



DNA Fingerprints Facial Prints and Other Digital Forensics as Evidence in Criminal Investigation and Court Proceedings

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Abstract:

The purpose of this paper is to focus on the legitimacy and importance of digital evidence such as fingerprints, DNA, polygraph, auto-radiography, and facial-prints and their admissibility in investigations and court proceedings. The extracts from criminal databases are also relevant in this context. The modus operandi of criminals, particularly in case of repetition of similar type of offence is also of immense significance. Normally, the criminals operate adopting a specific manner or method. The killers have their own way or mode of committing the offence. The modus operandi changes from person to person or groups to groups in committing the offences. It may determine that the offence is committed by a group or an individual. In view of its impotence, the modus operandi must be included in criminal databases as a separate column. The criminal images sketched by artists on the bases of description of witnesses present on scene of offence have relevance and must be included in the criminal databases for future reference and use.

Keywords: Evidence, DNA, Facial images, fingerprint, modus operandi, criminal history Database.

1. Introduction:

In criminal investigation and court proceedings the role of Information Systems is very important particularly regarding the physical appearance such as fingerprints,

face-prints, DNA code, polygraph and Iris Code are of relevance. In order to facilitate further discussion, following explanation is required.

According to [1], Digital Forensic is science useful for using the data and

information from digital devices such as mobile phones and computers. The area of knowledge is vastly being used. The major aim of forensics is to process and utilize the information collected from scene of offence in the investigation and later on in court proceedings.

Further, [1] developed a new technique to codify the fingerprint into a unique digital code for using as primary key to search the criminal database. This made the search system faster. The first author of this paper worked with Police Department for ten years and prepared feasibility study for implementation of Computerized Management Control and Information

System leading towards a strong Decision Support System. The major areas of study are given below:

- Technical, operational and Financial Feasibility Study
- Automation of Criminal history based on Fingerprint System
- Automation of Criminal History based on Physical appearance of the criminals

In [2] a new procedure has been developed to codify the person's names from Alpha Characters to digital characters (i.e. numeric characters) for efficient retrieval. The present authors have successfully designed an adaptive Algorithm for codification of facial images in digital codes. All the techniques of [1],[2] and [3] are effective applications in the area of digital forensic, storage and retrieval of criminal information. Moreover, [4] presents software for Finger Prints Storage and Retrieval of Criminal Identification and [5] develops Software for Storage and Retrieval of Criminal Information for Police. [1]

Appreciates the application of Biometrics Technology in forensic to analyze and examine DNA, facial images and other parameters associated with criminal information system.

There are several application of biometrics discussed in [1] related to forensics such as terrorist identification and missing children. In [14] it is emphasized that other investigation methods are becoming obsolete in view of the digital forensics, where in a detailed discussion is available on the use of digital forensics. In [15] the digital forensic has been termed as a rapid metamorphoses and a matter of educational study having great research potentials to construct new models for applications in various walks of life. The major focus of [16] is about virtualization and importance of digital forensics to develop communities of researchers. The paper [16] also throws light upon digital Forensics.

2. Composite images

The Facial Composite images of criminals prepared by artists are relevant in investigation and court proceedings. The images [18] and [19] sketched by the artists are based on the description by the eyewitnesses. They are used by Police Department to identify and locate the criminals particularly those involved in major crimes. The following composite images (a), (b), (c) and (d) have been discussed in [18],[19] and [20]:



Image (a)

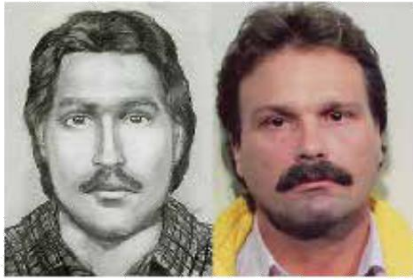


Image (b)



Image (c)

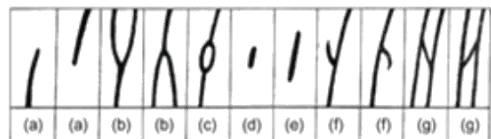
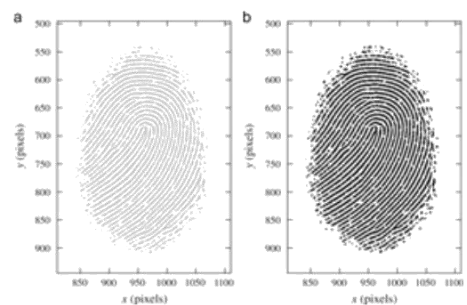


Image (d)

3. The uniqueness of Finger print images play pivotal role in criminal investigation

During the development of human fetus, before assignment of fingerprints impressions on hands and feet, an automatic natural process works which compares the impressions with all record of “natural

databases” of all dead persons, all the alive persons and also to be born in future. This is how uniqueness of fingerprints is achieved because nature does not repeat itself. Similarly, Iris possesses the property of uniqueness and used in databases to search the records. The technique [22] of matching fingerprints images has been discussed in depth and the fingerprints sensing is a presented in [23]. A very useful discussions and methodology is given in [24] regarding science of fingerprints. The following images of fingerprints have been discussed in detail in [1] and [4]:



According to [1] and [4] the structure of fingerprints is unique and they contain dots spirals, dashes, ridges, whorls, parabolas, arches and tented arches. All fingers have unique code. Therefore according to [1] fingerprint codes can be used as primary key in Databases to retrieve.

