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IEEE CAI 2023, an Industry-Centered Conference on AI

In a previous communication [1], we focused on *Industry Engagement in Conferences*, and the need for a new Industry-focused CIS conference without the requirement of scholarly papers. Here we highlight the inaugural 2023 IEEE Conference on AI (IEEE CAI 2023) - https://cai.ieee.org/2023/ - our first major conference with this new format.

IEEE CAI 2023 is co-sponsored by the IEEE Computational Intelligence, Computer, Signal Processing, and Systems Man and Cybernetics Societies. IEEE CIS is responsible for the first two events: on June 7–8, 2023, in Santa Clara, CA, USA, and June, 2024 in Singapore. IEEE CAI 2023 is structured along six verticals, covering *Industrial AI, AI in Healthcare/Life Science, Transportation/Aerospace, Energy, Earth System Decision Support, and Social Implications of AI/Privacy* (Fig. 1).

Each vertical will offer keynotes by thought-leaders from industry, panels covering critical issues related to the verticals, poster presentations, and workshops. Here is a brief description of each vertical.

(1) Industrial AI

Today's industrial machines are hyper-connected to the Industrial Internet of Things (IIoT) and have highly capable Edge computing. As a result, they constantly generate a wealth of diverse data that needs to be analyzed and consumed by other machines or human operators. This requires advanced descriptive, predictive, and prescriptive analytics, often combining physics-based and data-driven models. The vertical on Industrial AI will explore:

- *Robust Cyber-security, to protect deployed AI systems from being breached for blackmailing, sabotage, or industrial espionage.*
- *Effective use of Digital Twins, to provide reliable, actionable information.*
- *Comprehensive Prognostics and Health Management for industrial assets in Aviation, Oil & Gas, and Power Generation, to reduce/eliminate unplanned maintenance events.*

(2) AI in Healthcare/Life Science

The advent of genomics and personalized medicine has generated tremendous volumes of data at different biological scales with a need for improved decision-making to assist medical practitioners. The relationships between genotype, phenotype, and environment require a large-scale AI approach to tease out critical relationships relative to disease. However, this same opportunity comes with concerns for privacy and data security. Furthermore, many other medical issues can benefit from the use of AI, including personnel allocation and scheduling, automated sensing, improved medical devices and manufacturing processes, and supply chain optimization.

(3) AI in Transportation/Aerospace

Today's growing, dynamic, global transportation system includes many important AI application areas from autonomous cars and trucks to unmanned aircraft and spacecraft. Indeed, in long-duration space missions, the communication times are such that AI is required to perform smart decision-making in real-time without the need for confirmation from Earth-bound controllers. This vertical will focus on several areas including:

- *Optimal design of aerospace systems using AI.*
- *Routing, scheduling, and energy minimization of large- and small-scale transportation systems.*
- *Effective use of deep learning for autonomous driving.*
- *Autonomous decision-making in long-term space flight with and without human-in-the-loop management.*

(4) AI in Energy

AI tools have a noticeable impact on energy sector [2], [3], and can be used in:

- *Power load forecasting.* AI can provide precise load forecasting needed to handle widespread price variability due to changes in consumption and the use of renewable energy.
- *Power generation forecast of renewable energy to improve agility and resilience.* Renewable energy tends to be intermittent and variable when produced by cooperatives and prosumers. AI-based automation can identify grid vulnerabilities and reroute automatically.
- *Smart Grid Control.* AI can generate outage alerts before they happen; they can improve automated switching by predicting grid imbalances and differentiate between brief power interruptions and full-on outages; and can generate optimized power yield and more flexible demand-side management to reduce peaks in energy demand.
- *Power Network Security Protection.* We can improve security by detecting network attack features, malware, and intrusion and by providing network security protection for power systems.

