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ARTIFICIAL INTELLIGENCE IN MEDICINE: DATA SCIENCE MEETS KNOWLEDGE ENGINEERING

Mathematical methods for supporting clinical decision making have a long history but have not achieved wide adoption because: (1) acquiring the large data sets that are needed to build decision models has been difficult and (2) the perception that mathematical models of decision-making are medically naive. Big data techniques address the problem of acquiring large data sets, but the problem remains that abstract data and algorithms are "black boxes" that are likely to be unintelligible and mistrusted by healthcare professionals and their patients. Artificial Intelligence and knowledge engineering offer many techniques for clinical decision making and management of care that are complementary to analytic tools and there is good evidence that these methods have practical value and user appeal. The Dentists and OpenClinical approach is based on a naturalistic model of medical expertise formalised in first-order logic (Fox and Das 2000). The Perfume modelling language exploits this approach and the standard syntax and semantics are in the public domain (Sutton and Fox, 2003). Proforma has been used successfully in diverse applications and medical specialties, in some cases at scale and with high impact. Knowledge engineering has much to offer to our ever more pressured health services by increasing the quality and safety of care at reduced cost, but more is needed to establish the "learning health systems" that are being widely discussed. Combining Proforma with the power of data mining and machine learning may offer a sound foundation for safe and clinically appropriate decision support services and a platform for implementing rapid learning systems in health care. Fox J and Das S, Safe and Sound: Artificial Intelligence in Hazardous Applications, AAAI and MIT Press, 2000. Sutton D and Fox, J "The syntax and semantics of the Proforma guideline modelling language" J Am. Medical Informatics Association, 2003.

Biography

John Fox is an interdisciplinary researcher with interests in computer science, AI, cognitive science and medical informatics. After degrees at Durham and Cambridge Universities he worked with AI founders Allen Newell and Herbert Simon at Carnegie-Mellon, and with Ulric Neisser at Cornell University in the USA. After a period with the MRC back in the UK he joined the ICRF (now Cancer Research UK) where his group made many theoretical and practical contributions in decision science, cognitive theory and medical informatics, and founded The Knowledge Engineering Review. He has published widely (see Researchgate.org) and has led the foundation of several medical AI companies (Expertech, InferMed, Deontics). A current passion is OpenClinical.net, an open access, open source knowledge repository that uses AI and crowdsourcing techniques to capture and disseminate actionable knowledge of best medical practice.

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