

Initial post – Agent-based systems

When considered in the light of computer programming, agents are elements which are able of sensing the state of the environment they operate in, and affect that environment in some way through autonomous action (Wooldridge and Jennings, 1995; Luck, McBurney and Gonzalez-Palacios, 2006; Woolridge, 2009). Agent-based computing (ABC) aims to imbue computer programs with intelligence by replicating the behaviour of naturally-occurring agents, transposed into logical semantics and machine-readable instructions. Robots can be understood as application of agent-based computing to entities harnessed with a physical existence and capable of acting in and interacting with the real world.

The development of agent-based systems accompanied that of artificial intelligence more widely, which can be traced back to the original formulation of “machine intelligence” by Alan Turing in the 1950s. However, ABC was only first recognised as a distinct paradigm in programming in 1993 (Luck, McBurney and Gonzalez-Palacios, 2006; Russel and Norvig, 2021). Since then, ABC has seen substantial development, including the development of multi-agent systems and their application to multiple scenarios ranging from robotic soccer to intricate modelling systems in economics, epidemiology, and biology. More recently, ABC applications have expanded into highly-complex industries including logistics and traffic management, with contemporary applications spanning autonomous vehicles and virtual personal assistants supported by large-language models and computer vision (Niazi and Hussain, 2011).

The examples above highlight both the versatility and potential value of intelligent agents for individuals and organisations. Such systems can replace human agents in tasks that are either repetitive, risky, or highly-standardised (such as manufacturing, firefighting, or storage), thereby reducing threats to human lives or improving performance, but also aid in settings where time-critical action is paramount and where large amounts of data can be used to support decision-making, including algorithmic trading and cybersecurity (Abar *et al.*, 2017). Nonetheless, the potential value of ABC is mirrored by the many risks inherent to development and implementation, spanning from faulty programming, training on biased or incorrect data, and security vulnerabilities (Szpryngier and Matuszek, 2010). These and many other limitations should be adequately addressed to ensure safe and reliable deployment of ABC and the full realisation of their potential to advance and promote human well-being.

References:

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