
ANNOTATIONS OF THE PUBLICATIONS INCLUDED IN THE DOCUMENTS FOR THE PROCEDURE

1. Tabakova-Komsalova, V., Glushkova, T., Grancharova-Hristova, M., Krasteva, I., LEARNING TASKS IN ARTIFICIAL INTELLIGENCE EDUCATION, Educations and Technologies, VOL. 11/2020, ISSUE 1, ISSN 1314-1791 (PRINT), ISSN 2535-1214 (ONLINE), pp. 15-22,2020, pp.233-240, Crossref, DOI: http://www.edutechjournal.org/?page_id=1992&lang=en, <http://doi.org/10.26883/2010.201.2292>

Modern trends in the development of digital technologies are directly related to Artificial Intelligence and its application in all spheres of life. This determines the need to study this discipline not only in universities but also in schools. In the last few years, various schools in Bulgaria have introduced the study of elements of Artificial Intelligence as an innovation in specialized, professional and innovative schools, as well as in clubs of interest. The Ministry of Education and Science has approved a sample curriculum. Textbooks and teaching aids are being created. The report aims to present a classification of learning tasks in artificial intelligence training in different levels and forms of training. Some basic key examples will be considered, through which the basic concepts and rules in classical artificial intelligence are introduced, related to both the basic algorithms for solving problems through search and the presentation of knowledge through logical rules. The authors will share their experience in the study of Artificial Intelligence and will present some opportunities to increase the effectiveness of training.

2. Stoyanov, S., Glushkova, T., Grancharova-Hristova, M., Tabakova-Komsalova, V., Guidelines, Ideas and approaches for AI education in school. Knowledge structuring and semantic modelling, Education and Technologies, vol.12, issue 1, 100-102, ISSN 1314-1791, 2021, <http://doi.org/10.26883/2010.211.3216>

The strategic documents at European and national level set as a main goal for education the introduction of elements of artificial intelligence in the various educational levels and forms of training in a way appropriate for the learners. In the last two years, experimental training in artificial intelligence in high school has been implemented in Bulgaria. The report examines some problems and challenges in organizing and conducting this training in different types of schools, specialties and classes. Some guidelines are outlined and ideas for creating an appropriate curriculum and learning resources in the field of knowledge structuring and semantic modelling are shared. An approach to teacher and student training is proposed. The authors share their experience in teaching teachers and students and analyse the results of surveys and tests.

3. Tabakova-Komsalova, V., Glushkova, T., Krasteva, I., Some results and analyzes from the teaching of artificial intelligence in high school, Education and Technologies, vol.12, issue 1, 100-102, ISSN 1314-1791, 2021, <http://doi.org/10.26883/2010.211.3206>

In the last few years, various schools in Bulgaria have introduced the study of elements

of artificial intelligence as an innovation in specialized, professional and innovative classes, as well as in schools and clubs of interest. During this school year in Plovdiv district two schools introduced the study of artificial intelligence as an optional module in the profiled preparation of the profile „Software and Hardware Sciences“: High School „St. St. Cyril and Methodius,- Asenovgrad and High School“ Prof. Dr. Asen Zlatarov “- town of Parvomay. The training in these schools is conducted according to the curriculum approved by the Ministry of Education and Science, using the developed textbooks on the first topic „Solving problems through search“. The article presents some results and makes an analysis of the conducted training and the conducted test and survey. Conclusions and approaches for improving training are proposed.

4. Grancharova-Hristova M.T., Moraliyska N.S., Rusev K.N., Ivanova V.A., Tabakova-Komsalova V.V. Application of ontologies and digital libraries in school education. Informatics and education. 2021;(10):15-20. <https://doi.org/10.32517/0234-0453-2021-36-10-15-20>

The article discusses the application of digital libraries, including a network of ontologies and structured databases, in the education of students in secondary schools. The multi-agent platform of VES (the Virtual Educational Space) is presented, based on the reference architecture of ViPS (the Virtual Physical Space), which is being developed in the DeLC (the Distributed e-Learning Center) laboratory of the University of Plovdiv “Paisii Hilendarski”. The information and data in VES are supported by a hybrid structure of ontologies and databases, as the designed services are supported by intelligent agents and personal assistants. Through the interaction between these intelligent components, some functionalities are modeled such as conducting virtual excursions in the teaching of various school subjects, automatic generation of tests and surveys, development of project tasks, game-based training, etc.

5. Tabakova-Komsalova, V., Stoyanov, S., A Diagnostic Expert System Supported by the ZEMELA platform, 3rd International Scientific Conference "Artificial Intelligence and E-Leadership", (AIEL'2021), JOURNAL OF INFORMATICS AND INNOVATIVE TECHNOLOGIES, p.23, ISSN 2682 – 9517 (Print), ISSN 2683-0930 (Online), <https://journal.iiit.bg/wp-content/uploads/2021/12/br4-2021-min.pdf>

Currently, intelligent agriculture is becoming an increasingly attractive field of theoretical research and practical projects. This paper presents a platform for smart agriculture known as ZEMELA. Furthermore, an expert system for diagnosis of ruminant poisoning, which demonstrates the capabilities of the platform, is briefly described.

6. Stanimir Stoyanov, Todorka Glushkova, Veneta Tabakova-Komsalova, Vanya Ivanova, Asya Stoyanova-Doycheva, Alexandar Petrov. (2021). Integrated Domain in Support of Game-Based Learning in School Education. The Educational Review, USA, 5(11), 434-446, DOI: <http://dx.doi.org/10.26855/er.2021.11.004>, ISSN Print : 2575-7938, ISSN Online : 2575-7946

Educators are looking for more and more interesting and attractive forms of e-learning, especially in times like the current crisis related to the COVID-19 pan-demic. Most universities and secondary schools use e-learning environments and develop teaching materials. It would be interesting to share them in a single so-called integrated domain. This article presents a platform known as ViTOS supporting game-based learning in an integrated educational domain that includes university education and training in STEM centers of the secondary school. The front-end and the back-end components of the platform are also described. Furthermore, a personal assistant conducting the running

of the games is presented as well. The use of the platform is demonstrated by two examples from two different domains—smart city and smart agriculture. The games are conducted for real education in a school STEM center and in a university e-learning environment. Ideas for future improvements are also presented.

