IJREAT International Journal of Research in Engineering & Advanced Technology, Volume 5, Issue 2, April - May, 2017
ISSN: 2320 – 8791 (Impact Factor: 2.317)
www.ijreat.org

Increasing The Reliability Of Information-Measuring Technical Vision Systems

Mammadov Rahim, Imanova Ulkar, Khudaverdiyeva Mehebbet

Azerbaijan State Oil and Industry University, Baku, Azerbaijan

ABSTRACT
The article deals with the algorithms increase the accuracy of estimation of proximity measures between objects at recognition of images by reducing random errors of measurement of parameters of objects. It proposed and studied three algorithms, and among them choose the most effective. To minimize random error are encouraged to use a formula using the proposed algorithm, the soft value calculation measures the proximity between objects, which takes into account the required performance of the work recognition system.

Keywords: Reliability, Random Errors, Measurement Parameters, Pattern Recognition, Proximity measure between objects.

1. Introduction

The efficiency of the industry and industrial robots (IR) depends on the accuracy and reliability of recognizable images (RI) – information-measuring system of technical vision (IMSTV) which is one of the main parameters of flexibility and adaptability [1].

The reliability of RI is determined by the accuracy of the assessment of the distance measures between the objects (ADMO) whose parameters are determined by measurement. The errors made while measuring the values of the parameters of the images summed by complex laws create uncertainty assessment of ADMO in which IMSTV is commensurate with the actual value of the distance between the object parameters. Therefore, these errors reducing the value of RI reliability are serious obstacle to the use IMSTV for widespread introduction of flexible automated production [1,2].

2. Statement of the research problem.

Assessing errors of ADMO are divided into systematic and random. On minimization of systematic errors of ADMO a number of papers and recommendations are evaluated to reduce them [2,3].

However, theoretical and experimental investigations of error assessment of ADMO show that these methods cannot significantly improve the accurate assessment of the last view of the fact that the random error associated with the hidden effects and commensurate with the actual value of AMDO is enough big and minimization of these errors are necessary. They appear because characters and functions of the impact of these destabilizing factors on the creation of error assessment of AMDO differ slightly from our knowledge. For example, conductive characteristics of the creation contrary to our knowledge differ slightly from linear and even in different areas this nonlinearity is different in value and direction. Our knowledge and existing technology cannot identify the non-linearity.

For this, the sources of random errors creation should be analyzed.

In the search path of the methods reducing random errors of ADMO assessment various destabilizing factors were analyzed as the sources of creation of systematic and random errors.

As it is known, the measurement errors arise under the influence of various destabilizing factors (temperature, humidity, noise, variation, supply, voltage, etc.).

These factors create additive, multiplicative and a higher sequence of errors. The latter, along with the existing destabilizing factors that either not identified or difficult to take into account their effect or these actions are so small that they are not counted separately. However, these summed errors create random by value and polarity of the error which cannot be predicted.

Experiments have shown that the random error measurement of characteristic values of recognizable σ_x and standard σ_y images are normally distributed. Random errors of ADMO assessment can be found on the basis of these errors and the correlation coefficient ρ between them, since the latter is the composition of the distribution laws of random errors in the measurement values of the recognizable and standard images, and also it should be distributed normally. Since all STV signs are measured by one measuring device in the same conditions, then the evaluation of ADMO random error of measured values of individual subtracted signs would significantly reduce total error assessment of ADMO [3,4].

However, the presence of the module mark in the formulas for estimating ADMO has negative influence in the formation of random errors of ADMO evaluation. In this case, since the errors with a negative sign are positive, then the distribution of error assessment of ADMO gets truncated and the assessed value is shifted to the positive side. This drawback occurs when recognizable and standard images are so close that their ADMO is commensurate with the error assessment of its value. Since such cases appear a lot in the practice of STV, then additional error which is commensurate with the value of the standard deviation of ADMO assessment makes a significant negative contribution to recognition images.

