Title of invited session: Accuracy in Data Mining/ Machine Learning Applications

Names of proposers:

Dr. Omaru Maruatona

Associate Professor Paul Watters

Session importance:

The Accuracy in Data Mining/ Machine Learning session will get opinions of foremost ML researchers and the latest research on whether classification accuracy matters in modern systems, what the long term impacts of imperfect Machine Learning systems (less than 100% accurate) are and what could be done to curb these impacts.

Classification accuracy has become secondary as data mining applications, which are largely driven by machine learning (ML) algorithms have gained wide adoption and use in commercial systems. Traditionally, the no free lunch principle guided the selection of a ML algorithm in a given application. The recent increase in ML based commercial applications has driven the adoption of these algorithms with little regard to classification accuracy. Although most of the modern ML powered systems are functional, the accuracy threshold that qualifies a given algorithm to be used in a commercial system appears to be not as high. Although many commercial systems do not publicise their ML algorithms’ accuracy, the typical use of neural networks in a hybrid architecture with another ML algorithm suggests an attempt to boost classification accuracy.

This session will discuss, review and analyse classification accuracies of ML based commercial applications. The session will discuss the long term impact of imperfect classification accuracy in these systems particularly those with implications to human life or human safety. The session will invite papers on some of the latest architectures in ML and Data Mining applications and their classification accuracies. The session will also discuss the effects of growing misclassified cases in a system. For example, a system with 98% accuracy will have only 2 misclassified cases in a data of 100 cases, 20 in a data of 1000 cases, 2000 in a data of 1000,000 cases.

The session will conclude with a panel discussion featuring Professor Paul Compton, Associate Professor Paul Watters and Associate Professor Peter Vamplew, who are all accomplished Artificial Intelligence researchers. The panel will discuss and share their thoughts on the session’s three questions; whether classification accuracy matters in modern systems, what the long term impacts of imperfect Machine Learning systems are and what could be done to curb these impacts.

Proposer’s CV

1. Dr Omaru Maruatona

Omaru is a Machine Learning and Cyber security researcher and practitioner. He specialises in the design and development of knowledge based systems and data mining as well as Cyber security architecture, strategy, and governance. Omaru has over 7 years’ experience in the technology space spanning software development, Machine Learning and data mining systems development and Cyber security.

Areas of expertise

• Expert System design

• Machine Learning algorithm development

• Data mining research

• Cyber security (Cyber strategy, governance and management)

• Cyber threat and vulnerability management

Relevant experience

• Machine Learning based Internet banking fraud detection

Omaru’s PhD project was an industry funded task to develop a machine learning based system to detect and help reduce frauds on a commercial bank’ s Internet banking system. Working closely with academic advisors and the bank’s internal teams, Omaru proposed and developed a hybrid system comprising a rule base and an artificial neural network.

• Systems design and Software development

Omaru worked at the world’s largest diamond mine as a graduate systems engineer. Omaru’s responsibilities included managing the operation’s intranet, designing and developing internal software tools and business analysis for externally sourced software/system.

• Cyber Security

Omaru has extensive hands-on Cyber security experience, having worked as a technical security analyst at Australia’s largest stock transfer company and as a Senior Consultant at a Big Four consulting firm. Omaru has in-depth experience in Cyber risk assessments, Incident response, OT security assessments, threat and vulnerability management and cyber security project management.

Qualifications and memberships

• PhD (Machine Learning based Internet banking security)

• Bachelor of Software Engineering (1st class Honours)

• Certified Information Systems Security Professional (CISSP)

• Certified Cloud Security Professional (CCSP)

• SABSA Certified Architect

• Information Technology Infrastructure Library (ITIL) certified

Academic and other publications

• Google Scholar page: https://scholar.google.com.au/citations?user=kjc3UnsAAAAJ&hl=en

• LinkedIn page: https://www.linkedin.com/in/omaru-maruatona-80331365/

1. Associate Professor Paul Watters

A/Prof Watters is an expert in data mining applied to solving cybersecurity problems, especially in threat intelligence and forensic analysis. After early experience as a system administrator (and writing numerous books on UNIX, security in financial services, statistics and intelligence), he began his first R&D role in security in 2002, joining the CSIRO’s Networking Applications and Technologies (NAT) Group, and leading a programme in secure, distributed storage.

After moving to Macquarie University in Sydney, Dr Watters established the first cybercrime research laboratory in Australasia in 2006, in partnership with Dr Stephen McCombie, with the support of National Australia Bank (NAB). Dr Watters and Dr McCombie went on to win Australia’s first competitive research grant in phishing (ARC Linkage), with Professor Josef Pieprzyk. His work at Macquarie led to improvements in threat detection and response at NAB. He also worked as an expert witness, and developed the first cybercrime and cyber terrorism course at an Australian university.

After a stint dealing with security and privacy of electronic health records at the Medical Research Council in the United Kingdom, Dr Watters moved to the University of Ballarat in 2008, to become the first Research Director of the Internet Commerce Security Laboratory (ICSL), a partnership between Westpac, IBM, the State Government of Victoria, and the Australian Federal Police (AFP). The ICSL’s goal was to build capability in the cybercrime field, and to make Victoria the state of choice to undertake this type of work. In addition to numerous research publications, and skilled graduates who now protect Australia’s cyber frontline, the ICSL also produced significant outcomes for its research partners in the areas of threat mitigation (phishing, malware, identity theft, scams, piracy, child exploitation) and intelligence gathering. Dr Watters undertook consultancies for numerous external clients, including the Australian Federation Against Copyright Theft (AFACT), the Attorney General’s Department (AGD) and Google. While on sabbatical with the AFP, he developed an approach to detecting drug deals online.

In 2013, Dr Watters took up a Professorship in IT at Massey University in New Zealand. He continued his work in online threats, especially focusing on advertising as a vector for malware delivery and social harms. He also won two Callaghan Innovation grants to develop new algorithms for data analytics. He partnered with NGOs such End Child Prostitution and Trafficking (ECPAT) to systematically examine the links between film piracy and the proliferation of child abuse material online.

In 2015, Dr Watters also became an Adjunct Professor at Unitec Institute of Technology, the home of New Zealand’s first cyber security research centre. In recognition of his track record combating child abuse material online, he received an ARC Discovery grant in 2015 with colleagues at the University of Tasmania, University of Canberra and University College London.

Qualifications and memberships

• PhD in neural network modelling – Macquarie University

• MPhil in neural network modelling – University of Cambridge

• Fellow, British Computer Society

• Senior Member, IEEE

• Chartered IT Professional

Academic and other publications

• Google Scholar page: https://scholar.google.com.au/citations?user=dIfPL-0AAAAJ&hl=en&oi=ao

• LinkedIn page: https://www.linkedin.com/in/paul-watters-phd-0970b57