7. Tabakova-Komsalova, V., Stoyanov, S., Doukovska L., TWO-YEAR ARTIFICIAL INTELLIGENCE TEACHING IN THE SECONDARY SCHOOL, Education and Technologies, 2022, vol.13, issue 1, pp.165-170, ISSN 1314-1791 (print), ISSN 2535-1214 (online), DOI: <https://doi.org/10.26883/2010.221.4198>

For two years, due to the rapid development of digital technologies in the Bulgarian school, the teaching of artificial intelligence began. The article summarizes the two-year experience of the authors in supporting the teaching of artificial intelligence in high school. In Plovdiv district, two schools conduct training as an optional module in the specialized preparation of the profile „Software and Hardware Sciences“. These two schools conduct training on developed textbooks in 11th and 12th grade, respectively: „Solving problems by searching“ and „Presenting knowledge through logic“. Logical programming.

Based on the observations on AI training, the article analyzes the learning outcomes, shares the experience in applying this training and draws conclusions. The results of the conducted survey and test studies are summarized.

8. Tabakova-Komsalova, V., Stoyanov, S., Doukovska L., DIGITAL BULGARIA IN PROLOG PROJECT, Education and Technologies, 2022, Vol.13, issue 1, pp. 171-176, ISSN 1314-1791 (print), ISSN 2535-1214 (online), DOI: <https://doi.org/10.26883/2010.221.4202>

2022 marks the 50th anniversary of the logic programming language Prolog. In this regard, the authors received an invitation from the creator of the language – Robert Kowalski, to participate in a multi-year international initiative known as „The virtual Prolog ‘School Bus’ activity“. The initiative aims to acquaint students mainly with logical programming and Artificial Intelligence through the Prolog language. The article presents an idea for a project called „Digital Bulgaria in Prolog“, which was confirmed as part of the above international initiative. Furthermore, the structure of the project and the possibilities for involving students from Bulgarian schools are discussed. The main topics of the project, such as Bulgarian cultural-historical heritage, folklore, history, geography, language, literature, etc., are also presented. Some examples demonstrating the application of logic programming to implement knowledge repositories and suitable inference engines, regardless of the subject, are presented as well.

9. Todorka Glushkova, Stanimir Stoyanov, Sava Grozdev, Veneta Tabakova-Komsalova, APPROACHES, IDEAS AND SHARED EXPERIENCE IN ARTIFICIAL INTELLIGENCE TRAINING IN SCHOOL, Mathematics+, no. 4, ed. Archimedes, 2022, pp. 71-76, ISSN 2603-4964 (online), ISSN 0861-8321 (book version).

The article shares the authors' experience of teaching students, students and teachers in the field of Artificial Intelligence (AI). The conclusions drawn are in direct connection with the research under the European project FACILITATE-AI.

10. Veneta Tabakova-Komsalova, Ivan Stoyanov, Tsvetomira Ivanova, Radoy Doukovski, INTRODUCING ARTIFICIAL INTELLIGENCE TO THE MIDDLE SCHOOL THROUGH THE LOGIC PROGRAMMING LANGUAGE PROLOG, Education and Technologies,

2023, vol.14, issue 1, pp.186-192, ISSN 1314-1791 (print), ISSN 2535-1214 (online), DOI: DOI: <https://doi.org/10.26883/2010.231.5063>

The article presents the results and practical experience of the introduction of Artificial Intelligence training in secondary school. The initial stage and the current state of the introduction of experimental learning in two Bulgarian schools are discussed. Our experience in teaching students in different forms of learning and different age groups is presented, as well as the joint teaching of teachers and students. Particular attention is paid to logic programming using the Prolog language. The chronology of our approach is examined, with the introduction of Artificial Intelligence in education presented in three stages – beginning, current state and future intentions. We consider the three-year period to be sufficient for approbation of the curriculum, the used methodology and teaching materials. An original approach to the training of teachers and students is proposed. A summary analysis of the learning outcomes is presented in an appropriate form. Based on the accumulated experience, a critical analysis of the used approaches and teaching aids was made. Conclusions were made for continuing the study with students and improving the methods, approaches and teaching materials.

11. Veneta Tabakova-Komsalova, Atanas Dukovski, Laska Kostadinova-Tsankova, Magdalena Maglizhanova, ARTIFICIAL INTELLIGENCE AND LOGIC PROGRAMMING IN STEM EDUCATION, Education and Technologies, 2023, vol.14, issue 1, pp.193-199, ISSN 1314-1791 (print), ISSN 2535-1214 (online), DOI: <https://doi.org/10.26883/2010.231.5069>

In this article, the authors present one possibility for introducing artificial intelligence training, specifically Prolog logic programming, into the secondary school. The choice of Prolog logic programming as an appropriate artificial intelligence topic for secondary school study is motivated. The training is planned to take place within the school's STEM centres. The introduction is carried out through the training of science, mathematics and informatics teachers for the subsequent training of students in the school's STEM centres. The authors describe the structure and content of the curriculum created. The first results of the implementation of this program in teacher training are presented. One of the goals is to create a network of STEM centres offering training in artificial intelligence. The preferred form is project-based learning and multidisciplinary lessons. For the better organization of this training, a project called „Digital Bulgaria in Prolog“ has been proposed. The content of the project is demonstrated with a selected concrete example. Within this project, during the training courses, training resources are created that can be used by the participants of the network. Our experience shows that such organized training stimulates the teamwork of teachers from different specialties.