Therefore, while assessing ADMO its value shifts to the right side in the indefinite measurement which makes the result wrong and causes an error associated with the use of the module mark in the formulas for ADMO assessment. Displacement continues as long as the actual value of ADMO becomes equal or greater than the minimum values of the differences between the values of individual signs of recognizable and standard objects. The real distribution of random errors of ADMO assessment is observed entirely in the positive plane of Euclidean metric. Therefore, the use of different methods and techniques does not give any effect to reduce the impact of these destabilizing factors. Thus, direct reduction of random errors of ADMO assessment is necessary.

The use of traditional methods of static processing results of measurement using multiple measuring characteristic values of images increases the RC-time which is undesirable.

Therefore, the development of algorithms using a number of repeated measurements of values which does not reduce the possibility of STV on time PO significantly reducing the level of random errors of ADMO assessment is relevant.

3. Solving problem method and computer modelling.

3 algorithm reduction of random errors of AMDO assessment are proposed based on the method of static processing results of measurement and analysis of fuzzy random error distribution of ADMO assessment range on data sampling.

The algorithm is implemented as follows:

Step 1: The value of each current characteristic of recognizable and standard objects are measured in time j where $j = 3 - 18$;

Step 2: The proximity measures between the signs of recognizable and standard images is measured by the formula:

$$z_{i,j} = x_{i,j} - y_{i,j}$$

Step 3: The diapason of the value changes of proximity measures between the signs of recognizable and standard images is divided into intervals ($[-\infty, -3 * \sigma_z]$, $[-3 * \sigma_z, -2{,}5 * \sigma_z]$, $[-2{,}5 * \sigma_z, -2 * \sigma_z]$ $[-2 * \sigma_z, -1{,}5 * \sigma_z]$, $[-1{,}5 * \sigma_z, -\sigma_z]$, $[-\sigma_z, -0{,}5 * \sigma_z]$,$[-0{,}5 * \sigma_z, 0]$, $[0{,}0{,}5 * \sigma_z]$, $[0{,}5 * \sigma_z, \sigma_z]$, $[\sigma_z, 1{,}5 * \sigma_z]$, $[1{,}5 * \sigma_z, 2 * \sigma_z]$, $[2 * \sigma_z, 2{,}5 * \sigma_z]$, $[2{,}5 * \sigma_z, 3 * \sigma_z]$, $[3 * \sigma_z, \infty]$).

Step 4: The facts falling the values of proximity measures are checked between the signs of recognizable and standard images;

Step 5. Assignment of the values of the proximity measures between the signs of recognizable and standard images on the fact of their falling into these intervals is carried out on four options:

Option 1

$$IF\ z_{i,j} \in \left[d_{sr,i} - \Delta d, d_{sr,i} + \Delta d\right]\ THEN\ z_{i,j} = d_{sr,i}$$

$$IF\ z_{i,j} \in [-3 * \sigma_z, -\sigma_z]\ AND\ z_{i,j} \in [\sigma_z, 3 * \sigma_z]\ THEN\ z_{i,j} = d_{sr,i}$$

Option 2

$$IF\ z_{i,j} \in [-\sigma_z, \sigma_z]\ THEN\ z_{i,j} = 0$$

$$IF\ z_{i,j} \in [-3 * \sigma_z, -\sigma_z]\ AND\ z_{i,j} \in [\sigma_z, 3 * \sigma_z]\ THEN\ z_{i,j} = d_{sr,i}$$

$$IF\ z_{i,j} \in [-\infty, -3 * \sigma_z]\ AND\ z_{i,j} \in [3 * \sigma_z, \infty]\ THEN\ z_{i,j} = z_{i,j}$$

Option 3

$$IF\ z_{i,j} \in [-1{,}5 * \sigma_z, 1{,}5 * \sigma_z]\ THEN\ z_{i,j} = 0$$

$$IF\ z_{i,j} \in [-3 * \sigma_z, -1{,}5 * \sigma_z]\ AND\ z_{i,j} \in [1{,}5 * \sigma_z, 3 * \sigma_z]\ THEN\ z_{i,j} = d_{sr,i}$$

$$IF\ z_{i,j} \in [-\infty, -3 * \sigma_z]\ AND\ z_{i,j} \in [3 * \sigma_z, \infty]\ THEN\ z_{i,j} = z_{i,j}$$

