The Third International Conference "Problems of Cybernetics and Informatics"
September 6-8, 2010, Baku, Azerbaijan. Section #2 "Intellectual Technology and Systems"
www.pci2010.science.az/2/29.pdf

METHODS OF IMPROVEMENT OF EFFICIENCY IN RECOGNITION IDENTIFICATIONS SYSTEMS

Tofig Kazimov[1], Shafagat Mahmudova[2]

Institute of information Technology of ANAS, Baku, Azerbaijan
[1]*tofig@mail.ru*, [2]*shafagat_57@mail.com*

People significantly differ from each other by the location distance of face elements such as eye, eyebrow, nose, ear, mouth etc. Therefore, the first approach to solution of automatic identification problem based on facial description of a person is based on selection and comparison of some anthropometric characteristics of the face. This method was used in experimental forensic science, since measurements and comparisons were carried out manually. This method was efficient, when a person had no other pictures apart from their photo on the document (document control) [1].

[2] work is dedicated to identification of a person's face based on a photo-portrait. Authors have determined 19 main anthropometric points on a human face based on a photo-portrait, and developed an algorithm for calculation of distance among them and their geometrical characteristics. These points must be maximally durable to small changes (angle, light, mimics, make-up, changed related to ageing). It has been demonstrated that, advantage of developed algorithm over existing algorithms is in operability of this algorithm and it's capability to un-scale the images, even if the information about person on the photo compared to existing photos in the data base is missing.

In work [3], algorithms were developed for automatic addition of geometrical characteristics developed by authors to the data base, search and identification of a human face in the data base based on photo-portrait. "Recognition" automatic biometrical identification system (RABIS) was created based on photo-portraits. "Recognition" firstly developed a data base for RABIS. Pictures covering facial description of 102 different people were added to the data base. In addition, individual information about each person was entered to the data base (person's name, last name, patronymic, birth date, eye color, height etc). In addition to general information, 18 indications determining facial geometrical characteristics for each person were provided.

"Recognition" automated identification system prepared on proposed algorithm can be used during control of identifications cards (passports, diriving licences), information security (sending requests to computers, data bases etc), observing criminal events, as well as banks etc.

Definition of accuracy of idenfitication is an very important aspect of human face recognition based on photo-portrait. Definition of trust interval of geometrical characteristics is one of the main factors of recognition of a human face based on photo-portrait. In this article, we considred the process of detection of trust intervals of geometrical characteristics used in identification of human face based on photo-portraits. In works [2] [3], trust interval is a range containing the real value of parameter studying on exitsing reliability level during its main collection.

Advantage of experiments carried out with definition of trust interval to those performed without, are as following:

1. Insignificant effect of ultimate factors to main process during performance of expertiments;
2. Faster and more accurate performance of experiments;
3. Performance of necessary number of observations during experiments.

In order to define the trust interval, values of geometrical characterictics calculated thrugh "Recognition" identification system we used [3]. For this reason, initially, experiments were carried out on geometrical characteristics stored in the data base belonging to 102 people. Geometrical characteristics belonging to 102 people were were distributed among 18 clusters based on identical characteristics.

2 situations can occur while working with "Recognition" identification system:

1. Values of geometrical characteristics can be included in trust interval detected for them. In this case, system will continue its operation and pass on to the next level.
2. Values of some geometrical characteristics may not be included in trust interval included for them. In this case the system alerts the user and the distances suitable for them are re-calculated in order to determine those geometrical characteristics and process is continued.

Generally, values of 102*18 number of geometrical characteristics were used in order to calculate the trust interval [3]. Clusters by geometrical characteristics are indicated as Ns1, Ns2,..,Ns18.

Student method was used in order to define the trust interval [4,5]. Trust interval is described as below:

$$\bar{X} - t_{\beta}.m_{\bar{X}} \le \tilde{X} \le \bar{X} + t_{\beta}.m_{\bar{X}} \qquad (1)$$

Here,

$\bar{X}$ - average value of main collection,

$m_{\bar{X}}$ - error of average and

$$m_{\bar{X}} = \pm \frac{\sigma}{\sqrt{n}}, \qquad (2)$$

$$\sigma = \pm \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{X})^2}{n-1}}, \qquad (3)$$

t_{β} - Student factor selected from the schedule,

$x_i\ (n=1,n)$ - indicates the elements of main collection.

