Tuning results for the TSP

K-nearest Neighbor (KNN)

1. **Parameter grid/distribution**
   - scaler: [StandardScaler(), MinMaxScaler()]
   - knn__n_neighbors: [7, 8, 9, 10, 11, 12]

2. **Best parameters**
   - scaler: StandardScaler()
   - knn__n_neighbors: 8

3. **Tuning details**
   - Search type: GridSearchCV
   - Parameter combinations: 12
   - Total tuning time: 1m, 16s
   - Total tuning fit time: 1s
   - Total tuning prediction time: 4m, 22s

Ridge Regression

1. **Parameter grid/distribution**
   - alpha: [0.001, 0.01, 0.1, 1, 10]

2. **Best parameters**
   - alpha: 1

3. **Tuning details**
   - Search type: GridSearchCV
   - Parameter combinations: 5
   - Total tuning time: 1s
   - Total tuning fit time: 4s
   - Total tuning prediction time: 0s

Decision Tree

1. **Parameter grid/distribution**
   - max_depth: range(15, 50, 5)
   - max_leaf_nodes: [1750, 2000, 2250, 2500, 2750, None]
   - min_samples_leaf: range(1, 26)
   - min_impurity_decrease: [0.0001, 0.001]

2. **Best parameters**
   - max_depth: 45
   - max_leaf_nodes: 2000
   - min_samples_leaf: 19
   - min_impurity_decrease: 0.0001

3. Tuning details
- Search type: RandomizedSearchCV
- Parameter combinations: 50
- Total tuning time: 1m, 15s
- Total tuning fit time: 4m, 7s
- Total tuning prediction time: 3s

Random Forest

1. Parameter grid/distribution
- max_features: [15, 20, 25, 30, None]
- max_depth: range(10, 26)
- max_leaf_nodes: [2000, 2500, 3000, 3500, None]
- min_samples_leaf: range(1, 26)
- min_samples_split: range(2, 21)
- min_impurity_decrease: [0.0001, 0.001]

2. Best parameters
- max_features: 25
- max_depth: 13
- max_leaf_nodes: None
- min_samples_leaf: 6
- min_samples_split: 11
- min_impurity_decrease: 0.0001

3. Tuning details
- Search type: RandomizedSearchCV
- Parameter combinations: 50
- Total tuning time: 25m, 32s
- Total tuning fit time: 1h, 38m
- Total tuning prediction time: 20s

Gradient Boosting Regression Trees (GBRT)

1. Parameter grid/distribution
- n_estimators: range(80, 140, 20)
- max_features: [15, 20, 25, 30, None]
- learning_rate: [0.01, 0.05, 0.1, 0.3]
- max_depth: range(5, 26)
- max_leaf_nodes: [500, 1000, 1500, 2000, None]
- min_samples_leaf: range(1, 26)
- min_samples_split: range(2, 21)

2. Best parameters
- n_estimators: 120
- max_features: 25
- learning_rate: 0.1

- max_depth: 10
- max_leaf_nodes: 1500
- min_samples_leaf: 23
- min_samples_split: 6

3. Tuning details
- Search type: RandomizedSearchCV
- Parameter combinations: 25
- Total tuning time: 34m, 7s
- Total tuning fit time: 2h, 9m
- Total tuning prediction time: 10s

Extreme Gradient Boosting (XGBoost)

1. Parameter grid/distribution
- max_depth: [5, 7, 9]
- learning_rate: [0.05, 0.1]
- subsample: [0.6, 0.8, 1.0]
- colsample_bytree: [0.6, 0.8, 1.0]

2. Best parameters
- max_depth: 7
- learning_rate: 0.05
- subsample: 0.6
- colsample_bytree: 1.0

3. Tuning details
- Search type: GridSearchCV
- Parameter combinations: 54
- Total tuning time: 23m, 34s
- Total tuning fit time: 1h, 27m
- Total tuning prediction time: 2m, 21s

Support Vector Machine (SVM)

1. Parameter grid/distribution
- scaler: [StandardScaler(), MinMaxScaler()]
- SVM__C: [0.1, 1, 10, 50]
- SVM__epsilon: [0.01, 0.1, 1]

2. Best parameters
- scaler: StandardScaler()
- SVM__C: 10
- SVM__epsilon: 0.1

3. Tuning details
- Search type: GridSearchCV
- Parameter combinations: 24

- Total tuning time: 1m, 52s
- Total tuning fit time: 6m, 22s
- Total tuning prediction time: 2s

Kernel Machine

1. Parameter grid/distribution

- scaler: [StandardScaler(), MinMaxScaler()]
- SVM__C: [10, 100, 200]
- SVM__gamma: ['scale', 'auto']
- SVM__epsilon: [0.01, 0.1, 1]

2. Best parameters

- scaler: MinMaxScaler()
- SVM__C: 100
- SVM__gamma: scale
- SVM__epsilon: 1

3. Tuning details

- Search type: GridSearchCV
- Parameter combinations: 36
- Total tuning time: 43m, 23s
- Total tuning fit time: 1h, 46m
- Total tuning prediction time: 1h, 2m

Neural Network (NN)

1. Parameter grid/distribution

- mlpregressor__alpha: [0.0001, 0.001, 0.01, 0.1, 1]
- mlpregressor__solver: ['sgd', 'adam']
- mlpregressor__batch_size: [32, 64, 128]
- mlpregressor__learning_rate_init: [0.0001, 0.001]
- mlpregressor__early_stopping: [True, False]

2. Best parameters

- mlpregressor__alpha: 0.1
- mlpregressor__solver: sgd
- mlpregressor__batch_size: 32
- mlpregressor__learning_rate_init: 0.001
- mlpregressor__early_stopping: False

3. Tuning details

- Search type: GridSearchCV
- Parameter combinations: 120
- Total tuning time: 2h, 57m
- Total tuning fit time: 11h, 42m
- Total tuning prediction time: 24s