Option 4

$$IF\ z_{i,j} \in [-2 * \sigma_z, 2 * \sigma_z]\ THEN\ z_{i,j} = 0$$

$$IF\ z_{i,j} \in [-3 * \sigma_z, -2 * \sigma_z]\ AND\ z_{i,j} \in [2 * \sigma_z, 3 * \sigma_z]\ THEN\ z_{i,j} = d_{sr,i}$$

$$IF\ z_{i,j} \in [-\infty, -3 * \sigma_z]\ AND\ z_{i,j} \in [3 * \sigma_z, \infty]\ THEN\ z_{i,j} = z_{i,j}$$

The results of these options' algorithm are given in tab.1. The analysis of the table data shows that in terms of improving the accuracy of ADMO assessment the most effective is option 3.

The disadvantage of the algorithm A is that a further increase in the accuracy of ADMO assessment is due to the increase in the number of repeated measurement values of the recognizable and standard objects that carries an increase in the time of recognition images.

Algorithm B. The difference between this algorithm and algorithm A is characterized by the fact that due to this algorithm the value of proximity measures between the signs of recognizable and standard images is calculated by the formula.

$$\boldsymbol{z_{i,k} = x_{i,j} - y_{i,l}}$$

where $j=\overline{1,n_x}$; $\overline{l=1,n_x}$; $k=\overline{1,n_x^2}$.

This algorithm has been implemented in the options such as with the four options 1,2,3,4 and the results placed in table 1 (Options: 5,6,7 and 8).

Algorithm C. This algorithm is a kind of algorithm B. As the signs of a standard image are measured in a learning mode, the time required for repeated measurements of the signs of the standard images are not included in the time of recognizable images. Therefore, if it is necessary, further precision in increasing the ADMO assessment, the number of repeated measurements of the signs of standard image can be increased to acceptable values. In this case, we have taken 18 repeated measurement values of the signs of the standard images. In this case, the number of sample values of proximity measures between the signs of recognizable and standard images will be up to $18 * n_x$.

Algorithm C was also implemented in the four options (options 9,10,11 and 12) and the results are shown in table 1.

4. Conclusions.

1. In terms of increasing the accuracy of ADMO assessment by reducing random errors the most effective algorithm is C since it significantly increases the number of samples. For example, when $n_x = 7$ by the algorithm according to options of 1,2,3 and 4 values are z_i, respectively, 8.7, 7.5, 2.8 and 2.8, using the algorithm B - 7.9, 5.8, 2.4 and 2.4 and the algorithm C - 7.0 4.2 , 1.7 and 1.6.

2. The most accurate is the fourth option, where the same number n_x (e.g., $n_x = 7$) in algorithms A, B and C the values of $z_{i,j}$, are respectively equal to 2.8, 2.4 and 1.6.

3. The most effective on complex parameters is the third option, at the same n_x (e.g., $n_x = 7$) the values of $z_{i,j}$ are respectively equal to 2.8, 2.4 and 1.7 in algorithms A, B and C.

4. To minimize random errors the following formula should be used:

$$z = \frac{1}{ml}\left|\sum_{j=1}^{m}\sum_{k=1}^{l} f\left(x_{i,j^{-y_{i,k}}}\right)\right|$$

using the proposed algorithm calculating soft values of ADMO, where the number of l may have a sufficiently big value, and the number of m is accepted depending on the required speed of STV operation.

