

FEATURED PROJECT · ONE-PAGE SUMMARY

ReneWind: Predictive Maintenance

Failure prediction tuned for the economics an operator actually faces: a missed failure costs a generator replacement and downtime, a false alarm costs a cheap inspection. This is the proven predictive-maintenance pattern the SustainAI anchor build extends into sustainment and supply-exception triage.

Role: Data & AI Practitioner **Stack:** Python · scikit-learn · Keras · EDA · Cost-Based Optimization · Model Explainability

Data: Ciphred sensor dataset · 40 engineered predictors · 25,000 labeled observations (20k train / 5k test)

WHAT IT IS

A suite of classification models predicting wind turbine generator failures before breakdown, with model selection and threshold tuning driven by a custom cost function that encodes the asymmetry between missed failures and false alarms.

KEY CAPABILITIES

- **Cost-asymmetric objective:** false negatives (missed failures) mean replacement plus major downtime; false positives mean inspection cost only. The cost function, not raw accuracy, drives every decision.
- **Model suite:** multiple classifiers built and compared; final solution is a tuned neural network.
- **Threshold optimization:** decision threshold tuned to approximately 0.29 against the custom cost metric, validated on a true hold-out set.
- **Explainability:** diagnostics built so engineers can trust and act on the predictions.

MEASURED RESULTS

~88%

Recall on failures, unseen data

25,000

Labeled observations

≈0.29

Cost-optimized threshold

↓ Cost

vs baseline maintenance strategies

BUSINESS IMPACT

Materially reduces expected maintenance cost compared to baseline strategies by catching failures before breakdown while tolerating cheap over-inspection. Predictive maintenance for physical equipment is the exact problem shape of defense sustainment, which is why this project bridges directly to the SustainAI anchor.