ANALYSIS OF DERMATOGLYPHIC SIGNS
FOR DEFINITION PSYCHIC FUNCTIONAL STATE OF HUMAN'S ORGANISM

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Abstract: *Relation between dermatoglyphic signs and temperaments types is considered. An algorithm for papillary patterns classification and Izenk's two factors model are used for establishment relationship asymmetry signs with psychic functional state of human's organism.*

Keywords: *papillary patterns analyze, dermatoglyphic signs, temperament type*

ACM Classification Keywords: *J.3 Life and medical science. Medical information systems.*

Conference topic: *Information Systems*

Introduction

Studies of papillary patterns have two goals. First goal is to discover distinction concrete human patterns from patterns all other people. To find common group's sings is the second goal.

Finger-print's patterns have several common features. They contain papillary lines which have the same anatomic nature, properties, like outward sings and details of structure.

It is known that skin integuments are descended from the same embryo sources that central nervous system's. Therefore dermatoglyphic signs may be considered as original markers of central nervous system's morphological organization.

In papillary patterns of hand's finger-print are distinguished five zones: distal (1), left lateral (2), central (3), right lateral (4) and basic (5).
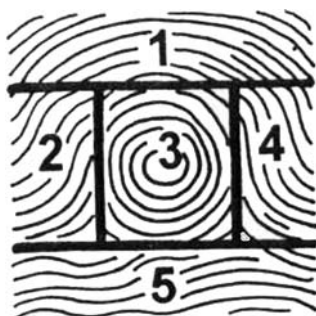

Fig 1 – Hand finger-print structure's zones

Across basic zone gone one stream of papillary lines, which usually cross nail phalange in horizontal direction. Left and right lateral zones are formed by streams arc like papillary lines. Distal zone is place above central zone, it separate from lateral streams by conditional line which touch extreme upper line of central drawing and is parallel to basic lines stream.

Maximum interest have present central zone. Its patterns contain one or two line's stream. In depend on stream's quantity patterns is divided for simple and double. By direct and stream line forms there are three global groups: arc-like, loop-like, and tangle wind-like.

Every group has several subgroups. Arc-like patterns may be simple, marquee, pyramidal or fir-treelike. Loop-like patterns contain ulnae, radial, half loops, closed loops and racket-like loops.

Circles, oval (ellipse-like), spirals, loop-spirals, tuber-like, snail loops and other come in wind-like (curl) patterns group. Sometimes papillary pattern's name is not corresponding to geometric figure one.

Usually in known algorithms for papillary pattern central zone analysis [1] have taken into account directs and density like («parallel») lines. In this way different version of pattern line's space frequency filtering are used. Discovered (filtered) distinctions are the basis for making decision in benefit one from standard papillary patterns.

It's known, that across profile uniform papillary lines (summit and hollow altitude) well describes by next periodic function.

$$Z(\gamma, l, L) = \cos(\pi \frac{l}{L(\gamma)} + \varphi_0),$$

In this formula expression *l* is distinct from start point around line which across papillary lines with angle γ, *L(γ)* is summit repetition period. Choice start point on line summit (φ_0=0) shorten parameter number in pattern analysis.

Summit repetition period *L* essentially depends from angle γ and in diapasons 0<γ<π has been singular minimum which is reached in γ=π/2, that is with perpendicular across if papillary pattern lines. Patten's lines in central zone may have any direct. Therefore practice use will be enough to select only four most typical angle values γ from set {0, π/4, π/2, 3π/4}. On this statutes are based the next algorithm for central zone papillary pattern analysis.

1. Choice pattern's start point and division finger-point on 48 segments (6 circle stripes with equal width in 8 equal sectors).

2. Choice mean values M_i of grey color level $I(x, y)$ in the limit of segment number *i*.

3. Definition of differences $K=I(x, y)-M_i$ and standard deviations V_i in the limit of segment number *i*.

4. Definition of normalized finger image $N_i(x,y)$ in each segment number point.

$$N_i(x, y) = \begin{cases} M_0 + \sqrt{\dfrac{(v_0) \times (I(x, y) - M_i)^2}{v_i}}, & if \quad I(x, y) > M_i, \\ M_0 - \sqrt{\dfrac{(v_0) \times (I(x, y) - M_i)^2}{v_i}}, & otherwise. \end{cases}$$

In this expression M_0 and V_0 are required mean and deviation values.

