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MDE Intelligence 2021: 3rd Workshop on Artificial Intelligence and Model-Driven Engineering

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***Abstract*—Model-driven engineering (MDE) and Artificial Intelligence (AI) are two separate fields in computer science, which continue to benefit from cross-fertilization and collaboration. Such integrations—which we call MDE Intelligence—can go both ways: MDE activities benefit from the integration of AI ideas and, conversely, AI can benefit from the automation and subject-matter-expert integration offered by MDE.**

This 3rd edition of the Workshop on Artificial Intelligence and Model-driven Engineering (MDE Intelligence), held in conjunction with the IEEE/ACM 24th International Conference on Model-Driven Engineering Languages and Systems (MODELS 2021), builds on the success of the previous two editions and provides the space for discussions of the integration of AI and MDE and for the identification of opportunities for new integrations between the two fields.

***Index Terms*—MDE, Artificial Intelligence, MDE Intelligence**

I. Introduction

Artificial Intelligence (AI) has become ubiquitous as it is present in most of our daily used devices. Companies are using AI to exploit huge amounts of data to improve their products, processes, and services. Thus, AI is nowadays also introduced to the system and software engineering lifecycle covering analysis, design, testing, deployment, operation, and maintenance. The promise is to help software and systems engineers to build software systems faster and with better quality while at the same time being able to deal with even more complex systems—GitHub's Copilot[1] is a prime recent example.

Model-Driven Engineering (MDE) is a dedicated paradigm to tame part of the complexity of modern systems. However, its adoption by industry requires smart tools which allow to fully benefit from the concepts and techniques developed by the MDE community. Here is a clear opportunity for AI-empowered MDE, which allows to develop the next generation of software-intense systems by benefiting from both, the abstraction power of MDE and the automation support by AI.

The MDE Intelligence workshop[2] [1] provides a forum to discuss how to choose, evaluate, and adapt AI techniques to MDE as a way to improve current modeling and generation processes while, at the same time, increasing the benefits and reducing the costs of adopting MDE and AI. Currently, we see emerging approaches exploiting AI techniques to empower MDE techniques and tools with new or improved features to deal complex, large-scale, and data-driven systems. We also like to emphasize that AI artefacts are in fact software artefacts, thus AI-enhanced MDE techniques and tools will also be beneficial for developing AI artifacts themselves, just think about "trustable" AI software. Therefore, the workshop also aims to discuss AI software as a target domain for MDE.

Although data-driven AI with machine learning is currently a popular paradigm to simulate intelligence, the workshop is open to any kind of technique that provides human cognitive capabilities to create "intelligent" software with MDE. Furthermore, we would like to emphasize that the workshop is considering both symbolic and non-symbolic AI approaches. Finally, hybrid approaches, i.e., smart combinations of different types of AI approaches, are of interest as well.

II. Goal of the workshop

This is the third edition of the MDE Intelligence series of workshops at MODELS. The success of the workshop series is evidence of the continued belief in the community that an integration between MDE and AI concepts, technologies, and ideas is important and timely. This third edition of the workshop aimed to build on this continued community interest to disseminate new work in the area and bring together researchers and practitioners working on these key topics.

III. Summary of the workshop

We solicited two types of papers: *(1)* research papers, and *(2)* vision papers, experience papers, case study papers or demos.

We received eight submissions, out of which the following four were accepted for publication in the proceedings and presentation during the workshop:

- Viola Wenz, Arno Kesper and Gabriele Taentzer. *Detecting Quality Problems in Data Models by Clustering*.

[1]https://copilot.github.com/
[2]https://mde-intelligence.github.io/2021/index2021.html

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- Panagiotis Kourouklidis, Dimitris Kolovos, Joost Noppen and Nicholas Matragkas. *A Model-Driven Engineering Approach for Monitoring Machine Learning Models*. (vision paper)
- Vishnudas Raveendran, Sapan Shah and Sreedhar Reddy. *A Model Driven Approach to Building Domain Specific Search Engines*.
- Kevin Lano, Sobhan Yassipour-Tehrani and Muhammad Umar: *Automated Requirements Formalisation for Agile MDE*.

The accepted papers thus cover both the use of MDE for AI (e.g., managing machine learning models using an MDE infrastructure) and the use of AI for the improvement of MDE.

IV. Acknowledgement

We would like to thank the MODELS 2021 organization for giving us the opportunity to organize this workshop, especially to the workshops chairs Huseyin Ergin (Ball State University, US) and Xiaoxing Ma (Nanjing University, China), who supported the organisation of the workshop with their prompt and helpful messaging. Many thanks to all those who trusted the MDE Intelligence workshop and submitted papers, regardless of whether they were accepted or not, and particularly to the presenters of the accepted papers. We also warmly thank the lightning talks presenters and the many participants who contributed to the open discussions with their comments and experience. Last but not least, our thanks go to the reviewers and the members of the Program Committee and Steering Committee, for their timely and accurate reviews and for their help in choosing and suggestions for improving the selected papers.

V. Steering Committee

- Marco Brambilla (Politecnico di Milano, Italy)
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Two additional sub-reviewers helped with the papers during the reviewing process:

- Joel Charles (RWTH Aachen University, Germany)
- Meysam Karimi (University of Isfahan, Iran)

References

[1] L. Burgueño, A. Burdusel, S. Gérard, and M. Wimmer, "Preface to MDE Intelligence 2019: 1st Workshop on Artificial Intelligence and Model-Driven Engineering," in *22nd ACM/IEEE International Conference on Model Driven Engineering Languages and Systems Companion, MODELS Companion 2019, Munich, Germany, September 15-20, 2019*. IEEE, 2019, pp. 168–169. [Online]. Available: https://doi.org/10.1109/MODELS-C.2019.00028