

OPINION

BY ASSOC. PROF. EMIL HRISTOV DOYCHEV, PHD

Faculty of Mathematics and Informatics at the University of Plovdiv “Paisii Hilendarski”

of a dissertation for awarding the educational and scientific degree “doctor”

in field of higher education 4. Natural sciences, Mathematics, and Informatics,

professional field 4.6. Informatics and Computer Science

doctoral program Informatics

Author: Mariya Todorova Grancharova-Hristova

Topic: Research on the creation of semantic models in the field of humanities.

Scientific supervisor: Prof. Asya Stoyanova-Doycheva, PhD and Prof. Todorka Glushkova, PhD, Faculty of Mathematics and Informatics at the University of Plovdiv “Paisii Hilendarski”

1. General presentation of the submitted materials

By order № RD-21-2231 от 27.11.2023 of the Rector of the University of Plovdiv “Paisii Hilendarski” (PU), I have been appointed as a member of the scientific jury to participate in a procedure for the defense of a dissertation on the topic of “*Research on the creation of semantic models in the field of humanities*” for acquiring the educational and scientific degree “doctor” in field of higher education 4. Natural sciences, Mathematics, and Informatics, professional field 4.6. Informatics and Computer Science, doctoral program Informatics. The author of the dissertation is Mariya Todorova Grancharova-Hristova – a full-time doctoral student at the Department of Computer systems, with scientific supervisors Prof. Asya Georgieva Stoyanova-Doycheva, PhD, and Prof. Todorka Atanasova Glushkova from FMI at the University of Plovdiv “Paisii Hilendarski”.

The set of materials presented to me by Mariya Grancharova-Hristova on electronic media is in accordance with Article 36 (1) of the Law on the Development of the Academic Staff of the University of Plovdiv.

Maria Grunchaova-Hristova holds a bachelor’s and master’s degree in "Mechanical Engineering" from the Technical University of Ruse and another Master's degree in "Informatics" from Plovdiv University “Paisii Hilendarski”. Since 2020, she has been a regular doctoral student at the Department of “Computer Systems” at the Faculty of Mathematics and Informatics at Plovdiv University. She has been working since 2000 as a senior teacher in computer science and information technologies at the High School "St. St. Cyril and Methodius" in Plovdiv. She has participated in two research projects funded by the Operational Program "Science and Education for Intelligent Growth" of the Ministry of Education and Science.

Relevance of the developments in the dissertation work on issues in both scientific and scientific-applied aspects.

The main focus of the dissertation work is on the semantic modeling of Bulgaria's cultural-historical heritage, with a focus on the humanities. The goal of the dissertation is formulated as follows: *to conduct research on semantic models that can find application in the field of humanities.*

The theme of the dissertation work is undoubtedly relevant. The main tasks set by the doctoral student are related to the creation of a semantic model in the form of an ontology covering the

development of the "St. St. Cyril and Methodius" school, one of the oldest schools. The ontology is developed to enable the automatic generation of test questions in Bulgarian. To achieve this, the doctoral student has devised algorithms for processing the semantic model, ensuring that the output is grammatically correct sentences (both interrogative and declarative) in Bulgarian.

This topic is highly relevant in both the field of semantic modeling and electronic education. The work also represents a continuation of the theme of generating test questions from ontologies, a topic the Department of Computer Systems has been engaged in since 2016, yielding positive results.

Knowledge of the research problem

The clearly defined aim of the dissertation, the well-motivated and specifically formulated four main tasks to achieve the aim, the literature review, analysis, and conclusions demonstrate a very good knowledge of the problem area on the part of the doctoral candidate. From the thesis and the bibliography containing 162 literature and internet sources, it can be concluded that the Ph.D. student has deeply and thoroughly researched the state of research in the area under consideration. The dissertation text is clear, precise, and analytical.

Research methodology

I believe that the chosen methodology of the study follows the usual developments in the field. The PhD student has developed a semantic model in the form of an ontology - an ontology for the evolution of "St. St. Cyril and Methodius" school. The ontology is considered from two perspectives - from the point of view of domain information and from the point of view of structure and addition of elements in it to allow the generation of grammatically correct communicative and interrogative sentences in Bulgarian. For this purpose, the further defined annotation properties related to Bulgarian grammar are described in great detail. As a second task in the study, algorithms for automatic generation of test questions are developed. After analyzing the result, two tools have been developed to support the processes of creating such ontologies and to easily retrieve the result of the algorithms execution - the generated test questions.

Characteristics and evaluation of the dissertation work

The dissertation is 186 pages long and consists of an introduction, five chapters, a conclusion, a bibliography, and an appendix. Including the appendix, the dissertation is 201 pages long.

