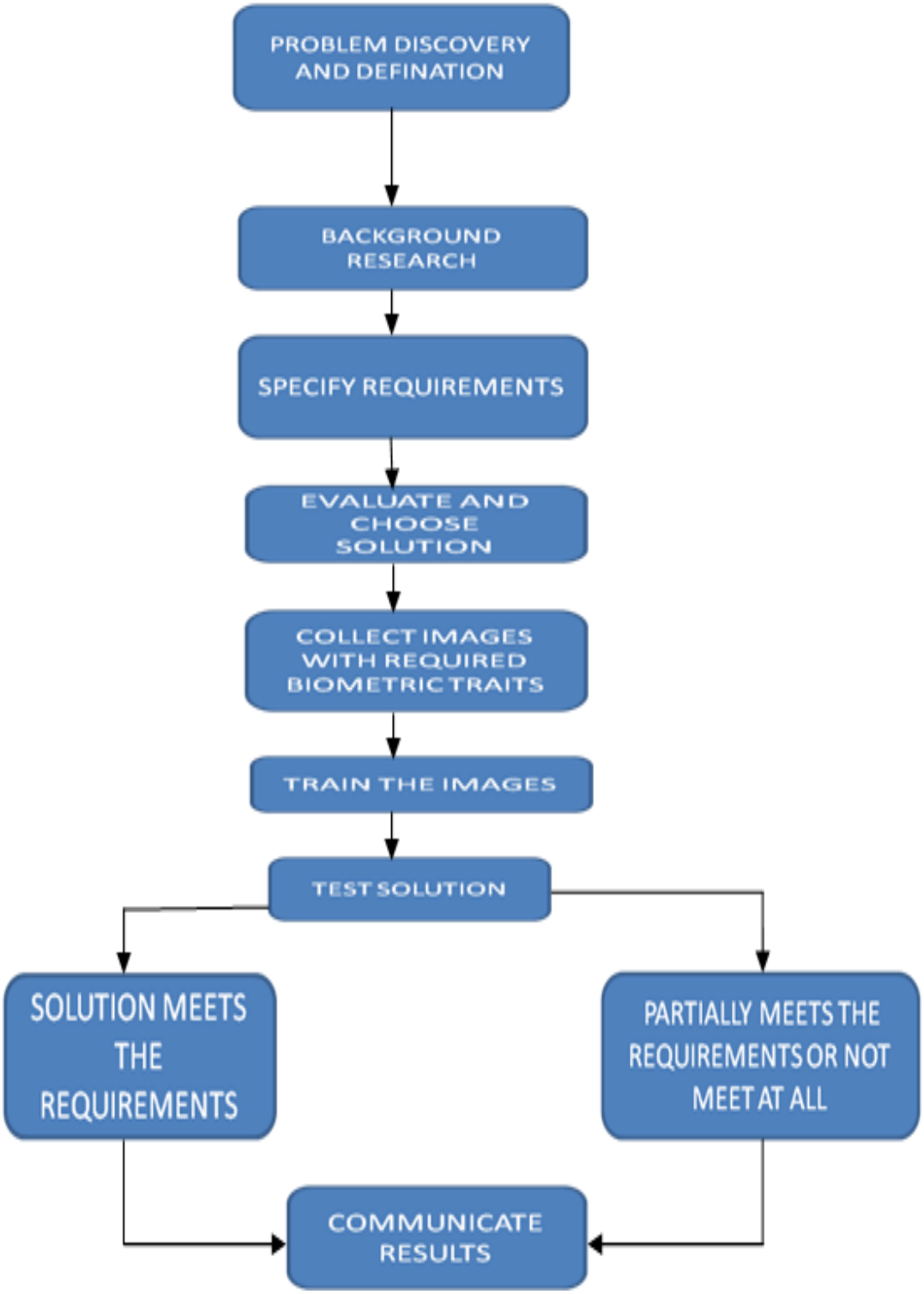


FIG:OPERATION AT EACH STAGE

Diagram shows a brief overview of essentially how our developed software works and what it does. Crime scene inquiry is the gathering point of law, logic and science. "Handing a crime scene" is an broad, tiresome method that involves focused documentation of the situation at the scene and the collection of any physical proof that could possibly point to who did it and make clear what happened .Criminals are usually alert to cover or hide their tattoos and faces, thus making their identification not easy. Naturally occurring skin marks, tattoos, face images, face sketches,

DNA, blood samples and dental records are often used for inquiry. So, use of vein pattern, permanent pigment skin mark and androgenic hair patterns is common biometric trait in our technique for identification of victims/criminals. Skin mark pattern is detected by skin detection algorithm .Set of database is trained and tested to check if recognized images meets the requirement by pca and score level fusion technique .

b)DESIGN METHODOLOGY



Our technique is based on TOP-DOWN approach. Models, tools and methodologies are the fundamental elements of any development to achieve competitiveness and usefulness in the project.

