

Models and Algorithms in The Field of Artificial Intelligence in University Research Projects

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The development of the scientific direction for artificial intelligence necessitates develop of models and algorithms with practical significance for learning in universities. This article describes a research project in this topical field of computer science under the guidance of the author. The project is divided into several tasks. The first task is to develop improved algorithms for the control of mobile robots in the training of students in the course "Artificial Intelligence". The second is related to the experimental study of deployment options system of multimodal interface cycle labs with bachelor's degree in the discipline "Human-computer interfaces." Third task creates automated system for assessing student development by fuzzy sets and models for decision-making.

Keywords: Artificial intelligence, Research project, Robot, An intelligent robot control algorithm, Human-computer interfaces, Fuzzy sets, Automated assessment system

1. Introduction

The actuality Necessary of research project is justified by the continuous development of intelligent computer systems and technologies as well as demand for new and improved forms and methods of teaching students. For this reason the improvement the hardware and software equipment as well as providing adequate training of the students is a necessity. Project envisages construction and efficient use of training facilities for artificial intelligence and related technologies. Research results are implemented and used for creating electronic and WEB-based textbooks and tool systems for automated and remote training and testing (Nenkov,2014, 2015). This supports the expansion of knowledge and skills of the students and their active participation in the learning process. Directions for research are:

- Algorithms for control of mobile robots;
- Intelligent human-computer interfaces;
- Intelligent optimization methods in the training process.

These studies and the results obtained are the basis for building Artificial Intelligence Laboratory.

2. Research problems

The project aims to create and / or improve the algorithms and methods for management of mobile robots (Laurens 2010, 2011), (Nenkov,2015), (Sepulveda,2011), intelligent

human-computer interfaces (Isaac,2012), (DARPA,2002)(Krylov,2008), (Mazadzhiev,2012), interfaces and fuzzy systems for decision making when assessing student development (Baker, 2001), (Bond,2007). Studies have practical and methodological significance for increasing the interest of students and the effectiveness of the training. They are divided into several research tasks:

- The first task is to create a laboratory environment for testing algorithms of AI robots LEGO MINDSTORMS NXT 2.0 and LEGO MINDSTORMS EV3.

The aim of the first task is to improve the existing standard algorithms for mobile robot control (Laurens,2010, 2014) and to testing them on two different models of the series robots Lego Mindstorms (Nenkov, 2015).

As a result of the systematic exploration of WEB-sources and literature on this subject information on the topic of the study is updated (Krylov, 2008), (Laurens, 2014), (Nenkov, 2013, 2014, 2015). The existing standard algorithms and their ability to adapt to the training of students in the course "Artificial Intelligence" or "Robots" are analysed. Offered practical implementation of case studies of theoretical learning on programming Algorithms movements and using of sensors for robots series LEGO MINDSTORMS. A detailed ontology of the subject area of programming robots series LEGO is offered (Laurens, 2014). It has been experimented with modified algorithms for two different models robots: LEGO MINDSTORMS NXT 2.0 (Laurens,

2010) and LEGO MINDSTORMS EV3 (Laurens, 2014).

The comparison of the test results prove the possibility of practical implementation in the students' training the interest and the attention of the educators increase in.

- The second task of the project is associated with the study of multimodal interface as an innovative component in the practical training.

Studies on the topic and the comparative analysis of the models used in the reference books show the current state of these research (DARPA, 2002), (Isaac, 2012), (Krylov, 2008), (Mazadzhiev, 2012). Done was an experimental study on the implementation of "Man – machine systems" in the practical training of the laboratory exercises has been conducted. Subject students in the „Computers science" exercises has been conducted at the Faculty of Mathematics and Informatics at the University of Shumen discipline "Human-computer interfaces." The analysis of the statistics obtained from the experiment with the students helped to optimize the content of the training units in the curriculum regarding the logical sequence, duration and relieving stress. The results were used to thematic module "Man – machine systems" as a part of the guide for conducting laboratory exercises in the course "Human-computer interaction" (DARPA, 2002), (Isaac, 2012), (Mazadzhiev, 2012). In conclusion the visual and practical elements of the training make it more effective, and attractive and improve classes and achieved results.

- The third task is the development of intelligent methods for optimizing the learning process.

After researching the literature on the subject and the Internet sources (Baker, 2001), (Bond, 2007) a comparative analysis of technologies, methods and algorithms for the evaluation of exchange projects and diploma theses has been conducted. The analysing reveals that there multiple approaches to solving problems largely connected with the correct selection of topics (Petrova 2006, 2008) and principles for objective assessments of student achievement. The project offers modified models that contribute to solving these important tasks of university education.

At the formalization of this type of the fuzzy sets theory (Baker, 2001) the dichotomous model of D.

