LDA Classifier & Multilayer Perceptron For Packet Status Prediction In Wireless Star Network Topology

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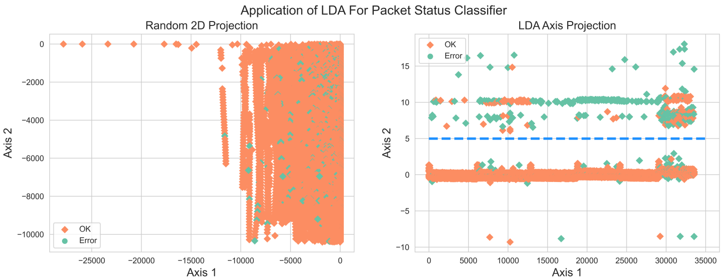
Content

Importance

- Packet loss describes lost packets of data not reaching their destination after being transmitted across a network.
- Organizations no longer work from a **fixed address**, or rely on a **wired connection** to keep the lines of communication open.
- Packet loss will generally **reduce the speed or throughput** of a given connection due to **recovery mechanisms** implemented, which involve **re-sending packets altogether**. Sometimes this can result in a **loss or reduction in quality** to applications.
- Packet loss sits in the trio **the major network performance complications: latency, jitter and packet loss**.

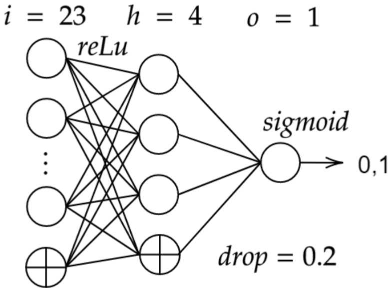
Techniques: LDA Dimensional Reduction Classifier

- LDA Dimensional Reduction
  - Linear Discriminant Analysis was performed over the balanced dataset since there were 23 features that seemed to have no tendency in the cartesian representation.
  - Still, **correlation analysis** showed relationships from the features to the classification column (Error or OK).
  - LDA was applied using the **eigenvalues solver**, so as to find the **axis that showed class separability**.



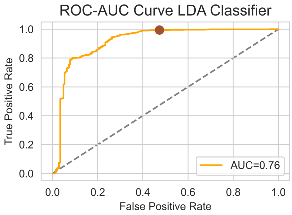
Techniques: Multilayer Perceptron Classifier

- Multilayer Perceptron Classifier
  - Multilayer Perceptron Neural Network was also built to see if a binary classifier could be trained for the prediction of the Packet Loss Status given a balanced dataset with 23 features.
  - The architecture used involved **3 Dense Layers**, **Dropout Regularization of 20%** after the **input and hidden** layers.

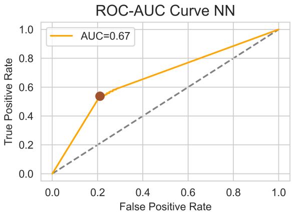


Results

- LDA Classifier: accuracy of 81%, AUC = 0.76



- Multilayer Perceptron Classifier: accuracy of 72%, AUC = 0.67



Conclusions

- The type of interference that showed the biggest impact to the class was **wireless interference**, with 0.13 linear correlation. Other interferences included: another star network, radiofrequencies, wind and no restrictions.
- Activation functions may lead to **false conclusions** if not used accordingly to the information that the data contains: the dataset had an RSSI column (negative) that must be converted to positive values before using ReLu activation function, otherwise the column will be set to zeroes.
- The more **hidden layers**, the more important **dropout regularization** becomes: accelerates the process of learning due to the dismiss of unimpactful data.
- In this case, the LDA classifer found an axis from which the data can be classified with better results than the Multilayer Perceptron, but in case there was not any axis, the Perceptron results in an intuitive solution.
- Source code: `https://github.com/the-other-mariana/star-network`

References

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