12. Tsanko Gechev; Petar Kazakov; Asia Ivanova; Tsvetomira Ivanova; Marina Mircheva; Vasil Kolev; Daniela Ganeva; Veneta Tabakova-Komsalova; Margarita Ruseva; Elitsa Kantardjieva et al., Establishment and development of the Center of Plant Systems Biology and Biotechnology in Plovdiv, Bulgaria, Open Research Europe, 2023-09-07 | Journal article, DOI: 10.12688/openreseurope.16514, <https://open-research-europe.ec.europa.eu/articles/3-140>

The Bulgarian research landscape, presented mainly by the research institutes that are part of the Bulgarian Academy of Sciences and the Agricultural Academy, needs diversification to match the research and innovation potential of the other European Union (EU) countries. This article describes the establishment of the Center of Plant

Systems Biology and Biotechnology (CPSBB), a new innovative type of independent research organization that is changing the research landscape in Bulgaria. Supported by the EU Commission, Bulgarian Government, and Plovdiv Municipality, CPSBB has quickly become the leading plant science institute in Bulgaria, creating knowledge in diverse fields such as bioinformatics, biotechnology, genetics and genomics, metabolomics, and systems biology. We outline the organizational structure of CPSBB, the development of its infrastructure, and its scientific productivity. Finally, we compare CPSBB with other similar research establishments in Europe and we conclude that such new types of institutes have a bright future in Bulgaria due to their operational flexibility, productivity, and connections with academia and industry.

Scopus / WoS

13. Stoyanov, Stanimir, Todorka Glushkova, Veneta Tabakova-Komsalova, Asya Stoyanova-Doycheva, Vanya Ivanova, and Lyubka Doukovska. 2022. "Integration of STEM Centers in a Virtual Education Space" *Mathematics* 10, no. 5: 744. <https://doi.org/10.3390/math10050744> , IF- 2.258, CiteScore 2020- 2.2, SJR 2020- 0.495, SNIP 2020-1.290, Q1 WoS

Training in STEM centers is becoming increasingly relevant in order to meet the new educational needs caused mainly by the rapid speed with which new technologies have been entering our lives in recent years. Existing university e-learning systems can enhance the capacity of these centers by providing shared learning material. This paper presents a distributed educational platform that supports sharable usage of teaching material at university and in STEM centers in secondary schools. The architecture of the platform is also presented including two basic components. The university e-learning environment operates as a back-end and the front-end component is located in the STEM center. Furthermore, the implemented prototype of the platform is also discussed in the article. The use of the platform is demonstrated by two educational games. The platform is expanded with four educational robots to increase the attractiveness of the educational process.

14. Cheresharov, S., Hristov, H., Tabakova-Komsalova , V., & Naneva, V. (2022). Hierarchical Learning Management System for the Insurance Industry. *International Journal of Emerging Technologies in Learning (iJET)*, 17(21), pp. 123–134. <https://doi.org/10.3991/ijet.v17i21.33595> (SCOPUS) Q2

This paper describes a model of a Hierarchical Learning Management System (HLMS) for the insurance industry. The problem is that LMSs are widely used, but not suitable for each educational environment and domain. The existing LMSs are with the general purpose and do not reflect the specific needs of different domains. The proposed LMS is a specific hierarchic system specially created for the insurance industry. The model uses a hierarchic approach to share, organize and present the learning content. It allows for building an LMS specific for the insurance industry which is reliable, efficient, fast, and easy to use by the insurance professionals.

15. Glushkova, T., Stoyanov, S., Tabakova-Komsalova, V., Grancharova-Hristova, M., Krasteva, I., An Approach to Teaching Artificial Intelligence in School, *Innovative Educational Technologies, Tools and Methods for E-learning Scientific Editor Eugenia Smyrnova-Trybulska "E-learning"*, 12, Katowice–Cieszyn 2020, pp. 257–267, DOI: 10.34916/el.2020.12.22 , Published: 2021-10-24, WoS (без Q) Published: 2021-10-24, <https://us.edu.pl/wydzial/wsne/wp-content/uploads/sites/20/Nieprzypisane/el-2020-12->

New realities in the digital age determine the comprehensive and rapid penetration of artificial intelligence in all areas of contemporary life. The article motivates the need to introduce the discipline "Artificial Intelligence" in high school and proposes an approach to the practical realization of this training. The possibility for development of a possible curriculum, selection and structuring of appropriate educational content, classification and creation of a package of learning tasks on the separate topics and sections in the curriculum are discussed. Opportunities are offered for the implementation of links with other school subjects, as well as with the everyday life of students. In the last two years, AI has been studied in various forms by more than 200 students from several experimental schools. The interest and motivation of students is constantly growing. Based on the experience gained and the results obtained, we can say that the discipline of AI can be successfully introduced in different degree, in different forms and in different volumes in the school education in Bulgaria.

Conference publications and books (or book chapters)

1. Veneta Tabakova-Komsalova, Todorka Glushkova, PROJECT LEARNING – EVALUATION OF THE ACHIEVEMENTS OF STUDENTS BY COMPUTER MODELING IN 4-TH GRADE, Collection of scientific papers from the Scientific Conference "Innovative ICT in scientific research and education: mathematics, informatics and information technologies", 29-30.11.2018, Pamporovo, University Publishing House "Paisiy Hilendarski", 2019 г., ISBN 978-619-202-439-0, <https://fmi-plovdiv.org/GetResource?id=3193>

The article examines issues related to the evaluation of the achievements of the students in computer modeling in IV grade of the Bulgarian school. Systematisation of the competencies that can be assessed during project work is done. Criteria for assessing knowledge, skills and different competencies are proposed. Practical assessment of the teacher is presented with a model of a performance evaluation card as well as a diagram for the analysis of the results obtained from the completed check form.

2. Glushkova, T. ., & Tabakova-Komsalova, V. . (2021). AN APPROACH FOR DEVELOPMENT AND APPLICATION OF CPSS- EDUCATIONAL ENVIRONMENTS IN BULGARIAN SCHOOL. Proceedings of CBU in Natural Sciences and ICT, 2, 20-26. <https://doi.org/10.12955/pns.v2.148>

Modern realities in the era of Industry 4.0 and the global Covid-19 pandemic place new challenges to education. It is a fact that classical learning, supported by modern information and communication technologies, provides an effective learning process, but the Covid-19 realities require a rapid transition to distance absentee learning. The use of computer-based training systems and cloud platforms has its advantages, but also problems related to the low level of personalization of the learning process and the adaptability of the learning content to the specific characteristics of each student. Cyber-physical and social systems (CPSS) largely solve the problems associated with integrating processes and interactions in the virtual world with the dynamically changing conditions of the physical world in which learning occurs. This gives grounds to draw the attention of specialists to the creation of CPSS educational platforms for secondary school. Following this approach, we created a prototype of ь CPSS educational space called BLISS. The results of the test application of this platform in

the school environment give us reason to believe that if we put the learner with his/her peculiarities, goals, and interests at the center of such a system, and present him/her in the virtual space through his / her personal assistant, we could significantly increase the interactivity of the learning process and the adaptability of the offered learning content.

