CrossMark

SHORT COMMUNICATION

Digital grid method for fingerprint identification and objective report writing

Mukesh Kumar Thakar *, **Tina Sharma**

Department of Forensic Science, Punjabi University, Patiala 147 002, India

Abstract   Fingerprints are considered to be one of the most important parameter for human iden-tification. The analysis of fingerprints for comparing/matching purpose requires 12–14 ridge char-acteristics or minutiae points to prove similarity or dissimilarity in the court of law. These unique features found within the patterns make us capable of giving opinion. But various studies have shown that even the trained and experienced experts commits various types the fingerprint, these may be because of the use of arbitrary/non standard terminology like clockwise/anticlockwise or directions etc. in writing a report. The classical method of fingerprint comparison with lens to locate minutiae in directions, which is a time consuming procedures needs to be revised.

In the present study an attempt has been made to develop a modified grid method for comparison of finger print. The step by step procedure to use this grid for comparison of inked fingerprints pre-sent on questioned or standard documents like property wills affidavits, bank documents and pass-ports etc along with the Adobe Photoshop CS5 has been discussed in detail. The modified grid enables the expert not only to perform a box by box comparison of the fingerprints but also a new way of write a report, which can be demonstrated well to the judiciary in the court room trials.

© 2016 The International Association of Law and Forensic Sciences (IALFS). Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

1. Introduction

Fingerprints are considered to be one of the absolute evidence to identify a person. The process of identification requires comparison of questioned and standard finger prints. The dogma adopted by numerous fingerprint examiners calls it an "exact" science, but now some of them consider it as a misconception. Because it is not "exact" as mathematics, in which results or measurements are expressed in exact numbers. At the same time the fingerprint identification science cannot be considered as "descriptive" science like ornithology, in which a particular species of bird identified, but not an individ-ual within the same species. Rather, fingerprint identification falls into a category of applied science in which the scientific knowledge and principles can be applied to the problems to arrive at conclusions. This application gives scientific validity to the conclusions.[1,2] These conclusions can be further strengthened by using automated Software. The Automated Fingerprint Identification System (AFIS) was introduced into forensic work after 2000. AFIS was based on biometric

identification methodology which uses digital imaging technology to obtain, store, and analyze data related to fingerprint.[3] The AFIS was originally used by the U.S. Federal Bureau of Investigation (FBI) in criminal cases. In this automated Software system, optical sensor based readers are used to read and acquired fingerprint images in the following three stages:

- Firstly, image processing algorithms are used to obtain gray tone impressions of the fingerprint image.
- Secondly, the processed image is thus used to extract the minutiae (only bifurcations and ridge ending).
- Third step is analyzing the placement of different minutiae (bifurcations and ridge ending) on fingerprints, with the help of placement directed algorithms.[3]

The extracted images are compared with the databases present in the system and results are obtained. But contrary to the above, in the present study a semi-autonomous the procedure has been used.

Therefore, in the present study, a comprehensive attempt has been made to extract manually all the minutiae present in the finger print with the help of Adobe Photoshop (CS5) Software and to develop a modified grid which can be used to systematically find the placement of the minutiae along with measuring certain additional feature like *Angle*.

In the present study the existing grid has been modified as shown in Fig. A. In this modified grid the comparison is based on the extraction of the minutae with the help of count tool of *Adobe Software*. Further, their placement on the fingerprint will be located with the help of modified grid (Fig. A). Modified grid has been divided into three parts namely rows, columns and angle or in other words it is a graphic image (Fig. 1) which is digitally superimposed on fingerprint pattern to carry out comparison by locating the minutae i.e. in which row, column and degree of angle the minutae is present will be clarified and documented in tabulated form. The method has robust potential to carry out comparison with grid methodology and is expected to add objectivity to the present day finger prints comparison scenario.

2. Materials and methods

2.1. Sample collection

Subjects were requested to give 3 sets of fingerprints i.e. Inked fingerprints, latent fingerprints (developed on glass and fiber sheet with iodine fumes) and scanned fingerprints with live scan (Futronic FS80 Pro USB 2.0 Optical Fingerprint Scanner). Photographs were captured and saved in Tiff format. The minimum system requirement is computer with at least a 386 microprocessor, eight MB of RAM, Windows 3.1 or later with the help of which second level details of fingerprints were studied.

2.2. Grid

In the past various types of grids have been prepared by various scientists to compare the finger prints. In 1910, Osborn
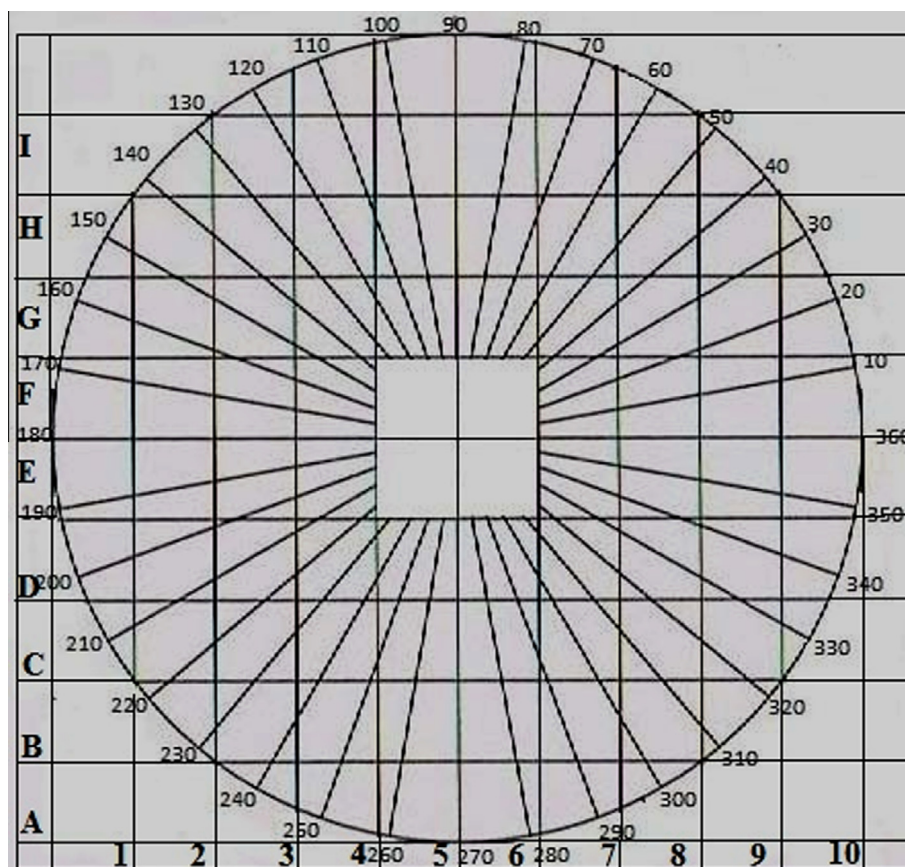

Figure A   Showing modified finger prints grid.