

REVIEW

by Prof. Asya Georgieva Stoyanova-Doycheva, 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: Viktor Plamenov Matanski

Subject: "Computational Framework for Cross-Modal Art Translation"

Supervisors: Prof. Anton Iliev, PhD, and Prof. Todorka Terzieva, PhD, Plovdiv University "Paisii Hilendarski"

1. General presentation of the submitted materials

By Order No. RD-22-1414 of July 17, 2026, issued by the Rector of Plovdiv University "Paisii Hilendarski" (PU), I have been appointed as a member of the academic jury for the defense of a dissertation on the topic "A Computational Framework for Cross-Modal Art Translation" for the award of the educational and scientific degree of "Doctor" in the field of higher education 4. "Natural Sciences, Mathematics, and Informatics," professional field 4.6. "Informatics and Computer Sciences," doctoral program "Informatics." The author of the dissertation is Viktor Plamenov Matanski, M.S. – a doctoral student in an independent form of study in the Department of Computer Technologies, supervised by Prof. Anton Iliev Iliev, PhD, and Prof. Todorka Zhelyazkova Terzieva, PhD, of Plovdiv University "Paisii Hilendarski".

The set of materials submitted by Viktor Matanski complies with Article 36(1) of the Regulations on the Development of Academic Staff at Plovdiv University and includes the following documents:

- a standard application to the Rector of Plovdiv University to initiate the procedure for the defense of a dissertation;
- a CV in European format;
- protocol from the preliminary discussion of the dissertation in the department and the academic advisor's opinion on the readiness to initiate the procedure;
- the dissertation;
- an abstract in Bulgarian and English;
- a list of scientific publications on the topic of the dissertation;
- copies of the scientific publications;
- a declaration of originality and authenticity of the attached documents;
- a statement of compliance with the minimum national requirements.

The attached documents meet the regulatory requirements set out in the Law on the Development of Academic Staff in the Republic of Bulgaria and the Regulations for its Implementation for the award of the educational and scientific degree of “Doctor.”

2. Brief biographical information about the doctoral student

The attached CV shows that the doctoral student earned a master’s degree in Software Engineering in 2014 from the Faculty of Mathematics and Informatics at Plovdiv University “Paisii Hilendarski.” Since 2018, he has been an assistant/computer scientist in the Department of Computer Technologies. His professional experience includes teaching at the Faculty of Mathematics and Informatics at Plovdiv University and working at various software companies, where he has held positions as a system architect, software engineer, mobile application developer, web application developer, and others. His research interests and professional activities are in the field of software engineering, data mining, computer graphics, software development using modern programming languages, and artificial intelligence (machine learning).

3. Relevance of the topic and appropriateness of the objectives and tasks set

This dissertation is dedicated to the development of a computational framework for cross-modal art translation, whose main objective is to formalize artistic translation as a distinct computational problem. The primary task of the developed system is to transfer a specific work of art from one artistic form into another while preserving certain of its properties and allowing this to be verified. To achieve the goals and objectives, the doctoral candidate uses current and innovative techniques – a combination of ontological modeling with OWL 2 RL and SHACL, a multi-agent architecture, and a large language model, with every decision of the system being recorded in a traceable manner and subject to verification.

I consider the topic to be relevant from the point of view of computer science in the context of the rapid development of generative artificial intelligence, which produces convincing results but provides no mechanism for these results to be substantiated. It is also relevant with regard to developments in the field itself, since existing cross-modal systems produce thematic variations rather than verifiable translations, whereas the combination of ontologies with artificial intelligence leads to a more reliable and more faithful solution to this problem. I also consider the work relevant in the field of cultural and historical heritage, where the compatibility of the CDAO ontology with the international standards CIDOC-CRM and Getty AAT allows museums and digital humanities projects to describe the relationships between works in a structured manner instead of through free text. I find the applicability of the framework for people with various special needs to be particularly significant, since visual works can be presented in textual or auditory form while remaining traceably linked to the original. Last but not least, the topic also has a pedagogical aspect – the visualized knowledge graph and the typed correspondences can be used as a teaching aid in the instruction of cross-modal analysis.

