Theme 1: Support the Maintainer

Each time a maintainer interacts with equipment, a work order record captures in linguistic text their observations of the asset and a record of what was done, when, and how. These records contain unstructured text containing jargon, abbreviations, and incomplete data. Of primary interest are the needs to establish the as-found condition, the causality of failure regarding the failure mechanism and cause, and what maintenance work was done. This data is often in the work order texts but is not stored in a machine-readable way. These shortcomings lead to inadequate information about the asset condition, the failure cause and what work was actioned. As a result maintenance staff rely heavily on word-of-mouth and ad-hoc data exchange. The absence of standard schema for maintenance data representation hinders the ability to convert semantic meanings in the maintenance work orders into axiom based reasoning and useful information. We need to enable maintainers and the staff that support them to efficiently capture, retrieve, absorb, process and exchange knowledge about equipment and maintenance work.

Initial project areas for Theme 1 include:

1

Ontology for Maintenance

Data are key to the effective and safe maintenance of assets over their life cycle. This data is generated by, and drawn from, various sources such as maintenance management systems, design documentation, original equipment manufacturer manuals, process control systems, third party service providers, risk management assessments and failure investigations, to name just a few. However, due to the heterogeneity of data sources and diversity of data types, unlocking the real value of data and discovering the useful patterns of knowledge embedded in the maintenance data has always presented a major challenge. Ontologies can effectively address this challenge by semantic annotation, integration, consistency checking and organization of data. The aim of this project is to demonstrate automation of transactions involving data exchange about asset performance and maintenance work using interoperable and extensible ontologies.

2

Natural Language Processing of Maintenance records

Each time a maintainer interacts with equipment, a work order record captures in linguistic text their observations of the asset and a record of what was done, when, and how. Given that there are multiple technicians within an enterprise, the human-generated data is often inconsistent, error-filled, and replete with domain-specific jargon. If this data could be parsed, it could lead to determinations such as failure mode identification, rework, problem spot identification, and more accurate mean time to repair (MTTR) or mean time between failure (MTBF), which can lead to improved maintenance strategy, reduced risk of failure and improved maintenance efficiency. This project will develop novel natural language processing and machine learning approaches to achieve enable machine readability of maintenance records and use of the liberated data to support maintenance decision making.

3

A conversational interface for Maintenance Planners

Publications

- A Whole-of-Organisation Approach for Reliability Analytics (...) —

Book Chapter

Prof Melinda Hodkiewicz

Authors: Melinda Hodkiewicz, Tyler Bikaun, Michael Stewart
2023-02-16

- An ontology for reasoning over engineering textual data stored inFMEA spreadsheet tables (...) —

Journal Article

Prof Melinda Hodkiewicz

Authors: Melinda Hodkiewicza,, Johan W. Klüwerb, Caitlin Woodsc, Thomas Smokerc, Emily Low
2021-05-27

- Cleaning and visualization of unstructured text in safety records (...) —

Conference Publishing

Dr Michael Stewart

Authors: Michael Stewart1, Wei Liu1, Rachel Cardell-Oliver1 And Mark Griffin
2020-11-01

- CylE: Cylinder Embeddings for Multi-hop Reasoning over Knowledge Graphs (...) —

Conference Publishing

Chau Nguyen

Maintenance planning is a complex task. Each week the planner approves new work notifications, reviews work orders already on the backlog, reviews scheduled preventive maintenance work orders due in the next maintenance work cycle and from the resulting list prioritizes the tasks. High priority tasks are moved to the planning stage. For each task the planner needs estimates for the following types of questions: How long the job will take? How much and what types of labour will be required? What parts and materials will be required and do we have them on hand? What are the costs? What tools, equipment or other resources, including external contractors, will be required? What permits will be required? What are the job hazards and how will they be managed? The aim of this project is develop a dialog management system for knowledge capture and inference to enable semi-automated plan validation. In addition to computer science skills the PhD candidate should have HMI and UX interests and skills.

