Predicting high-tension transmission line failures due to atmospheric discharges

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Highlights

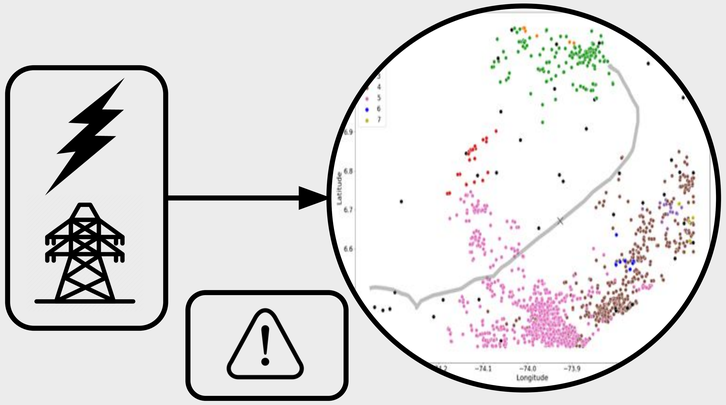
- Predicting transmission line failures due to lightning strikes has been studied for several decades.
- Our model was capable of predicting such failures, meeting the stated requirements.
- Our model can be seen as a baseline for future developments (see Future Work)

Background

Lightning strikes can cause blackouts in cities and towns. The interruption of electrical power supply causes many troubles to society. We aim to predict transmission line failures due to atmospheric discharges to reduce the potential losses at organizational and societal levels.

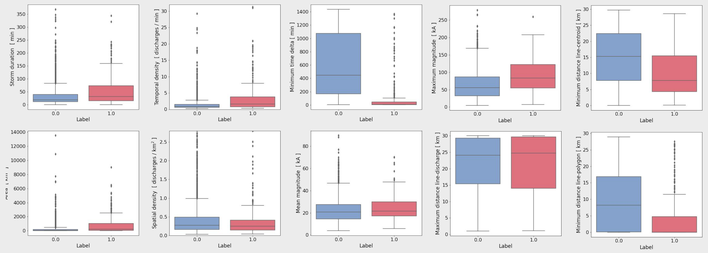
Data and transformations

We identified the challenge as a classification problem. Consequently, lightning discharges near transmission lines were clustered in space-time using ST-DBSCAN, so features could be built.



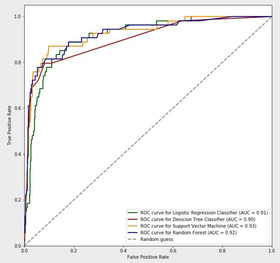
Features

We built several features suggested by research we reviewed, all linked to each cluster. This dimensionality reduction allowed us to identify which clusters were associated with transmission line failures. In the plot, the distribution of the majority of features can be seen, grouped by label (failure, non-failure).



Models & results

	Recall	Precision	Accuracy
Decision Tree	0.8	0.98	0.91
Random Forest	0.74	0.97	0.94
SVM	0.8	0.98	0.92
Logistic Reg.	0.81	0.98	0.88



We tested four models listed on the table. With the ROC curve below, 4 performance metrics are shown. SVM was selected for the final solution given these metrics.

Our model meets the target metrics

5 Min

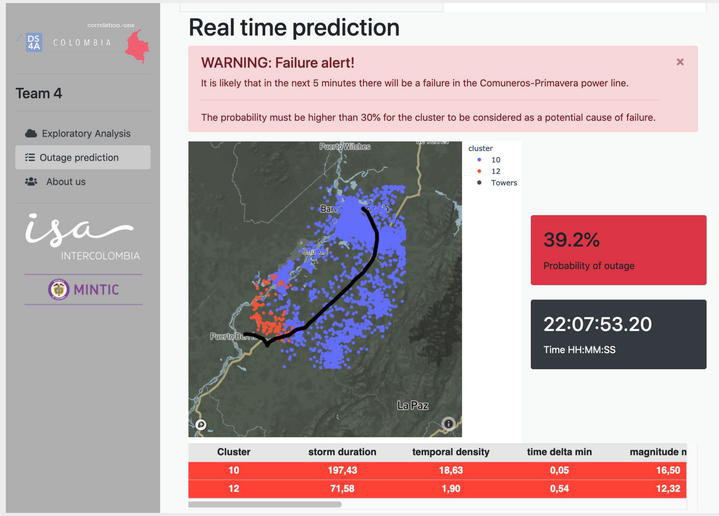
Prediction minimum anticipation

> 70%

True positive rate (TPN)

> 80%

True negative rate (TNR)



Application front-end. Section “Outage prediction. ds4a.aleatoria.co

Future work

- Include other meteorological variables
- Experiment with new features
- Test new models, and re-test the ones we employed in this work.