

Link Outage Prediction Model for Very High Throughput Satellite Systems

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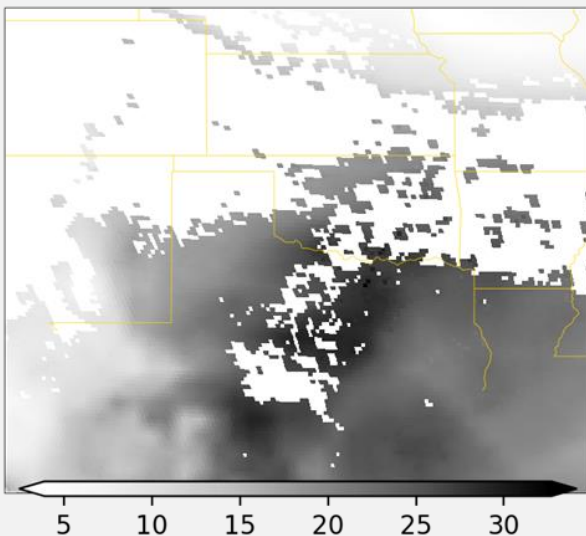
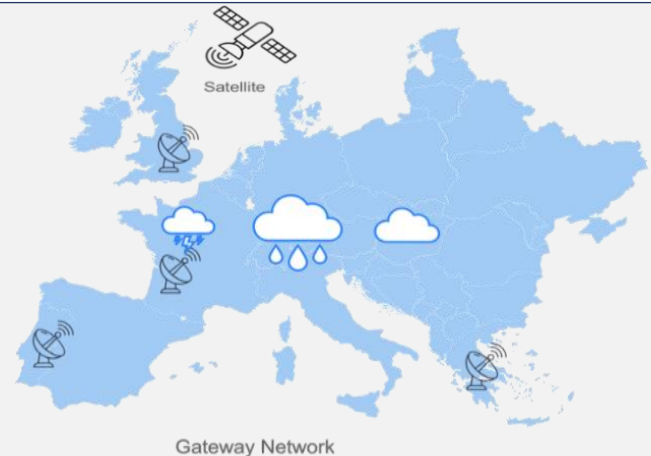
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ABSTRACT

Atheras Analytics has developed an AI-based, SaaS-delivered toolkit to enable the prediction, management and mitigation of atmospheric impairments encountered by HTS systems operating at Ka- and Q/V-bands. Our ML-powered software employs a proprietary Outage Prediction Algorithm (OPA) to deliver a 90%+ reduction in weather-related link outages when accurate weather data is available. Shortcoming in the quality of weather data in some regions has led us to explore image-based machine learning techniques as a means of predicting link-outages using satellite image data.

INTRO

- Demand for increased data rates is driving the use of higher (Ka-band and Q-band) frequencies for emerging High Throughput Satellite (HTS) systems
- However, these high frequency satellite links are subject to significant atmospheric signal impairments – primarily from rain
- Smart Gateway Diversity is a cost-effective solution



DATA & PREPROCESSING

- NASA GOES satellites provide advanced imagery and atmospheric measurements of Earth's weather, oceans, and environment, and this information is made available through a range of data products.
- Rainfall Rate/Quantitative Precipitation Estimation (RRQPE) data with a resolution of 2km is published every 10 minutes.
- With suitable preprocessing, this data can be passed as input to a convolutional neural network (or another architecture).
- With suitable hyperparameter tuning and training, this will result in a model capable of predicting a link-outage based on the most recent satellite image data.

RESULTS

- The data is heavily imbalanced, which makes training difficult. There are approx. 120x more negative samples than positive samples.
- Some progress has been made to prevent the model from only predicting one outcome e.g. through class weighting.

NEXT STEPS

- Further measures will be necessary to train the model on the imbalanced dataset.
- Possibilities include different scaling methods, oversampling of positive samples, and undersampling of negative samples.
- Once trained, the model can be integrated into the existing OPA for use with SGD-based networks.

