Artificial Intelligence for Robust Engineering & Science

AIRES 3: Machine Learning for Robust Digital Twins

Hybrid Workshop
April 26-28, 2022

Overview

Robust engineering is the process of designing, building, and controlling systems to avoid or mitigate failures. The introductory Artificial Intelligence for Robust Engineering and Science (AIRES) workshop in January 2020 explored these foundations while the second AIRES workshop in January 2021 focused on the foundations of AI for constructing, deploying, and assuring the robustness of digital twins. The third AIRES workshop, to be held April 26-28, 2022, will build on the successes of the first two workshops in this series and explore and develop the foundations of AI in knowledge-informed modeling and prediction, deployment considerations, and related topics. The workshop will comprise the following thrusts:

Knowledge informed AI: This thrust focuses on the technical challenges associated with developing robust digital models, including but not limited to:

- Integrating physics or other knowledge into machine learning
- Methods for multi-scale prediction (especially multi-scale time-series prediction)
- Control of physical systems with assistance of learned AI models

Assurance: This thrust focuses on the technical challenges associated with assuring robustness of digital twins and includes:

- Uncertainty quantification
- Verification, validation, and calibration
- Assurance, including causal inference, explainability, and interpretability
- Security and resilience
- Detecting and dealing with bias

Co-design Ecosystem: This thrust focuses on the practical challenges when using digital twins, such as:

- Edge deployment for real-time and power-efficient deployment of digital twins
- Federated learning for privacy or for data reduction
- Integrating HPC and edge systems, including model and data management
- Online and offline continuous learning on edge-based systems
- Human-machine interface design
- Interoperability and standardization

Talks addressing a broader set of challenges will also be considered.

For more information, please visit https://AIRES.ORNL.gov.

Meeting format

AIRES 3 is currently planned as a hybrid meeting hosted by Oak Ridge National Laboratory, with a combination of in-person and virtual attendees, from April 26-28, 2022. The program committee is monitoring the status of the pandemic and will make a final decision on the format (hybrid vs. fully virtual) in alignment with DOE guidance for in-person meetings and travel by the end of March 2022.

AIRES 3 is focused on user participation with the objectives of exploring current work in the use of machine learning for robust engineering and digital twins, identifying research challenges and investment areas, and developing collaborations among participants. The workshop will include:

- *Keynote presentation.*
- *Invited talks* by leaders in the field.
- *Contributed talks* by participants (15-minute slot). Participants may propose a contributed talk during the registration process. The program committee will select from the proposed talks for presentation during the workshop.
- *Flash talks* by participants (5-minute slot). Participants may propose a flash talk during the registration process to highlight their research areas and encourage follow-up discussions and collaborations among attendees.
- *Breakout sessions* to address specific questions proposed by the program committee and by participants. Registered participants will have the opportunity to provide input on breakout sessions before the workshop.
- *Networking opportunities* to enable attendees to identify opportunities for collaboration.

How to participate

With the goal of increased collaborations, AIRES 3 participants will be expected to actively contribute to the workshop including small group interactions and breakout sessions. In addition to providing basic personal and contact information during registration, participants will also provide their research interests and be given the opportunity to propose a full length contributed talk or a short flash talk. Registration is free.

Participation is by invitation only. Requests to participate can be emailed to AIRES@ornl.gov. The deadline to request an invitation is March 20, 2022.

Meeting organization

General Chairs:

Pradeep Ramuhalli, Oak Ridge National Laboratory
David Womble, Oak Ridge National Laboratory

Logistics and Planning Chairs:

Christy Hembree, Oak Ridge National Laboratory
Taylor Bullock, Oak Ridge National Laboratory

Program Committee:

Kevin Cao, Arizona State University
Jana Doppa, Washington State University
Frank Liu, Oak Ridge National Laboratory
Dan Lu, Oak Ridge National Laboratory
Jibo Sanyal, Oak Ridge National Laboratory
Abhinav Saxena, GE Global Research
Malachi Schram, Jefferson Lab
Sudip Seal, Oak Ridge National Laboratory
Steve Sun, Columbia University
Nathaniel Trask, Sandia National Laboratories
Draguna Vrabie, Pacific Northwest National Laboratory