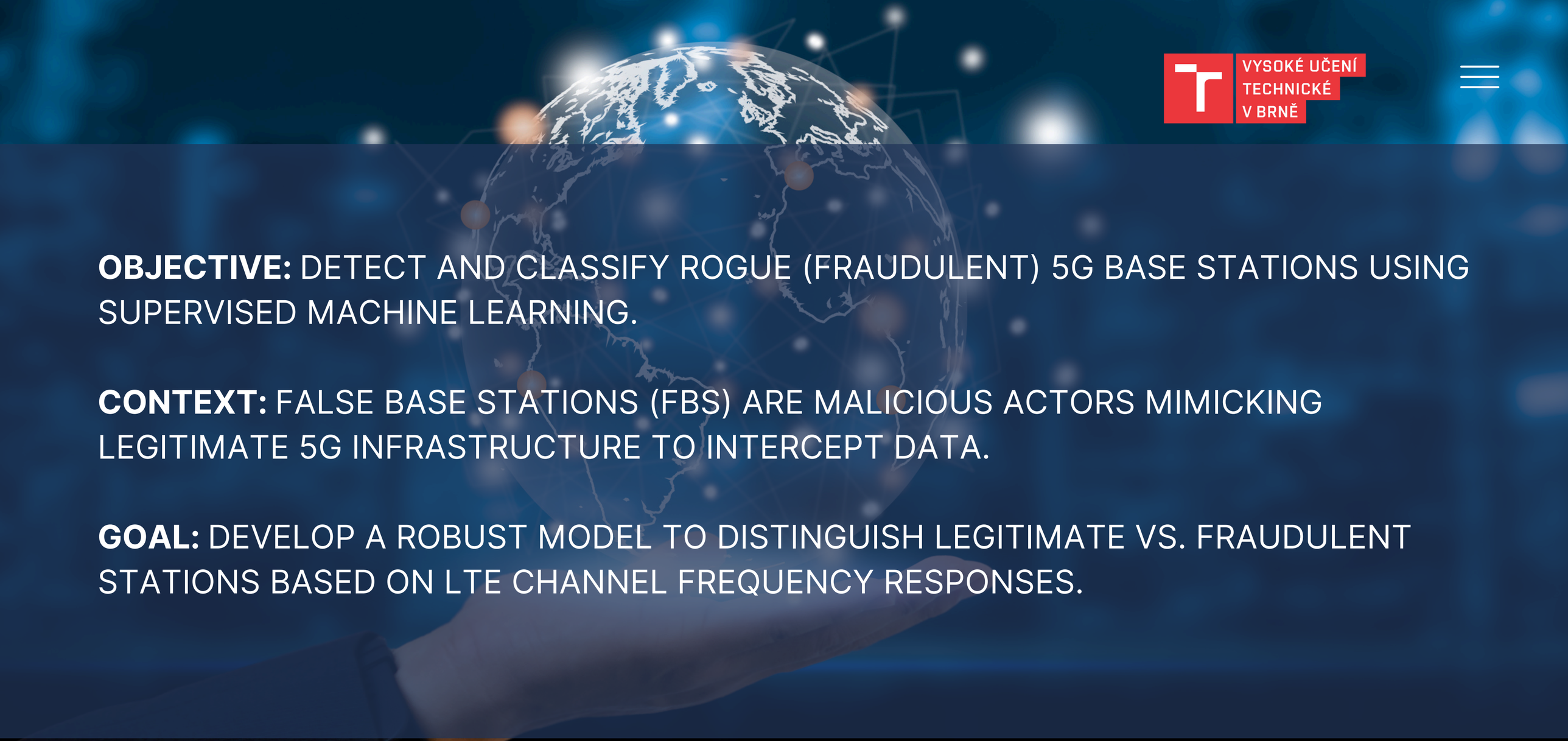
MIKAEL DOS SANTOS
ADRIAN DORFMULLER

VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ

# CLASSIFICATION OF 5G BASE STATIONS

Machine Learning Project

isep
École d'ingénieurs du numérique



**OBJECTIVE:** DETECT AND CLASSIFY ROGUE (FRAUDULENT) 5G BASE STATIONS USING SUPERVISED MACHINE LEARNING.

**CONTEXT:** FALSE BASE STATIONS (FBS) ARE MALICIOUS ACTORS MIMICKING LEGITIMATE 5G INFRASTRUCTURE TO INTERCEPT DATA.

**GOAL:** DEVELOP A ROBUST MODEL TO DISTINGUISH LEGITIMATE VS. FRAUDULENT STATIONS BASED ON LTE CHANNEL FREQUENCY RESPONSES.

