2018 IEEE CIS Summer School on Artificial Life and Computational Intelligence (ALCI)

Location: Victoria University of Wellington, New Zealand

When: December 11, 2018

Website: http://ecs.victoria.ac.nz/Events/AI2018/WebHome

Summary

While Artificial Life (AL) attempts to understand nature through modelling and simulation, Computational Intelligence (CI) attempts to translate this understanding into algorithms for learning and optimisation. This summer school on Artificial Life and Computational Intelligence features international research in AL and CI and provided an educational platform for innovative, interdisciplinary research associated with the computational concepts underlying living and intelligent systems.

This summer school was organised in broad tutorial sessions that bring together experts from different fields in AL, CI and associated areas. This event also hoped to encourage ALCI applied research in domains as diverse as health, the creative arts and finance. The primary targets of this school were undergraduate students and non-academics curious about bleeding-edge technology and wanting to upskill.

This summer school was co-located with the 31st Australasian Joint Conference on Artificial Intelligence (AI'18) conference, which was held at Victoria University of Wellington (general chairs Prof. Mengjie Zhang and Prof. Michael Blumenstein), New Zealand. AI is the premier event for Artificial Intelligence researchers across Australasia, organised under the governing auspices of the AI steering committee, but it is an international conference attracting world-wide researchers from both academia and industry.

General Chairs (two of equal responsibilities)

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Acknowledgements

Schedule

Time	Room	Program
9:00 am – 10:30 am	**AM102**	**Tutorial 1**: Methods and Techniques for Combating False Information in Social Media **Presenter**: Wei Gao **Chair**: Hoai Bach Nguyen
	AM104	**Tutorial 2**: Managing and Communicating Object Identities in Knowledge Representation and Information Systems **Presenters**: David Toman and Grant Weddell **Chair**: Harith Al-Sahaf
11:00 am – 12:30 pm	**AM102**	**Tutorial 3**: Academia and Entrepreneurship: How to Start and Run a Technology Company **Presenter**: Zbigniew Michalewicz **Chair**: Binh Tran
	AM104	**Tutorial 4**: Computational Intelligence for Brain Computer Interface (CIBCI) **Presenter**: Chin-Teng (CT) Lin **Chair**: Cao Truong Tran
2:00 pm – 3:30 pm	**AM102**	**Tutorial 5**: Evolutionary Computation for Digital Art **Presenters**: Frank Neumann and Aneta Neumann **Chair**: Harith Al-Sahaf
	AM104	**Tutorial 6**: Grammar-Guided Genetic Programming **Presenters**: Grant Dick and Peter Whigham. **Chair**: Qi Chen
	AM101	**Workshop**: The 5th Workshop on Machine Learning for Sensory Data Analytics. **Organisers**: Amir Hussain, Ashfaqur Rahman, and Jeremiah Deng
4:00 pm – 5:30 pm	**AM102**	**Tutorial 7**: Machine Learning in Uncertain Environments **Presenter**: Ke Tang **Chair**: Yanan Sun
	AM101	**Workshop**: The 5th Workshop on Machine Learning for Sensory Data Analytics. **Organisers**: Amir Hussain, Ashfaqur Rahman, and Jeremiah Deng

Speakers

Academia and Entrepreneurship: How to Start and Run a Technology Company

Zbigniew Michalewicz

The process of building a business "from rags to riches" is never easy, but there are many tips and techniques that can be used to smooth some of the bumps in the road. The only thing better than learning through your own personal experience is learning from someone who did it. During the talk we would discuss many of such tips and techniques that are often lost among the myriad of issues that emerge during the journey of growing business. The fundamental question we would address is "*What should I do to make people believe in my business?*" The talk will be illustrated by presenting a few selected projects and additional insights.

