International Engineering Journal For Research & Development
Vol.5
Issue 6
E-ISSN NO:-2349-0721
Impact factor : 6.549

HUMAN PERSONAL IDENTIFICATION ALGORITHMS FROM THE IMAGE OF THE EAR

[1]jumaev Turdali Saminjonovich, [2]Mahkamov Anvarjon Abdujabborovich
Department of "Modern Information and Communication Technologies"
International Islamic Academy of Uzbekistan[1], Department of "Modern Information and Communication Technologies"International Islamic Academy of Uzbekistan[2]
turdali_83@mail.ru[1] , an_8287@mail.ru[2]

INTRODUCTION

One of the most dynamically developing areas in biometric technology is human identification based on the image of the ear. [1].

One of the central tasks in the problem of biometric identification of a person based on the image of the ear is associated with the issues of constructing personality recognition algorithms with a high redundancy of the initial description of identification objects. It should be borne in mind that many of the features that describe the objects of identification are interconnected, and the construction of a recognition algorithm in this case is associated with great computational difficulties.

This paper considers the development of a model of personality identification algorithms based on the geometric features of the ear. This uses an approach based on assessing the representativeness of features. The model of recognition algorithms based on the principle of potentials is considered as an initial model for personality recognition [2,3].

KEYWORDS: biometrics, digital image, image processing, recognition, cosine transform, feature extraction.

FORMULATION OF THE PROBLEM

A set of admissible objects $\{\Im\}$ is given, which is covered by a finite number of subsets (classes) $K_1, K_2, ..., K_l$, ($K_i \bigcap K_j = \varnothing$, $i \neq j$, $i, j \in \{1, ..., l\}$). Partitioning of a set of objects $\{\Im\}$ is not fully defined. There is only some basic information J_0 about classes [4]:

$$J_0 = \{\Im_1, ..., \Im_i, ..., \Im_m;\ \ \tilde{\alpha}(\Im_1), ..., \tilde{\alpha}(\Im_i), ..., \tilde{\alpha}(\Im_m)\},$$

where $\tilde{\alpha}(\Im_i) = (\alpha_{i1}, ..., \alpha_{ij}, ..., \alpha_{im})$, α_{ij} is the value of the predicate $P_j(\Im_i) = "\Im_i \in K_j"$ $(\forall \Im_i \in \{\Im\}, i = \overline{1, m})$. The vector $\tilde{\alpha}(\Im_i)$ is called the information vector of the object $\Im_i$, and the matrix $\left|\alpha_{ij}\right|_{mxl}$ is called the information matrix $\tilde{\Im}^m$.

Let an arbitrary set of objects $\tilde{\Im}^q = \{\Im_1', ..., \Im_q'\}$ be given, which is a control set $(\tilde{\Im}^q \in \{\Im\})$. It is required to construct an algorithm A that calculates the values of the predicate $P_j(\Im_i)$ from the initial information J_0:

$$A(J_0, \tilde{\Im}^q) = \|\beta_{ij}\|_{qxl}, \quad \beta_{ij} \in \{0,1,\Delta\}.$$

Here β_{ij} is interpreted as in the works of Yu.I. Zhuravlev.

SOLUTION METHOD

To solve this problem, a heuristic approach is proposed, which is a logical continuation of the work of Academician Yu.I. Zhuravlev and his students. On the basis of this approach, a model of recognition algorithms has been developed, based on the identification of independent subsets of tightly coupled geometric features and the selection of representative from each subset of strongly connected features.

Setting the proposed model of recognition algorithms includes the following main stages.

1. Highlighting the contours of the image of the ear. At this stage, the color image is converted to a binary one, where the objects are the contour outside the line of the ear. In this case, the determined contour lines depend on the parameter. This parameter sets the minimum difference between the contour lines and the rest of the image. In this case, a simple method is used to search for the sharp changes in brightness themselves [5].

2. Determination of the set of characteristic features of the image of the ear. Consider k_i concentric circles centered at the center of the image, in δ pixel increments. For each circle the following is calculated: 1) the number of points of intersection of circles and contour lines; 2) the sum of all distances between the intersection points; 3) the number of interruptions of the contour lines; 4) the number of bifurcations of the contour lines; 5) coordinates of points of intersection of circles and contour lines; 6) coordinates of the points of interruption of the contour lines; 7) coordinates of the bifurcation points of the contour lines.

3. Selection of subsets of characteristic tightly coupled features. At this stage, a system of "independent" subsets of characteristic features is set, which depends on the parameter n'. As a result of this stage, a set of "independent" subsets of strongly connected features $W_A = \{\Xi_1, \Xi_2, ..., \Xi_{n'}\}$ is determined [6].

4. Isolation of representative features. For each subset of strongly connected features Ξ_q at this stage, a representative feature is determined, which is denoted by χ_q. As a result, a set of representative features $\chi_1, \chi_2, ..., \chi_{n'}$ is formed [7]. Only representative features are considered below.

