

On the Role of Modelling and Simulation for Artificial Intelligence

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Prof. Abbass is a Fellow of IEEE, a Fellow of the Australian Computer Society, a Fellow of the UK Operational Research Society, a Fellow of the Australian Institute of Managers and Leaders, and a Graduate Member of the Australian Institute of Company Directors (GAICD). He is a Distinguished Lecturer for the IEEE Computational Intelligence Society. Prof. Abbass is the Founding Editor-in-Chief of the IEEE Transactions on Artificial Intelligence, an Associate Editor of several IEEE journals, and a Senior AE for ACM Computing Surveys. He was the National President (2016-2019) for the Australian Society for Operations Research (ASOR), the Vice-President for Technical Activities (2016-2019) for the IEEE Computational Intelligence Society, a member of the Australian Research Council (ARC) College of Experts (2013-2015), and a Chair (2013-2014) of the Emerging Technologies Technical Committee, IEEE Computational Intelligence Society. His current research focuses on AI-enabled swarm systems, shepherding-based swarm guidance, human-AI teaming, and machine education.

Abstract

Artificial Intelligence (AI) is the ubiquitous revolutionary technology of this century. AI has revolutionised humanity, including industry and government organisations, and transformed our world into smart digital spaces. As a discipline, one of the definitions of AI is the automation of cognition; or, put simply, the set of technologies required to support the design and implementation of artificial cognition in artificial systems. To design an intelligent system/machine, technologists need to transform the algorithms of AI into a system-of-systems design of cognition, whereby the artificial agent can sense, make sense, make decisions, take decisions, and learn about the contexts it is situated within. Modelling and Simulation (M&S) sit at the core of an artificial agent's design and implementation components.

In this presentation, I will cover the use of M&S within AI from different angles . In doing so, I will bring elements from my research to showcase how M&S not only contributes to AI but also shows that without M&S, AI can't operate. I will paint futures that range from very concrete and narrowly defined uses of AI to a world of human and artificial cognitive agents. Humans educate AI agents, and AI agents educate humans. I will then conclude with some challenges for the M&S community to support the effort in advancing AI.

This presentation will be drawn from many of my published works; below are some critical references for interested readers.

1. Abbass, H. (2021). What is Artificial Intelligence?. *IEEE Transactions on Artificial Intelligence*, 2(2), 94-95.
2. Tang, J., Leu, G., & Abbass, H. A. (2019). *Simulation and Computational Red Teaming for Problem Solving*. John Wiley & Sons.
3. Abbass, H. A. (2015). *Computational red teaming*. Springer.
4. Abbass, H., Petraki, E., Hussein, A., McCall, F., & Elsawah, S. (2021). A model of symbiomemesis: machine education and communication as pillars for human-autonomy symbiosis. *Philosophical Transactions of the Royal Society A*, 379(2207), 20200364.