4. Legal Position of Forensic Evidence

The Punjab Forensic Science Agency Act, 2007 provides the procedure for conducting the Forensic Tests and to examine the forensic material to enable the experts to submit their reports in courts, tribunals and investigators [17].

5. Importance of Deoxyribonucleic Acid Test (DNA)

According to [6], Deoxyribonucleic acid is the chemical dispatcher for genetic information. The DNA is unique and identical for every person like finger prints. However, the twin babies have the same DNA configuration. There are several kinds of DNA Test such as maternity test, paternity test, DNA Paternity/maternity test and DNA grandparent test. The Sibling test tells the information about half sibling or no sibling relation. Figures 1, 2 ,3and 4 show the DNA structures.

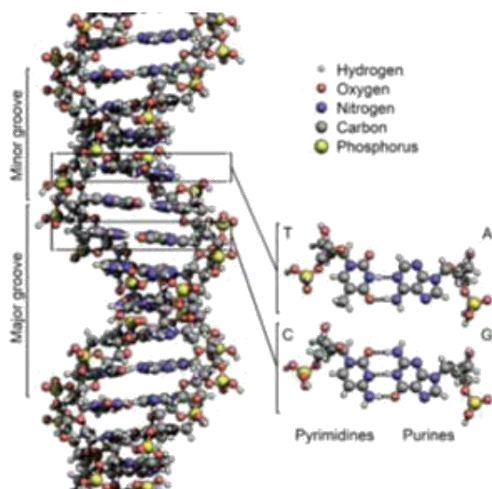


Figure 1: DNA Structure

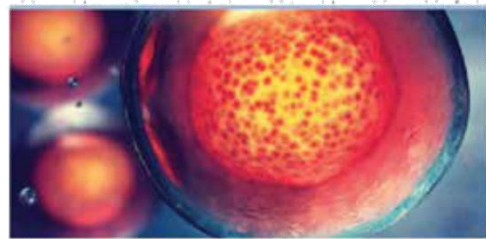


Figure 2: DNA Shape

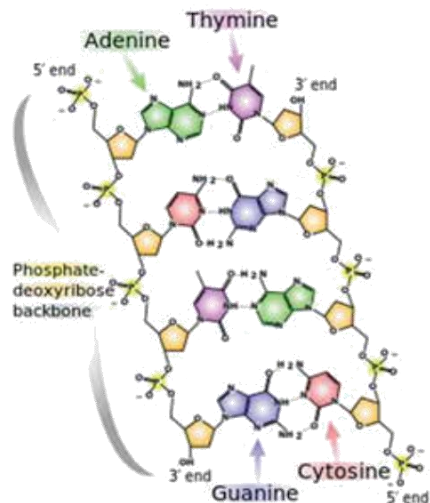


Figure 3: Molecular Structure of DNA from I61

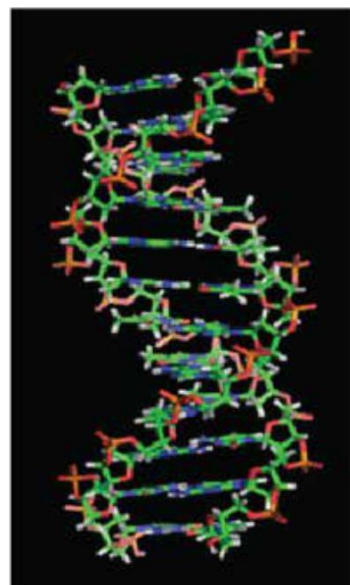


Figure 4: Stairlike Structure

The DNA is used in development, growth, functioning and reproduction of all living beings. In the present age of advancement in forensic science, the investigators prosecutors and courts are giving weight to the relevance of DNA test in USA, UK and now in Pakistan.

According to [7], the profiling of DNA is prepared using Microbiology techniques from blood samples, swab, semen or other materials possessing DNA. The basic Technique discussed in [6] is RFLP abbreviated as Restriction Fragment Length Polymorphism for analysis has been developed by Edwin Southern. It detects that DNA for a particular gene and can be separated from the provided sample.

The use of X-ray for Autoradiography [6] in Polymorphic DNA Test method is based on photography to observe the DNA segments by means of radioactive probes exposed to the photographic plate.

5.1 Acceptance of DNA test as Evidence

In United States the courts allow the councils and attorneys to present the DNA test as evidence. The famous Frye Rule [6] advocates for acceptance of DNA test carried out on scientific basis by experts. This rule is very popular. According to [7] and [8] the opinion by experts is relevant and accepted in courts. The document of DNA [8] carries the approval of House of Commons for the implementation of expert opinion in England and Wales. The evidence of the expert, who has conducted the DNA Test, is required to submit the source of sample. The judges normally make sure this requirement. According to [9] the secondary evidence is admissible in courts.

