PANEL #3

VALENCIA
November 2023

SocSys 2023 & SoftNet 2023

Theme

Simulation and Validation Challenges for (AI-based) Complex Systems

CONTRIBUTORS

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Moderator

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Chair position

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Simulation and Validation Challenges for (AI-based) Complex Systems

- When do we call a system complex?
- When do we simulate, when do we validate?
- What does AI-based mean?

Carlo Simon
HS Worms,
Germany

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When do we call a system complex?

- Number of elements
- Interaction and interdependencies between elements
- Structure
- Process

- Problem: Complexity of algorithmic (causal) analysis

Carlo Simon
HS Worms,
Germany

Chair position

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Carlo Simon
HS Worms,
Germany

When do we simulate, when do we validate?

- Check the correctness of a system
- Observe a possible behavior of a system

- Validation is general
- Simulation is specific
- Both handle causality

Chair position

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Carlo Simon
HS Worms,
Germany

- What does AI-based mean?

- AI-methods are integrated into a method
- May solve only a specific task

- Statistics
- Correlation instead of causality

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Mart Verhoog

IU International University
of Applied Sciences

When simulating AI-based complex systems, key challenges include:

1. ensuring high **data quality**,
2. managing the **complexity of models**,
3. addressing **uncertainty**,
4. securing adequate **computational resources**,
5. considering **ethical implications and biases**,
6. and establishing rigorous **validation methods**.

These factors are crucial for accurate and reliable simulations.

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Jos van Rooijen
Huis voor Software kwaliteit

- **Business, Integration, Metrics**
  - **Business Process validation is my perspective**
  - **Do we know how the (complex) system is working?**
  - **Cooperation between the manual and the automatic part of the system**
  - **Integration in the total IT landscape**
  - **When to apply simulation in the development chain?**
  - **Some metrics**

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Isaac Caicedo-Castro

- **General challenges**
  1. Quality of Data and acquisition
  2. Ethic concerns
  3. Domain transfer
  4. Scalability
  5. Regulatory compliance
  6. Budget constraints
- **Supervised machine learning challenges**
  1. Imbalance data sets
  2. Interpretability and explainability
  3. Validation is limited to the domain: the probability distribution of the training set is unknown!

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- **Unsupervised machine learning challenges**
  1. There's no ground truth
  2. Lack of objective criteria for validation
  3. Scalability: recommender systems and dimensionality reduction.
  4. Adaptation to evolving data distribution
- **Challenges for generative models, recommender systems, and self-driven vehicles**
  1. Requires human-driven evaluation
  2. Cybersecurity
  3. Reliability and public acceptance
- **Quantum AI Complex Systems: What can we expect?**
  1. Decoherence
  2. Scalability issues and limitations in simulated and real systems due to the number of qubits.
  3. Integration challenges in hybrid systems

Dr. Isaac
Caicedo-Castro

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Christos Kalloniatis
University of the Aegean

- So, what about Privacy and GDPR compliance?
  - Industry 4.0 vs Industry 5.0 Challenges – A transition more towards Human side!
  - Users privacy protection is in the center
  - GDPR compliance demands a set of organizational, legal and technical measures to be enforced prior to system development
  - How feasible is to bring GDPR compliance in a complex system?
  - GDPR tools for compliance should be considered prior to simulations and validations
  - AI and Privacy in complex systems. Friends or enemies?