Model Run Documentation

Overview

This document details the results of several machine learning model runs for comparison of performance metrics and parameter configurations. The models evaluated include:

- Gradient Boosting (v2)
- K-Nearest Neighbors (KNN)
- Linear Regression
- Gradient Boosting
- Random Forest

➢ Data Logging

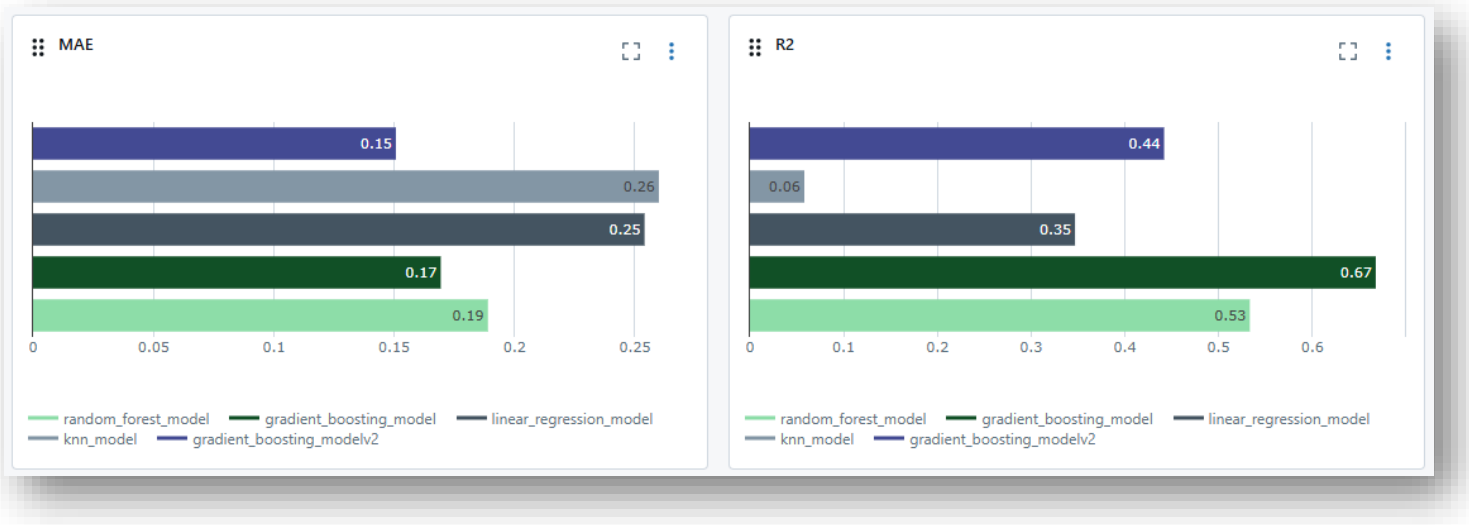
Data logging is the foundational step in tracking machine learning experiments. In the presented MLflow interface, critical data parameters were logged to ensure reproducibility and detailed experimentation.

- **Logged Parameters:**

Parameter	Gradient Boosting (v2)	KNN	Linear Regression	Gradient Boosting	Random Forest
algorithm	-	auto	-	-	-
fit_intercept	-	-	True	-	-
learning_rate	0.9	-	-	0.1	-
max_depth	6	-	-	3	10
min_samples_leaf	-	-	-	-	1
min_samples_split	-	-	-	-	2
n_estimators	100	-	-	100	100
n_neighbors	-	5	-	-	-
random_state	42	-	-	42	42
weights	-	uniform	-	-	-

➢ Performance and Metrics Tracking

Metric	Gradient Boosting (v2)	KNN	Linear Regression	Gradient Boosting	Random Forest
Duration (s)	4.6	4.5	4.2	4.3	4.9
MAE	0.151	0.26	0.254	0.169	0.189
MSE	0.276	0.466	0.323	0.164	0.231
R^2	0.442	0.058	0.347	0.668	0.533



➢ Model Comparison

1. **Gradient Boosting (v2)**:
    - Performed better than its counterpart due to a higher learning rate (0.9) and deeper trees (max_depth = 6).
    - Best **MSE**: 0.276
    - Best **R^2**: 0.442
2. **KNN**:
    - Had the weakest performance among the models tested.
    - Lowest **R^2**: 0.058

- Highest errors (**MAE** and **MSE**).

3. **Linear Regression**:
   - Achieved decent performance but lagged behind Gradient Boosting and Random Forest in accuracy.
4. **Random Forest**:
   - Showed strong performance, balancing low errors and high **R^2** (0.533).

Conclusion

- The **Gradient Boosting (v2)** and **Random Forest** models are the top performers in this comparison.
- For tasks prioritizing interpretability, **Linear Regression** might be suitable despite its lower accuracy.
- **KNN** may require parameter tuning to improve its performance.