# DATA EXTRACTION & PREPROCESSING

INPUT: .NPY FILES CONTAINING 2D MATRICES (72X48), EACH REPRESENTING FREQUENCY RESPONSES.

LABELS: MAPPED FROM LABEL_TRAIN.CSV USING UNIQUE SAMPLE IDS.

PREPROCESSING:

- FLATTENED EACH 2D SAMPLE TO A 1D VECTOR OF 3456 FEATURES.
- APPLIED STANDARDSCALER FOR NORMALIZATION.

# MODEL – RANDOM FOREST CLASSIFIER

ENSEMBLE OF DECISION TREES VOTING TOGETHER.

JUSTIFICATION:

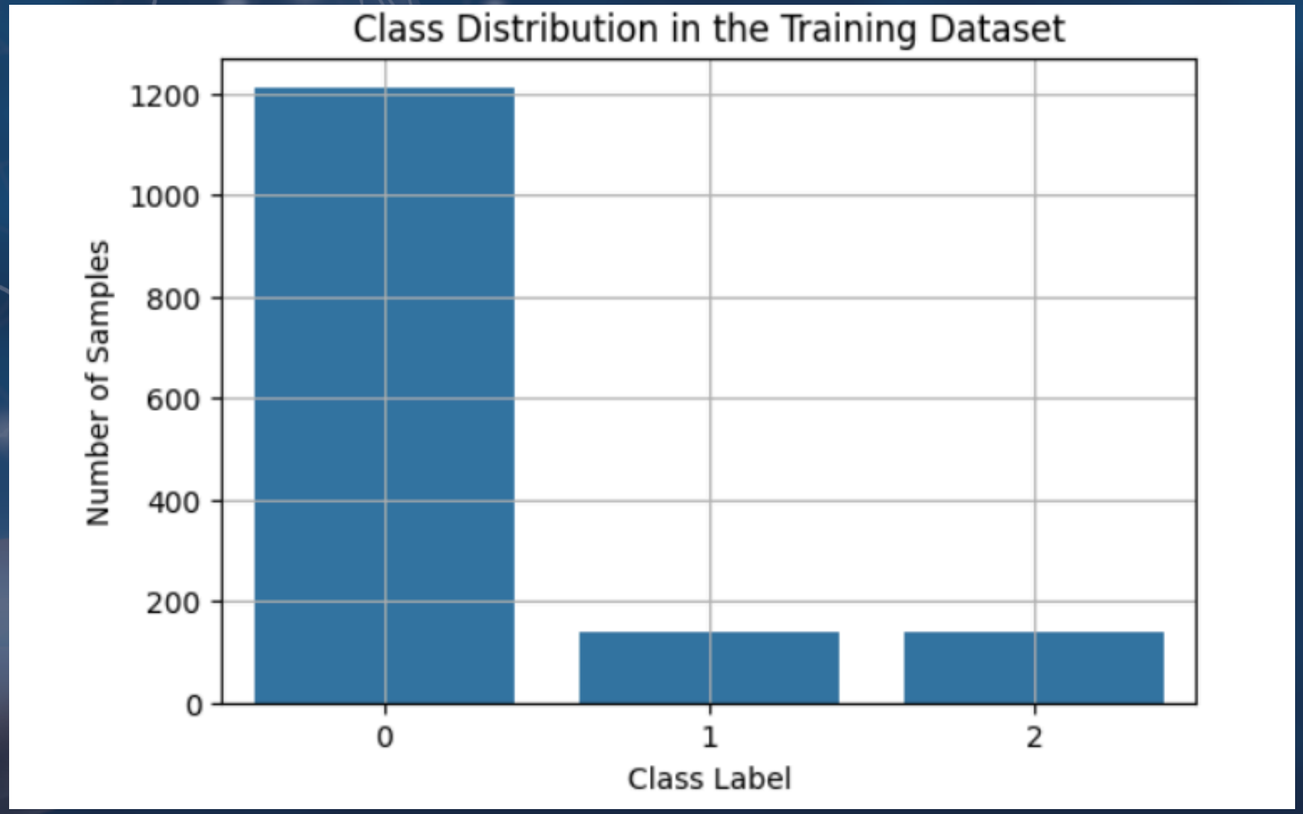
- HANDLES HIGH-DIMENSIONAL DATA WELL
- RESISTANT TO OVERFITTING
- FAST AND INTERPRETABLE

