

Artificial Intelligence as an Instrument of Successful Pedagogical Monitoring and Affect Assessment for Disabled People Employment*

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Abstract. The article presents the influence of artificial intelligence on the quality of the criteria-diagnostic apparatus of the system of pedagogical monitoring. The necessity of creating automated tools for assessing the existing competencies of the listener and necessary for participating in the process of mastering the discipline is noted; automated diagnostic systems in digitalization to form an individual training route. The authors have developed methods for providing an automated process of pedagogical monitoring, describe the principles of work of the developed methods from the technical and pedagogical side, and also give examples of their implementation. It also offers the implementation of an expert assessment method using image theory and machine learning. The article confirms that AI allows you to expand the range of possibilities of pedagogical monitoring in digitalization, while maintaining the principles of traditional pedagogy. Based on the proposed technology and the creation of a training automated system, the proposed approach will solve this problem and improve the accuracy of the individual educational route and disabled people employment.

Keywords: Digital transformation, Learning platform, E-learning, Pedagogical monitoring, Competency matrix.

1 Introduction

The structural components of the existing information educational environment including the up-to-date computing aids due to difficulties in relation to analysis of texts with competency subject don't provide the possibility for the teacher to manage the diagnostics of the students' results and control the student knowledge.

None of the organizations will be able to maintain the high growth rates without qualified employees. Considering this the stable trend on study issues concerning motivation theories (as one of the main tasks during human resource management) for employees in order to increase their labour efficiency is currently formed in the organizations. Moreover, the organizations starts working out issues concerning improvement of the personnel professional competency as one of the elements influenc-

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ing the personal motivation aspect of each employee and the whole staff in general. In fact, the process of development and improvement of the professional competency for the whole staff will contribute to increase in the level of motivation environment in the organization.

Under current conditions informational support and improvement of education become the most important means for implementation of new educational paradigm, creation of favourable conditions for achievement of new educational results. Moreover, the educational process is considered as forming the special information and educational environment based on application of achievement in the up-to-date information technologies. But the components of the existing information and educational environment don't consider non-linear nature of the dependences between competencies, when the superposition principle is violated, and this unavoidably results in system errors and restricted possibilities for use of e-learning functional for more exact knowledge diagnostics.

At the present time the scientific works in the area of automated knowledge diagnostic systems only partially cover the certain problems. Therefore, the system, where all scientific methods will be combined in this trend, shall be developed. A substantial contribution to development of artificial intelligence and computer-aided learning for informational support of the education and creation of more exact knowledge diagnostic systems were made by the foreign scientists: B. Widrow, P. J. Werbos, S. Papert and domestic ones: A.B. Novikov, A.N. Gorban, V.A. Okhonin, V.N. Vapnik, Yu.I. Zhuravlev, K.V. Rudakov, etc. [1-3].

2 The Algorithm of Successful Pedagogical Monitoring with the Help of AI

The scientific idea consists in development of knowledge diagnostic system, which would allow evaluating knowledge not only by the results of testing or ready canned responses, but also diagnosing any responses of the students and comparing the results with the expert evaluation. For this purpose, it is necessary to create information classifier including linguistic structures. This classifier will allow forming the pattern of the interesting expert opinion for search of the more approximate response. Moreover, it is necessary to create the algorithm for collection and selection of the most relevant materials according to the user's request based on the developed information classifier.

It has been experimentally proven that when using the integrated system of semantic analysis accuracy of search is significantly increased in comparison with separate use of the semantic analysis methods, as well as that use of SVD decomposition during implementation of matrix LSA-algorithm efficiency of rules construction for obtaining of definitions and relevant terms from the texts containing materials for search of the more approximate replay of the student is increased.

Based on the obtained algorithm, single adapted software has been created for students' knowledge diagnostics. The program analyses the text inside the document and compares it with the request. Thus, semantic kernel is formed. When adding the cer-

tain document/response into the kernel, it is indexed, the program form the semantic pattern by one or another criteria as per the information in the header and any sections, identifies the key words and forms the tree/cloud from them separating the document semantic kernel. The request can be composed in standard form and then compared with the base upon conversion by the program into the semantic tree. In case of inclusions, one or other documents meeting the request will be issued. For the set problems the original competency models shall be created, as well as a new approach, which will allow determining previously unforeseen competencies for different categories of users considering different presentations of connections both between users and between the complexes of expert evaluations.

It is necessary to implement the special database management system and create the algorithm of intelligent search for the complex of learning programs allowing software management for the scheme of these aids, as well as user self-learning. Development of neural networks allows implementing the principle of education democratization and development of the individual track, as there is a possibility of individual approach to the student requests. Thus, for example, if in its result the listener represents a part of words, which is in the expert card, during execution of the case task, then the algorithm of the neural network will be able to easily recognize these words and give the result. The present-day development of the pattern recognition algorithms with high accuracy allows diagnosing terms, figures, tables, etc. Let's make one of the examples of our experiment. Table 1 shows the results of case execution, which is intended for development of communicative competency, where m – additional features for more accurate diagnostics of the result.

