CTMTDS Newsletter 22, November 2023

This month's newsletter focuses on the activities in November and includes award won by our Research Fellows Eden Li and Sirui Li

IN THE SPOTLIGHT

Congratulations to Research Fellow Eden Li on being named a finalist in the *2023 Research and Engagement Awards*.

These awards recognise the achievements of Curtin researchers across all disciplines and stages of their career and acknowledges those who are making a positive contribution to raising the University's research profile. Eden presented her research virtually in the early career researchers section in partnerships.

Eden presenting her research virtually at the *2023 Research and Engagement Awards*

INTERNATIONAL COLLABORATIONS

Hoa Bui was an invited speaker of the Continuous Optimisation cluster at the XL National Congress of Statistics and Operations Research and the XIV Conference on Public Statistics from 7 to 10 November 2023 in Elche, Spain. She shared her recent research on "Single-projection procedure for solving convex optimisation problems in Hilbert space." She also gave two seminal talks at the Universität der Bundeswehr München (Munich, Germany) and the University of Alicante (Alicante, Spain).

The AustMS WIMSIG Cheryl E. Praeger Travel Award funded her visit to the University of Alicante to collaborate with Professor Marco Lopez and Professor Abderrahim Hantoute, world-renowned experts in semi-infinite optimisation. They are collaborating to extend Hoa's recent results on single projection procedure to semi-infinite programming.

Hoa at the conference: XL National Congress of Statistics and Operations Research and the XIV Conference on Public Statistics

Congratulations to Research Fellow Sirui Li for being named a ACS WA 1962 Prize and 1962 Medal Awards - finalist.

This prestigious award, sponsored by Professor Dennis Moore AM, showcases the best and brightest minds in WA and are a celebration of local talent, student excellence and the next generation of ICT professionals.

Sirui with the finalists at the ACS WA 1962 Prize and 1962 Medal Awards dinner

In Oslo, Melinda Hodkiewicz and Caitlin Woods attended the Industrial Data Ontology Use Case workshop hosted by DNV in Oslo on 1st Nov 2023.

Melinda and Caitlin are actively participating in the development of use cases for the new ISO 23726 standard on Ontology-based Interoperability as part of Standards Australia's WG26 on ISO TC 184 TC4 (Industrial Data). While in Oslo they also delivered an all day workshop on the T1/nlp-tlp group's maintenance work order to KG pipe to Software Architect and Global Maintenance professionals at Equinor and the SIL/SIS group at SINTEF. Following that they attended the International Semantic Web Conference in Athens where they were co-authors of a paper with Grundfos Pumps and Siemens on an IOT application using the IDO ontology. This was also a chance to benchmark how work of T1 is stacking up against others working on industry data.

From there Melinda was in Milan to examine a PhD thesis from Polytechnic di Milano on NLP on Safety and maintenance data and took the opportunity to give a talk and workshop on the Research Theme 1's work. Following this there have been a number of follow up Teams meetings with groups in Europe including interest from the Swedish Interoperability Consortium, and a Norwegian EPC group working on Engineering design ontologies.

Melinda collaborating Italian style

TEAM NEWS

Débora Corrêa, Shuixiu Lu and Sirui Li attend the MRIWA networking session for Women Advancing Minerals Research (WAMR). An initiative to connect like-minded researchers looking to engage with a community and connect with others in Western Australia who are driving progress in minerals research

Events

Researchers Catch-Up

Michael Stewart **Large Language Models for Failure Mode Classification: An Investigation**

Large Language Models (LLMs) have received a surge of interest recently due to their ability to encapsulate knowledge from a variety of domains. However, research has yet to explore the applicability of LLMs to maintenance. In this presentation, Michael provided details on his investigation into using LLMs to perform Failure Mode Classification (FMC), a critical maintenance task that reduces the need for reliability engineers to spend their time manually analysing work orders.

 Michael demonstrated his prompt engineering approach that enables fine-tuning an LLM (GPT-3.5) to predict a nominal failure mode code from a given observation. He illustrated that the LLM-based model outperforms a state-of-the-art text classification model, but only when the LLM is fine-tuned. Michael's investigation reinforces the need for high quality fine-tuning datasets for maintenance-specific tasks using LLMs.

Ziyu Zhao presents **Cy-Spider: Semantic Parsing Corpus and Baseline Models for a Property Graph** Australasian Joint Conference on Artificial Intelligence held in Brisbane 2023.

Enterprise knowledge graphs are gaining popularity in industrial applications. There is a pressing demand for natural language interfaces to support non-technical end-users. In this research, Ziyu presented the development of a generic SQL2Cypher algorithm that can map a SQL query to a set of Cypher clauses.

Why? It is because Cypher is a query language used by a popular property graph database, Neo4j.
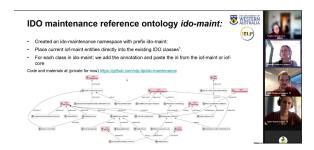
Yingying Yang **-** Long-term Integrated Maintenance Scheduling Optimization

An integrated mining site is a complex production system comprising many processing assets, intermediate buffer storages and linking facilities. Disruption of any unit may impact upstream/downstream product flow, stock levels, throughput, and the ability to satisfy customer demands. Thus, efficient coordination and strategic maintenance scheduling are essential to ensure a smooth flow of products and maximize the throughput.

Yingying presented a case study that explores the optimization of the interplay between maintenance timings and the whole system's performance over a long-term horizon. She also gave a sensitivity analysis, adjusting parameters to gain more practical insights, such as how gaps between major shutdowns affect throughput and the key factors affecting overstock.

Melinda Hodkiewicz **along with** **Caitlin Wood**s present IDO maintenance reference ontology** to Tornbjorn Holm from Eurostep in Sweden and Erik Molin from SEIIA. They are planning to continue to collaborate in this area of maintenance ontologies and extracting information from unstructured maintenance texts.

In addition, Ziyu presented the features of four transformer-based baseline models. The availability of baseline models is critical in developing and benchmarking new machine learning methods in advancing natural language interfaces for fact retrieval from large graph-based knowledge repositories. Ziyu has made her source code and datasets available - https://github.com/22842219/SemanticParser4Graph.

Publications

Congratulations YIngying Yang, Ryan Loxton, Andrew Rohl and Hoa Bui on publishing Long-term maintenance optimization for integrated mining operations" (OPTE-2023-3815-R1) for publication in Optimization and Engineering Springer.

In this paper, Yingying considered an interconnected mining system in which there are complicated maintenance relationships and stock accumulation at intermediate nodes. She proposes a time-indexed mixed-integer linear programming formulation to optimize the long-term integrated maintenance plan and maximize the total throughput.

Stay tuned for our next issue where we will cover:

- Research presentations by Research Fellow Hoa Bui and PhD candidate Tyler Bikaun
- New publications for 2023

Do you have news to share?

Please email natasha.m.bartlett@curtin.edu.au