

Abstract

Master's degree on the theme

"Investigation of the principal component analysis for the reduction of the input space in pattern recognition problems"

by

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The actuality

The problem of efficient pattern recognition is of great importance in the fields of automation of certain processes of human activity associated with the identification of various objects around the world. For example, there are authorization of personnel working by fingerprints or retina, identification by the product and pricing on the bar-code in the store and so on.

There have been created a lot of methods for recognition during the development of cybernetic sciences. However, despite the fact that in this area of research and made a number of important results, in general, the problem of pattern recognition is still far from being solved. The main difficulties lie in the fact that pattern recognition should be independent of changes in camera angle and lighting conditions while shooting, noise, etc. In addition, the problem has no exact analytical solutions. It requires the selection of key attributes that characterize the visual image, determining the relative importance of attributes by choosing their weights and accounting for the relationship between the attributes.

In the work there is used principal component analysis to solve this problem. It's also researched the ability of PCA to reduce space and thereby reduce the amount of input data, which is especially important for large databases.

The purpose

The aim of this work is to implement its own system of recognition, research PCA's ability to reduce space, as well as additional researching of factors that affect learning and

recognition: initialization of weights, normalize the data. Also the purpose is to develop recommendations for further improvement of image recognition system that uses principal component analysis.

Solved problems

1. Analysis of the effect of the image features on recognition process.
2. Investigation of the existing methods features for pattern recognition.
3. Development of image recognition system that is based on PCA and neural networks.
4. Research of the effect of normalization of the data and select the method of initial weight initialization of neural network learning and recognition.
5. Research the ability of PCA to reduce space of input data in pattern recognition problems.
6. Development of recommendations to improve the work of pattern recognition system that is used principal component analysis.

Achieved results

Solving the problems that put in the work, the author defends:

1. results of analysis of the impact on the image features on recognition process;
2. results of investigation of the existing methods of recognition;
3. the developed architecture of a software system for pattern recognition;
4. results of researches of the effect of normalization method and initialization of weights in the process of learning and recognition;
5. results of researches of capabilities of PCA to reduce space of input data;

6. recommendations for improvement of image recognition system that uses principal component analysis.

The scientific novelty of the work

The scientific novelty of the work lies in the fact that:

7. analyzed the impact of image features on the image recognition process;
8. marked the advantages and disadvantages of different methods for recognizing;
9. developed recommendations for improving the system of pattern recognition that uses principal component analysis.

The practical value of the work

The practical value of the work lies in the fact that:

10. developed a system of pattern recognition that uses principal component analysis for data reduction and neural networks for classification;
11. investigated experimentally the effect of normalization method and the initialization of weights on the learning and recognition;
12. investigated experimentally the ability of PCA to reduce the space of input data for solving problems of pattern recognition.

Conclusions

1. There was analyzed the effect of the image features on recognition process.
2. There was investigated the existing methods features for pattern recognition.

3. There was developed image recognition system that is based on PCA and neural networks.
4. There was researched the effect of normalization of the data and select the method of initial weight initialization of neural network learning and recognition.
5. There was researched the ability of PCA to reduce space of input data in pattern recognition problems.
6. There was developed recommendation for improvement the work of pattern recognition system that is used principal component analysis.

The work contains 113 p., 27 figures, 4 tables, 38 sources.

Keywords: PRINCIPAL COMPONENT ANALYSIS, RECOGNITION, REDUCTION, NEURON, NETWORK, LEARNING, NORMALIZATION, INITIALIZATION, WEIGHT COEFFICIENTS.