AI-Based Road Surface Condition Estimation

Regression and Classification using Random Forest

Problem Overview

- • Predict road surface friction coefficient (μ)
- • Classify surface condition as dry, wet, or icy
- • Use AI (Random Forest) for both regression and classification

Model Features and Targets

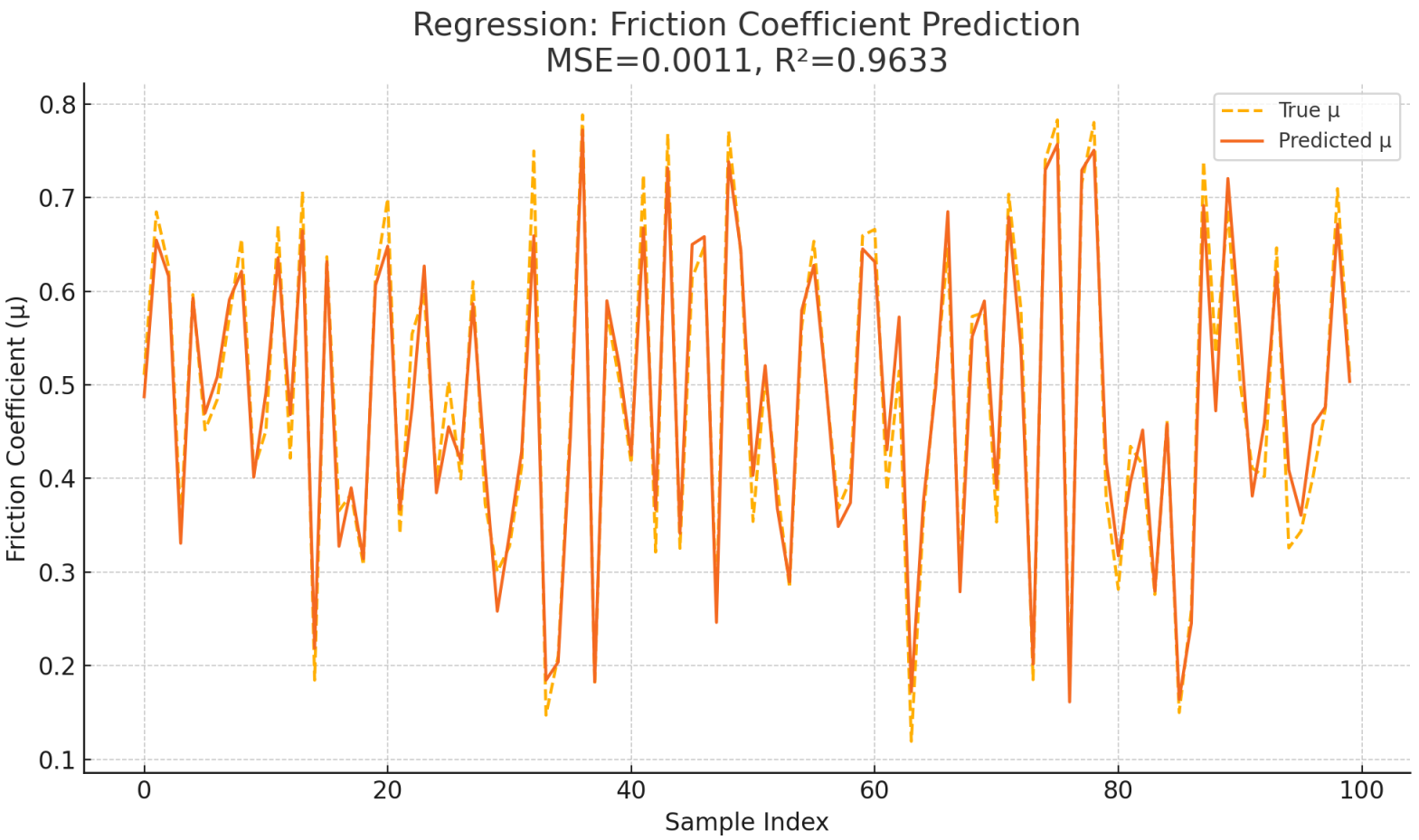
- Features:
- • ax, ay, slip_ratio, temperature, road_texture_score