The main activities are:

1) **Problem discovery and definition**

2) **Background Research**

3) **Specify Requirements**

4) **Train The images**

5) **Test The images**

   i) Solution meets the requirements

   ii) Partially meets the requirements or not meet at all

6) **Communicate Results**

IV. IMPLEMENTATION

PCA is a familiar technique for recognising patterns in high dimension data. Application are face recognition and image compression.

Implementation for PCA

Step-1)We are using our own made-up data set with 100 images of 10 subjects.

Step-2)Open matlab->set the path to the specified location to obtain the code ,test and train folder.

Step-3)Run the code,GUI will appear.

To insert images into the database

Step-4)To create a class,select the image from the train folder->add image to database->create a class to the image belonging to same subject.

Step-5)Repeat the same steps for remaining 9 subjects.

For recognition:

Step-6)Select the image from the test folder,click on recognition button.

It will recognize the nearest possible image matching the given database.

Same steps are repeated for remaining 9 subjects.

Score level fusion technique is used to recognize faces obtained from distant cameras , when images are corrupted and Image degradations due to noise and blur.

Implementation for Score Level Fusion

Step-1)We are going to use our own made-up data set with 100 images of 10 subjects.

Step-2)Open matlab->set the path to the specified location to obtain the code ,test and train folder.

Step-3)Run the code,

It will recognize the nearest possible image matching the given database.Same steps are repeated for remaining 9 subjects.

Skin detection algorithm can detect skin regions in the image**.**

Implementation for Skin detection algorithm using Phython

i)Hardware implementation:

ODROID (XU3)

OS-Ubuntu

Internal Memory (64 GB card).

Step-1)One end of the HDMI port to the display Mode(tab) and another end to the ODROID board.

Step-2)Connect Keyboard and mouse to the board.

Step-3)Power on the device.

ii)Implementation steps

Step-1) Open the terminal->open CV(open access)

Step-2) To run the python code, use cd command to set the pathname.

Step-3) Run python skin detector.py

Step-4) Check for each image in the test folder.

Step-5) It will detect the skin regions.

Hardware Requirements

- INTEL NUC i5-4250U

Software Requirements

- Fastone Photo Resizer
- OS-windows 7,8
- Matlab

V. RESULTS

We have designed the interface with login page with username and password for providing authentication as shown in fig3. On login, it proceeds to the main page with three different techniques (pca,score level fusion,skin detection algorithm) and logout option as shown in fig4 .To test our project, experiments were carried out on a database which contains 100 images with different parts of the human body collected from 10 subjects. As shown in the fig5,dialog box will appear with processing steps.

In the first technique, we run pca code and following results are obtained as shown in fig6.In the second technique, we run the score level fusion code and results are obtained as shown in the fig7. In the third technique, we run the python code to detect the skin regions and the detected skin regions are compared with images in the database as other two techniques shown in the fig8.