3. Todorka Glushkova, Veneta Tabakova-Komsalova, SOME ASPECTS OF APPLICATION OF ARTIFICIAL INTELLIGENCE IN SCHOOL EDUCATION, MATHEMATICS AND MATHEMATICS EDUCATION, 2021, Proceedings of the Fiftieth Spring Conference of the Union of Bulgarian Mathematicians, 2021, http://www.math.bas.bg/smb/2021_PK/tom_2021/pdf/245-251.pdf, ISSN 1313-3330

The paper presents two areas for the application of artificial intelligence in school education – the study of the basic methods, aspects and algorithms of AI and the use of intelligent educational environments in school practice. Two approaches for the implementation of the first direction are described – formal study of AI and acquaintance of students with the applications and capabilities of AI. The authors share their experience from experimental training in various specialized, innovative and professional classes, as well as in interest clubs.

4. Ivan Stoyanov, Lubka Dukovska, Veneta Tabakova-Komsalova, Vladimir Monov, PERSONAL ASSISTANT FOR AGRICULTURISTS, National scientific conference TechCo-2022, Lovech, collection of reports, 85-92, ISSN 2535-079X, <https://tugab.bg/images/tk-lovech/Techco-Lovech-22.pdf>

This article presents a personal assistant known as Jitco. The personal assistant build the core of a platform implemented to support intelligent agriculture. Unlike the general-purpose personal assistants our personal assistant is specialized in supporting farmers and operators of intelligent agricultural systems. Some implementation details are also given in this paper. The operation of the personal assistant is demonstrated by a small example.

5. Veneta Tabakova-Komsalova, Stanimir Stoyanov, Lubka Dukovska, Vladimir Monov, DIAGNOSTIC EXPERT SYSTEMS FOR INTELLIGENT AGRICULTURE, National scientific conference TechCo-2022, Lovech, collection of reports, стр. 93 – 99, ISSN 2535-079X, <https://tugab.bg/images/tk-lovech/Techco-Lovech-22.pdf>

In this paper, a reference architecture of an expert system is presented. An expert system is a computer program that simulates the judgment and behaviour of a person with expert knowledge and experience in a particular field. The basic components of the architecture are also briefly presented. Furthermore, the adaptation of the reference expert system for the diagnosis of poisoning in farm animals is described. The work of the diagnostic expert system is demonstrated by a specific case. The Flex 8000 development environment was chosen for the development of the presented expert system.

6. Tabakova-Komsalova, V., S. Stoyanov & L. Doukovska, L., Digital Bulgaria in Prolog project, VI International conference “Informatization of Education and E-Learning Methodology: Digital Technologies in Education”, Noskov, M. editor, ,pp.459-463, UDC 528.8.04, 373.1, <https://conf.sfu-kras.ru/DTE-2022/proceedings>

2022 marks the 50th anniversary of the logic programming language Prolog. In this regard, the authors received an invitation from the creator of the language – Robert

Kowalski, to participate in a multi-year international initiative known as “The virtual Prolog ‘School Bus’ activity”. The initiative aims to acquaint students mainly with logical programming and Artificial Intelligence through the Prolog language.

The article presents an idea for a project called “Digital Bulgaria in Prolog issue 3”, which was

confirmed as part of the above international initiative. Furthermore, the structure of the project and the possibilities for involving students from Bulgarian schools are discussed. The main topics of the project, such as Bulgarian cultural-historical heritage, folklore, history, geography, language, literature, etc., are also presented. Some examples demonstrating the application of logic programming to implement knowledge repositories and suitable inference engines, regardless of the subject, are presented as well.

7. Veneta V. Tabakova-Komsalova, Stanimir N. Stoyanov, Todorka A. Glushkova, Sava I. Grozdev, AI TRAINING IN SCHOOL – APPROACHES, RESULTS AND CONCLUSIONS, VI International scientific conference, “Informatization of education and e-learning methods: digital technologies in education”, 2022, issue 3, pp.464-468, r. Krasnoyarsk, Russia,, <https://conf.sfu-kras.ru/DTE-2022/proceedings>

Trends in modern development determine the need for training in the field of artificial intelligence already at school. In recent years, experimental training in artificial intelligence (AI) has been implemented in school education in Bulgaria. The report examines some aspects of the organization of this training. An analysis of the results of the conducted experimental training is presented and some conclusions and directions for future development are offered.

8. Veneta Tabakova-Komsalova, Asya Stoyanova-Doycheva, Lyubka Doukovska, Stanimir Stoyanov, THE PROJECT „DIGITAL BULGARIA IN PROLOG”, International Scientific Conference “Informatics, Mathematics, Education and Their Applications”, IMEA’2022, 23-25 November 2022, Pamporovo, Bulgaria, pp. 213-222, <http://fmi-plovdiv.org/index.jsp?ln=1&id=4397>

This paper presents a project aiming to support the introducing the artificial intelligence study in the secondary school. Special attention is paid to logic programming by the Prolog language. The project is part of the global initiative “Prolog Education and Thinking”, proposed by the creator of the Prolog language Prof. Robert Kowalski. The idea, main goals and structure of the project as well as the first results of its implementation are also presented.

9. Veneta Tabakova-Komsalova, Stanimir Stoyanov, Asya Stoyanova-Doycheva, Lyubka Doukovska, Diagnostic expert systems for intelligent agriculture, International Scientific Conference “Informatics, Mathematics, Education and Their Applications”, IMEA’2022, 23-25 November 2022, Pamporovo, Bulgaria, pp. 232 , <http://fmi-plovdiv.org/index.jsp?ln=1&id=4397>

This article provides a definition, purpose and general architecture of diagnostics expert systems. A possible technology for implementing such type of knowledge-based systems is considered. The main components of a reference architecture of diagnostic expert systems are discussed in detail. Two specific diagnostic systems under development are presented. Both systems are designed for use in smart agriculture applications.