4. Understanding the problem

The introduction and literature review presented in Chapter 1 of the dissertation clearly demonstrate the doctoral candidate’s familiarity with the subject area. The review is

structured along six lines. The historical conceptions of the relationships between the arts are traced – from Newton’s color circle and ekphrasis to modern attempts at correspondence between color, sound, and rhythm. The scientific explanations of why such correspondences are possible at all are examined – synesthesia, the stable cross-sensory associations observed in the general population, and the role of emotion as the most stable link between the different arts. Contemporary generative models, multi-agent systems, ontologies in the field of art, and approaches to the evaluation of creative results are analyzed.

Special attention is paid to the weaknesses of existing generative systems, showing that simply increasing the size of the models does not solve the problem and that the same types of errors appear when a work is transferred from one artistic form into another. A clear distinction is drawn between three closely related but different tasks – transferring a specific work into another form, applying style alone, and free generation on a theme. With regard to evaluation, it is substantiated that human judgment remains indispensable but is not sufficient on its own and must be complemented by verifiable indicators.

The review concludes with a summary in which five specific gaps in the research on the topic are formulated and it is indicated how the dissertation is positioned with respect to them. The analytical review conducted in the dissertation’s subject area demonstrates in-depth knowledge of the subject matter and current issues, as well as the potential for finding new solutions with scientific and applied value.

5. Research Methodology

The research methodology for conducting the study and achieving the intended results begins with the development of a theoretical formulation of the problem. Artistic translation is formalized as a distinct computational task by means of an intermediate representation, a set of properties that must necessarily be preserved, a hierarchy of constraints, and a clear condition for accepting or rejecting the result. Unlike existing approaches, in which the relationship between the input work and the resulting output remains implicit, the proposed solution makes this relationship explicit and subject to verification.

As a second step in the methodology, an ontology in the field of art (CDAO) was developed, which structures the knowledge required for the analysis and the verification and has been aligned with international standards. On its basis, a multi-agent architecture with five specialized roles was designed, in which the translation is performed not as a single pass but as a repeating cycle – analysis, generation, verification, and targeted repair of the identified deviations, with provision for points of human intervention.

The third step is the development of a working prototype that implements the proposed theoretical model for translation between painting, poetry, and music and is publicly available for independent verification (<https://art-translator.com>). Experiments were conducted and a multi-layer evaluation protocol was applied, combining formal checks, automated indicators, and expert assessment, with the automated evaluations being validated against the human ones. On the basis of the results obtained, it is demonstrated that the proposed theoretical model works and is effective and practically applicable.

The methodological approach implemented fully meets the stated objective and tasks of the dissertation research.

6. Characteristics and Evaluation of the Dissertation

The dissertation is 197 pages long and consists of an Introduction, 7 chapters, a Conclusion, an Author's Statement of Contributions, Prospects for Future Development, Approbation of the Results Obtained, Publications Related to the Dissertation, an Appendix with evaluation data, Lists of Figures, Tables and Abbreviations Used, a Glossary of Terms, and a Bibliography. In accordance with the requirements, a Declaration of Originality and Authenticity of the Results is attached to the materials. The list of references includes 250 titles, including sources by Bulgarian and foreign authors and websites. The text is illustrated with 53 figures and 48 tables. The list of publications on the dissertation topic contains 3 titles, the principal publication being in a refereed international journal (Future Internet, Q2, WoS, IF 4.6). The doctoral student has participated in three research projects, two of which are part of Plovdiv University's Scientific and Research Department and one under the Program "Research, Innovation and Digitalization for Smart Transformation" 2021–2027, co-financed by the European Union.