Computational Intelligence for Brain Computer Interface (CIBCI)

Chin-Teng (CT) Lin

Brain-Computer Interface (BCI) enhances the capability of a human brain in communicating and interacting with the environment directly. BCI plays an important role in natural cognition, which concerns the studies of brain and behavior at work for enhancing or restoring cognitive functions. BCI is widely considered a 'disruptive technology' for the next-generation human-computer interface in wearable computers and devices. Many people may benefit from BCI, which facilitates continuous monitoring of fluctuations in cognitive states under monotonous conditions in workplace or at home. People who suffer from episodic or progressive cognitive impairments in daily life can also benefit from BCI. In this tutorial, I will first introduce the current status of BCI and its major obstacles: lack of wearable EEG devices, various forms of noise contamination, user/circadian variability, and lack of suitable adaptive cognitive modeling. I will then introduce some methodologies to overcome these obstacles, including discovering the fundamental physiological changes of human cognitive functions at work and then utilizing these main bio-findings and computational intelligence (CI) techniques to monitor, maintain, or track human cognitive states and operating performance. In the second part of the tutorial, I will introduce an innovative BCI-inspired research domain called Cyber-Brain-Physical Systems. Some future research directions in

this domain will be explored and discussed, including BCI-embedded wearable computing, BCI-based neuro-prosthesis and assistive devices, wearable cognitive robots, and BCI-empowered training. The potential real-life applications of BCI on various aspects of training/education, healthcare, rehabilitation, and medical treatment will also be introduced and discussed.

Methods and Techniques for Combating False Information in Social Media

Wei Gao

Traditionally, fact-check of news stories follows investigative journalism which requires significant amount of time and manual effort. With the deep penetration of social media in our daily lives, large number of news updates disseminated widely can be generated from unreliable or unverified information sources. This renders conventional fact-checking effort increasingly ineffective, evidenced as massive-scale circulation of rumors and fake news online, which has become a serious phenomenal issue in recent years. In this tutorial, I will introduce automatic approaches, techniques and their new development for combating false information online especially in social media from the perspective of natural language processing and machine learning. I will focus on the characterization of rumours and fake news, their linguistic, temporal and propagational patterns and dynamics, as well as the effective machine learning models for detecting, tracking and classifying rumorours events. The tutorial will conclude with takeaways from past and ongoing research, and discuss potential future directions.
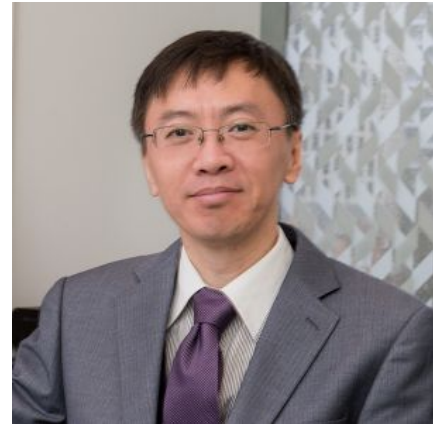
Managing and Communicating Object Identities in Knowledge Representation and Information Systems

David Toman and Grant Weddell

A *referring expression* in linguistics is any noun phrase identifying an object in a way that will be useful to interlocutors. In the context of knowledge representation and information systems *constant symbols* occurring in an underlying knowledge base are the artifacts usually used to identify a subset of the objects for which the knowledge base captures knowledge.
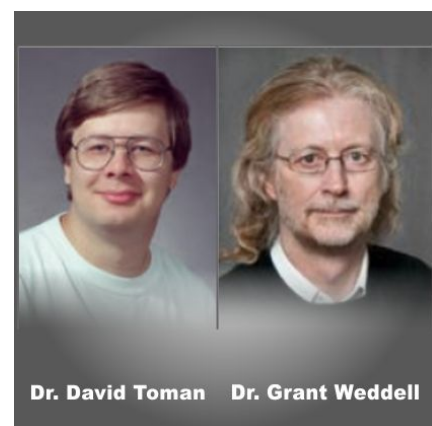
This tutorial explores how objects that can be usefully identified can be extended by allowing more general formulas in the underlying language of the knowledge base, called *singular referring expressions*, to replace constants as syntactic identifiers of such objects. Expanding the possibilities of identifying (possibly implicitly defined) objects serves

numerous purposes, ranging from allowing query answers to contain additional tuples (which are typically eliminated due to lack of constant symbols denoting components of such tuples), to answers that are more informative, to decisions on how to communicate references to objects among various cooperating agents, to identification issues related to physical data representation in computer storage (such as relying on *addresses* in main-memory databases).

