S T A T E M E N T

about the Ph.D. thesis in professional field of study: 4.6 Informatics and computer sciences, scientific specialty: „Informatics”

Ph.D. student: Pavel Aleksandrov Kyurkchiev

Title of the Ph.D. thesis: Methods and architectural approaches for semantic indexing and simulation of dynamic processes in a cloud environment

Member of the jury: prof. D.Sc. Ph.D. Eng. Todor Atanasov Stoilov, Institute of information and communication technologies – Bulgarian Academy of Sciences, Sofia, Acad.G.Bontchev str., BL.2

1. Actuality of the problems in the PhD thesis

The thematic focus of the dissertation is on the execution of search queries in an unstructured text environment. The classical implementation of software systems performing information search is based on the use of pre-indexed text arrays. The search results are based on a combination of information obtained from the pre-defined indexes. Such information search cannot obtain results with undefined indexes for the content of the information arrays. The complexity of the requirements and content of search queries also requires the definition of relationships between the elements of the information array. The result of such a query with indexed search methods cannot obtain a meaningful result, since the relationships between the elements of the information array are not indexed. For the execution of such a class of searches, solutions are developed by processing and analyzing results from unstructured information arrays. The dissertation develops a solution for information search in unstructured arrays. A software product has been created that processes graphically entered information arrays and has the ability to analyze dynamic changes in the information arrays.

I appreciate that the research task of the dissertation work has a difficult and abstract nature. This is related to knowledge of information interactions in software systems, methods for formalization and modeling of free unindexed

information arrays, formalization of unstructured arrays in graph structures and their quantitative representation as vector arrays. As a result, information retrieval systems can also provide comparisons with results close to those sought by the user.

I find that the presented research has a current significance related to the development of software solutions that implement artificial intelligence functions.

2. Degree of knowledge of the state of the problem and academic interpretation of the literary material

The analysis made in Chapter 1, and in the subsequent development of the program prototype, shows a high professional level of the doctoral student in the field of solutions for information search in unstructured arrays. High knowledge of the processes of converting text arrays into graph structures, analyzing graph structures and converting them into a linear sequence, converting the resulting sequence into vector arrays, searching for correspondences at a defined threshold of such correspondence has been demonstrated. Additionally, knowledge of determining cycles in the information graph, storing data in vector databases, coordinating and interacting with different program systems using a corresponding standardized representation of data and information has been demonstrated.

From the analysis made in Chapter 1, I assess that knowledge has been demonstrated about the working method and functional capabilities of methods, tools, problems and solutions for implementing information search in unstructured data arrays.

3. Correspondence of the chosen research methodology and the set goal and tasks of the dissertation with the contributions achieved

The Ph.D. research uses a highly abstract area to implement an extended search in unstructured arrays and data. This allows searching for results that are not available when using the technology for working in indexed structured arrays. The results that are obtained also have properties close to a potentially expected solution. The positive effect of the developed information search algorithm is that

the potential usefulness of the obtained results for a user is expanded. The methodology chosen in the dissertation work is to formalize the unstructured array in a graph structure, to introduce quantitative dependencies arising from the physical law of fluid continuity, to quantitatively evaluate the graph formalization made as numerical vectors. The search for close and similar answers to a query is performed by quantitative comparison of the proximity of numerical vectors.

I assess that the chosen methodology corresponds to the task set in the dissertation work to perform information search with logically difficult questions in arrays of unstructured information.

4. **Scientific and practical achievements in the PhD thesis**

Scientific-applied contribution can be defined for the development of a general algorithmic structure that allows the implementation of information search in unstructured data sets. The implementation of this search takes into account significant limitations that aim to obtain valuable search and comparison results.

I evaluate as an applied contribution the development of a prototype programming environment that performs complex searches in unstructured data. The programming system is evaluated by analyzing the results obtained from searches in reference data sets.

5. Assessment of the Ph.D. publications and correspondence with the minimal national legislative requirements

The dissertation research includes 3 scientific publications. Two were made at conferences in our country. The publication in the journal Future Internet, which has SJR=0.845, Q=1, is significant achievement. This is a highly specialized publication and the publication made is a merit of the dissertation research.

According to the internal rules of the University of Paisiy Hilendarski, they satisfy the required threshold of points through categories A, D7.

6. Few assessments, recommendations, and remarks

The author of the statement does not consider it necessary to make notes and assessments. His opinion about the dissertation research and the declared results is positive. As an opinion, I share that the writing style is highly qualified and this makes reading and understanding difficult.

7. Conclusion

I positively assess the scientific and applied contributions of the dissertation work of Pavel Kyurkchiev. I find that the requirements of the Act on the Development of Academic Staff in Bulgaria and the Regulations for its Implementation are met in the presented dissertation work. The above gives me reason to give a positive assessment of the presented dissertation work and to recommend to the Scientific Jury to award **Pavel Alexandrov Kyurkchiev** the educational and scientific degree "Doctor" in professional field 4.6. Informatics and Computer Sciences, doctoral program "Informatics".

24.8.2026 Member of the jury:

Prof. D.Sc. Ph.D. Eng. Todor Stoilov