The Introduction substantiates the relevance of the research topic and formulates the scientific problem and the research gap, the objective, the hypothesis, the six research questions and the five tasks of the dissertation, as well as the limitations of the study.

Chapter 1 – "Literature Review" – presents an analysis of the scientific literature along six lines: historical conceptions of the relationships between the arts, cognitive and neuroscientific foundations of cross-modal correspondences, contemporary multimodal generative models, multi-agent systems, ontology engineering in the field of art, and computational creativity. A synthesis is made in which five specific gaps in the research on the topic are formulated and the contribution of the dissertation is positioned with respect to them.

Chapter 2 – "Formalization of Cross-Modal Art Translation" – defines artistic translation as a computational task and distinguishes it from free generation, style transfer, and descriptive paraphrase. The four founding principles of the framework, the intermediate representation as the central object, the hierarchy of constraints, the two-stage acceptance condition, and the taxonomy of deviations are presented. The exposition is illustrated with a worked example of translation from painting to poetry.

Chapter 3 – "An Ontology for Cross-Domain Art" – presents the developed CDAO ontology (Cross-Domain Art Ontology) with its class hierarchy, properties, validation rules by means of SHACL, and a mechanism for inference through property chains. The ontology has been aligned with the international standards CIDOC-CRM and Getty AAT, which ensures compatibility with the infrastructure of cultural heritage. A formal evaluation of the ontology through competency questions has also been carried out.

Chapter 4 – "Architectural Specification of a Multi-Agent System for Artistic Translation" – contains a comparative analysis of six architectural candidates and a justification of the chosen hybrid solution. The five agent roles, the two-layer memory model, the control flow,

and the mechanism for verification and iterative repair are specified, including the formal points of human intervention.

Chapter 5 – “Prototype” – presents the reference implementation by means of a three-layer system architecture: a web application layer, an implementation layer of the multi-agent system built with LangGraph, and a knowledge–data layer with a PostgreSQL database and a live knowledge graph. The prototype is publicly available and allows independent verification of the results.

Chapter 6 – “Evaluation” – presents a five-layer evaluation protocol covering translation fidelity, robustness under cyclic and chained translations, automated evaluators, user validation, and expert review. The automated evaluations are validated against the human ones, and the measurement procedures are verified by means of negative controls.

Chapter 7 – “Discussion, Limitations and Future Work” – interprets the results obtained in a broader theoretical context, analyzes the balance between fidelity and interpretative freedom, and outlines the limitations of the study.

The Conclusion provides an analysis of the achievement of the set goals and objectives, summarizes the results obtained and the scientific and applied contributions, and outlines directions for the future development of the research.

7. Contributions and significance of the study for science and practice

I accept and positively evaluate the contributions outlined in the dissertation and the abstract. These are primarily of an applied scientific and applied nature and can be summarized as follows:

Applied scientific contributions:

1. An original formal formulation of cross-modal art translation as a distinct computational task is proposed, distinguished from free generation and style transfer, together with an apparatus for its specification and evaluation – a modality-independent intermediate representation, a hierarchy of constraints, an acceptance condition, and a typed taxonomy of deviations. I consider this contribution to be the principal one in the dissertation.
2. An ontology in the field of art (CDAO) has been developed, aligned with the international standards CIDOC-CRM, Getty AAT, and PROV-O, and on its basis a hierarchical multi-agent architecture has been designed, in which the translation proceeds as a repeating cycle of analysis, generation, verification, and repair, with formally defined points of human intervention. It is essential to note that the ontology has been made available for free access.
3. A five-layer protocol for the evaluation of creative results is proposed, in which the automated evaluations are validated against the human ones and the measurement procedures by means of negative controls, and through which the limits of formalizable fidelity in artistic translation have also been established.

Applied contributions:

1. A prototype system for translation between painting, poetry, and music with a three-layer architecture has been developed, publicly available together with the live knowledge graph, and the CDAO ontology has been published as an open resource, usable on its own by museum collections and by digital humanities projects.