5. Defines the function of difference $d(S, S_v)$ between objects S and. At this stage, a difference function is set, which characterizes the difference between objects S and S_v in the feature space $\tilde{\chi}$. The larger the function value $d(S, S_v)$, the greater the difference.

Defines the function of difference $d(S, S_v)$ between objects S and S_v. At this stage, a difference function is set, which characterizes the difference between objects S and S_v in the feature space $\tilde{\chi}$. The larger the function value $d(S, S_v)$, the greater the difference.

6. Sets the proximity function $\phi(S, S_v)$ between objects S and S_v. At this stage, the function of proximity between objects S and S_v is determined using potential functions $\phi(S, S_v)$ [2]:

$$\phi(S, S_v) = \exp(-\tau d(S, S_v)),$$

where τ – parameter of the algorithm.

7. Calculation of the membership score for class K_j**.** At this stage, the grade for class K_j is calculated. Consider an assessment for a K_1 class, which includes $S_1, S_2, ..., S_{m_1}$ objects.

Let the estimates of proximity $\phi(S_1, S), \phi(S_2, S), ..., \phi(S_{m_1}, S)$ be calculated. The assessment of the belonging of the object S to the class K_j ($j = 1,2$) is determined as a function of the proximity assessment [3]:

$$\mu_j(S) = \sum_{u=m_1+1}^{m} \gamma_u U(S_u, S) - \sum_{u=1}^{m_1} \gamma_u U(S_u, S),$$

where γ_u – parameter of the algorithm.

Decisive rule. The last step in setting the model of algorithms is setting the decision rule in the form [4]:

$$\beta_{ij} = C(\mu_j(S)) = \begin{cases} 0, \text{ if } \mu_j(S) < c_1; \\ \Delta, \text{ if } c_1 \le \mu_j(S) \le c_2; \\ 1, \text{ if } \mu_j(S) > c_2, \end{cases}$$

where c_1, c_2 - parameters of the algorithm ($0 \le c_1, c_2$).

Thus, a model of modified algorithms $\{A\}$ of personality recognition based on the image of the auricles has been determined. Any algorithm A ($A \in \{A\}$) from this model is completely determined by specifying a set of parameters $\pi = (k, p, n', \{\lambda_i\}, \tau, \{\gamma_u\}, c_1, c_2)$. The sets of all recognition algorithms from the considered model are denoted by $A(\pi, S)$. The search for the best algorithm within the framework of the considered model is carried out in the parameter space 5 π.

EXPERIMENTAL VERIFICATION

For the purpose of practical use and verification of the operability of the algorithm built within the framework of the considered model, functional diagrams have been developed that determine the structures of the created recognition program. The software implementation of the developed algorithms is carried out in the Delphi language. The efficiency of these programs was tested when solving the problem of identifying a person from images of ears.

In the sample under consideration, there were 150 ear images for each class. The number of classes (people) is five.

Experimental studies have shown the high accuracy of the developed model of algorithms when solving the problem of personality identification by the image of the auricles. As a result of the experiment, all dependent geometric features were identified and on their basis an effective algorithm was built that allow recognizing the personalities of people from the image of the ears with an acceptable error.

CONCLUSIONS

A model of personality identification algorithms based on the auricle images based on the principle of potentials is proposed. An experimental study of the considered recognition algorithms in solving the problem of personality identification showed their efficiency. The developed model can be used in compiling various software systems aimed at solving problems of object classification, which are given in the form of images.

