Report 00 – Intro: Model training for classification

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Date: April 3, 2025

Objective

This report summarizes the initial work on a security classification model for power system scenarios using Random Forests. The focus was on understanding the dataset and validating an existing trained model that was shared via email. I explored model performance, feature importance and evaluated classification metrics including the confusion matrix.

Data preparation

1 Input data

The dataset used was `simulation_security_labels_n-1.csv`, containing:

- **273 columns** (including `timestamp`, `status` and power system measurement values)
- **8769 rows**, representing hourly simulations over one year

2 Cleaning & Transformation

Steps performed:

- Dropped some columns
- Mapped `status` values to binary format:
  - `secure` → 0
  - `insecure` → 1
- Split data into:
  - `X` → features
  - `y` → target labels
- Performed `train_test_split` (stratified, test_size = 20%)

3 Class distribution

- `secure` (0): **3597 samples**
- `insecure` (1): **3418 samples**

Model training

1 Algorithm

- Model: `RandomForestClassifier`
- Parameters: `n_estimators=100`, `random_state=42`

2 Results (on test set)

```
              precision    recall  f1-score   support

           0       0.94      0.94      0.94       854
           1       0.94      0.94      0.94       900

    accuracy                           0.94      1754
   macro avg       0.94      0.94      0.94      1754
weighted avg       0.94      0.94      0.94      1754
```