Table 1. The User's Response Result Using SVD-Decomposition

Word	Word core	m1	m2	m3	m4	m5
W1	development	2	∞	1	-	∞
W2	skills	2	∞	0	-	∞
W3	communicative	2	∞	0	-	2
W4	activities	2	∞	0	-	2
W5	communication	2	∞	0	-	2
W6	activity	2	∞	0	-	2
W7	DEVELOPMENT	2	∞	1	-	∞
W8	Skill*	2	6	0	-	∞
W9	Commu*nication	1	∞	0	-	2
W10	efficiency	1	∞	0	-	1

Table 1 shows that to organize the process of forming an individual route using machine learning theory, a teacher needs only to form a database of competencies (a list of competencies) that a student can acquire when passing the case.

This method gives to electronic space the following functionality: the interface adapted to the user displays a list of competencies, when one of them is selected, there is a selection of business cases and business games that must be performed to

develop the selected competence; determination of the level of existing competence and the potential for its growth.

If we compare the expert opinion or assessment of this case and the result of that will be displayed in their work the listener, then the matrix relevance of the results will be in the s look as shown in Figures 1, 2.

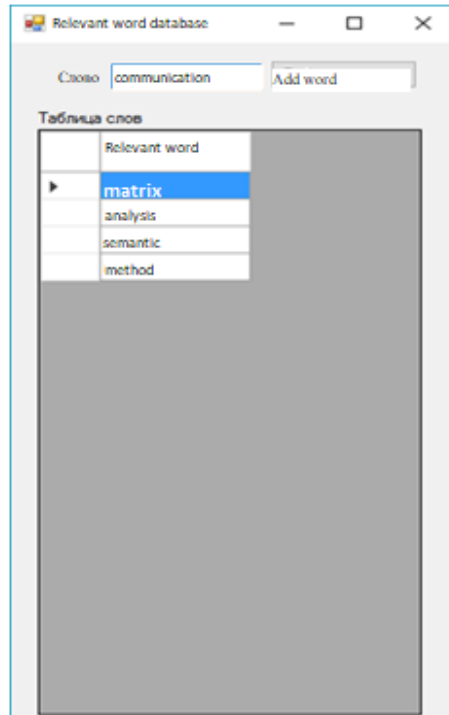


Fig. 1. Relevant word database

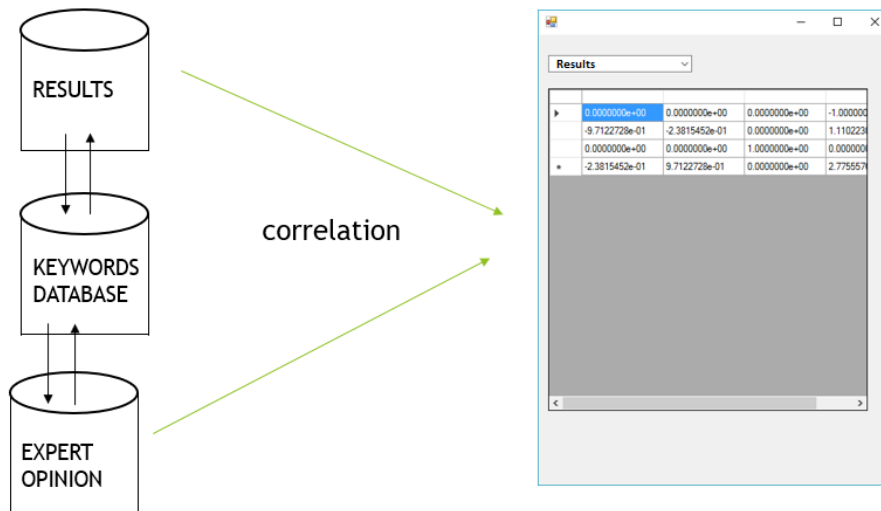


Fig. 2. Matrix matching results

The experiment has shown that the developed diagnostics system works with high accuracy and the ratio of the expert opinion and the listener response is 0.999999. High value of correlation factor means that the student has shown a high positive result when using the case technology.

Many authors in their works offer several technical possibilities with the help of which it is possible to implement the search for cases according to the development of the required competence, for example: the clustering method, the method of the latent semantic algorithm, but it was experimentally revealed that the Template matching method described above gives more clear results. With the advent of opportunities for using information technology methods in pedagogy, it is possible to build a trajectory of individual learning, both for the student himself, and reduce and optimize the teacher's work (presentation of material, diagnostics of knowledge, building communications, creating groups, interactivity).

