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Duale Hochschule Baden-Württemberg

IARIA

DaMIA – Data Mining in Industrial Applications of Digital Twins

Pattern 2023 – IARA

Track Chair: **Prof. Dr. Jens Weber**

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A warm welcome to our special track!

Track Chair
Prof. Dr. Jens Weber

Head of Mechatronics Trinational
Faculty of Technology
Baden-Wuerttemberg Cooperative State University
Loerrach, Germany

Track Chair Deputy
Jan Spoor

PhD student and research fellow
Karlsruhe Institute of Technology
& Mercedes-Benz Group AG
Stuttgart, Germany

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The special track creates a panel for leaders, researchers, industry practitioners, and users to drive the development of the field of **Data Mining in Industrial Applications of Digital Twins** by discussing emerging trends and opportunities.

The objective is exchanging **new ideas as well as tested best practices.**

We achieve this by promoting a **transdisciplinary and cross-domain collaboration**.

The contributions show **the wide range of Digital Twin concepts** in manufacturing and the automotive industry as well as in digital threat detection.

The contributions of this special track enable **solutions for real-world challenges** of industrial applications such as:

- Two useful **datasets for future research projects for digital threat detection** are evaluated and presented.
- An **IT landscape roadmap for the development of an Industrial Metaverse**.
- A foundation for a development of application of **Digital Twins and knowledge graphs in manufacturing**.

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Three facts about **Digital Twins** regarding the special track:

1. The core idea of a Digital Twin as a **virtual representation of a physical system** but also a functional entity on its own was first introduced in 2002 by Grieves [1].

2. The **research activities are growing** in field of manufacturing.

3. The Digital Twin concept is today **more versatile and applied in different scenarios and domains** which is also confirmed by the contributions today.

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Insights into the **Contributions** of the special track:

Digital Threat Detection

- The Digital Twin is used as method to track the online vulnerability of individuals regarding privacy [2].
- In this context, we will see a contribution that lays the foundation for future research with focus on the evaluation of Digital Twin capabilities in mitigating privacy threats [3].

Industrial Metaverse

- The Metaverse emerged from the field of Digital Twins to enable an immersive collaboration among all participants.
- For the application of Industrial Metaverse solutions, the IT landscape of a manufacturing company must be adjusted for the specific requirements of such complex systems, which we also will see in one of our session presentations [4].

Knowledge Graphs

- Knowledge graphs are discussed as enablers and source for contextual and semantically enriched information [5].
- Knowledge graphs are applications which acquire and integrate information into an ontology and provide a reasoning [6].
- The last contribution points out that methods and requirements of practitioners and literature differ [7].

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Agenda

1. 14:30 – 14:40
   Welcome and Introduction to DaMIA – Data Mining in Industrial Applications of Digital Twins
   Jens Weber, Baden-Wuerttemberg Cooperative State University, Loerrach, Germany

2. 15:45 – 15:10
   Protecting Your Online Privacy: Insights on Digital Twins and Threat Detection
   Sergej Schultenkämper, Bielefeld University of Applied Sciences, Germany (Online)

3. 15:15 – 15:40
   Architecture Options to orchestrate Digital Twins in an Industrial Metaverse for the Predictive Production with AI methods
   Bernd Lüdemann-Ravit, University of Applied Science Kempten, Germany

4. 15:45 – 16:10
   Requirements for the Application of Knowledge Graphs in Body-In-White Manufacturing
   Christian Graewe, NTT Data Deutschland AG, Germany

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References

[1] M. Grieves, J. Vickers, "Digital Twin: Mitigating Unpredictable, Undesirable Emergent Behavior in Complex Systems," In: F.-J- Kahlen, S. Flumerfelt, A. Alves, A. (Eds.): "Digital Twin: Mitigating Unpredictable, Undesirable Emergent Behavior in Complex Systems," vol. 89, Cham, pp. 85-113, 2017.

[2] F.S. Bäumer„ S., Denisov, Y. Su Lee, M. Geierhos, "Towards authoritydependent risk identification and analysis in online networks," In: Proceedings of the IST-190 Research Symposium (RSY) on AI, ML and BD for Hybrid Military Operations (AI4HMO), 2021.

[3] B. Schultenkämper, F.S. Bäumer, "Protecting Your Online Privacy: Insights on Digital Twins and Threat Detection," The Fifteenth International Conference on Pervasive Patterns and Applications (PATTERNS'23), Nizza, 2023.

[4] B. Lüdemann-Ravit, F. Heieck, "Architecture Options to orchestrate Digital Twins in an Industrial Metaverse for the Predictive Production with AI methods," The Fifteenth International Conference on Pervasive Patterns and Applications (PATTERNS'23), Nizza, 2023.

[5] G. Buchgeher, D. Gabauer, J. Martinez-Gil and L. Ehrlinger, "Knowledge Graphs in Manufacturing and Production: A Systematic Literature Review," In: IEEE Access, vol. 9, pp. 55537-55554, 2021

[6] L. Ehrlinger and W. Wöß, "Towards a Definition of Knowledge Graphs," In: SEMANTiCS, vol. 48, pp. 1-4, 2016.

[7] J.M. Spoor, C. Graewe, J. Weber, "Requirements for the Application of Knowledge Graphs in Automotive Manufacturing," The Fifteenth International Conference on Pervasive Patterns and Applications (PATTERNS'23), Nizza, 2023.