Scour Depth Prediction Model Guide

The following instructions guide you to use the machine learning models provided in this repository for predicting scour depth around bridge piers. These models are part of the research work published in: **"Prediction of scour depth around bridge piers using Machine Learning Algorithms"** *By Farooque Rahman and Dr. Rutuja Chavan.*

Prerequisites

Before using the models, make sure you have:

- Python 3.8+
- The following Python libraries installed: numpy, pandas, scikit-learn, matplotlib, tensorflow.

Input Data Format

Prepare your input data as a .csv file with the following dimensionless input parameters, based on Equation (2) in the manuscript:

- b/y : Pier width to flow depth ratio
- V/Vc : Approach velocity to critical velocity ratio
- Fr : Froude number
- b/d50 : Pier width to median sediment size
- σg : Geometric standard deviation of sediment
- ys/y : Normalized scour depth (target/output)

Update each Python script with actual column names as needed.

Running a Model

- Replace the placeholder your_dataset_file_path.csv in each script with your actual data path (e.g., data/test_data.csv).
- Run the script in a Python environment.
- View outputs of Regression metrics (R^2, RMSE, MAE, MAPE) and scatter plots of actual vs predicted scour depth.

Quick Test Option

- We provide a sample test_data.csv file in the repository to allow users to quickly verify model execution.

Notes

- All models are trained on dimensionless parameters for better generalizability.

- The Random Forest (RF) model demonstrated the highest accuracy across all datasets in this study.
- ANN and GPR models also show strong predictive performance.
- Code and plots are easily modifiable for experimentation.

Conclusion

This repository provides open-source Python implementations of five machine learning models—MLR, SVR, RF, GPR, and ANN—for predicting scour depth around bridge piers. Developed as part of a study, the models demonstrate high predictive performance compared to traditional empirical methods, with the Random Forest model yielding the best results. By using dimensionless parameters and rigorous validation, the models offer a reliable and practical tool for researchers and engineers in hydraulic and civil engineering.

Disclaimer

This code is provided for academic and research purposes only. While every effort has been made to ensure the correctness of the models and predictions, the results should be validated against field data before being used in real-world engineering design or decision-making.