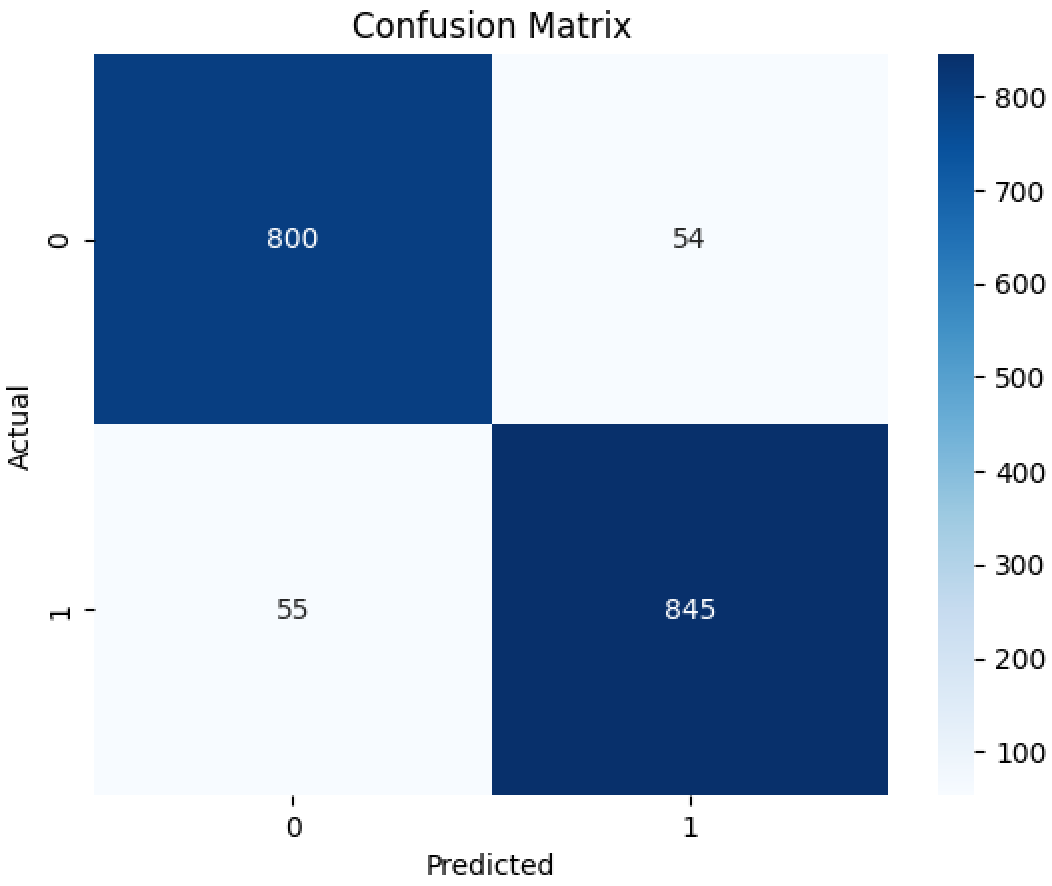
3 Confusion matrix

True Positives: 845

True Negatives: 800

False Positives: 54

False Negatives: 55



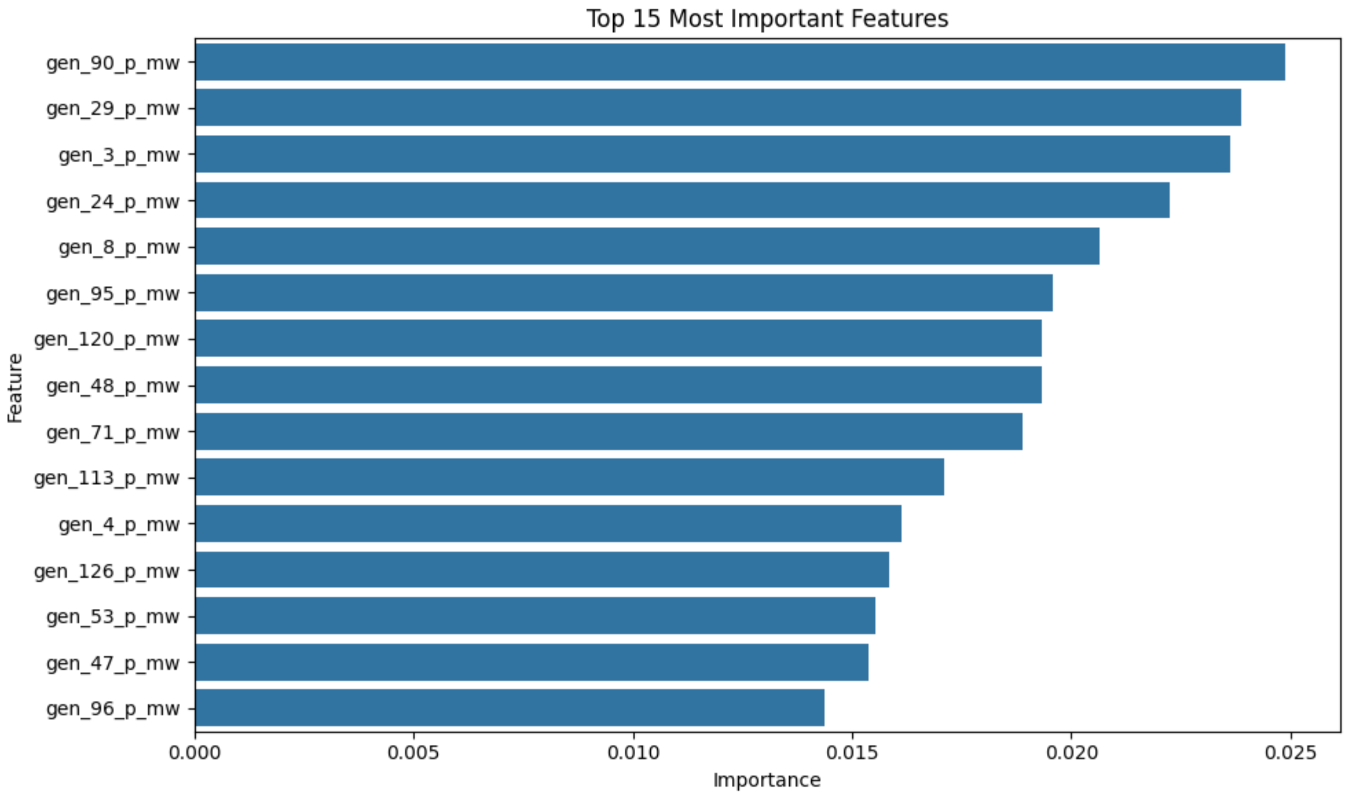
Feature importance analysis

Top 5 most important features:

1. `gen_90_p_mw`
2. `gen_29_p_mw`
3. `gen_3_p_mw`
4. `gen_24_p_mw`

5. `gen_8_p_mw`

> Visualized with `sns.barplot()` – see figure below.


Top 15 Most Important Features
Feature
gen_90_p_mw
gen_29_p_mw
gen_3_p_mw
gen_24_p_mw
gen_8_p_mw
gen_95_p_mw
gen_120_p_mw
gen_48_p_mw
gen_71_p_mw
gen_113_p_mw
gen_4_p_mw
gen_126_p_mw
gen_53_p_mw
gen_47_p_mw
gen_96_p_mw
Importance