CONFIGURATION:

- 200 ESTIMATORS, MAX DEPTH = 20
- EVALUATION ON 15% VALIDATION SPLIT

# MODEL PERFORMANCE RESULTS

- CLASS 0 DOMINATES THE DATASET (LEGITIMATE STATIONS)
- CLASSES 1 & 2 UNDERREPRESENTED (FRAUDULENT STATIONS)
- HIGHLIGHTS CLASS IMBALANCE ISSUE

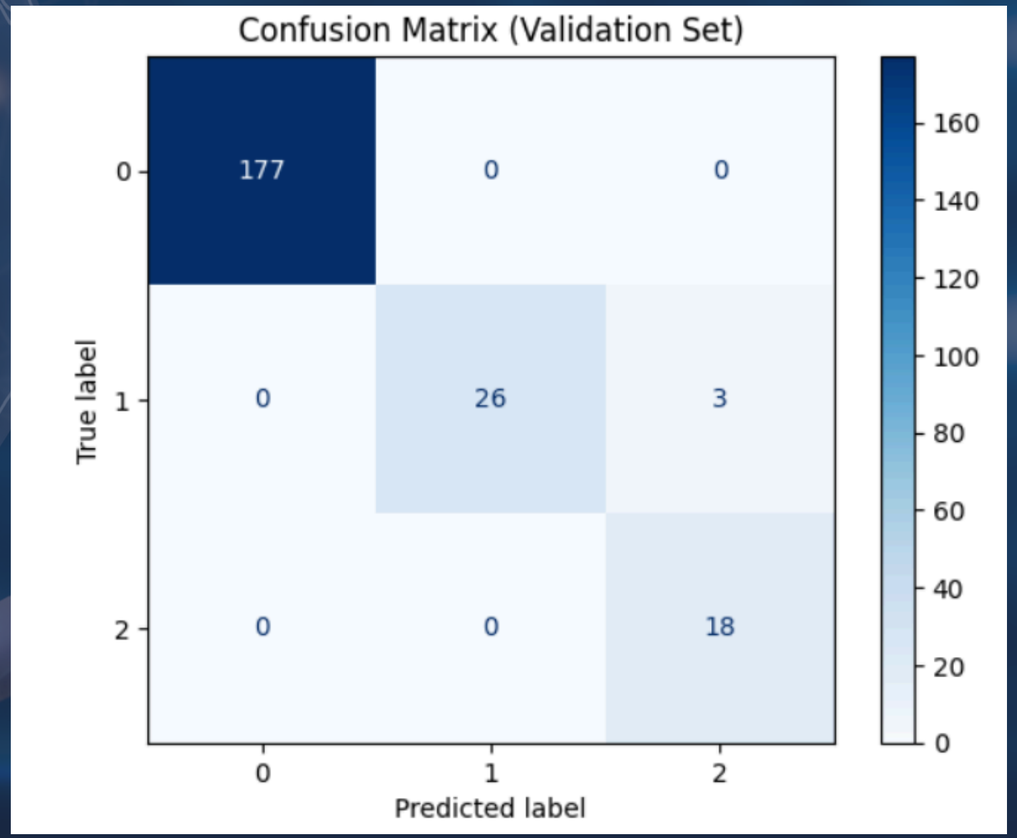


# MODEL PERFORMANCE RESULTS

VALIDATION ACCURACY: 99%

Classification Report (Validation Set):

| | precision | recall | f1-score | support |
|---|---|---|---|---|
| 0 | 1.00 | 1.00 | 1.00 | 177 |
| 1 | 1.00 | 0.90 | 0.95 | 29 |
| 2 | 0.86 | 1.00 | 0.92 | 18 |
| accuracy | | | 0.99 | 224 |
| macro avg | 0.95 | 0.97 | 0.96 | 224 |
| weighted avg | 0.99 | 0.99 | 0.99 | 224 |



# KAGGLE SCORE & FINAL CONCLUSION

| Submission and Description | Private Score | Public Score | Selected |
|---|---|---|---|
| **submission (3).csv**<br>Complete (after deadline) · 28m ago | 0.96666 | 0.96666 | ☐ |

MODEL SUCCESSFULLY CLASSIFIES LEGITIMATE VS. FRAUDULENT BASE STATIONS

VALIDATED WITH STRONG TEST PERFORMANCE ON KAGGLE

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# THANKS FOR LISTENING!