2022 Artificial Intelligence Conference

23rd - 24th June 2022
Swansea - Bay Campus - Computational Foundry

Thursday 23rd June - Talks

Name: **Ben Winter**

Background information:
Third year at Bangor University, part of the CDT AIMLAC.

Title of talk:
Grammatical Neuroevolution

Theme:
The future of AI

Abstract:
Grammatical Neuroevolution is the marriage of grammatical evolution and neural networks. This talk will feature my current work, which involves using grammatical evolution to automate the production of custom loss functions that have been optimised for a given dataset and outputting the function as python code.

Name: **Phil D Hall**

Background information:
I am a professional practitioner of conversational AI across sectors for the last 22 years. Originally trained as an engineer I have also worked in cabinet making and other production systems before studying anthropology as a mature student. During this study I undertook an ethnography in a virtual world (1997 to 1998).

My work now is primarily in; education, entertainment and healthcare working with academia as well as industry. The core of my interest is in the ethical delivery of hybrid AI solutions to complex systems.

Title of talk:
Setting conversational AI and the metaverse into an historical and future context

Theme:
The future of AI

Abstract:
Picking up one of the buzz terms of the year , the "metaverse", and exploring it through the lens of 40 years of interest in the human computer interface is the driver for this talk; but let's start with the current situation and work backwards.

The presentation of information, tools, marketing, and players in the conversational AI marketplace is overwhelming by any standards. Gartner recently noted that they were actively tracking 2,000 players at this time though the figure of active entities is likely an order of magnitude more.

From this position of cacophony knowing what is real and what is marketing, technical or academic hype takes a deep knowledge of where we really are right now and how we've got here. In this dynamic and approachable talk Phil D Hall will be pulling back the curtain to show what are the realities, in his humble opinion, of today's methodologies and the socio-cultural impact of such.

Phil is the founder of Elzware and represents an association of people behind some highly innovative conversational systems, for instance:
- The I am Echoborg show which pits an audience against an AI to agree a; "best possible outcome between humans and intelligent machines"
- The Lana system using two photo realistic Avatars to help health care professional practice 'Motivational Interview' techniques.

He hopes that you'll find this talk interesting, his Avatar is currently engaged elsewhere.

Name*:* Richard Pitts, Senior Principal Research Advocate EMEA - ORACLE FOR RESEARCH

Background and information: Originally an environmental biologist and after 26 years at Oracle arrived 18 months ago at what he describes as his dream Oracle job. In becoming the Senior Oracle for Research European Advocate, it allows him to combine all his passions; an interest in wide range of scientific areas; "STEAM" in society and Open source & Oracle technology to assist in solving research problems and issues. His own research work ranged from the influence of environment on Polymorphic Genes, IUCN funded environmental studies in Saudi Arabia and Africa. He first met the Oracle Database, 1985, in a real time chemical production management. Joining Oracle support in 1996 he rose to be a "Top Gun" and member of the Bug Diagnosis and Escalation team and Global Lead for Oracle Spatial and Graph. Richard has been customer facing for the last 8 years leading, as a cloud Architect, many customer engagements employing a wide range Oracle and Cloud Native technologies. He also found time since 2018 to promote University/Industry cross over for HPC and subsequently contributing and promoting to Oracle for Research projects. Oracle for Research Projects in Europe nurtured by Richard range from medical, SARS-COVID2 spike research, computer science, applied AI and ML to Biodiversity Research.

Title: The Future of AI as a cloud commodity service and as seen from an Oracle for research perspective

Abstract for a 10-minute talk:

The mission of Oracle for Research is to bring about positive change in the world by advancing research through cloud computing. We approach this is through a program of direct support and community engagement. OfR provide grants, collaborative marketing around published work and research stories. As well as most importantly local architecture support and access to global expertise to assist in working on Oracle Cloud infrastructure.

It is through supporting and working with research groups, Richard and the Oracle for Research European team has discovered there are some who have the desire to apply AI and ML techniques in their research but have no interest in software/technologies required. The cloud services Oracle have created for commercial organizations, industrial strength AI models, an AI workbench and data science tools that will equally serve the higher education research community. This talk, will after, a short introduction on Oracle for Research, highlight what services are available, the accelerated time to science and how researchers can engage with the Oracle for Research team to try the services out for themselves or develop their own tools on Oracle cloud infrastructure.

Name: **Biagio Lucini**

Background information:
I am Technical Director of the CDT, deputy ProVC for Research Culture at Swansea and a Professor in the Mathematics Department. My main research field is Theoretical Physics, which I study using High Performance Computing resources and methods of Machine Learning. I have been involved in multidisciplinary projects, lately about Covid-19 modelling in Wales.

Title of talk:
Machine learning from Quantum Field Theory

Theme:
The future of AI

Abstract:
Machine learning is gaining wider adoption and it is by now used to provide reproducible decision making in a variety of industrial segments and societal settings, including the economy and health. Having robust machine learning models then becomes mandatory to guarantee robust and accurate predictions. In this talk, I will show how ideas from Quantum Field Theory can be used to construct novel machine learning methods and discuss the performance of the latter when compared to more traditional algorithms.

