REVIEW

of a dissertation for obtaining the educational and scientific degree "Doctor" in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.5 Mathematics, specialty – Mathematical Logic

Author of the dissertation: Dimitar Dimitrov Dobrev
Title of the dissertation: "Artificial Intelligence – Definition, Realization, and Consequences"
Reviewer: Assoc. Prof. Dr. Zlatko Zahariev

1. Brief Biographical Data and Procedure Details

Dimitar Dimitrov Dobrev completed his higher education, obtaining a master's degree at Sofia University "St. Kliment Ohridski", Faculty of Mathematics and Informatics, specializing in Mathematics with a focus on Mathematical Logic and its applications in 1995. Since 1996, he has worked as a mathematician at the Institute of Mathematics and Informatics of the Bulgarian Academy of Sciences, where he is part of the "Algebra and Logic" section. He has strong interests in Artificial Intelligence and Logical Programming and is the author of numerous publications related to the subject of his dissertation. He has experience in lecturing and conducting exercises at Sofia University and the New Bulgarian University in disciplines related to Artificial Intelligence, Mathematical Logic, Logical Programming, Prolog Programming, Discrete Mathematics, and Discrete Structures.

2. Relevance of the Dissertation Problems in Scientific and Applied Context

The topics discussed have both scientific and practical value. Scientifically, the dissertation offers new definitions and models for AI and examines models for describing deterministic and non-deterministic world descriptions, as well as methods for implementing AI, such as the Event-Driven models presented in the dissertation. The practical significance of the research lies in the potential applications of the proposed models and methods in areas such as automation, data analysis, process management, and others. The dissertation also includes an example of the chess game, which demonstrates the use of the presented models for creating intelligent systems capable of simulating real worlds. Special attention is given to the consequences of creating AI, as the author explores different future scenarios and proposes strategies for managing potential risks.

3. Degree of Knowledge of the Problem and Creative Interpretation of the Literature

The dissertation consists of 115 pages, of which 6 pages are introductory sections, 103 pages are the main text, and 6 pages are concluding material, including a bibliography with 92 titles. Dimitar Dobrev's dissertation demonstrates a thorough knowledge of the current state of the researched area. The work includes an extensive literature review that covers publications and developments

related to artificial intelligence. The author examines different approaches and definitions in AI and provides a historical overview of the development of this field. Existing theories and methods are presented, further analyzed, and new ideas and improvements are proposed. This creative interpretation of the literature shows a good understanding of the issues related to artificial intelligence.

4. Correspondence of the Selected Research Methodology to the Aims and Objectives of the Dissertation

The main aim of Dimitar Dobrev's dissertation is to propose new definitions and models for artificial intelligence, as well as to explore their applications and consequences. To achieve this aim, the author formulates the following objectives:

1. To propose an informal and formal definition of artificial intelligence.
2. To develop a language for describing worlds that allows automatic search for descriptions without human assistance.
3. To investigate and present different models for implementing artificial intelligence, including Event-Driven (ED) models.
4. To analyze the potential consequences of creating artificial intelligence.

The selected research methodology corresponds to the aims and objectives of the dissertation. The author uses a combination of theoretical analyses and practical examples to present and prove his ideas. This approach is suitable and effective for achieving the set aims.

5. Brief Analytical Characterization and Evaluation of the Credibility of the Material on Which the Contributions of the Dissertation Are Based

Dimitar Dobrev's dissertation is based on extensive and reliable literature and empirical material. In the first chapter, the author conducts a thorough analysis of the current state of artificial intelligence, including various definitions and models. In the second chapter, new models for implementing AI, such as Event-Driven (ED) models, are proposed and supported with concrete examples and evidence. In the third chapter, the author analyzes the potential consequences of creating artificial intelligence by presenting different future scenarios. The evaluation of the credibility of the used material shows that the author has relied on significant and current sources. The bibliography includes 92 titles, which demonstrates the depth of the research. The presented examples and evidence are well-argued, ensuring the reliability of the conclusions and contributions in the dissertation.

6. Scientific and Applied Contributions of the Dissertation

The scientific and applied contributions of Dimitar Dobrev's dissertation can be summarized as follows:

1. **Definitions of AI:** The author proposes both informal and formal definitions of AI. The proposed informal definition is already widely spread and is the first result when searching for "Definition of Artificial Intelligence" on Google.
2. **Languages for Describing Worlds:** The introduction of a language for describing worlds, where the description can be automatically searched, is an important contribution. This language allows for automatic search for a world description without human assistance, which is an advantage over existing approaches.
3. **Models for AI Implementation:** The presentation of Event-Driven (ED) models and their application for describing worlds and implementing AI is another significant contribution. The author shows how these models can be used to create AI that can operate in unfamiliar environments.
4. **Analysis of AI Consequences:** The dissertation examines the potential consequences of creating AI and proposes different future scenarios. This includes an analysis of the opportunities and risks associated with AI development and suggestions for managing these risks.

7. Assessment of the Degree of Personal Contribution of the Doctoral Candidate in the Contributions

Dimitar Dobrev's dissertation, together with the related scientific publications and the overall research and teaching activities of the author, convincingly shows that the obtained results are exclusively his work. The author demonstrates a deep knowledge of the researched area as well as creative and research activity.

8. Evaluation of the Publications Related to the Dissertation: Number, Nature of the Editions in Which They Are Published

Dimitar Dobrev has a significant number of publications related to the research in his dissertation, including articles in scientific journals. These publications show that the author actively participates in the scientific community and shares the results of his research with a wide range of specialists. Five (5) publications related to the research in the dissertation are presented, and therefore, the minimum requirements for the educational and scientific degree "Doctor" of the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for the Conditions and Procedures for Obtaining Scientific Degrees at the Bulgarian Academy of Sciences in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.5 Mathematics, are met.

9. Opinions, Recommendations, and Notes

Dimitar Dobrev's dissertation is prepared in accordance with the requirements and demonstrates a thorough knowledge of the researched area. However, there are some aspects that need attention and corrections:

- Although rare, there are occasional spelling errors in the dissertation.
- In my opinion, the general style of expression in most parts of the dissertation is not suitable for academic work.
- The text expresses extreme opinions about artificial intelligence, which may not be suitable for scientific work. These statements should either be softened or supported with more formal evidence.
- The way the literature is cited in the text does not conform to commonly accepted standards (e.g., [1][2][3] or [1..3]).
- Not all sources from the bibliography are cited in the main body of the dissertation.
- The dissertation mentions the concept of "fuzzy sets" but seems to refer to "probability" instead of "membership," which is a significant misunderstanding of the concept of "fuzzy sets." I attribute this to the style of expression in the dissertation, which may mislead the reader.
- It would be good to provide a formal definition for some concepts such as "sufficiently close to the best strategy," "sufficiently large h," etc.

10. Conclusion with a Clear Positive or Negative Evaluation of the Dissertation

In conclusion, I consider that the dissertation titled "Artificial Intelligence – Definition, Realization, and Consequences" by Dimitar Dimitrov Dobrev is professionally prepared. The obtained contributions of scientific and applied nature are significant, fully satisfying the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria, as well as the Regulations for the Conditions and Procedures for Obtaining Scientific Degrees at the Bulgarian Academy of Sciences. I recommend that the scientific jury award Dimitar Dimitrov Dobrev the educational and scientific degree "Doctor" in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.5 Mathematics.

Date: 06.06.2024 Reviewer:

Sofia (Assoc. Prof. Dr. Zlatko Zahariev)