5. Division formalized finger image to four components by Gabor's space-frequency filtering [2] accordance to four directs which are defined by values (0, π/4, π/2, 3π/4).

$$G(x, y, \gamma, f) = \exp\left\{\frac{-1}{2}\left(\frac{x'^2}{\delta_x^2} + \frac{y'^2}{\delta_y^2}\right)\right\} \times \cos(2\pi f x'),$$

$$x' = x \cdot \sin\gamma + y \cdot \cos\gamma,$$
$$y' = x \cdot \cos\gamma - y \cdot \sin\gamma.$$

In last expression *f* is sin-like wave frequency in direct γ, x' and y' are new coordinates for point (*x,y*) after turning coordinate system on angel γ, δ_x and δ_y describe Gauss rounding around axes *X* and *Y*.

6. Definition pattern's codes $F_{i\gamma}$ as standard deviation for four variants in 48 segments (in all 192 values)

$$F_{i\gamma} = \sqrt{\sum_{K_i} \left(G_i(x, y, \gamma) - M_{i\gamma}\right)^2}.$$

In this expression $G_i(x,y,\gamma)$ is component image which correspondent to angle γ for segment number i, K_i – quantity of points in segment number i, $M_{i\gamma}$ – means of grey level in segment number i for concrete value of angle γ.

7. Analyzed pattern relate to one from five most typical kind (curl, left or right loop, arc, half sphere) accordance to maximum coincidence pattern's codes (192 measured signs vectors) with codes previously received etalons.

Next moments are used for most precision account disposition of the points which forms papillary pattern's lines.

If for reserved number of points are correct next expression

$$(r - \frac{\Delta}{2})^2 \leq (x - x_0)^2 + (y - y_0)^2 \leq (r + \frac{\Delta}{2})^2,$$

then this number of points forms circle with central coordinates x_0 and y_0, radius r and circle line width Δ.

If for reserved number of points are correct two next expressions

$$\frac{(x - x_0)^2}{\left(a \pm \frac{\Delta}{2}\right)^2} + \frac{(y - y_0)^2}{\left(b \pm \frac{\Delta}{2}\right)^2} = 1 \quad and \quad b^2 = a^2 - c^2,$$

then this number of points forms ellipse with central coordinates x_0 and y_0, half axes a and b, half focus distance c, ellipse line width Δ.

Increase distance from each new neighbour point of figure to some central point (x_0, y_0) which are accompanied simultaneous continuous increasing or decreasing of the turn angle straight line which going over new and central points testify to presence of spiral in papillary pattern.

This moments and classification papillary patterns results by described algorithm are the basis for research relationship hand finger nail phalange papillary pattern's type with psychic functional state of human's organism. Dermatoglyphic phenotypes of 78 persons with different temperaments were examined. Temperament type (choleric, sanguine, phlegmatic or melancholic) previously are defined by Izenk's two factors model. This model by means of basic index extraversion-introversion and neurotismus allows to estimate personality direction for internal or external world and to expose his emotional uneasiness level.

Papillary patterns were classified to five types: 1 – arcs (marquee arcs, fir-treelike), 2 – ulnae loops, 3 – another loops (radial, half loops, closed loops), 4 –curls (circle, ovals, spirals), 5 – another curls (tuber-like, snail loops). Described algorithm, partial analyses conditions and visual classification are used for this aims.

Results of these studies are presents into next table.

Presence dermatoglyphic signs of persons with different temperament type

Sign	Extravert		Introvert	
	Choleric	Sanguine	Melancholic	Phlegmatic
Asymmetry $\Delta r > \Delta l$ 1 finger	+	+	–	–
Asymmetry $\Delta r < \Delta l$ 2 finger	+	+	–	–
Asymmetry $\Delta r > \Delta l$ 2 finger	–	–	+	+

"+" means presence of sign, "–" means absence of sign

Accordingly to these results extraverts have next dermatoglyphic signs: asymmetry of threeradiuses on thumb $\Delta r > \Delta l$ and asymmetry $\Delta r < \Delta l$ on forefinger.

Introvert's finger pattern allows to mark out dermatoglyphic type which is characterized by symmetric patterns on thumb and asymmetry $\Delta r < \Delta l$ on forefinger.

Next results are obtained in the sense relationship temperament's type with papillary patterns. The first, choleric have high probability of presence arcs patterns on the one from fingers. Second, melancholic have small probability of presence curl patterns, in particular circle.

Conclusion

Dermatoglyphic signs are marks central nervous system's types which are sensitive to external influence and this way they are connected with emotional uneasiness level.

As results studies of papillary patterns persons with various temperaments are ascertained that there are reasons to say about characteristic of them certain dermatoglyphic types.

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