Evolutionary Computation for Digital Art

Frank Neumann and Aneta Neumann

Evolutionary algorithms have been used in various ways to create or guide the creation of digital art. In this tutorial we present techniques from the thriving field of biologically inspired art. We show how evolutionary computation methods can be used to enhance artistic creativity and lead to software systems that help users to create artistic work. We start by providing a general introduction into the use of evolutionary computation methods for digital art and highlight different application areas. This covers different evolutionary algorithms including genetic programming for the creation of artistic images. Afterwards, we discuss evolutionary algorithms to create artistic artwork in the context of image transition and animation. We show how the connection between evolutionary computation methods and a professional artistic approach finds application in digital animation and new media art, and discuss the different steps of involving evolutionary algorithms for image transition into the creation of paintings. Afterwards, we give an overview on the use of aesthetic features to evaluate digital art. The feature-based approach complements the existing evaluation through human judgments/analysis and allows to judge digital art in a quantitative way. Finally, we outline directions for future research and discuss some open problems. The tutorial will contain various animations to showcase digital art. We also plan to allow the audience to interact with recent computer systems for digital art.
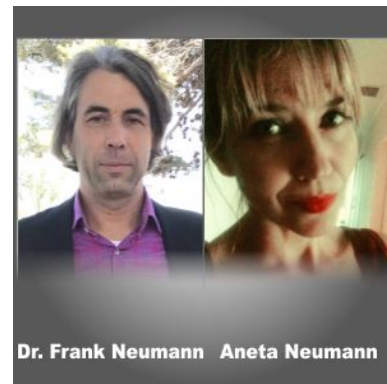
Machine Learning in Uncertain Environments

Ke Tang

Machine learning have been shown to be a powerful technique for intelligent data analytics. Due to the inherent uncertainty associated with the environments, most real-world data are subject to various uncertainty, such as non-stationary data distribution, noisy labels and uncertain misclassification costs, which brought great challenge to machine learning. This talk will introduce how standard machine learning

techniques, especially ensemble learning, could be adapted to address the above challenge.

Grammar-Guided Genetic Programming

Grant Dick and Peter Whigham

Genetic programming (GP) is an evolutionary computation method with a focus on representations using an arbitrary length data structure. Relaxing the need for an upfront selection of solution size and shape allows GP to explore a rich space of solutions. However, most variants of GP require some form of closure, where each subcomponent of a solution must be freely interchangeable with any other subcomponent. The incorporation of a grammar into GP allows it to maintain a flexible structure for its representation, but also frees GP from its closure requirement and allows GP to factor in domain knowledge and bias.

In this tutorial, we will provide a brief introduction into grammar-guided GP, including the historical development of the method, an overview of its primary operators, and highlight some useful and interesting applications. We will also provide a brief overview of the current trends in grammar-guided GP, centred mainly along the lines of appropriate design of representation and associated search operators.
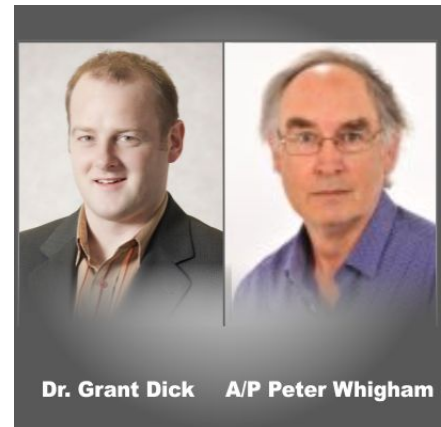
Photos

Budget:

Expenses (NZD)	
Half registration fee of the AI conference for each tutorial	2800
VIP dinner for all tutorial presenters	1500
Water for presenters	30
Lunch and tea	3500
Bag, program, notepad, pen	Cost covered by the AI conference
Venues	Cost covered by the AI conference
Total	7830

Income (NZD)	

Registration	2000
CIS, 3200 USD	4640
AI conference support	1190