LITERATURE

1. Фазылов, Ш. Х., Мирзаев, Н. М., & Мирзаев, О. Н. (2009). Об одной модели модифицированных алгоритмов распознавания типа потенциальных функций. Математические методы распознавания образов, 14(1), 200-203.
2. Mirzayev, N. M., Radjabov, S. S., & Zhumayev, T. S. (2008). O parametrizatsii modeley algoritmov raspoznavaniya, osnovannyh na otsenke vzaimosvyazannosti priznakov. Problemy informatiki i energetiki, 2-3.
3. Jumayev, T. S., Mirzayev, N. S., & Makhkamov, A. S. (2015). Algorithms for segmentation of color images based on the allocation of strongly coupled elements. Studies of technical sciences, (4), 22-27.
4. Жумаев, Т. С., Мирзаев, Н. С., & Махкамов, А. С. (2015). Алгоритмы сегментации цветных изображений, основанные на выделение сильносвязанных элементов. Исследования технических наук, (4), 22-27.
5. Fazilov, S. X., Mahkamov, A. A., & Jumayev, T. S. (2018). Algorithm for extraction of identification features in ear recognition. In Информатика: проблемы, методология, технологии (pp. 3-7).
6. Мирзаев, Н. М., Раджабов, С. С., & Жумаев, Т. С. (2008). О параметризации моделей алгоритмов распознавания, основанных на оценке взаимосвязанности признаков. Проблемы информатики и энергетики, (2-3), 23-27.
7. Жумаев Т.С. Биометрик технологияларда кулоқ чаноғи тасвирига қўйилган талаблар ва уни таҳлили // Доклады Республиканской научно-технической конференции «Современное состояние и перспективы применения информационных технологий в управлении», Джизак, 5-6 сентября 2016 г., с.396-400.
8. Махкамов А.А. Алгоритмы идентификации личности человека по изображению ушных раковин // Электронный научный журнал "Исследования технических наук". Выпуск 4(18) Октябрь-Декабрь 2015. С. 28-32.
9. Маҳкамов А.А., Мадолимова Д.Ж. Қулоқ чаноғи тасвирини характерловчи белгилар ёрдамида шахсни таниб олиш алгоритмлари // «Информатики ва энергетика муаммолари», Ўзб.журнали, №1 2018.-49-55 б.
10. Mirzayev, N. M., Radjabov, S. S., & Jumaev, T. S. Isolation of characteristic features of facial images in personality recognition problems. Neurocomputers and their application.-2016.-S.
11. Xodjayeva M., Jumayev T., Dadamuhamedov A., & Saydakhmedova, B. (2020). Creation of mobile applications for the shrines of Al-Hakim Al-Termizi. The Light of Islam, 2020(2), 176-182.
12. Saminjonovich, J. T., & Irgashevich, A. D. (2020). Creation of electronic programs on the sanctuary of al-hakim al-termizi. The Light of Islam, 2020(1), 215-222.
13. Мирзаев Н.М., Жумаев Т.С. Шахсни таниб олиш масаласида қулоқ чаноғи тасвирини белгиларини ажратиш алгоритми // Современное состояние и перспективы применения

информационных технологий в управлении: Доклады Республиканской научно-технической конференции. 7-8 сентября 2015. ЦРПП и АПК при ТУИТ, 338-342 б.

14. Мирзаев О.Н., Жумаев Т.С. Построение алгоритмов распознавания личности по изображению ушных раковин // Современное состояние и перспективы применения информационных технологий в управлении: Доклады Республиканской научно-технической конференции. 7-8 сентября 2015. ЦРПП и АПК при ТУИТ, 342-348 б.
15. Жумаев Т.С. Тасвирдаги объектни характерловчи репрезентатив белгилар тўпламини шакллантириш // Ўзбекистон журнали “Информатика ва энергетика муоммолари”. – Тошкент, 2011. -№5. 25-31 б.
16. Жумаев Т.С. // Дискрет косинус алмаштириши асосида қулоқ чаноғи тасвирининг белгиларини ажратиш алгоритми // ТАТУ хабарлари. – Тошкент, 2011. -№2. 74-78 б.
17. Irgashevich, D. A. (2020). Development of national network (tas-ix). ACADEMICIA: An International Multidisciplinary Research Journal, 10(5), 144-151.
Dadamuhamedov, A. (2019). The role of information and communications technologies in pilgrimage tourism in Uzbekistan. The Light of Islam, 2019(1), 17.
18. Irgashevich, D. A. (2019). Development of national network and corporate networks (in the case of Tas-IX network). International Journal of Human Computing Studies, 1(1), 1-5.
19. Дадамухамедов, А. И. (2017). РАЗВИТИЕ НАЦИОНАЛЬНОЙ СЕТИ И КОРПОРАТИВНОЙ СЕТИ (НА ПРИМЕРЕ СЕТИ IX). Актуальные научные исследования в современном мире, (3-2), 133-137.
20. Saminjonovich, J. T., & Irgashevich, A. D. (2020). CREATION OF ELECTRONIC PROGRAMS ON THE SANCTUARY OF AL-HAKIM AL-TERMIZI. The Light of Islam, 2020(1), 215-222.
21. Irgashevich, D. A. (2019, February). THE ROLE OF INNOVATIVE, INFORMATION AND COMMUNICATIONS TECHNOLOGIES IN PILGRIMAGE TOURISM IN UZBEKISTAN. In International Scientific and Practical Conference" Innovative ideas of modern youth in science and education" (pp. 262-265).
22. Dadamuhamedov, A. (2019). THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN THE DEVELOPMENT OF RELIGIOUS AND EDUCATIONAL PROGRAMS ON ISLAMIC SUBJECTS. The Light of Islam, 2019(4), 34.
23. Dadamuxamedov, A., Turdali, J., & Mavlyuda, X. (2020). Electronic religious programs on islamic subjects on the example of the sanctuary of Al-Hakim Al-Termizi. ACADEMICIA: An International Multidisciplinary Research Journal, 10(7), 316-330.
24. IRGASHEVICH, D. A. (2020). METHODS OF USING CLOUD TECHNOLOGIES IN ISLAMIC EDUCATION INSTITUTIONS. METHODS, 7(5).
25. XODJAYEVA, M., Jumayev, T., Dadamuhamedov, A., & Saydakhmedova, B. (2020). CREATION OF MOBILE APPLICATIONS FOR THE SHRINES OF AL-HAKIM AL-TERMIZI. The Light of Islam, 2020(2), 176-182.