Fig3:Login Page

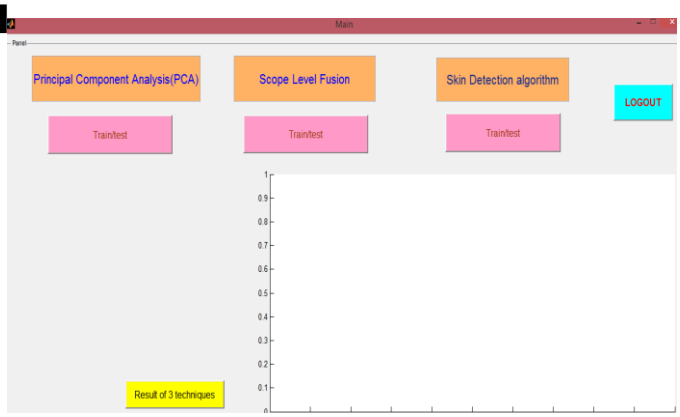


Fig4:Main Page

Fig5:Main Page with identification menu

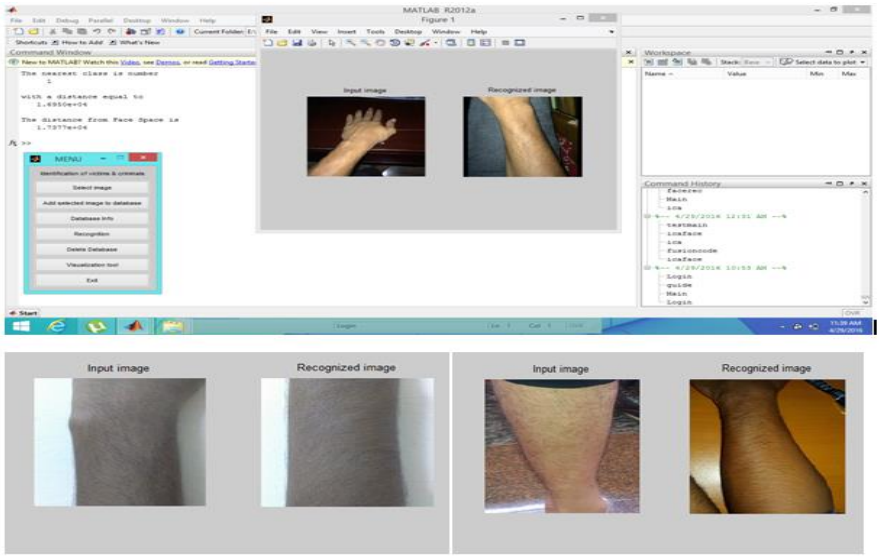


Fig6:PCA results with recognized image

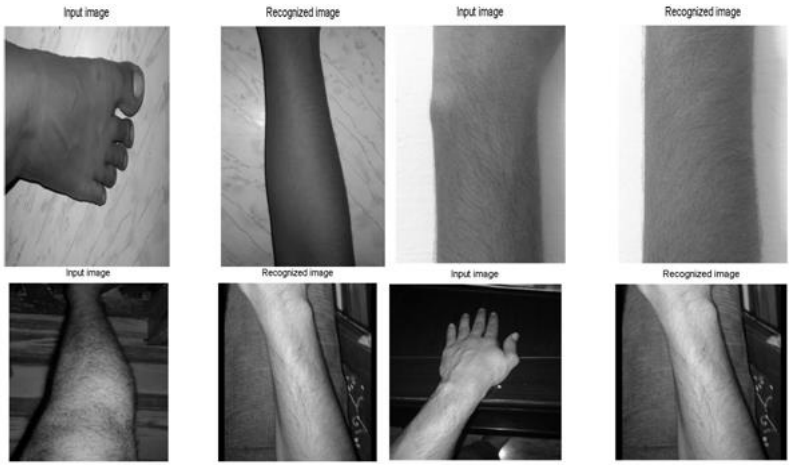


Fig7:Score Level Fusion results with recognized image

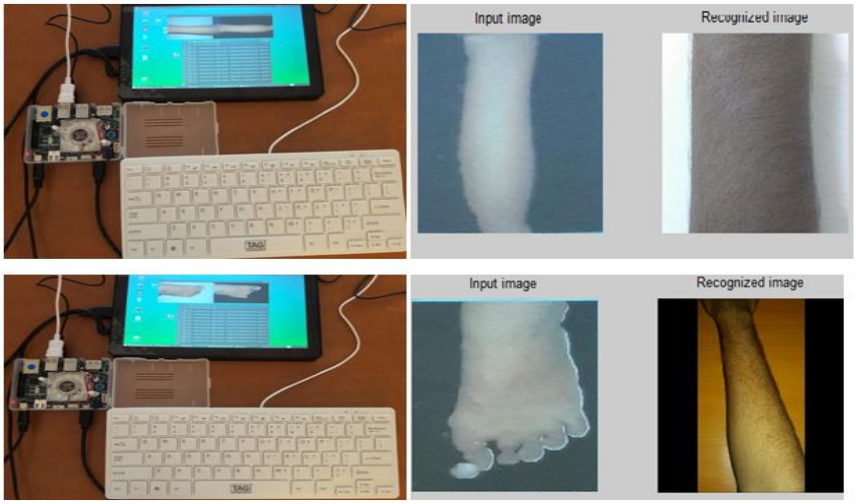


Fig8:skin region detected using phython code and recognized with database images

VI. CONCLUSION

This software allows the users to identify victims/criminals of sexual exploitation using training/testing databases. Existing techniques use high resolution images and divide them into four different layers ─ individual organs (e.g.,eyes, nose, mouth) , skin of cheek and forehead, global appearance and irregular details (e.g., skin marks).Three techniques were implemented to check the recognition of images. This technique can be used in forensic investigation. Basic knowledge of MATLAB software with some basic programming skills.Our software is made compatible by allowing to transfer it to other device using intel NUC**.**

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