Rash (1 Parametric Logistic Latent Trait Model - 1PL) (Bond, 2007) and the parameters model of A. Birnbaum (2PL).

An assessment is applied to the proximity of the fuzzy and probabilistic models to the linguistic model for decision making in assessment and graduation theses. A software package for automation of the evaluation of exchange projects and diploma theses at the university has been developed. The same is applied in testing the developed software applications for e-learning system, Faculty of Mathematics and Computer Science, Shumen University.

The results proved that the chosen approaches are effective and can contribute to the improvement of this important component of student learning. This would help greatly to change confidence and positive attitude towards courses that are organized in this way.

3. Conclusion

The results of the research project are probated through the testing of practical developments in a real learning environment and are embedded in the curricula of the of the "Bachelor" degree in "Computer Science", "Economic Informatics", "Computer Information Technologies" and master's programs "Multimedia technologies" and "Software Engineering" at the Faculty of mathematics and Informatics at Shumen University "Episkop Konstantin Preslavsky" and „Synthesis and Analysis of Algorithms“, „Searching for information in the database“, „Software Practical exercises“ at University of Agribusiness and Rural Development.

In particular, the results have been implemented into the practice of training: Artificial Intelligence Languages for functional and logic programming, Informatics, Expert Systems (Nenkov, 2006, 2013), Programming, Programming office systems, object-oriented programming, and human-computer interfaces.

The development of the project will be continued with a new research, development and implementation in practical exercises of broader range of courses in this scientific field.

Interesting perspective opens for organizing the training in the field of computational linguist and applied aspects of artificial intelligence and other fields of universities such as the humanities.

The author pays special attention to attracting students and PhD students in the realization of the goals set for the project, which will increase the interest and learning achievements.

References

- Baker F.B. (2001). *The Basics of Item Response Theory*. 2 ed. Heinemann. Portsmouth. New Hampshire. <http://edres.org/irt/baker/final.pdf>
- Bond T.G, James Cook. (2007). *Applying the Rasch Model. Fundamental Measurement in the Human Sciences*.
- DARPA to Support Development of Human Brain-Machine Interfaces.(2002). <http://www.sciencedaily.com/releases/2002/08/020820071329.htm#>
- Isaac Leung. (2012). Game changer opening access to the brain.<http://www.electronicnews.com.au/features/game-changer-opening-access-to-the-brain>
- Krylov. (2008). OCZ NIA - managed computers by thought!<http://www.3dnews.ru/peripheral/ocz-nia>
- Laurens Valk. (2010). *The LEGO MINDSTORMS NXT 2.0 Discovery Book*. ISBN: 978-1593272111.
- Laurens Valk. (2014). *The LEGO MINDSTORMS EV3 Discovery Book: A Beginner's Guide to Building and Programming Robots*. ISBN-13: 978-1593275327.
- Mazadzhiev D. (2012). Mobile information systems support - priorities and innovations in warfare magazine. CIO. ICT Defence. July. 2012.Issue 7. ISSN 13112-5605
- Nenkov N.V. (2006). *Expert systems*. University Publishing House "K. Preslavsky". Shumen. ISBN-10: 978-954-577-383-9.
- Nenkov N.V. (2013). *Artificial intelligence and Expert systems*. ISBN 978-954-577-695-3. University Publishing House "K. Preslavsky". <http://cdo.shu.bg/course/view.php?id=213>.
- Nenkov N.V. (2015). *Software environment to teach programming of robots. Computer modelling and new Technologies 2015 19(D4)*. 20-24. ISSN 1407-5806. ISSN: 1407-5814. Riga. Latvia. (On-line: www.cmnt.lv)
- Nenkov N.V, Spasova E.Z. (2016). Implementation of a neural network using simulator and Petri nets, (IJACSA) *International Journal of Advanced Computer Science and Applications*, Vol. 7, No. 1, 2016,(in print)
- Petrova M.M (2008). *Software Tools for Project Management Bulgaria in EU: first results*. ERI. Bulgarian Academia of sciences. Faculty of Economic UVT, GorexPress, pp. 355-363
- Petrova M (2006). *Implanting the information and communication technologies in the bulgarian education - reality and perspectives*. VI ISC "Science and education" Belovo, Kemerovo State University, March 2-3, 2006 CH1, pp..514-517
- Sepulveda F. (2011). *Brain-actuated Control of Robot Navigation*. URL: <http://www.intechopen.com/books>
- Stefanov, T. *System for Information Extraction from News sites, Mathematical and Software Engineering*, Vol. 1, No. 1 (2015), p. 25-30, ISSN: 2367-7449, URL: <http://varepsilon.com/index.php/mse/article/view/8>