

Neural network model for predicting the level of residual knowledge of the subjects of study

The task is to build a neural network model depending on residual knowledge the trainees with whom they come into the labor market. Neural network model makes it possible with enough precision to predict the level of professional training according to their individual abilities.

At the present time the quality issue of training expert crews are very relevant, due to the mismatch of quality of training education requirements of their customers, and the lack of necessary competences needed by modern technology.

The main tools in this case are the intelligent methods of modeling and optimization, which allow to predict the course of events, the consequences of different management decisions, and most importantly, allow you to find the best optimum decision on training of aviation personnel. After the synthesis of architectures of neural networks (NN) for determining the residual knowledge of subjects of study, was based on a multi-layered network of direct distribution. Education of NN was conducted by "learning with teacher" method by feedback distribution errors algorithm. NN estimation of residual knowledge of subjects from their individual abilities offers synthesize using the following steps:

- 1) forming a set of statistical data;
- 2) structural NN synthesis according to residual knowledge of subjects of learning from their individual abilities;
- 3) parametric synthesis model of professional training with NN training on formed signs with training algorithm;
- 4) verification of the quality of training of NN according to residual knowledge of subjects from their individual abilities.

To construct NN training specialists should consider factors that affect the subjects and to identify their degree of influence. As each subject is a person, first we should do is to analyze his personality characteristics. Factors affecting subjects in their preparation [1] were analyzed. As a result of personality analysis were formed the following factors: motivation for education, intellectual abilities of subjects, psychological characteristics, physical factors that affect learning. Each of these types is divided into several indicators, which can be determined by the results of test surveys [2, 3].

The process of expert preparation is a transfer of teacher's knowledge and skills. The quality of teaching is recorded in the examination information. NN learning process should form the output of residual subject's knowledge in a particular discipline with which subject enters the labor market. During this process the employers decide on candidates for job vacancies.

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For NN learning there are following objectives:

- psychological portrait of individual abilities that characterizes the mentality of the subjects;
- curriculum disciplines;
- evaluation criteria of knowledge;
- the examination sheet that reflects the success of the subjects.

Prediction of residual knowledge of one specific discipline for one subject, is carried out in two stages.

The first stage is projected on the basis of test scores of individual abilities.

In the second stage, based on the estimated scores an average set of knowledge and skills which corresponds to this assessment is formed.

The first NN will be trained based on the individual abilities of a group of subjects and examination information.

Input parameters of the second NN are test rating obtained from the output of the first NN.

Outgoing signals of second NN forms a vector, components of which record the presence or absence of corresponding residual knowledge or skill. Teacher forms the training set for the second NN for his discipline, using the approved evaluation criteria and curriculum subjects, which contains the list of knowledge and skills.

NN education was carried out by the "learning with teacher" method by back propagation of errors algorithm.

For the modeling environment for NN was used the Neural Network Toolbox package, which is included in the standard supply of MATLAB [4, 5].

In the construction of training set for the first NN 10 subjects were chosen, who attended a training course "Automation and automation in transport" and already got the exam scores.

For the training set data first 9 subjects were taken. The results of subjective at number 10 were used to verify trainees NN.

As can be seen from fig. 1, for the training of two-layered NN 5 eras at zero accuracy was enough.

Fig. 2 represent a errors histogram of 10th subject, which values were used for verification the NN.



Fig. 1. Histogram errors of trainees set

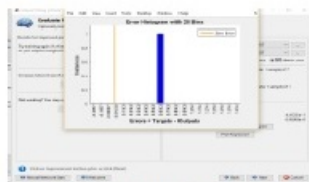


Fig. 2. Histogram errors of testing set

Analysis of the first stage showed that the value of a component of the original signal close to code (1110111111).

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This encoding matches the examination mark "excellent", which this subject really got at examination.

Estimated valuation of the output of the first NN came to the entrance of the second NN, which forms the effective vector Y of knowledge and skills of this subject.

Where the value of a vector Y can be interpreted as a degree of confidence that this entity is stored in his memory of the appropriate knowledge and skills [6].

Comparing the received result (1110111111) to the criteria of assessment in the discipline, the represented set of predictive knowledge and skills matches the assessment of "excellent".

That confirms the correctness of the proposed ideas to tackle the problem. The proposed NN allows to predict the level of professional training with high enough precision.

Conclusions

The proposed approach to the neuron modeling of weakly-formalized process of training of aviation specialists, based on the definition of professional skills and knowledge of the subjects of the education, which they enter the labor market with.

Special software for automated systems of learning and knowledge control in the preparation of aviation personnel can be developed based on this NN.

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