(5) AI in Earth System Decision Support

As our climate changes, weather events and phenomena such as drought and

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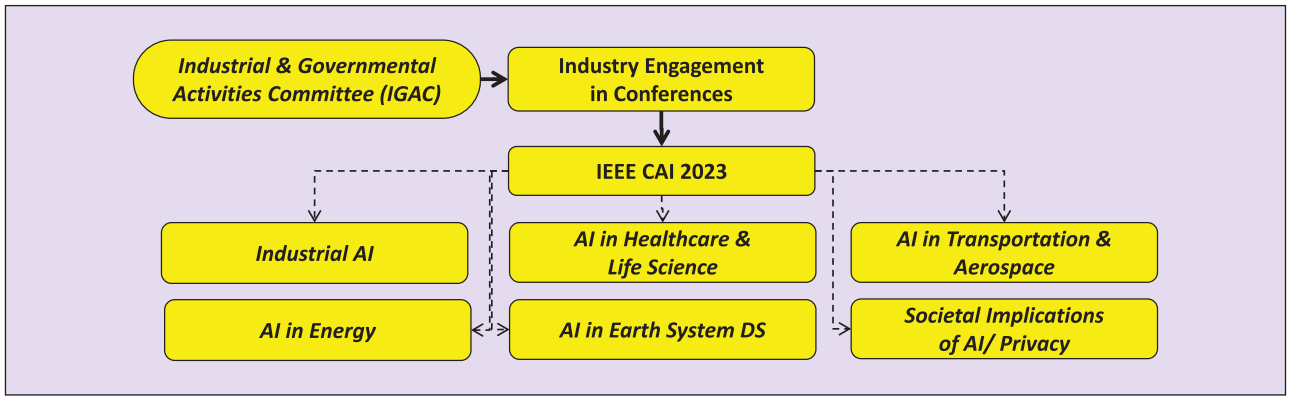

FIGURE 1 IEEE CIS Industrial and Governmental Activities Committee focused on Industry Engagement in Conferences. We showcase the six verticals in the IEEE CAI 2023.

wildfire impact many industries, which are then forced to manage the associated risks. The Earth System has complex processes on a wide range of length and time scales, which makes AI a critical tool to predict the impacts of these complex events on industries such as:

- ❏ *Power utilities: Energy system management and optimization, generation, and transmission.*
- ❏ *Agriculture: Management of crops to maximize yield.*
- ❏ *Insurance: Management of risks associated with natural disasters.*
- ❏ *Civil Engineering: Design of resilient infrastructure, including transportation and logistics.*

(6) Social Implications of AI/Privacy

To use AI ethically in human-critical applications that could affect well-being, environment, lifestyle, etc., we need to trust the AI systems and those who develop and implement them. The National AI Initiative (*https://www.ai.gov/strategic-pillars/advancing-trustworthy-ai/*) notes:

"To be trustworthy, AI technologies must appropriately reflect characteristics such as accuracy, explainability and interpretability, privacy, reliability, robustness, safety, and security or resilience to attacks – and ensure that bias is mitigated."

This vertical will focus on these characteristics, highlighting their technical and business challenges. The following definitions have been adapted from many sources [4], [5], [6].

- ❏ *Explainability and Interpretability.* Understanding is a requirement for developing trust. Explanations are necessary to enhance understanding, trust, and informed decision making. *Explainability* is the extent to which the internal mechanics of a model can be explained in human terms. *Interpretability* is about the extent to which a cause and effect can be observed within a system.
- ❏ *Transparency.* The AI data, system, and business models must be transparent. Humans must be aware when they are interacting with an AI system, and must be informed of its capabilities and limitations. Ultimately, transparency improves traceability and accountability.
- ❏ *Privacy, Governance Risk, and Compliance.* Besides providing privacy and data protection, data governance mechanisms must also be used, to guarantee data quality and integrity, while ensuring legitimized access to data.
- ❏ *Robustness, Security/Resilience to attacks.* ML algorithms could be vulnerable to novel adversarial inputs. Trustworthy AI systems must have Robustness (the ability to withstand the effects of adversaries), including adversarial threats and attacks.
- ❏ *Fairness/Bias.* Hidden biases could lead to discrimination and exclusion of underrepresented/vulnerable groups. To prevent this, AI systems must include proper safeguards against bias and discrimination. Except for when the bias is intrinsic to the ML algorithm (*Algorithm Bias*), biases are usually introduced in the ML model through its training data set: *Sample Bias*, *Prejudice Bias*, *Measurement Bias*, and *Exclusion Bias*.

While each of the verticals is interesting in its own right, their interconnectivity is obvious. Energy minimization is of great importance in transportation systems. Privacy and explainability are important in healthcare decision-making. Cybersecurity in industrial settings is just as critical in an autonomous car as in a hospital, or the control of smart energy grids. While IEEE CAI 2023 aims to focus discussion on these verticals, we also plan for discussion and panels that will allow time for the important cross-pollination between them. We invite interested readers to follow IEEE CAI 2023 developments via *https://cai.ieee.org/2023/*, submit papers for the poster sessions when the CFP is released, and attend the conference to benefit directly from the interactions between industrial thought-leaders, practitioners, and researchers.

References

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