10. Laska Kostadinova-Tzankova, Stanimir Stoyanov, Asya Stoyanova-Doycheva, Veneta

Tabakova-Komsalova, Model and architecture of a supply chain, International Scientific Conference “Informatics, Mathematics, Education and Their Applications”, IMEA’2022, 23-25 November 2022, Pamporovo, Bulgaria, pp.165-173, <http://fmi-plovdiv.org/index.jsp?ln=1&id=4397>

This paper presents the first research results for the development of a supply chain management model. Some definitions (of the vast number that exist) of a supply chain are referenced and a new definition of our own is proposed. A short review of existing models and solutions of such chains is presented. The individual stages of a supply chain are also discussed in this article. Furthermore, an approach for modelling and its prototype implementation for intelligent supply chain management are proposed. The prototype will be developed as an upgrade to the ZEMELA smart farming platform.

11. Stanimir Stoyanov, Ivan Stoyanov, Veneta Tabakova-Komsalova, Creation and application of an event model, International Scientific Conference “Informatics, Mathematics, Education and Their Applications”, IMEA’2022, 23-25 November 2022, Pamporovo, Bulgaria, pp. 243-251, <http://fmi-plovdiv.org/index.jsp?ln=1&id=4397>

This paper discusses a model for presenting and working with events. The model is intended to serve as a theoretical foundation of cyberphysical- social systems. The general approach, necessity and applicability of such models are also discussed. Furthermore, a general characteristic of models and the possible operations with events are described in the article. Two classifications of events are also given, which play an essential role in adapting the model for various applications. The usability of the model is demonstrated by its adaptation to a smart farming platform known as ZEMELA.

12. Tabakova-Komsalova Veneta V., Stoyanov Stanimir N. Introducing artificial intelligence in STEM education., VII International Scientific Conference, “Informatization of education and e-learning methods: digital technologies in education”, 2023, pp. 113-117, Krasnoyarsk, Russia, ISBN 978-5-00102-654-9, file:///C:/Users/veni_/Downloads/materialy%207%20konferencii%202023.pdf

The article describes an approach to introduce artificial intelligence through STEM education in the Bulgarian school. The introduction is carried out through the training of science, mathematics and informatics teachers for the subsequent training of students in the schools STEM centres. The authors describe the structure and content of the study material. The article presents the first results of the implementation of this program. Guidelines, ideas and approaches for introducing artificial intelligence and logic programming through training in STEM centres are defined. One of the goals is to create a network of STEM centres offering training in artificial intelligence.

13. Stoyanov Stanimir N., Tabakova-Komsalova Veneta V. Project Digital Bulgaria in Prolog by examples, VII International Scientific Conference, “Informatization of education and e-learning methods: digital technologies in education”, 2023, pp. 1440-1444, Krasnoyarsk, Russia, ISBN 978-5-00102-654-9, file:///C:/Users/veni_/Downloads/materialy%207%20konferencii%202023.pdf

This paper presents the results of the implementation of the project “Digital Bulgaria in Prolog” for the last one year. The project aims to support project-oriented learning in the STEM centres of secondary schools. The content of the project is demonstrated by two selected examples.

Scopus/WoS

14. Tabakova-Komsalova, V., Glushkova, T., Krasteva, I., Stoyanov, S. AI training – approaches, results, analyses and conclusions, E-learning in the Time of COVID-19 Scientific Editor Eugenia Smyrnova-Trybulska “E-learning”, 13, Katowice–Cieszyn 2021, pp. 176–186 <https://doi.org/10.34916/el.2021.13.15> – WoS

The development of the digital society is directly related to the training and use of algorithms and concepts of artificial intelligence. Packages of strategic documents have been developed at European and national level, which set as a main goal for education the introduction of elements of artificial intelligence in different educational levels and forms of education. In recent years, experimental training in artificial intelligence (AI) has been applied in school education in Bulgaria. New approaches are also applied in the training of computer science students. The report addresses some issues and challenges in organizing and conducting this training. Some guidelines and approaches for creating an appropriate curriculum in the field of knowledge structuring and semantic modelling are outlined. As a result of the conducted experimental training, it was established that this subject can be successfully studied in secondary school.

15. S. Stoyanov, A. Stoyanova-Doycheva, V. Ivanova, V. Tabakova-Komsalova, V. Monov and Z. Radeva, "An Event Model for Smart Agriculture," 2021, IEEE International Conference Automatics and Informatics, ICAI'21, 30 September-2 October 2021, Varna, Bulgaria, IEEE Xplore, DOI:10.1109/ICAI52893.2021.9639710 , 314-317. (SCOPUS), <https://ieeexplore.ieee.org/document/9639710>

Events are a very important aspect of building cyber-physical systems. The article discusses an event model that is integrated into a reference architecture for cyber-physical applications. In addition, an adaptation of the event model is presented for use in intelligent agriculture. Two versions of an interpreter of event models are also discussed.

16. A. Stoyanova-Doycheva, V. Ivanova, L. Doukovska, V. Tabakova, I. Radeva and S. Danailova, "Architecture of a Knowledge Base in Smart Crop Production," 2021 International Conference Automatics and Informatics (ICAI), 2021, pp. 305-309, doi: 10.1109/ICAI52893.2021.9639874, <https://ieeexplore.ieee.org/document/9639874> , (SCOPUS)

The article presents an architecture of a knowledge base in the field of intelligent plant agriculture. The proposed architecture includes three layers – an ontology layer to represent common knowledge in the domain, a database layer for dynamic data from various measurements of evaluation characteristics and plant influencing factors, and an application layer consisting of intelligent components for connection between the two layers of knowledge.