Authors: Chau Nguyen, Tim French, Wei Liu, Michael Stewart

2023-05-02

- CySpider: A Neural Semantic Parsing Corpus with Baseline Models for Property Graphs (...) —

Conference Publishing

Ziyu Zhao

Authors: Ziyu Zhao, Wei Liu, Tim French & Michael Stewart

2023-11-27

- Data-driven reliability analysis of Boeing 787 Dreamliner - ScienceDirect (...) —

Journal Article

Prof Melinda Hodkiewicz

Authors: G Pandian, M Pecht, E Zio, M Hodkiewicz

2020-03-12

- Digitalization and reasoning over engineering textual data stored in spreadsheet tables (...) —

Conference Publishing

Prof Melinda Hodkiewicz

Authors: Melinda Hodkiewicz, Johan W. Klüwer, Caitlin Woods, Thomas Smoker, Tim French

2020-12-18

- DRAT: Data risk assessment Tool for University-Industry collaborations (...) —

Journal Article

Prof Melinda Hodkiewicz

Authors: Sikorska, J., Bradley, S., Hodkiewicz, M. and Fraser, R.

2020-12-11
- E2EET: from pipeline to end-to-end entity typing via transformer-based embeddings (...) —

Journal Article

Dr Michael Stewart

Authors: Michael Stewart, Wei Liu

2021-11-30
- Framework for Validation of Permanently Installed MEMS-Based Acquisition Devices Using Soft Sensor Models (...) —

Journal Article

Prof Melinda Hodkiewicz

Authors: A Bartels, E Cripps, A Keating, I Milne, B Travaglione, M Hodkiewicz

2020-07-28
- Maintenance in an Industry 4.0 and COVID world - the case for Remote Operations (...) —

Conference Publishing

Prof Melinda Hodkiewicz

Authors: None

2020-11-01
- MWO2KG and Echidna: Constructing and exploring knowledge graphs from maintenance data (...) —

Journal Article

Dr Michael Stewart

Authors: Stewart M, Hodkiewicz M, Liu W, French T

2022-11-05
- Pipeline for machine reading of unstructured maintenance work order records (...) —

Conference Publishing

A/Prof Wei Liu

Authors: Yiyang Gao, Caitlin Woods, Tim French, Melinda Hodkiewicz
2020-11-01
- RelOps-A Whole-of-Organisation Approach for Reliability Analytics (...) —

Book Chapter

Prof Melinda Hodkiewicz

Authors: Melinda Hodkiewicz, Tyler Bikaun, Michael Stewart
2023-02-16
- Rethinking maintenance terminology for an industry 4.0 future (...) —

Journal Article

Prof Melinda Hodkiewicz

Authors: Melinda Hodkiewicz, Sarah Lukens, Michael P. Brundage, Thurston Sexton
2021-03-21
- SConE: Simplified cone embeddings with symbolic operators for complex logical queries (...) —

Conference Publishing

Chau Nguyen

Authors: Chau Nguyen, Tim French, Wei Liu, Michael Stewart
2023-07-14
- Semi-automated Estimation of Reliability Measures from MaintenanceWork Order Records (...) —

Conference Publishing

Tyler Bikaun

Authors: Bikaun, T., & Hodkiewicz, M.
2021-06-21
- Sensing system for low cost condition monitoring of remote assets (...) —

Conference Publishing

Prof Melinda Hodkiewicz

Authors: Aiden J. Ziegelaar, Ben C. Travaglione, Melinda R. Hodkiewicz
2020-12-18
- Seq2KG: An End-to-End Neural Model for Domain Agnostic Knowledge Graph (not Text Graph) Construction from Text (...) —

Conference Publishing

Dr Michael Stewart

Authors: Michael Stewart, Wei Liu
2020-09-01
- Technical Language Processing: Unlocking Maintenance Knowledge (...) —

Journal Article

Prof Melinda Hodkiewicz

Authors: Michael P. Brundage, Thurston Sexton, Melinda Hodkiewicz, Alden Dima, Sarah Lukens
2020-12-11
- Template Libraries for Industrial Asset Maintenance: A methodology for scalable and maintainable ontologies (...) —

