Model Evaluation Metrics

We evaluated **four classification models** for both:

- **Predicting Machine Failure** (Binary Classification)
- **Classifying Type of Failure** (Multiclass Classification)

The models tested:

- Logistic Regression
- Support Vector Classifier (SVC)
- Decision Tree Classifier
- Random Forest Classifier

Machine Failure - Model Comparison

	Model	Accuracy	Precision	Recall	F1 Score
0	LogisticRegression	0.838	0.866	0.895	0.880
1	SVC	0.961	0.949	0.995	0.971
2	DecisionTreeClassifier	0.990	0.989	0.996	0.993
3	RandomForestClassifier	0.993	0.990	0.999	0.995

Random Forest Classifier gave the best performance for predicting machine failure.

Classification Report - Random Forest (Machine Failure)

	Precision	Recall	F1 Score	Support
Class 0 (No Failure)	0.999	0.980	0.989	3,873
Class 1 (Failure)	0.990	0.999	0.995	7,710
Macro Avg	0.994	0.989	0.992	11,583
Weighted Avg	0.993	0.993	0.993	11,583

Type of Failure - Model Comparison

	Model	Accuracy	Precision	Recall	F1 Score
0	LogisticRegression	0.823	0.816	0.824	0.818
1	SVC	0.939	0.941	0.940	0.937
2	DecisionTreeClassifier	0.985	0.985	0.985	0.985
3	RandomForestClassifier	0.992	0.992	0.992	0.992

Random Forest Classifier also performed best for identifying the type of failure.

Classification Report - Random Forest (Type of Failure)

	Precision	Recall	F1 Score	Support
0 (TWF)	0.996	1.000	0.998	1,880
1 (HDF)	0.994	0.999	0.997	1,933
2 (OSF)	0.995	1.000	0.997	1,959
3 (RNF)	0.992	0.998	0.995	1,915
4 (PWF)	0.976	1.000	0.988	1,934
5 (No Failure)	0.998	0.954	0.976	1,962
Macro Avg	0.992	0.992	0.992	11,583
Weighted Avg	0.992	0.992	0.992	11,583