Research Proposal Outline

Introduction

- ➤ *Introduce myself*

- ➤ *Introduce project title*

Background and Significance

- ➤ *Research Problem* (Bouchrika, 2024)*:*

  - o Current Powerlink Queensland Telecommunications model is reactive where certain maintenance is attended to only once a fault has arisen.

  - o Faults attended to in the above manner cost money and effort as well as carry significant risk.

  - o Traditional data analysis techniques cannot easily determine relationships between variables especially across different layers of the OSI model.

  - o Real time analysis is not easy using traditional methods and is not probabilistically driven unless hardcoded as such.

- ➤ *Significance to the Academic Community and World at Large* (Bouchrika, 2024; Alkema, 2021)*:*

  - o Resolving this issue will save money, increase utilisation of assets (not having to replace assets early), decrease service downtime.

  - o Academically, the outcomes will prove the efficacy of ML models in common use within the project focus area. Additionally, it will also prove the ability to use typical inhouse data sources, and in-house computation to produce a workable real-time applicable model.

Aims, Objectives, and the Research Question

- *Research Question:*

  - Can ML be used effectively to Significantly Predict Telecommunication Equipment Failure in Powerlink Queensland?

- *Aims* (Bouchrika, 2024; DISCOVERPHDS, N.D.)*:*

  - To decrease the number of service-affecting network disruptions by accurately predicting equipment failures using a machine learning model that has been trained by disparate data sets currently gathered by network management systems for real-time equipment monitoring purposes.

- *Objectives* (Bouchrika, 2024; DISCOVERPHDS, N.D.)*:*

  - Gather historical data pertaining to equipment

  - Analyse data for appropriate characteristics

  - Clean data

  - Organise data into feature vectors

  - Train various machine learning models

  - Test trained models with test data and select best one

  - Testing best performing model with real-time network data

  - Analyse results

Key Literature

- *Vendor direction*:

  - Various industry leaders are incorporating ML into their products, however, there is no research applying these practices to existing

networks of different vendors using bespoke code. Specifically, to a power system communication network and its associated technologies. Furthermore, there is very little on how to practically apply these models in real-life situations using applicable opensource tools.

➢ *Academia direction*:

- o ML is being applied to various use cases, where a lot pertain to new equipment and future technologies, also to very focussed areas like optical transmission correction mechanisms. There has been mention of applications in predictive maintenance, but no publications on the process of such and efficacy.

Research Design

➢ *Theory development approach* (Saunders et al., 2019)*:*

- o Deduction where the use of data analytics and Machine learning theory will be applied

➢ *Methodological approach* (Saunders et al., 2019)*:*

- o Quantitative by using current fault statistics as well as various test results

➢ *Research Strategy* (Saunders et al., 2019)*:*

- o Experimental approach where faults raised prior to a ML model and post will be compared

➢ *Data collection and analysis* (Saunders et al., 2019)*:*

- o Existing data will be gathered, and new data sets created during experimentation, these will be analysed according to standard descriptive and inferential statistics methods.

Ethical Considerations and Risk Management

➢ *Ethical Considerations*:

  o Anonymity of datasets

  o Confidentiality pertaining to data that is not open to the public domain, or would put the organisation at risk in any way

  o Ensure all stakeholders are aware of the project goals and implications

  o Maintaining overarching professional and ethical standards presented by bodies such as the British Computer Society (BCS). For instance, open reporting of findings, unbiased reporting and the like.

➢ Risk Management:

Hazard	Risk	Control
Testing failures of equipment	Loss of services	Test on laboratory equipment
…	…	…
…	…	…

Artefacts

➢ A trained machine learning model

➢ Basic backend code containing the ML model as well as APIs to fetch and feed real-time data through the model

➢ Basic frontend code to present real-time data analytics

Timeline

➢ *Gantt chart of activities*:

  o Deep literature review

  o Gathering of data

  o Analyse data for appropriate characteristics

- Clean & Organise data into feature vectors

- Train various machine learning models

- Test trained models with test data and select best one

- Testing best performing model with real-time network data

- Analyse results

- Draw up report

<u>References</u>

Alkema, P. (2021) Contribution vs. Significance of Your Study. Available from:

https://studentsuccess.coach/contribution-vs-significance-of-your-study/ [Accessed

29 June 2024].

Bouchrika, I. (2024) How to Write a Research Proposal in 2024: Structure, Examples

& Common Mistakes. Available from: https://research.com/research/how-to-write-a-

research-proposal [Accessed 26 June 2024].

DISCOVERPHDS. (N.D.) Aims and Objectives: A Guide for Academic Writing:

Available from: https://www.discoverphds.com/advice/doing/research-aims-and-

objectives#:~:text=Research%20aims%20focus%20on%20a,written%20as%20a%2

0numbered%20list. [Accessed 29 June 2024].

Saunders, M., Lewis, P., Thornhill, A. (2019) *Research Methods for Business

Students*.8th ed. Harlow: Pearson Education Limited.