Conference Publishing

Prof Melinda Hodkiewicz

Authors: Lupp, D.L., Hodkiewicz, M., and Skjæveland, M.G.
2020-11-02

- Using Context-Free Grammar to Generate Synthetic Technical Short Texts (...) —

Conference Publishing

Tyler Bikaun

Authors: Tyler Bikaun, Michael Stewart, Melinda Hodkiewicz
2022-12-03

Presentations

- A fresh look at the Future of Technical Language Processing Research in the eyes of ChatGPT (...) —

A/Prof Wei Liu

Theme Lead

Theme 1
2023-04-21

- A pattern-based natural language interface for knowledge graph querying (...) —
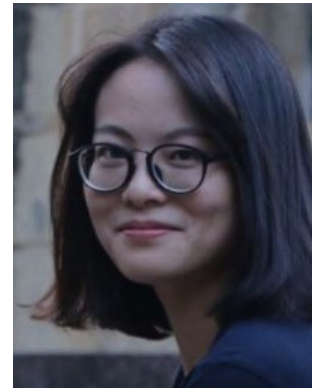
Ziyu Zhao

PhD Student

Theme 1
2021-09-09

- A technical language processing-based solution to automatically calculating lubrication-related costs from maintenance work orders - presentation at PHM 2021, TLP Workshop (...) —

Dr Michael Stewart

Research Fellow

Theme 1
2021-11-29

- AI and Predictive Maintenance (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2024-04-17

- AI on maintenance data - challenges to value delivery (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2023-02-14

- AI On Maintenance Data - Challenges To Value Delivery. (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2021-12-12

- Answering Logical Queries on Technical Knowledge Graphs (...) —
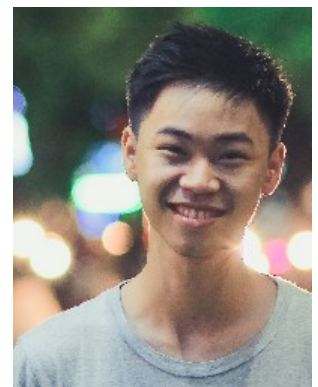
Chau Nguyen

PhD Student

Theme 1
2023-09-15

- APOS Workshop Data Automation (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2020-06-16

- Applications of Open-source Large Language Models (...) —

Dr Sirui Li

Research Fellow

Theme 1
2024-04-19

- Breakfast seminar - Sirius Centre and Energy Valley in Oslo (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2019-06-24

- Cleaning and Visualization of Unstructured Text in Safety Records ESREL 2020 PSAM 15 (...) —

Dr Michael Stewart

Research Fellow

Theme 1
2020-11-04

- Common definitions for mining technology (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2022-10-26

- Cost Aggregate Queries on Knowledge Graph Augmented by Reference Data Libraries (...)
—
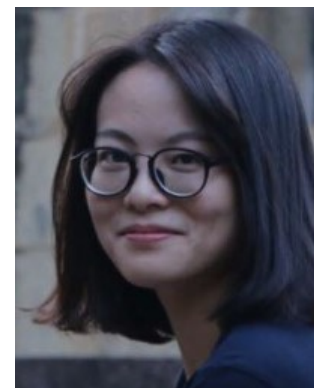
Ziyu Zhao

PhD Student

- CylE: Cylinder Embeddings for Multi-hop Reasoning over Knowledge Graphs - poster presentation (...) —
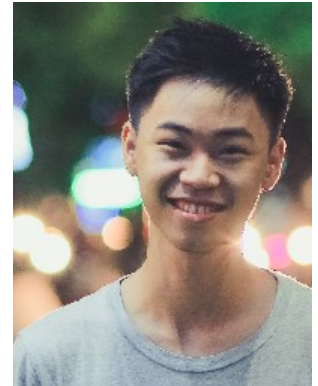
Chau Nguyen

