Vegetation Detection Challenge – Approach & Algorithm Summary Sheet – Sevvandi's Team

Powerline Bushfire Safety Program (PBSP) Vegetation Detection Challenge Background:

In May 2017, the PBSP launched a Vegetation Detection Challenge as there is currently no mechanism that can identify vegetation faults in a timely manner and more specifically what type of species of vegetation is on/touching (causing a fault) a powerline. For example, if a tree or branch touches the line a device could detect the type of tree and send a message back to the distribution business as to whether there is potential for a fire start e.g. urgent action required or that the tree is a peppercorn (for example) and poses no risk, however in time it should be removed from the line.

The Vegetation Detection Challenge aim was for the development of an algorithm that can identify what particular plant species is causing a fault if a tree branch were to fall onto a powerline.

A large amount of Fault Signature detection data collected throughout the PBSP assisted teams with the development of the algorithm.

The Challenge focused on three particular plant species:

- Salix species (Willow) high fire probability
- Franxinus Angustifolia (Desert Ash) medium fire probability
- Schinus Molle (Peppercorn) low fire probability

A consolidation of the fault signature data for the above three species is available on the DataVic website - Vegetation Detection Challenge data. This consolidation removes the need to download the entire fault signature data set.

The full authorised data set including 300GB of photos, videos, test logs and report, are available on the DataVic website.

For a summary of Sevvandi Kandanaarachchi's and her teams' algorithm please see details in the below table:

Summary of Approach & Algorithm

• This team analysed one of the three data sets provided for each species (time series).
• The team used the low frequency current time series data to develop a principal component analysis algorithm.
  ○ The team tested the different time series features, such as, mean, variance, strength of trend, strength of linearity, spikiness, flat spots, lumpiness, entropy, auto-correlation and linearity to determine which factors showed the most variation and consistency for the different species or fire danger levels.
  ○ The team developed basic code to evaluate the proposed method and demonstrated that it works for a danger level indication, however, did not provide a meaningful result for species identification.
  ○ The team used auto-correlation as the best feature from the principal component analysis.

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- The team also used a visual method and a support vector based machine learning method to detect danger.
    - The intention is to use these three methods together to understand the level of fire risk.
- This team used a very limited number of tests (17) for evaluating accuracy. Of the 17 tests 16 were used for training and one was used for validation. This approach led to a seemingly significantly higher level of accuracy of approximately 98%. However, this could be significantly impacted if a larger data set were used, and with more out of sample data and more vegetation species included.