I consider that the contributions formulated are the doctoral candidate's own work, possess the necessary novelty and originality, and are reflected in the publications related to the dissertation, the principal one of which is in a refereed international journal with an impact factor.

8. Evaluation of the publications related to the dissertation

Three publications related to the dissertation topic are presented, written in English, of which one is co-authored and two are single-authored, published between 2016 and 2026. Publication number 2 on the list of publications is indexed in Web of Science, with an impact factor of 4.6 and Q2 – Future Internet, volume 17, issue 11 (2025). The doctoral candidate is the first author of it. Publications numbered 1 and 3 are single-authored and were presented at international scientific conferences in Pamporovo, in 2016 and 2026 respectively. The publications reflect substantial parts and key results of the conducted research and meet the requirements for obtaining the educational and scientific degree of "Doctor." The publications related to the dissertation are fully sufficient to meet the minimum national requirements of the Regulations for the Implementation of the Law on the Development of Academic Staff; with a minimum requirement of 30 points under Group G indicators, the doctoral candidate has 60 points.

The results of the dissertation have also been approbated along other lines – through the publicly available working prototype with a live knowledge graph, allowing independent verification of the translations and of the semantic layer, as well as through the research conducted within three scientific projects, one of which under the Program "Research, Innovation and Digitalization for Smart Transformation" 2021–2027, co-financed by the European Union. This ensures the necessary publicity for the doctoral candidate's research activity and the results of the dissertation research.

9. The doctoral student's active participation

I know the doctoral candidate personally as a colleague at the Faculty of Mathematics and Informatics and have a good impression of his work. My review of the dissertation, the abstract, and the publications gives me reason to believe that the dissertation and its contributions are the doctoral candidate's own work, produced under the direct supervision of his academic advisors Prof. Anton Iliev, PhD, and Prof. Todorka Terzieva, PhD. I am not aware of any evidence of plagiarism.

10. Abstract

The abstracts, written in Bulgarian and English, are 32 pages long and comply with the formatting requirements. Their content corresponds to that of the dissertation and presents the main findings of the dissertation.

11. Critical comments and recommendations

I have no substantive criticism of the dissertation or the results presented. The comments and recommendations made during the preliminary discussion of the dissertation have been incorporated into the dissertation. I have the following question for the doctoral candidate regarding the future development of the work:

The dissertation establishes an asymmetry between the preservation of affective and of stylistic properties in translation, with the stylistic ones being preserved less well. Do you consider that this result is due to an insufficiently developed layer of stylistic correspondences in the CDAO ontology and can be overcome by enriching it, or is it a structural limit of the approach, in which style is a property dependent on the expressive means of the particular artistic form and therefore in principle not transferable between modalities?

My recommendation to the doctoral candidate is to continue the research activity in accordance with the directions for future work outlined in the dissertation, and in particular to carry out the planned ablation study, which would allow the contribution of the individual components of the framework to be established empirically. I also recommend the preparation and publication of single-authored papers in referred journals.

CONCLUSION

I give a positive assessment of the scientific research conducted and the results presented in the dissertation. The dissertation contains original applied scientific and applied results that meet the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria, the Regulations for the Implementation of the Law, and the relevant Regulations of Plovdiv University "Paisii Hilendarski." The dissertation demonstrates that the doctoral candidate possesses in-depth theoretical knowledge and professional skills in the scientific field of "Informatics," demonstrating the qualities and abilities to conduct independent scientific research.

I strongly recommend that the distinguished Academic Jury award the educational and scientific degree of "Doctor" to Viktor Plamenov Matanski in the field of higher education: 4. "Natural Sciences, Mathematics, and Informatics," professional field 4.6. "Informatics and Computer Sciences," doctoral program "Informatics".

11.08.2026

Reviewer:

/Prof. Asya Stoyanova-Doycheva, PhD/