17. V. Tabakova-Komsalova, L. Doukovska, I. Stoyanov, J. Todorov, S. Stoyanov and Z. Radeva, "ViSMod – An Environment for Modeling of Scenarios and Processes in Intelligent Agriculture," 2021 Big Data, Knowledge and Control Systems Engineering (BdKCSE), 2021, pp. 1-6, doi: 10.1109/BdKCSE53180.2021.9627313, <https://ieeexplore.ieee.org/document/9627313> (WoS)

In this paper, an environment for modelling scenarios and processes in intelligent agriculture settings, known as ViSMod, is presented. ViSMod is developed as an expert system the architecture of which is also given in the article. The use of the environment is demonstrated by an example - a system for diagnosing possible poisoning of ruminants.

18. S. Stoyanov, J. Todorov, I. Stoyanov, V. Tabakova-Komsalova, L. Doukovska and A. Dukovski, "ZEMELA - An Intelligent Agriculture Platform," 2021 Big Data, Knowledge and Control Systems Engineering (BdKCSE), 2021, pp. 1-6, doi: 10.1109/BdKCSE53180.2021.9627248, <https://ieeexplore.ieee.org/document/9627248> (WoS)

This paper presents a platform called ZEMELA. ZEMELA is developed as a cyber-physical-social space providing various services for intelligent agriculture. The general architecture of the platform is briefly described. Furthermore, the kernel of the platform consisting of an event model and personal assistants are also presented. One example demonstrates the interaction between the two components of the platform.

19. V. Tabakova-Komsalova, S. Stoyanov, L. Doukovska, I. Stoyanov and S. Cherecharov, "Personal Assistant Supporting Diagnosis of Livestock Poisoning," 2022 International Conference Automatics and Informatics (ICAI), 2022, pp. 189-192, doi:10.1109/ICAI55857.2022.9960100, <https://ieeexplore.ieee.org/document/9960100> (SCOPUS)

This paper presents a personal assistant that is able to support veterinarians in diagnosing livestock poisoning. The assistant is implemented as an intelligent agent on top of ZEMELA platform. ZEMELA provides an infrastructure for integration of the physical and virtual worlds that can be used for development of smart agriculture applications. The architecture of the assistant is also presented in the paper. Furthermore, the assistant's operation is demonstrated by a small example.

20. P. Yochkova, V. Tabakova-Komsalova, S. Cherecharov, L. Doukovska, S. Stoyanov, DEVS Modeling of an Irrigation System, IEEE Intelligent Systems IS'22, Warsaw, Poland, October 12-14, 2022, <https://ieeexplore.ieee.org/document/10019652> (SCOPUS)

This article presents an modelling approach known as DEVS (Discrete Event System Specifications) and its application for modeling of irrigation systems. The DEVS models are saved in a model library that is integrated in a smart agriculture platform called ZEMELA. Furthermore, the application of a DEVS model is demonstrated by a real example.

21. S. Stoyanov, V. Tabakova-Komsalova, L. Doukovska, I. Stoyanov & A. Dukovski, An Event-Based Platform Supporting Smart Agriculture Applications, IEEE Intelligent Systems IS'22, Warsaw, Poland, October 12-14, 2022, <https://ieeexplore.ieee.org/document/10019674> (SCOPUS)

This article presents a platform supporting development of smart agriculture applications. The platform provides a cyber-physical infrastructure that is able to integrate the physical and virtual worlds. The architecture of the platform is briefly presented. Furthermore, the kernel of platform consisting of personal assistants and an event engine are described in more detail. The interaction between the last two modules are demonstrated by a short example.

22. A.Stoyanova-Doycheva, E. Doychev, V.Ivanova, V.Valkanov, V.Tabakova-Komsalova, Event Ontology about Wheat Cultivation, AgriControl 2022The 7th IFAC Conference on Sensing, Control and Automation Technologies for Agriculture, 14-16 September 2022, Munich, Germany, DOI10.1016/j.ifacol.2022.11.140, (SCOPUS, SJR = 0.342 и Q3) <https://www.sciencedirect.com/science/article/pii/S2405896322027732>

The article presents the development of the Wheat Event Ontology that includes events in the cultivation of winter wheat. The ontology divides events into two main types – domain events and emergency events. Each of the domain events leads to a state, in which the wheat is present during cultivation. Emergency events are conditions of wheat or soil, the overlook of which will lead to reduced yields. The Wheat Event Ontology is created to be integrated into an intelligent agricultural environment called ZEMELA. It is implemented from intelligent components that use the ontology to warn of various wheat-growing events, which facilitate the work of farmers.

23. Tabakova-Komsalova, V., Stoyanov, S., Stoyanova-Doycheva, A., Doukovska, L. (2023). Prolog Education in Selected Secondary Schools in Bulgaria. In: Warren, D.S., Dahl, V., Eiter, T., Hermenegildo, M.V., Kowalski, R., Rossi, F. (eds) Prolog: The Next 50 Years. Lecture Notes in Computer Science(), 2023, vol 13900. Springer, Cham. https://doi.org/10.1007/978-3-031-35254-6_12 , Online ISBN978-3-031-35254-6, Online ISBN978-3-031-35254-6 (WoS)

This article presents our activities for introducing the training of Prolog programming to the secondary school. The beginning was the development of an appropriate curriculum. The results of an experiment conducted with a group of selected students are summarized in this paper. A project is briefly presented, the purpose of which is to provide an opportunity to share knowledge and experience about Prolog programming and at the same time help build a community of interested students. In the conclusion, we have tried to summarize our experience which would possibly help to introduce Prolog programming in secondary school in other conditions.

24. Tabakova-Komsalova, V., Stoyanova-Doycheva, A., Petrov, A., Kostadinova-Tzankova, L., An Approach to Data Representation and Processing of Knowledge from the Bulgarian Folklore, Digital Presentation and Preservation of Cultural and Scientific Heritage, vol.13/ 2023, 149–158. ISSN: 1314-4006 (Print), eISSN: 2535-0366 (Online), <https://doi.org/10.55630/dipp.2023.13.14> (WoS)

In the context of global and high-tech development, cultural fields are often overlooked during these transitions. Therefore, it is essential to pay close attention to their inclusion. Cultural-historical heritage, which has undergone centuries of changes, deserves to be introduced into the technological world and made as accessible as possible to society, without territorial or border restrictions. Digitizing a part of this heritage, including folklore, can make it high-tech while preserving its character, peculiarity, and identity. This article examines the digitalization of Bulgarian cultural and historical heritage. It explores existing international standards for presenting cultural heritage and proposes a formalism for an adequate presentation of knowledge in the field of Bulgarian folklore. This article presents the first version of a model for the formal description of objects from Bulgarian folklore. We provide examples of the formal presentation of objects from Bulgarian folklore and their corresponding computer implementation.