PhD Student

- Cylinder Embeddings for Multi-hop Reasoning over Knowledge Graphs (...) —

Chau Nguyen

PhD Student

Theme 1
2023-06-02

- EACL 2023 - CylE: Cylinder Embeddings for Multi-hop Reasoning over Knowledge Graphs (...) —

Chau Nguyen

PhD Student

Theme 1
2023-05-04

- [Exploiting Domain Knowledge for Neural Technical Language Processing.](...) (...) —
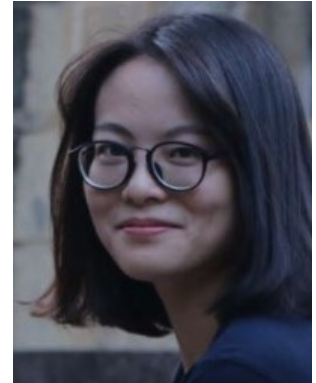
Ziyu Zhao

PhD Student

Theme 1
2020-04-24

- [Failure project briefing Oslo](...) (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2024-02-27

- Failure Project presentation (...)
  —

Prof Melinda Hodkiewicz

Chief Investigator

Prof Melinda Hodkiewicz

Chief Investigator

A/Prof Wei Liu

Theme Lead

Theme 1
2022-09-01

- ICMIAM AI on maintenance data -challenges to value delivery (...) —

Prof Melinda Hodkiewicz

Chief Investigator

- Improving how engineers communicate - with computers (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2021-10-26

- Industrial data and the resurrection of ontologies (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2023-07-21

- Industrial Data Extraction and Use - SIEMENS Technology (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2024-02-21

- Industrial Knowledge Graphs for Maintenance applications (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2023-03-01

- Integrating Domain Knowledge into Neural Technical Language Processing (...) —
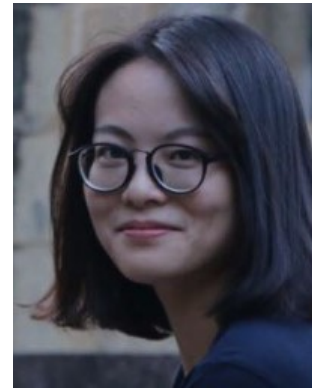
Ziyu Zhao

PhD Student

Theme 1
2020-09-25

- Intelligent Maintenance Conference 2020 (...) —

Dr Debora Correa

Chief Investigator

Prof Melinda Hodkiewicz

Chief Investigator

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2019-10-26

- Key Note Speaker - Maintenance in an industry 4.0 and COVID-19 world – the case for remote operations (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2020-11-05

- Knowledge-Graph-Based Question Answering (...) —

Ziyu Zhao

PhD Student

Theme 1
2022-02-18

- Large Language Models for Failure Mode Classification: An Investigation (...) —

Dr Michael Stewart

Research Fellow

- Latest advances in Natural Language Processing and how this can improve automation (...) —

A/Prof Wei Liu

Theme Lead

- LexiClean: An annotation tool for rapid multi-task lexical normalisation (...) —

Tyler Bikaun

PhD Student

Theme 1
2021-11-09

- Mineral Resource Institute of Western Australia - PhD Research Showcase Poster (...) —

Tyler Bikaun

PhD Student

Theme 1
2021-08-03

- Mini-symposium Ontologies for Infra and Building Sector16th April 2019, Delft (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2019-04-16

- Modular ontologies for maintenance texts (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2021-11-04

- Natural Language Query For Technical Knowledge Graph Navigation (...) —

Ziyu Zhao

PhD Student

Theme 1
2022-12-12

- NLP meets ontologies for industrial knowledge graphs on maintenance texts (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2023-04-21

- NLP Workshop (...) —

Dr Michael Stewart

Research Fellow

Theme 1
2020-02-10

- Ontologies meet NLP (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2022-11-10

- Ontologies meet NLP - with a spare parts perspective (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2023-02-07

- Ontologies meet NLP NLP-with a spare parts perspective (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2023-01-30

