Mathematical Modeling of the Algorithm of Special Points Dispersion Distribution for Biometric Identification Systems

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***Abstract* - This paper deals with basic methods of biometric identification and considers the algorithm of dispersion distribution of the special points around their imaginary centers of gravity.**

***Keywords* - biometric identification methods, dactyloscopy, dispersion distribution.**

INTRODUCTION

Biometric identification methods are divided into two groups: static and dynamic. The static group includes the following biometric characteristics (BMC): fingerprints, face shape, wrist size, iris, retina, hand veins subcutaneous picture and others.

The dynamic group includes such BMC: voice, handwriting, typing handwriting and other types of handwriting.

Static methods are based on physiological human characteristics that are unique for each person and provide a greater probability of correct identification in comparison with the dynamic methods, and they are called basic methods.

Dynamic methods are based on behavioral human characteristics, namely on the specific subconscious movements. Such methods have a lower probability of correct identification due to the fact that they measure parameters strongly depending on the human state (emotional, psychological, physical) at the time of registration.

BIOMETRIC IDENTIFICATION ALGORITHM

Dactyloscopy – is a method using fingerprints as the main type of biometric characteristics. Namely, this method handles papillary lines orientation and their branching. For registration of fingerprints three types of scanners can be used: semiconductor, optical and ultrasonic. Registration is performed by scanning and assigning a name or a number to a fingerprint. Imprints are to be processed in the following way: coincidences of an imprint's special points are to be compared with the pattern and the estimation of fingerprints identity for a decision-making are to be done.

One of the methods of comparing fingerprints in special points is a comparison of the variances of distribution of special points around their imaginary centre of gravity (fig.1).

Suppose that the mass is only at the tops, all tops weigh equally. In this case, the coordinates of the center gravity are expressed by formulas:

$$XC = (M1*X1 + ... + MN*XN)/M \quad (1)$$

$$YC = (M1*Y1 + ... + MN*YN)/M \quad (2)$$

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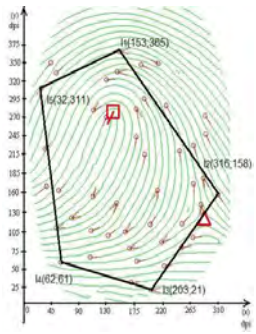

Fig. 1. Choice of coordinates of the special points of fingerprint

(Xi, Yi) are coordinates of i-th vertex (top) of the polygon;

Mi is the weight of i-th vertex;

M is the mass of all peaks (M = M1 + ... + MN).

Let's find the distance from the centre of mass to each point by the formula:

$$S_i = \sqrt{((X_c - X_i)^2 + (Y_c - Y_i)^2)} \quad (3)$$

These distances are the values of the random variable S, for which you can calculate the expectation and variance of formulas:

$$M[X] = 1/N \times \sum i = 1..N \; Si \quad (4)$$

$$D[X] = 1/(N - 1) \times \sum i = 1..N \; (Xi - M[X])^2 \quad (5)$$

Thus, for each fingerprint by its special points one can calculate the variance and use its value for comparison, grouping, and searching.

Mathematical modeling of this algorithm was performed in MathCAD, which enables us to calculate all the variables and unknown parameters concerned to this method of fingerprint identification.

CONCLUSION

The basic methods of biometrical identification are described in this paper. The algorithm of dispersion distribution of the special points around their imaginary centre of gravity is considered. It gives an opportunity to perform identification of a person upon the analysis of the special points of fingerprints.

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