25. Tabakova-Komsalova, V., Dukovski, A., Stoyanov, I., Kostadinova-Tzankova, L., Ivanova, T., Prolog Education in Selected High Schools in Bulgaria, International Conference AUTOMATICS AND INFORMATICS`2023, October 05 - 07, 2023, Varna, Bulgaria (ICAI'23). (to print) (SCOPUS)

2022 marks the 50th anniversary of the logic programming language Prolog. In this regard, the authors will join the international initiative known as “Prolog Education and Thinking”. The initiative aims to acquaint students mainly with logical programming and

Artificial Intelligence through the Prolog language. The article presents shortly the project called “Digital Bulgaria in Prolog”, with which we want to join the above-mentioned initiative. The main topic and the architecture of the supporting software are also presented. Furthermore, the beginning and the current state of the introduction of artificial intelligence education in two Bulgarian schools are briefly discussed.

26. Tabakova-Komsalova, V., Stoyanov, S., Stoyanova-Doycheva, A., Stoyanov, I., Doukovska, L., Dukovski, A., An Expert System for the Diagnosis of Livestock Poisoning, In-ternational Conference AUTOMATICS AND INFORMATICS' 2023, October 05 - 07, 2023, Varna, Bulgaria (ICAI'23). (to print) (SCOPUS)

In recent years, artificial intelligence systems have become increasingly attractive for use in agriculture. Diagnostic expert systems are designed to determine the nature of various deviations from the usual course of biological or technical processes based on a set of symptoms. Although the first diagnostic expert systems appeared in the late 60s and early 70s of the 20th century, diagnostics remains an interesting domain for artificial intelligence. In this paper, we present an expert system that aims to assist veterinarians and farmers in the diagnosis of livestock poisoning. Our preliminary studies show that due to the wide variety of poisonings and their symptoms, the diagnosis of poisonings is a particularly difficult task, and providing such a system would be useful. Furthermore, the system architecture is presented and its use is demonstrated by an example in this paper. The system is implemented by Flex and VisiRule development tools.

27. Stoyanov, S., Kumurdjieva, M., Tabakova-Komsalova, V., Doukovska, L., Using LLMs in Cyber-Physical Systems for Agriculture – ZEMELA, Big Data, Knowledge and Control Systems Engineering (BdKCSE), 2023.(to print) (WoS)

This paper presents the idea of developing an advisory service using the capabilities of generative artificial intelligence and in particular of Large Language Model. The service will assess the risks for farmers when preparing projects under different programs, taking into account the Bulgarian legislation related to agriculture, as well as the requirements of the relevant program. The results of a feasibility analysis are summarized in the article. Furthermore, two architectural approaches are discussed.

28. Stoyanov, S., Tabakova-Komsalova, V., ARTIFICIAL INTELLIGENCE – LOGIC PROGRAMMING WITH PROLOG, Mathematics and Education in Mathematics, Volume 52, Pages 221 – 223, 2023, <https://smb.math.bas.bg/mem/index.php/memjournal/issue/view/4/4>

The proposed course introduces the need to learn and develop skills for working with artificial intelligence (AI) and to adapt the education system accordingly. The main approaches to representation and processing of knowledge, necessary for the development of intelligent systems in various fields, are considered. An overview is made of the knowledge and skills that the course participants will acquire. For the practical exercises, the programming language Prolog is used, which has recently attracted revived interest and is suitable for working with classical artificial intelligence”.

29. Makrides, G & Glushkova, T., Grozdev, S., Stoyanova-Doycheva, A., Staribratov, I., Stoyanov, S., Tabakova-Komsalova, V., R1: AI Teaching Guide for teachers facilitating

the learning of students in grades 7-12, FACILITATE – AI: Guidelines for facilitating the learning of Artificial Intelligence (AI) by School Students of Grades 7-12, ISBN: 978-9925-713-50-9, <https://facilitate-ai.eu/>

Industry 4.0 defines new challenges and tasks for the solution of which artificial intelligence (AI) plays an increasingly important role. The White Paper on Artificial Intelligence of the European Community (WPAI-EU, 2020) sets the main guidelines for its development. According to the document, it is necessary to develop skills necessary for work in the field of AI and to adapt the education systems of all European countries. The report of the Committee on Culture and Education (CULT) in the European Parliament on the application of AI in education makes an in-depth analysis of the need to train specialists to develop and implement intelligent approaches in various areas of modern business and services. Based on these strategic documents, some main directions in the application of AI in school education have been identified.

*As the first result (R1) of the project (Guidelines for facilitating the learning of Artificial Intelligence (AI) by School Students of Grades 7-12): "Guidelines for facilitating the learning of Artificial Intelligence (AI) by School Students of Grades 7-12" is created a guide for target group teachers to enable them to introduce AI to students in grades 7-12. The Guide to Teaching AI sets out a pedagogical and learning framework that describes, among other things, the competencies that teachers need to acquire and develop to successfully facilitate learning with AI. In addition, this deliverable provides resources and develops the content of a C1 training event, which aims to enable partner staff to fully understand the concept of AI and how it can best be approached to it in secondary education. To facilitate learning, the partners developed sample AI - L&C plans **related** to competencies for understanding AI concepts and how they can be used in the 7-12 STEAME curriculum. R1's main innovation is the creation of a Model AI Learning and Creativity Plan (L&C Plan) that can be used by any teacher in any field to embed AI learning and thinking into their teaching for the best development of competence and skills in students. To our knowledge, no such AI L&C plans exist.*

30. Makrides, G & Glushkova, T., Grozdev, S., Stoyanova-Doycheva, A., Staribratov, I., Stoyanov, S., Tabakova-Komsalova, V., Terzieva, T., R2: Training Course for Facilitators of learning in AI-STEAME education, FACILITATE – AI: Guidelines for facilitating the learning of Artificial Intelligence (AI) by School Students of Grades 7-12, ISBN: 978-9963-713-51-6, <https://facilitate-ai.eu/>

Given the rapid development of artificial intelligence and the accumulated backwardness of the formal education system from the needs of the labor market, it is necessary to increase the quality and efficiency of education, to update its content and to ensure a connection between the education system and the needs of business and society in the era of digital transformation. Based on this, two main directions in the application of AI in school education are identified: familiarization and in-depth study of the main methods, aspects and algorithms of AI; use of intelligent educational environments and tools in school practice.