- Periscope: A tool for centralised asset reliability assessment powered by NLP (...) —

Tyler Bikaun

PhD Student

- Presentation - Semi-automated Estimation of Reliability Measures from Maintenance Work Order Records (...) —

Tyler Bikaun

PhD Student

Theme 1
2021-07-01

- Presentation on Semi-automated Estimation of Reliability Measures from Maintenance Work Order Records (...) —

Tyler Bikaun

PhD Student

Theme 1
2021-04-13

- QUARRY: A Graph Model for Queryable Association Rules (...) —

Dr Michael Stewart

Research Fellow

Theme 1
2022-10-07

- Question Answering over Temporal Knowledge Graphs (...) —
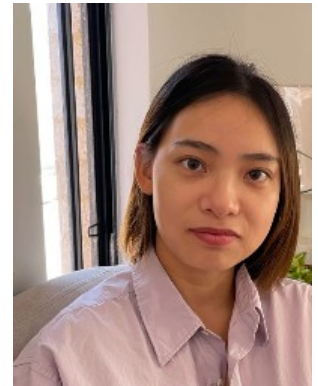
Dr Sirui Li

Research Fellow

Theme 1
2023-05-19

- Questioning your maintenance data and get accurate answers (...) —

Ziyu Zhao

PhD Student

Theme 1
2023-03-17

- QuickGraph: A Rapid Annotation Tool for Knowledge Graph Extraction from Technical Text (...) —

Tyler Bikaun

PhD Student

Theme 1
2022-05-27

- Reasoning about technical language for incomplete knowledge graphs using query embedding (...) —

Chau Nguyen

PhD Student

Theme 1
2022-04-08

- Redcoat: A Collaborative Annotation Tool Supporting Technical Language Processing Research (...) —

Dr Michael Stewart

Research Fellow

Theme 1
2021-04-13

- SConE: Simplified Cone Embeddings with Symbolic Operators for Complex Logical Queries poster presentation (...)
—

Chau Nguyen

PhD Student

Theme 1
2023-07-12

- Semantic Arts in US - Industrial Data Extraction and Use (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2024-02-09

- Simplified Cone Embeddings with Symbolic Operators for Complex Logical Queries poster presentation (...) —

Chau Nguyen

PhD Student

Theme 1
2023-09-05

- TBA (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Prof Melinda Hodkiewicz

Chief Investigator

Prof Andrew Rohl

Training Centre
Director

Directorate
2019-06-29

- Towards a set of open
  reference ontologies for
  reasoning and text
  interoperability across the
  manufacturing domain (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Theme 1
2021-04-16

- Tutorial at AJCAI 2022 (...) —

Dr Michael Stewart

Research Fellow

Theme 1
2022-12-05

- Tutorial at AJCAI 2022 - A Practical Guide to Knowledge Graph Construction from Technical Short Text (...) —

Dr Michael Stewart

Research Fellow

Theme 1
2022-12-05

- Unlocking knowledge buried within technical records (...) —

Dr Michael Stewart

Research Fellow

Theme 1
2020-06-25

- Unlocking knowledge in Maintenance Work Orders with Echidna and Redcoat (...) —

Dr Michael Stewart

Research Fellow

Theme 1
2021-04-13

- Unlocking knowledge in Maintenance Workorders (...) —

Dr Michael Stewart

Research Fellow

Theme 1
2020-09-11

- WA Mining Conference (...) —

Prof Melinda Hodkiewicz

Chief Investigator

Tools

- [Aquila](...) (...) —
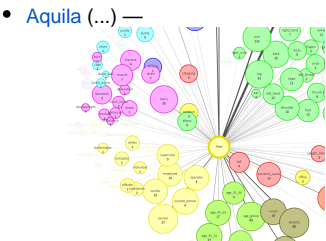
2020-01-31

An Interactive Web-based Toolset for Knowledge Discovery from Short Text Log Data

[Theme 1](...)