5.2 Evidence

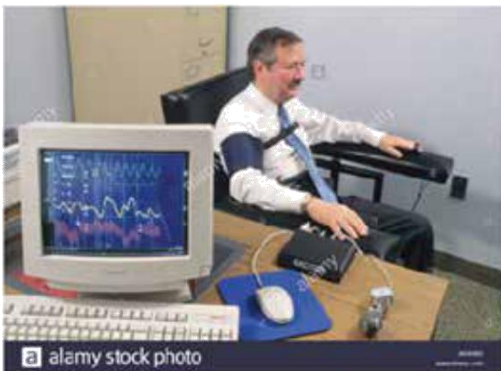
According to [10] the evidence is any fact that contains probative force i.e. it is of that quality which can be presented to court as evidence of some other fact in issue. The purpose of evidence is to exhibit clarity. According to the provisions of Qanun-e-Shahadat Act promulgated in Pakistan in 1984, there are several types of evidence such as Direct, Secondary, Primary or original documentary (public or private), oral or Circumstantial evidence. The DNA is nowadays admissible in courts in Pakistan as evidence.

6. Admissibility of Polygraph Test

This section focuses on the admissibility of Polygraph in investigation or court proceeding as evidence. The equipment used in this technique is also known as “lie detector”. It measures and computes the changes occurring in physical indicators such B.P, pulse rate, heartbeat, skin conductivity and respiration during question answer session. In USA, Philippine, England, and Wales, the private detectives use this computerized method frequently.



According to [11] and [12], the polygraph test may not be reliable if conducted by unskillful and inexperienced person. Nowadays, some business firms are also using this computerized device to explore wrong full acts at duty place. The FBI also uses the equipment in connection with case related to civil and criminal nature for investigation purposes. The polygraph is successfully used for testing the veracity of any two person making different statements in an issue. In legal language, it is termed as pair-testing. In 1989, the US court of appeal, in the case of US vs Picionnona decided that Polygraph test has advanced to that level to accept it in courts as evidence.



The inferences from polygraph are deduced from the graphical display and variation occurring during investigation. Figure No 5 shows a screen shot.

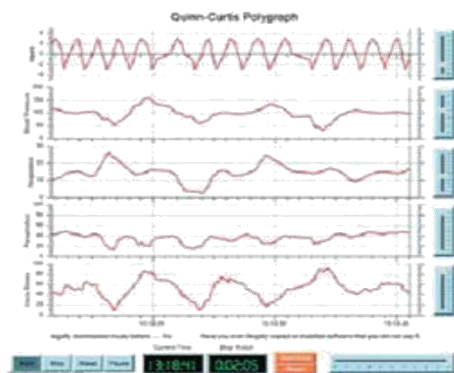


Figure 5 with courtesy of Quinn Curtis

[13] Describes the working of the computerized polygraph. The figures 6 and 7 are illustrative and self explanatory.



Figure 6: Polygraph test machine



Figure 7: Working with Polygraph equipment

7. Modus Operandi

Modus operandi is particular manner of performing any task or doing something, for example every criminal adopts a specific manner to commit a crime. The killers have their different own ways and steps to commit murder. While using criminal information Systems, it is proposed that a separate column must be reserved for indicating the modus operandi because it is very relevant in case of criminal investigation and court proceedings. The plan of action carried out in following a particular technique is also modus operandi the way in which work is operated. The modus operandi is relate to brain function.

8. Case study

The purpose of presenting this case study is most relevant to the thesis of this paper. In this case, the DNA matching test, Polygraph and modus operandi played extremely important role for the investigators, prosecutors and the court to reach to correct decision. It is murder case of 6 year old girl. There have been multiple offences committed by the serial killer such as abduction, unnatural sexual activity, rape, killing and mutilation of human body during killing and after death.

In this case modus operandi led the investigator to make the criminal confess about six other killings in the same manner. The matching DNA test of the deceased girl and the criminal resulted in reaching to conclusion. The Supreme Court of Pakistan played excellent supervisory role while anti terrorist court imposed the death penalty on four counts. The case was contested under the Anti Terrorist Act and under provisions of PPC sections 201, 364-A, 376,377,302 as well as section 7(A) of ATA 1997 for causing fear and terror in the area. The Police collected DNA samples of 1187 suspects for matching but only it matched with one person, the real culprit. After the confession of the criminal in this case, the prosecutor submitted list of 56 witnesses out of which only 22 were crossed examined. This case has included Pakistan in the list of countries that have used scientific technology and forensics to prosecute and sentence a criminal.

9. Conclusion:

The extensive use of digital forensics, fingerprints, DNA test, Polygraph, auto-radiography, facial-prints, Composite images and their admissibility play pivotal role in investigations and court proceedings. These

factors formulate essential basis of evidence.

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11. Reference

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