$n = 102$, While using formula (1) for cluster Ns1,

$\sigma = 0{,}3551$,

$k = n$, $\beta = 95\%$, $t_{\beta} = 1{,}98$,

$m_{\bar{X}} \approx \pm 0{,}0353$,

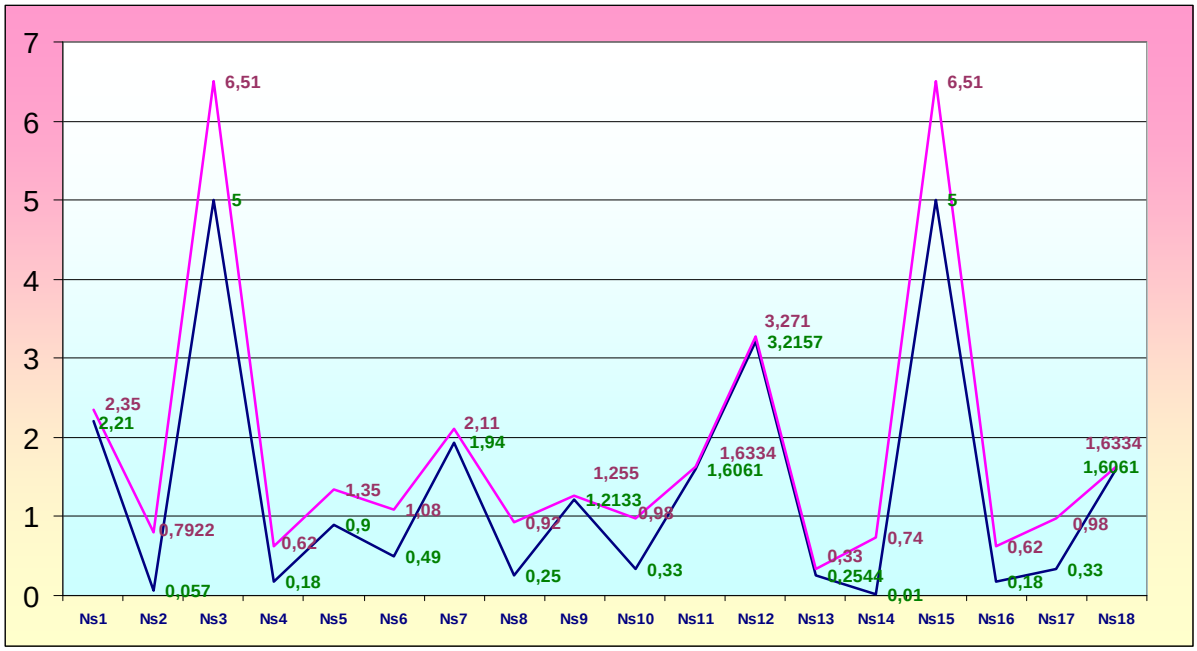
We will get $2{,}21232796 \le \bar{X} \le 2{,}35227203$.

Here Student coefficients were taken based on the value of t_{β} and values of k and β.

In such manner, values of trust interval in accordance with other clusters are calculated and shown in table 1.

Ns1	**Ns2**	**Ns3**
2,21 ≤ 2,28 ≤2,35	0,05≤0,42≤0,79	5≤5,76≤6,51
Ns4	**Ns5**	**Ns6**
0,18≤ 0,22 ≤0,62	0,9≤1,13≤1,35	0,49≤0,79≤1,08
Ns7	**Ns8**	**Ns9**
1,94≤2,03≤2,11	0,25≤0,59≤0,92	1,21≤1,23≤1,25
Ns10	**Ns11**	**Ns12**
0,33≤0,665≤0,98	1,6061≤1,6198≤1,6334	3,2157≤3,2434≤3,2710
Ns13	**Ns14**	**Ns15**
0,2544≤0,29≤0,33	0,01≤0,293437745≤0,74	5≤5,76≤6,51
Ns16	**Ns17**	**Ns18**
0,18≤0,22 ≤0,62	0,33≤0,66≤0,98	1,6061≤1,6198≤1,6334

Table 1. Trust intervals of geometrical characteristics used in identification of human face based on photo portrait in accordance with other clusters



Picture 1. Trust intervals of geometrical characteristics used for identification of human face based on photo portrait.

Student methods was used for definition of trust intervals of geometrical characteristics used for identification of human face based on photo portrait. Definition and use of trust intervals results in fast and effective operation of human face identification program. This, results in preveting time loss during identification.

References

1. Д.И. Самаль, В.В. Старовойтов. Подходы и методы распознавания людей по фотопортретам / Беларусия, Минск, 1998. 54 с. (Препринт / Ин-т техн. кибернетики НАН Беларуси; N.8).
2. Т.Г. Кязимов, Ш.Дж. Махмудова. Система компьютерного распознавания людей по фотопортретам / "Информационные технологии" теоретический и прикладной научно-технический журнал. Россия, Москва, № 1, 2009, с. 13 – 16.
3. Т.Г. Кязимов, Ш.Дж. Махмудова. Автоматизированная система по распознаванию человека на основе идентификационных геометрических характеристик изображения лица / "Телекоммуникации" ежемесячный производственный, информационно-аналитический и учебно-методический журнал. Россия, Москва, №11, 2008, с. 22-25.
4. А.И. Орлов. Математика случая: Вероятность и статистика – основные факты: Учебное пособие. – Россия, Москва: МЗ-Пресс, 2004. 110 с.
5. http://mschool.kubsu.ru