Electricity north west
Bringing energy to your door

NIA ENWL020
Artificial Intelligence & Machine Learning

Progress Report

31 July 2020

VERSION HISTORY

Version	Date	Author	Status	Comments
V1.0		Geraldine Paterson		

REVIEW

Name	Role	Date
Lucy Eyquem	Innovation PMO Manager	23.07.20
Dan Randles	Head of Innovation	27.07.20

APPROVAL

Name	Role	Date
Steve Cox	Engineering & Technical Director	31.07.20

CONTENTS

GLOSSARY

Term	Description
ML	Machine learning
AI	Artificial intelligence
DSP	Digital Signal Processing
LV	Low voltage
LCT	Low carbon technologies

1 PROJECT FUNDAMENTALS

Title	Artificial Intelligence and Machine Learning
Project reference	NIA_ENWL020
Funding licensee(s)	Electricity North West Limited
Project start date	October 2018
Project duration	3 years
Nominated project contact(s)	Geraldine Paterson (innovation@enwl.co.uk)

2 PROJECT SCOPE

This project will be a research piece investigating the application of machine learning (ML) and artificial intelligence (AI) to data already being collected by low voltage monitoring equipment and transformer monitoring equipment already deployed on the network. The research will investigate whether machine learning can be used to identify hidden trends and make recommendations for network investment.

3 OBJECTIVES

- Collate data from the various systems.
- Build, train and evaluate a model to classify and work with the data.
- Produce recommendations for network operation and investment.

4 SUCCESS CRITERIA

- Report on the methodology for collating the data.
- Production of a model to interrogate the data sets.
- Report detailing outputs from the model and recommendations for network operation and investment.
- Report detailing how the model can be transferred to business as usual.

5 PERFORMANCE COMPARED TO THE ORIGINAL PROJECT AIMS, OBJECTIVES AND SUCCESS CRITERIA

Project Progress

The project partners progress for the delivery of the project has been outlined below. Good progress has been made in a number of areas, with further additional data collection and analysis/modelling work set to continue.

LV Data collection activities

Data has now been collected for a full year using the updated triggers developed as part of this project and deployed as a firmware update to a number of devices installed in the network. This data collection was and continues to be essential to the modelling and analysis activities of this project.

LV Modelling

An advanced LV model for classification of load types attached to each feeder has been created and run on a large data set, producing a total of 16 individual classifications, with 12 uniquely identifiable and labelled with their type, and 4 highly mixed load types.

A second model uses device information to perform a basic health assessment and ranking of the health of cables, and a report including the ranking of networks is produced on a weekly basis for the Rising and Lateral Mains installations, helping to prioritise resources.

A third model is currently being developed by a team specialising in machine learning, targeted firstly at identifying existing issues created by low carbon technologies. Continuation of this work will be used to predict feeders and network areas that will likely develop problems in the future.

Additional stages of the LV modelling will attempt to identify any unknown patterns and relationships that may exist in the data.

Fault Management

Improvements to fault management systems are ongoing, with fault classification and labelling work dependent on feedback and collation of data about actual fault locations.

Tap Changer Monitor Data Analytics

The separate project investigating the monitoring of tap changer operations by collating vibrational and electrical information during the operation of tap changers has provided data from over 170,000 events, with more than 1.5M waveforms collected. A machine learning model has been developed to analyse this data and build an anomaly detection system. A detection model was trained for each tap changer using its historical data and the model produces an anomaly score for each switchover event.

This model makes the identification of risky conditions and actual breakdowns possible, as well as spotting anomalous events and patterns not easily detectable during routine maintenance.

Whilst collecting the data from the tap changers, one unit developed a fault. Analysis was then carried out on the collected data which demonstrated that the faulted condition could have been detected prior to the fault occurring.

The work has shown that vibro-acoustic data can reveal relevant anomalies that cannot be seen with any other means.

Transformer Analytics

Later stages of the project will research methods for predictive analytics for transformers.

6 REQUIRED MODIFICATIONS TO THE PLANNED APPROACH DURING THE COURSE OF THE PROJECT

There have been no changes to the planned approach.

7 LESSONS LEARNED FOR FUTURE PROJECTS

As many sections of this project are ongoing, final conclusions and lessons learnt are not available for publishing at this stage.

8 THE OUTCOME OF THE PROJECT

Not applicable.

9 DATA ACCESS

Electricity North West's innovation data sharing policy can be found on our website.

There is currently no data available from the project.

10 FOREGROUND IPR

There is no foreground IPR associated with this project.

11 PLANNED IMPLEMENTATION

Not applicable.

12 OTHER COMMENTS

Not applicable.