The research work is structured into several logical components, which are dealt with in the individual chapters of the dissertation:

The introduction presents the necessity and positive aspects of semantic models. The aim of the dissertation is formulated and the main tasks necessary to achieve this aim are described. The strategy for the implementation of the research is also presented here. Chapter 1 - Current state of the research area: this section aims to introduce the concept of semantic web and semantic modeling. Information representation technologies such as semantic models are discussed as well as the importance of semantics in e-learning. Different approaches to automatically generate questions from ontologies are also explored. Chapter 2 - Ontology Structure: provides a description of the structure of the ontology built, including classes, properties, and personalities. Approaches for categorizing the available information and building relationships that provide a logical link between different pieces of information are explored. Newly developed annotation properties that are used for grammatically correct sentence generation in English are presented. Chapter 3 - Algorithmic Queries for Sentence Generation: this section describes the different types of questions and the algorithmic structures written in SPARQL that are used to extract information from the ontology and check the correctness of the answer provided. Chapter 4 - Applications for ontology generation and information retrieval:

here are presented the logic schemas of two applications, "OnthologyGenerator" and "OnthologyReader". The former is used to create a new ontology by populating JSON structures with configured information, while the latter is used to extract information from the ontology using SPARQL queries. Chapter 5 - Analysis and verification of the proposed approach: this section presents a new ontology created using the "OnthologyGenerator" application and extracts information from it using the "OnthologyReader". The structure of the returned information is analyzed, as well as the advantages, disadvantages, and possibilities for improvement of the proposed algorithms. The conclusion summarizes the results of the work carried out, in this dissertation.

A very good impression is made by the finalization of the individual chapters, where the main conclusions, generalizations, and analyses are synthesized, as well as Table 12, showing the relationship between the results, objectives, structure of the dissertation, and the publications made.

The PhD student has pointed out some possibilities for future development of the work: it is possible to create new algorithms to generate meaningful and structured text from the developed ontologies. A future development is the modification of the developed TGE e-testing environment, which has been implemented as a multi-agent system in VOP. This can be achieved by integrating the test question generation algorithms in Bulgarian into this environment.

The results achieved in this dissertation are original and correspond to the stated aim and objectives. I accept the main 4 contributions of the work summarized at the end of the dissertation, which, in my judgment, can be systematized as scientific, scientific-applied, and applied, as follows – the creation of a semantic model for test question generation in Bulgarian, creation of algorithms for automatic test question generation from ontologies and applied contributions are the developed two tools "OnthologyGenerator" and "OnthologyReader". The contributions relate to the areas of semantic modeling, natural language text generation from structured knowledge, and to the area of e-testing. I believe that the goal of the PhD has been achieved.

Evaluation of the dissertation publications and personal contribution of the PhD student

Mariya Grancharova-Hristova has submitted six publications on the thesis, all co-authored. Two publications are indexed in SCOPUS and Web of Science, four publications are in international conferences and journals. I accept that the results of the dissertation are well presented to the scientific community. I have no doubts that the dissertation and the results obtained are the personal work of the PhD student. I have not noticed or detected any plagiarism.

This satisfies the minimum national requirements of the Rules for the Implementation of the Act for the Development of the Academic Staff in the Republic of Bulgaria for a minimum of 30 points under group G indicators, where the doctoral student has 36 points.

Abstract

The abstract is provided in Bulgarian and English, according to the requirements, in the volume of 32 pages; in terms of size and content, it meets the requirements for accurate, complete, and concise coverage of the dissertation.

Critical remarks and recommendations

I recommend the PhD student to continue the research, as the topic has a high degree of applicability and wide perspectives for further development..

CONCLUSION

The dissertation contains **scientific, scientific-applied and applied** results, which represent an original contribution to science and meet all the requirements of the Act for the Development of the Academic Staff in the Republic of Bulgaria, the Rules for the Implementation of the Act for the

Development of the Academic Staff in the Republic of Bulgaria (ADASRB), and the relevant Rules of the University of Plovdiv “Paisii Hilendarski”. The presented materials and dissertation results fully correspond to the minimum national requirements in the Rules for the implementation of the ADASRB.

Due to the above, I confidently give my **positive** assessment of the conducted research, presented by the above-reviewed dissertation work, abstract, achieved results, and contributions, and I propose to the honorable scientific jury to award the educational and scientific degree “doctor” to Mariya Todorova Grancharova-Hristova in field of higher education: 4. Natural sciences, Mathematics, and Informatics, professional field: 4.6. Informatics and Computer Science, doctoral program: Informatics.

16.01.2024

Plovdiv

Signature:

/Assoc. Prof. Emil Doychev/