REFERENCE

[1] Burdun G.D., Markov B.M. Osnovi metrologii.- M.: Izd. Standartov, 1985.- 256 pp.
[2] Pronkin N.S. Osnovi metrologii: praktikum po metrologii I izmereniyam.- M.: Izd. Universitetskaya, 2006.- 392 pp.
[3] Panfilov V.A. Elektricheskie izmereniya.- M.: Izd. Akademiya, 2006.- 288 pp.
[4] Korn G., Korn T. Spravochnik po matematike.– M.: Izd. Nauka, 1968.- 831 pp.
[5] Mammadov R.G. Povishenie dostovernosti kontrolya obyektov v rezultate ucheta korrelyachii me;de izmeryaemimi parametrami.- «Metrologiya», 1998, № 1, p. 9-13.
[6] Mammadov R.G. Ispolzovanie Evklidova rasstoyaniya dlya tochnoy ochenki meri blizosti mejdu obyektami pri raspoznavanii obrazov.- «Metrologiya», 1998, № 3, p. 10-14.
[7] R.G.Mammadov. Analysis of the methods increasing the reliability of the recognition of image systems of technical vision. "Automation in modern technologies", 1998, №9, p. 21-26.

IJREAT International Journal of Research in Engineering & Advanced Technology, Volume 5, Issue 2, April - May, 2017
ISSN: 2320 – 8791 (Impact Factor: 2.317)
www.ijreat.org

Table 1.

N		z	Options											
			Algorithm A				Algorithm B				Algorithm C			
			1	2	3	4	5	6	7	8	9	10	11	12
1	9.0	9.0	10.9	10.9	0.0	0.0	10.9	10.9	0.0	0.0	5.8	3.6	0.0	0.0
2	4.5	4.5	5.4	5.4	0.0	0.0	10.3	10.3	4.9	4.9	5.8	3.5	0.5	0.5
3	-0.3	6.3	7.2	7.2	0.0	0.0	8.7	7.0	2.1	2.1	6.1	4.0	0.3	0.3
4	-2.0	6.5	7.1	5.4	0.0	0.0	8.1	6.0	1.2	1.2	5.9	3.1	0.2	0.2
5	-1.2	5.6	6.1	4.3	0.0	0.0	7.2	4.7	0.7	0.7	5.7	2.6	0.2	0.2
6	-4.3	8.0	8.3	6.9	3.2	3.2	8.5	6.3	2.7	2.7	7.1	4.3	0.7	1.6
7	-2.0	8.5	8.7	7.4	2.8	2.8	7.8	5.7	2.4	2.4	6.9	4.1	1.6	1.5
8	-1.5	7.7	7.9	6.5	2.4	2.4	7.2	4.8	2.0	1.8	6.6	3.7	1.5	1.4
9	-0.6	7.5	7.7	5.8	2.1	2.1	6.9	4.5	2.0	1.7	6.5	3.7	1.5	1.4
10	-0.1	7.3	7.6	5.2	1.9	1.9	6.8	4.0	1.6	1.3	6.4	3.4	1.3	1.2
11	0.0	6.8	7.1	4.7	1.7	1.7	6.8	4.1	1.8	1.4	6.5	3.7	1.5	1.4
12	0.0	6.6	7.1	4.3	1.6	1.6	6.7	3.8	1.6	1.3	6.4	3.4	1.3	1.3
13	-1.0	6.9	7.3	4.8	1.5	1.5	6.7	3.8	1.5	1.2	6.4	3.5	1.2	1.2
14	-0.9	6.5	7.0	4.5	1.4	1.4	6.5	3.5	1.3	1.1	6.3	3.3	1.1	1.1
15	-1.7	6.9	7.2	4.9	1.3	1.3	6.6	3.7	1.2	1.0	6.3	3.4	1.1	1.0
16	-1.1	7.0	7.2	4.6	1.2	1.2	6.4	3.5	1.1	0.9	6.3	3.4	1.1	1.0
17	-0.4	7.2	7.4	5.0	1.1	1.1	6.3	3.5	1.1	0.8	6.2	3.4	1.0	1.0
18	0.0	7.2	7.4	4.7	1.0	1.0	6.2	3.3	1.0	0.8	6.2	3.3	1.0	1.0