

# Decision Tree, Random Forest, Bagging and Boosting

# Exercise 1

- Objective:

- Implement a decision tree regression model using scikit-learn to predict the output of a 2D sinusoidal signal based on two input features.

```
tree = DecisionTreeRegressor(max_depth=5)
```

- Check on the scikit manual what are the hyperparameter that you can tune for the decision tree regressor
- Perform a brief analysis of the effect of max\_depth and splitter on the test error
- Compare the decision tree's performance on the test set with a polynomial regression.

- Requirements: mamba/conda env with numpy, matplotlib, and scikit learn

# Exercise 2

- Objective:
  - Utilize the bagging ensemble method with decision trees to regress a 2D sinusoidal signal.

[illegible]

- Analyze the model's accuracy on the test set
- Requirements: mamba/conda env with numpy, matplotlib, and scikit learn

# Exercise 3

- Objective:
  - Implement a Random Forest regressor using scikit-learn to predict the output of a 2D sinusoidal signal.

```
# Initialize and train the Random Forest regressor
```

```
random_forest = RandomForestRegressor(n_estimators=50, random_state=42)
```

- Analyze model accuracy on the test set
- Requirements: mamba/conda env with numpy, matplotlib, and scikit learn

# Exercise 4

- Objective:
  - Employ AdaBoost, a foundational boosting algorithm, to model a 2D sinusoidal signal.

```
ada_regressor = AdaBoostRegressor(base_estimator=DecisionTreeRegressor(max_depth=4),  
                                  n_estimators=50, random_state=42, loss='linear')
```

- Compute the prediction error on the training set
- Requirements: mamba/conda env with numpy, matplotlib, and scikit learn

# Exercise 5

- Objective:

- Compare the fit results of every regression model on the test set
- Which is the best one?

## Optional Objective:

- Based on your study use the best model tested on synthetic data to predict the house value using the California Housing Prices dataset

You can find all the file here

[https://github.com/VModugno/lab\\_sessions\\_COMP0245\\_PUBLIC/tree/main/week\\_2](https://github.com/VModugno/lab_sessions_COMP0245_PUBLIC/tree/main/week_2)