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Friday 24th June - Talks

Name: Prof Maurice van Putten

From: Sejong University

Title of talk: GWI 70817 and post-merger firefworks

Name: Mingu Kim

From: Promedius

Title of talk: AI in Medical Imaging

Name: **Sophie Sadler**

Background information:
Sophie is a member of the AIMLAC CDT, with a research topic in explainability of graph-based machine learning. She recently spent eight months working at Meta (formerly Facebook) as part of their Core Data Science team, doing research related to her PhD. She also worked previously at Microsoft Research.

Title of talk:
Uncertainty in Social Media Popularity Prediction

Theme:
Applications of AI

Abstract:
Predicting popularity of social media content is an important task for many reasons, from making advertising decisions to identifying and removing content likely to cause harm. Reasonable predictions can be attained when the content has been live for over a few minutes. However, the task becomes tricky when making predictions at the time of posting, especially due to the large range of possible numbers of views, from zero to hundreds of millions. For this reason, it may be interesting to predict a range rather than a single value, expressed as a lower and upper bound on the number of expected views. In this talk I will explore ways to make predictions for ranges of values and discuss the effectiveness of these on predicting social media content popularity.

Name: **Kevin Parry**

Background information:
I am Head of Data at Dwr Cymru Welsh Water and am responsible for the delivery of the organisation's Data and Analytics Strategy. My role includes leading the Data Team within the organisation, consisting of 42 colleagues belonging to data management, data engineering and analytics teams.

Title of talk:
Data and AI at Dwr Cymru Welsh Water

Theme:
Applications of AI

Abstract:
An overview of data and analytics within Dwr Cymru Welsh Water, and how the in-house Data Team supports the organisation with meeting business challenges. To include an overview of an applied example that utilises data science/AI to support data-led decision making.

***Name:* Liam Betsworth**

Background information:
Liam is the CTO at AMPLYFI - a company that is using AI to help organisations make better decisions.

Since joining AMPLYFI in 2018, Liam has held a number of key roles, including Head of User Experience, Vice President of Engineering and Chief Technology Officer.

Liam has spent the last decade leading software development activities in government, private sector and academia, winning awards such as the Digital Public Service Innovation of the Year 2017.

Prior to this, Liam completed a PhD in Human-computer Interaction at Swansea University, working alongside IBM and the BBC in conducting research, design and development of novel interactive technologies; appearing at international conferences and published in journals.

Title of talk:
Using AI to solve complex & meaningful problems at scale

Theme:
Applications of AI

Abstract:
Artificial intelligence - the technology that promises to either solve all of our problems or turn rogue and take over the world!

In reality, without valuable direction from humans, AI is rather stupid. This talk focuses on how to choose meaningful problems for AI to solve, and how to scale them outside of an academic context.

Name: **Hattie Stewart**

Background information:
I am a third year CDT student at University of Bristol. My research involves trying to find faster automated ways of detected and classifying source populations in Radio Sky data using Machine Learning.

Title of talk:
Radio Image Segmentation with Autoencoders

Theme:
Applications of AI

Abstract:
The Square Kilometre Array (SKA) will be the world's largest radio telescope, producing data at a rate of about 1Tb per second. Even after conversion to images, traditional methods of source detection and classification will not be sufficient. The pre-construction phase of the SKA project saw the launch of SKA Data Challenge 1 (SDC1), a model dataset released for analysis by the community. This work develops a machine-learning approach to detecting and classifying the full radio source population. An Autoencoder (AE) is presented as a method of image segmentation. The trained network reconstructs the raw image data as a binary segmentation map, which describes the location of the sources within the data. Source parameters such as angular size, eccentricity and position angle can be recovered using a second Variational Autoencoder (VAE). The classes of the source population can be represented by the latent space of the network if appropriate latent vectors are chosen. This work serves as a proof of concept that Autoencoders can detect and classify radio source populations from SKA-like data.

Name: Jola Mirecka

Title of talk:
cryo-EM data interpretation and validation using AI

Theme:
Applications of AI

Abstract:
Understanding the molecular basis of biological activities is essential to tackle pathologies and develop drugs to treat infections like the one associated with covid-19 pandemic. Cryogenic Electron Microscopy (cryo-EM) is an important technique to study the structures of biological macromolecules/viruses. Images of these macromolecules are used to reconstruct 3D volumes or shapes which are then used for building atomic coordinate models which are readily interpretable. Although the field has developed significantly over the last decade, there is a clear scope for better data processing, interpretation and validation. AI has recently had a huge impact in related fields, e.g. structure prediction from sequence using AlphaFold. In the CCP-EM team at STFC, we are interested in developing new methods, software tools and pipelines to streamline cryo-EM data processing. The low-resolution and heterogenous nature of majority of cryo-EM data currently available limits their interpretation and downstream use. In this context, we are exploring the application of AI for different problems including 2D/3D feature detection, classification, reconstruction/prediction and segmentation.