- [Data Risk Assessment Tool](...) (...) —
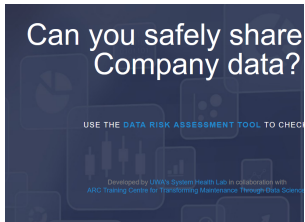
2020-01-31

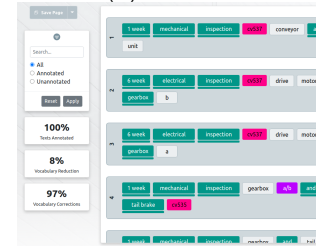Can you safely share your company data?

[Theme 1](...) [Theme 5](...)

- [Echidna](...) (...) —
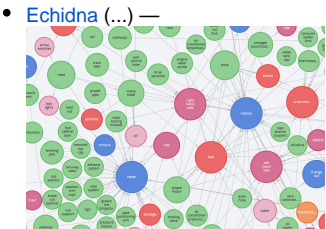
2020-01-31

A Knowledge Graph for Maintenance

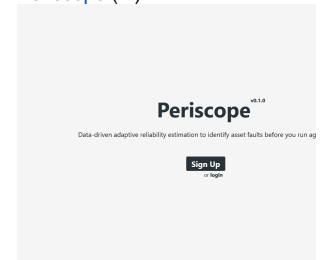[Theme 1](...)

- [Lexiclean](...) —

2020-01-31

An annotation tool for rapid multi-task annotation of noisy corpora for the task of lexical normalisation
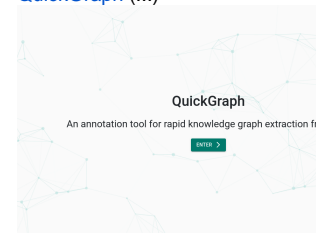
[Theme 1](#)

- [Periscope](...) —

2020-01-31

Data-driven adaptive reliability estimation to identify asset faults before you run aground
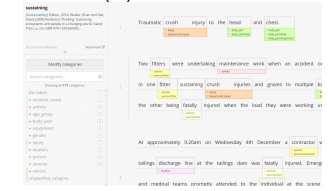
[Theme 1](#) [Theme 5](#)

- [QuickGraph](...) —

2020-01-31

A collaborative annotation tool for rapid multi-task information extraction for knowledge graph construction.

[Theme 1](#)

- Redcoat (...) —

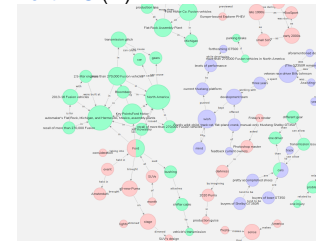2020-01-31

A Collaborative
Annotation Tool
for Hierarchical
Entity Typing

Theme 1

- Text2KG (...) —

2020-01-31

An Automated
Text to Knowledge
Graph System

Theme 1

The Team
Lead

- A/Prof Wei Liu (...) —
A/Prof Wei Liu

Theme Lead

Theme 1

Chief Investigators

- [A/Prof Timothy French](#) (...) —

[A/Prof Timothy French](#)

Chief Investigator

Theme 1
- [Prof Melinda Hodkiewicz](#) (...) —

[Prof Melinda Hodkiewicz](#)

Chief Investigator

Theme 1
- [Prof Tele Tan](#) (...) —

Prof Tele Tan

Chief Investigator

Theme 1

Partner Investigators

- Dr Ulrich Engelke (...) —

Dr Ulrich Engelke

Partner Investigator

Theme 1

Research Fellows

- Dr Michael Stewart (...) —

Dr Michael Stewart

Research Fellow

Theme 1

- Dr Sirui Li (...) —

Dr Sirui Li

Research Fellow

Theme 1

PhD Students

- Chau Nguyen (...) —

Chau Nguyen

PhD Student

Theme 1
- Tyler Bikaun (...) —

Tyler Bikaun

PhD Student

Theme 1
- Ziyu Zhao (...) —

Ziyu Zhao

PhD Student

Theme 1