ОРИГІНАЛЬНІ ДОСЛІДЖЕННЯ

APPLYING DIGITAL METHODS IN DERMATOGLYPHICS RESEARCH

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Resume. In the article the method of obtaining the picture scans of comb fingers and toes and processing the obtained data during forensic identification using fingerprinting. It was determined number of advantages of obtaining dermal prints by digital method (using scanner Futronic's FS80), and ways to improve the quality of scans were described, namely by converting raster prints into vector graphics using the algorithm VeriFinger 6.6 / MegaMatcher 4.4 Identification Technology Algorithm.

Keywords. Identification of the person fingerprinting, dermatoglyphics.

Introduction. Identification of persons is a universal process, based on scientific principles. At present, different identification systems are widely used, including important element of fingerprinting. Picture of comb fingers, palms and feet belong to one of the few parameters of the body that remain unchanged throughout life and after death postmortem changes and development. This feature allows the skin structure to be widely used during fingerprinting forensic identification. Nowadays popular method for DNA identification, which is both highly effective and quite costly (requires as expensive equipment and reagents), holding it requires a certain period of time. In this case, rapid method that can be used for identification is fingerprinting. [1,2,3].

Conducting research of dermatoglific skin relief is possible using many methods. For a long time the most common method has been applying ink. This method is characterized by easiness of use, low cost of materials and that it's not time-consuming. However, besides the advantages, this method has several disadvantages. These disadvantages are the discomfort associated with contamination of the extremities ink, the quality of the prints is not always satisfactory, requiring a repeat of the procedure and entails additional costs in time, there are also disadvantages associated with the processing of the data and creating digital archives . For the improvement of this method a number of researchers were asked to carry out digitization of obtained finger prints on paper, scan through [4].

The aim of our work was to develop methods to improve the quality scans of dermatohlifiv fingers and feet by converting raster prints into vector graphics using the algorithm VeriFinger 6.6 / MegaMatcher 4.4 Identification Technology Algorithm.

Material and methods. The material of our study were dermatohlify of fingers and toes (547) obtained by scanning with the scanner Futronic's FS80 USB 2.0 Fingerprint Scanner using the program ftrScanApiEx.exe. followed by the transfer of data to a personal computer and the subsequent conversion of raster prints into vector graphics using the algorithm VeriFinger 6.6 / MegaMatcher 4.4 Identification Technology Algorithm.

Results and its discussion. Dermatohlifyc received by classical method using ink, in the present conditions for the creation of computer databases, require digitization. However, when they are scaned there are certain difficulties associated with the quality of the scans (Pic. 1). The picture may be distorted due to background effects caused by uneven application of turning the substance uneven illumination of the object surface structure of paper, noise recording equipment, scanning equipment noise, quantization noise during digitization of images [5].

Using a computer for further image processing involves a person need to obtain dermatoglific prints in high quality, in order to prevent further mistakes in the calculations. To facilitate the task, which concerns the researcher and to improve the quality of the resulting image, we proposed to use the scanner Futronic's FS80 USB 2.0.

Scanner Futronic's FS80 USB 2.0 uses advanced technologies such as CMOS-sensor and precise optical system for removal of high-quality fingerprint image, and is compatible with all modern operating systems (Windows, Linux, MAC OS, Android), it connects via a standard USB -portu. Scanner Software can be installed by using the CD or by download from the manufacturer's website. The software that comes bundled with the scanner allows scans to invert the colors. The scanner is able to capture fingerprint images and create 480h320 pixels (500 DPI). 16h24mm scanning window size with 14mm thick glass, confirming its reliability and gives it advantages over any other sensors for fingerprinting semiconductor type. Said scanner can be used for the removal of finger prints not only the distal phalanges, but the middle and proximal (Pic. 2).
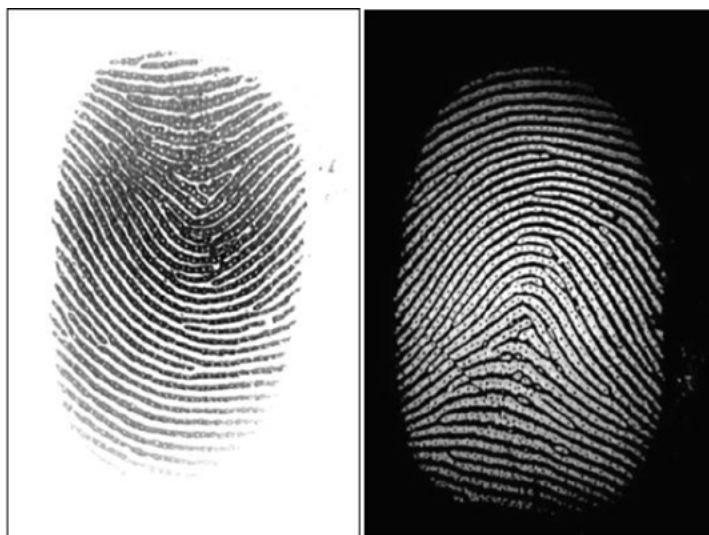
Picture 2. Scans Futronic's FS80 USB 2.0. Invertatsiya colors.

