Research Interests

Andrew Owen Martin
Email: andrew@aomartin.co.uk Tel: 07901 65 35 28

7 May 2020

My passion of AI determined my undergraduate degree in Computer Science and Cybernetics at the University of Reading, which I attended 2003-2006. Cybernetics considered not only the software engineering required to make autonomous machines, but also the mechanical and electronic engineering, and the philosophy and ethics thereof. After my degree I worked at PKR Tech, an online gaming company where my final role was to automate the quality assurance process. In 2009-2010, while working part time at PKR Tech, I started the Cognitive Computing MSc at Goldsmiths, University of London under Prof. J. Mark Bishop. I eventually left PKR Tech to work as a freelance software engineer and to pursue a PhD.

My thesis [1] (accepted April 2020) was founded upon the notion that Artificial Intelligence projects could largely be categorised as those that leant on symbolic logic, and those which relied on Connectionist architectures [2]. Symbolic logic projects are clearly defined and interpretable, and met with intoxicating early success in the 60s and 70s. They were also brittle and failed to generalise their knowledge, or perform in noisy or poorly defined contexts. Connectionist projects currently demonstrate awesome power and potential, they appear to learn from raw datasets and smoothly interpolate their knowledge between presented data points. They have also been criticised as requiring significant intelligent preprocessing, and as providing little insight into the nature of biological intelligence. I therefore presented Swarm Intelligence as drawing from both approaches: like a symbolic logic project, agents may have internal states and algorithmically defined behaviour; like a Connectionist architecture, simple agents determine their action as a result of interactions and from this intelligent behaviour emerges at the population level. By describing Swarm Intelligence as the combination of both approaches, it is expected that the criticisms of both will apply, but as it is not fully defined by either approach, the criticisms will be mitigated somewhat. One further reason for believing in a combined approach is the similarity with systems seen in nature. For example, the algorithm developed in my thesis models closely the distributed decision making behaviour of some species of bees and ants.

If I were given complete freedom to perform research I would attempt to combine

Freeman's observations of real-time neurodynamics [3] with Campos and Froese's work in minimal cognition [4]. Freeman describes a neural network as being defined less as a set of weights, but more as a set of steady states of activity in a dynamical phase space, each steady state effectively implementing a feedforward neural network appropriate for the current situation. In this sense stimulation performs the dual role of either inducing action, or inducing a change in the steady state such that the network is always attuned to the context. Campos and Froese, independent of Freeman, demonstrate that with a simple three-neuron real-time dynamic neural network that communication, representation and the adopting of roles, may emerge when two instances of the network with identical weights are allowed to interact in an environment. I believe that the algorithm investigated in my thesis, Stochastic Diffusion Search, is a suitable model for developing, modelling and analysing the real-time dynamics of such a system. The forms of real-time, environmental and context sensitive behaviour described in these sources are exactly the kinds of dynamics that traditional Artificial Intelligence projects have been criticised for lacking by philosophers of the Continental tradition such as Dreyfus, H. [5] and Wheeler, M. [6]. Such an investigation will provide empirical evidence towards the longstanding critiques of AI, whether the evidence is in support of them, or contrary to them remains to be seen.

[1] Martin, Andrew. O., "Local Halting Criteria for Stochastic Diffusion Search Using Nature-inspired Quorum Sensing" Diss. Goldsmiths College, University of London, 2020. [https://www.aomartin.co.uk/uploads/thesis-andrew-owen-martin.pdf]

[2] Dreyfus, Hubert L., and Stuart E. Dreyfus. "Making a mind versus modelling the brain: artificial intelligence back at the branchpoint." *Understanding the Artificial: On the future shape of artificial intelligence*. Springer, London, 1991. 33-54.

[3] Freeman, Walter J. *How brains make up their minds*. Columbia University Press, 2000.

[4] Campos, Jorge I., and Tom Froese. "Referential communication as a collective property of a brain-body-environment-body-brain system: a minimal cognitive model." *2017 IEEE Symposium Series on Computational Intelligence (SSCI)*. IEEE, 2017.

[5] Dreyfus, Hubert L., and L. Hubert. *What computers still can't do: A critique of artificial reason*. MIT press, 1992.

[6] Wheeler, Michael. *Reconstructing the cognitive world: The next step*. MIT press, 2005.