2.1 Example of Developed Method Affect Assessment for Disabled People Employment

For The developed method, which includes the special database management system and the algorithm of intelligent search for the complex of learning programs allowing software management for the scheme of these aids, as well as user self-learning, is a tool for implementation of the continuous education for disabled people and their employment. The algorithm affect assessment is confirmed by the correlation methods and regression. Let's consider the example of such an algorithm (Figure 3).

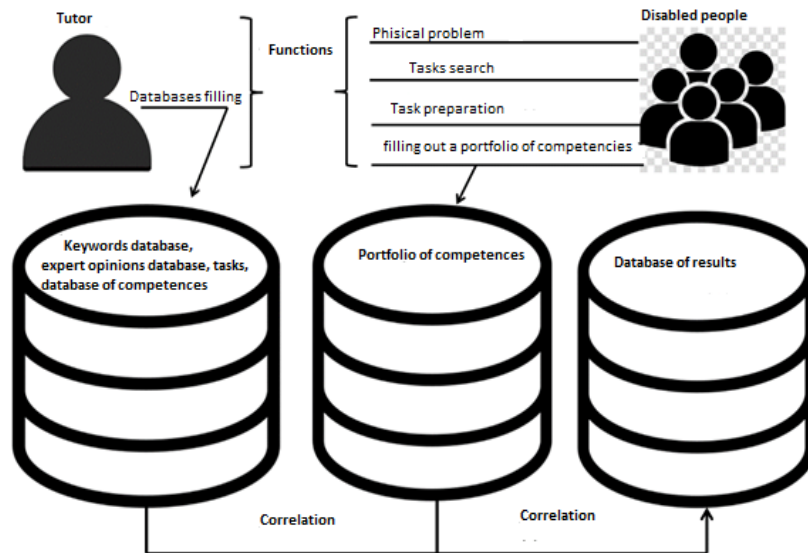


Fig.3. E-learning scheme for disabled people

Figure 3 shows the functions of tutor and disabled people. In order to ensure efficient learning process and improve its skills the tutor shall fill the databases with the materials, expert evaluations for assessment of the results of case and design task and competencies associated with the learning courses. The learning-disabled people shall just fill the portfolio of competencies and select the kind of its disability. The correlation method will select the educational route and the results for independent examination.

3 Conclusion

The algorithm what was proposed provides a search for tasks for the development of a certain competence. The proposed platform using the theory of machine learning and artificial intelligence, in particular, the method combining the use of keywords and matching with templates (Template matching), is largely devoid of drawbacks. In the project activities of students and the use of case technologies by the teacher, this method allows:

- organize the selection of a team for group work in the electronic space;
- to match the project and teams to each other.
- use the competency matrix as a standard for comparing the level of development of competencies after project activities and the use of case technologies;
- set up pedagogical monitoring in the platform in such a way that the student can assess the degree of already existing competence and acquired in the course of the project or case implementation independently.

– to ensure the individualization and personalization of the learning process (optimal methods, forms, and teaching methods, including the organization of project activities of students, the use of the potential of e-learning, etc.) through:

- 1) A large volume of educational material and its availability;
- 2) Variability of formats and forms of presentation of educational content: inclusion of asynchronous elements of e-learning, offering a wide range of types of tasks, etc. The more variations in content management, the more opportunities for students to demonstrate their knowledge and develop the necessary competencies;
- 3) A variety of forms of interactive interaction between subjects of the information and pedagogical platform and elements of electronic educational content;
- 4) Adjustment of the pace of learning and navigation system (structure, design, toolkit): use headings on each web page to organize e-learning content and avoid confusion; providing students with extra time to complete assignments;
- 5) Designing ready-made templates for placing a wide range of material without the need to master a specialized design, both for the listener and the teacher;
- 6) Flexible educational content so that you can use the same educational program for different purposes.

The formation of ICT competencies is becoming critically important for every teacher and student in the field of education. A superficial knowledge of the theory of AI and machine learning will allow solving many pedagogical problems (for example, pedagogical monitoring of project activities and the use of case technologies for self-learning in the context of digital transformation). The study showed that in order to organize work in electronic space using AI and machine learning methods, it is enough for a teacher to be able to:

- to form a competence base according to the discipline assigned to it,
- to upload educational and methodological materials into ready-made templates,
- to form a database of expert assessments to compare learning outcomes using case technologies,
- to use various types of communication tools (wiki, skype, zoom, etc..).

In the field of information technology, there is an imbalance between the requirements of the labour market and the actual training of graduates, which is why it is necessary to change the trajectory and automate many pedagogical processes in order to eliminate the backlog of curricula from the requirements of the labour market. The most suitable solution is to create a unified electronic platform, the database of which has a certain set of competencies that meet the needs of graduates. Thus, an individual educational track is designed. It is for this reason that a lot of online courses have appeared today, in particular massive open online courses (MOOCs), but their design and creation does not speak of the successful implementation and organization of pedagogical monitoring.

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