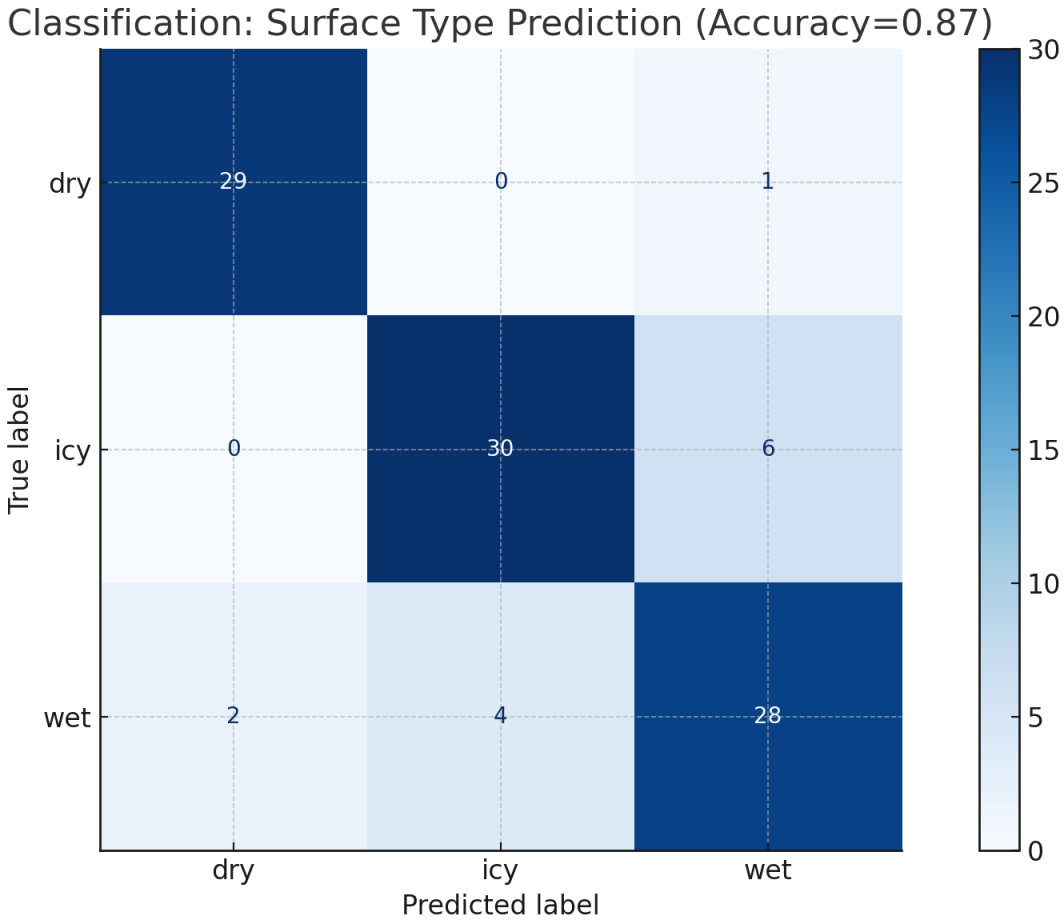
- Targets:
- • Regression: μ
- • Classification: dry, wet, icy

Equations Used

$$\mu = 0.8 - 0.3 * slip\_ratio - 0.01 * (35 - temperature) + 0.1 * road\_texture\_score + noise$$

Classification:
- dry if $\mu > 0.6$
- wet if $0.4 < \mu \leq 0.6$
- icy if $\mu \leq 0.4$


Regression: Friction Coefficient Prediction
MSE=0.0011, R²=0.9633
True μ
Predicted μ
Friction Coefficient (μ)
Sample Index
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
20
40
60
80
100


Classification: Surface Type Prediction (Accuracy=0.87)
True label
Predicted label
dry
icy
wet
29
0
1
0
30
6
2
4
28
30
25
20
15
10
5
0