To remove receipt scanner uses four differently-directed infrared LED-lights that automatically change the intensity of radiation depending on the characteristics of the scanned finger (wet, dry, dirty, etc.) to optimize the quality of recorded images print.

Images obtained by the scanner Futronic FS80 are usually of high quality and allows to assess the characteristics of papillary picture. But skin lesions investigated fingers, operator error and other unforeseen cases, there is a need for additional image processing.

In its work to improve the image we used Fingerprint identification algorithm (FIA). The main objective of this software is to convert raster images into vector. When using this procedure are likely to misinterpretation of the data pixel matrix, so the choice of algorithm (or software) that is right for processing photos with papillary pattern is extremely important (Pic. 3).

Picture 3. Key points (red) in papillary figure found by FIA.

Conclusions. Thus, improving the method prints comb figure fingers and toes (when using the scanner Futronic's FS80), as well as digitize the data using a digital method (algorithm VeriFinger 6.6 / MegaMatcher 4.4 Identification Technology Algorithm), and improving the quality of the obtained scans (using prints transforming raster to vector graphics) will improve the objectivity of evidence and forensics to identify the individual.

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ВИКОРИСТАННЯ ЦИФРОВИХ МЕТОДИК У ДЕРМАТОГЛІФІЧНИХ ДОСЛІДЖЕННЯХ

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Резюме. В статті представлена методика отримання сканів гребінцевого малюнку пальців рук і ніг та обробки одержаних даних при проведенні судово-медичної ідентифікації особи за допомогою дактилоскопії. Визначено ряд переваг цифрового методу отримання дермальних відбитків (при використанні сканеру Futronic's FS80), а також відображено шляхи покращення якості отриманих сканів, а саме за допомогою перетворення растрових відбитків у векторні графічні об'єкти з використанням алгоритму VeriFinger 6.6/MegaMatcher 4.4 Identification Technology Algorithm.

Ключові слова. Ідентифікація особи, дактилоскопія, дерматогліфіка.

APPLY OF DERMATOGLIPHIC METHOD DURING IDENTIFICATION OF A PERSON (literature review)

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Abstract: The article analyzes the recent publications on the issue of applying dermatoglyphics method of research as one of the methods that are used for identification of person. Importance of dermatoglific method of research in forensic medicine and criminology is dispalayed. Connection of forensic dermatoglyphics with other medical and non-medical sciences is presented.

Key words: dermatoglyphics, fingerprinting, identification of individuals.

Dermatoglyphics has been the subject of research by specialists in various fields of knowledge for over a century. Results obtained by examining comb drawing of person's hands and feet still remain informative source in medicine, criminology, anthropology and population genetics. Genetic conditionality of dermatoglyphics parameters allows to use dermatoglyphics to solve a number of issues that arise during etno-antropological and population-genetic studies [19, 27, 28, 29]. Widespread use of dermatoglyphics was found in medicine: clinical (in predicting the like lihood of various pathological conditions) [33, 34, 36] sports (in determining the physical capabilities of individuals) [1, 20, 35]. In practice of forensic medicine dermatoglyphics has been used till recently in the examination of disputed paternity [9, 10, 11, 12],therefore during last decades it has also been actively used in the definition of family membership (examination of affinity), analysis of family ties with the further use of the data for identification of unknown persons, using dermatoglyphics parameters of relatives [3, 9, 10]. It is important to note that the greatest problem in diagnostic family ties, ethnic-territorial and racial variability of dermatoglyphics parameters is considered in methodological researches, based on the study of main palmar lines [35], dermatoglyphics signs of feet, papillary drawings of distal phalanges of the fingers [2, 3] and feet [24, 25, 26] as well as avarageand medium phalanges of fingers [30].

Easiness in use, little waste of time and money allows to use widely dermatoglific methods, namely fingerprinting (from Gr. «dactilos» - finger) and palmoscopics (from Gr. «palma» - palm) and plantogliphics (from Gr. «panta «- foot) in forensic science, criminology and forensic medicine [2, 3, 8, 9, 12, 23]. Using dermatoglific markers, criminalists