Name: **James Ronald Msonda**

Background information:
James Msonda obtained a BSc in Electrical Engineering from University of Malawi, Malawi. Later, received an MSc in Intelligent Systems from University of Sussex, United Kingdom. He is currently a PhD student in the department of Computer Science at Aberystwyth University. His research interest is in the application of Machine learning to signal processing for purposes of classification, regression, anomaly detection etc. Present work includes processing of neurological and physiological signals for mental health applications.

Title of talk:
A Quasi-Transparent Graphical Framework for EEG Signal Understanding

Theme:
Applications of AI

Abstract:
Graph attention networks (GATs) based architectures have proved to be powerful at implicitly learning relationships between adjacent nodes in a graph. For electroencephalogram (EEG) signals, however, it is also essential to highlight electrode locations or underlying brain regions which are active when a particular event related potential (ERP) is evoked. Moreover, it is often important to identify corresponding EEG signal time segments within which the ERP is activated. The goal of the presentation is to introduce a GAT Inspired Spatial Temporal (GIST) network that uses multilayer GAT as its base for three attention blocks: edge attention, node attention and temporal attention layers, which focus on relevant brain regions, interdependencies between these regions and informative time windows for better EEG signal classification performance and interpretability. We assess the capability of the architecture by using publicly available Siena epilepsy (SE), Transcranial Electrical Stimulation (TES), neonatal pain (NP) and DREAMER EEG datasets. With these datasets, the model achieves classification accuracies of 83.33%, 99.4%, 76% and 79.18% in that order. The presentation will also provide attention layer visualisations and suggest ways of interpreting them for EEG signal understanding.

Name: **Zara Siddique**

Background information:
I am a PhD student at Cardiff University, with research interests in bias in NLP, intersectionality, news and the media, and explainable AI.

Previous projects have looked at automatically detecting political bias in news articles and creating a map of what news topics are being reported on.

I am a brown, lesbian, single parent so I have a vested interest in seeing AI serve marginalised communities, and in educating others on how AI impacts these communities.

Title of talk:
Measuring Cultural Perceptions of Intersectional Identities in the News

Theme:
Applications of AI

Abstract:
Most efforts to look at bias in NLP analyse a single dimension such as gender, race, or sexuality, however, those who face multiple forms of oppression deal with unique challenges. For example, removing gender bias from content online may benefit a young, white woman, however, it may not have the same effect for content written about an older Black lesbian.

We will look at what intersectionality is and why research into it is important, as well as the limitations of current research looking at bias in word embeddings. We will then take a dive into my current research, which looks at words that have shown semantic similarity to identities like 'Black woman' and 'Asian woman' in the news over the past 40 years, and how we can map cultural change using this data.

Name: **Tonicha Crook**

Background information: I'm a third year PhD student at Swansea University, my supervisor is Arno Pauly. My research areas are Game Theory and Computability.

Title of talk: A Computability Persepctive on (Verified) Machine Learning

Theme: Impact of AI

Abstract: There is a strong consensus that combining the versatility of machine learning with the assurances given by formal verification is highly desirable. It is much less clear what verified machine learning should mean exactly. We consider this question from the (unexpected?) perspective of computable analysis. This allows us to define the computational tasks underlying verified ML in a model-agnostic way and show that they are in principle computable.

Name: **Simon Hands**

Background information:
Theoretical Physicist,
Community Development Director, DiRAC High Performance Computing

Title of talk:
Scientific Computing using DiRAC

Theme:
Applications of AI

Abstract:
I will describe the DiRAC facility and review some recent science highlights

***Name:* Tabitha Lewis**

Background information:
I am currently a first-year mathematics PhD student with the AIMLAC CDT based at Swansea University. My research explores the modelling of sepsis, applying both mathematical and computational techniques.

Title of talk:
How data can be used to map the temporal immune landscape of sepsis in early life

Theme:
Applications of AI

Abstract:
Sepsis is defined as an abnormal and uncontrolled response of the immune system to infection. Because of our lack of understanding of why and how our immune response goes awry, at present there is no cure for sepsis, only strategies to manage the symptoms. Critically, in many cases, patients that present with mild symptoms can very quickly degenerate into organ failure and life-threatening conditions that require resuscitation. Therefore, it is crucial that we not only understand the early onset of sepsis. But also identify those turning points of when sepsis can become critical. A dynamical systems approach to the description of the dynamics is suitable to capture the key interactions between key players in the immune systems and the virus concentration. Currently, the correct functional forms are chosen arbitrarily. However, by following a data-centric approach, we can develop a workflow for the systematic identification of these forms and the critical thresholds resulting in severe sepsis. In this talk, I will introduce the dataset that I am using which consists of time series readings of an extensive set of markers characterising the mice's immune status at multiple time points. I will also showcase some of my current work and discuss the next possible steps in my research.

Name: **Andrew F**

Background: NCSC

Title of talk: AI Supporting Secure Critical National Infrastructure