One of the main innovations and challenges of the R2 result is structuring an appropriate training course to use learning materials and learning resources for students from different countries and schools supporting the age groups (grades 7-12). This course should acquire the necessary competencies to create and use an Artificial Intelligence Learning and Creativity Plan (L&C Plan) that can be used by teachers of various subjects in the integration of topics related to artificial intelligence. The aim is to develop the necessary digital competences of both teachers and students. To our

knowledge, such AI L&C plans do not exist and are not used in school education.

Books

31. Stanimir Stoyanov, Veneta Tabakova-Komsalova, Lyubka Doukovska, ARTIFICIAL INTELLIGENCE IN 24 .../book one, BAS Publishing House "Prof. Marin Drinov", 2023, Sofia, ISBN 978-619-245-305-3.

Artificial intelligence, until recently perceived as a specialized scientific field, today is entering more and more powerfully into our everyday life. One of the reasons for this is that with the rapid increase in the power of computer systems, theoretical results are becoming a reality, bringing practical benefits.

This book examines the topics that were the subject of research in the first 30 years of artificial intelligence, let's call it classical artificial intelligence. The foundations of artificial intelligence should be sought in philosophy, mathematics, management theory and cybernetics, economics, medicine, psychology, linguistics. We believe that knowledge of the classical methods and tools of the field is essential for understanding modern artificial intelligence. So, for example, modern computer games massively use variants of A - one of the classic algorithms for solving problems by means of search, created in the early years of artificial intelligence.*

Together with the rapid entry of artificial intelligence into our lives, we are of the opinion that the need for literature in the Bulgarian language is also increasing. With this book, we expect to make a certain contribution in this regard.

The first part of the book examines various methods of solving problems by means of search, i.e. methods can look ahead to find a sequence of actions that lead to a desired goal. When the right action to take is not immediately obvious, the method can plan ahead - consider a sequence of actions that form the path to the goal. Such a method is called a problem-solving method, and the computational process undertaken is called a search.

The second part of the book examines the presentation of knowledge based on deductive and predicate logic.

32. Veneta Tabakova-Komsalova, FORMATION OF ALGORITHMIC AND DECLARATIVE THINKING IN SECONDARY SCHOOL STUDENTS, published book based on a defended dissertation work for the award of PhD, "Paisii Hilendarski" University Publishing House, 2023, ISBN: 978-619-7663-89-1

The book presents the formation of algorithmic and declarative thinking in secondary school students in Bulgaria. In the first part, research is presented on the formation of algorithmic thinking, through the introduction of Computer Modeling in the initial stage during the academic year 2018-2019. Based on this research, a study was conducted on the formation of declarative thinking through the introduction of Artificial Intelligence and logical programming in secondary schools in Bulgaria. The results of introducing such training in different forms (optional module in the profiled preparation of XI and XII grades, in different profiles; interest-based activities, according to the Inclusive Education Ordinance; STEM subject) and in different age groups are presented..

33. Veneta Tabakova-Komsalova, PRESENTATION OF KNOWLEDGE IN SYSTEMS WITH ARTIFICIAL INTELLIGENCE, monograph, 2023, Paisii Hilendarski University Publishing

House, 2023, ISBN 978-619-7663-96-9.

Knowledge is an essential component of artificial intelligence. It is the ability of an intelligent system to understand and use information to perform tasks. There are many different types of knowledge that can be represented and used by AI systems.

The monographic study describes knowledge representation in artificial intelligence systems. The author's attention is focused on six problem areas: Knowledge in Artificial Intelligence; Rule-based systems; Representation of knowledge through rules; Representation of knowledge through frames; Language for representing knowledge through logic - Prolog; Flex AI Toolkit. The scientific monograph is intended for researchers, teachers in higher education institutions, doctoral students, students; teachers in secondary education, teachers, students. The monograph can benefit anyone interested in the complex and heterogeneous problems of artificial intelligence in the context of knowledge representation.

Textbooks and educational aids

- 1) Veneta Tabakova-Komsalova, Todorka Glushkova, Stanimir Stoyanov, MANUAL OF ARTIFICIAL INTELLIGENCE, Paisii Hilendarski University Press, 2022, ISBN: 978-619-202-749-0

This teaching aid has been developed in accordance with the requirements and the curriculum in Artificial Intelligence at the Faculty of Mathematics and Informatics of Plovdiv University "Paisiy Hilendarski". It examines the main approaches to the presentation and processing of knowledge necessary for the development of intelligent systems in all spheres of the modern world - education, intelligent agriculture, transport, healthcare, etc.

The content of this manual is dedicated to the topic "Representing and processing knowledge through logic rules and logic programming". Along with the issues related to problem solving through search, this topic has been explored since the dawn of artificial intelligence and is established as fundamental to the discipline. Most of the presented concepts, approaches and methods have a long history, but are still relevant and "enjoy" unceasing scientific and practical interest. After some hiatus, the logic programming language Prolog is making a resurgence. This is mainly due to the increased power of the computing equipment used in everyday life. The subject matter in this guide is an essential part of the core of so-called "classical artificial intelligence". To aid the absorption of the material in this aid we have included a variety of examples, in the hope that they will bring pleasure and satisfaction to the students in their learning process. This study guide has been developed in accordance with the requirements of the approved study programs for the "Bachelor" degree of the Faculty of Mathematics and Informatics at Plovdiv University "Paisiy Hilendarski" for the mandatory disciplines "Artificial Intelligence" and "Intelligent Systems", respectively for "Informatics" majors and "Software Engineering".

The guide can also be used for electives in the field of Artificial Intelligence.

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