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# **CAPSTONE PROJECT**

## **PREDICTIVE MAINTENANCE OF INDUSTRIAL MACHINERY**

**Presented By:**

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# OUTLINE

- **Problem Statement** (Should not include solution)
- **Proposed System/Solution**
- **System Development Approach** (Technology Used)
- **Algorithm & Deployment**
- **Result (Output Image)**
- **Conclusion**
- **Future Scope**
- **References**

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# PROBLEM STATEMENT

- Develop a predictive maintenance model for a fleet of industrial machines to anticipate failures before they occur. This project will involve analyzing sensor data from machinery to identify patterns that precede a failure. The goal is to create a classification model that can predict the type of failure (e.g., tool wear, heat dissipation, power failure) based on real-time operational data. This will enable proactive maintenance, reducing downtime and operational costs.

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# PROPOSED SOLUTION

- The proposed system aims to build a **Predictive Maintenance Model** that uses historical and real-time sensor data from industrial machines to **predict potential failures** such as:
  - Tool wear
  - Heat dissipation issues
  - Power failure
- By identifying failure patterns early, the system allows for **proactive maintenance**, minimizing **unexpected downtime** and **repair costs**, and improving machine reliability.

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# SYSTEM APPROACH

- **System Requirement : Window 10/11,8GB RAM**
- **Technology Used :IBM Cloud Lite Version**

# ALGORITHM & DEPLOYMENT

## Modeling Process:

### 1.Data Preprocessing:

- Clean null/missing values
- Feature engineering (e.g., moving averages, thresholds)
- Label encoding for failure types

### 2.Model Selection:

- Random Forest Classifier** for prediction
- Evaluation Metrics:** Accuracy, F1-score, Precision, Recall

### 3.Training & Validation:

- Split dataset (train/test)
- Apply cross-validation
- Tune hyperparameters using GridSearchCV

### 4.Deployment:

- Export trained model using joblib
- Create REST API using Flask for real-time prediction
- Interface for maintenance teams to receive alerts

# RESULT

IBM watsonx.ai Studio

Search in your workspaces

Upgrade

?

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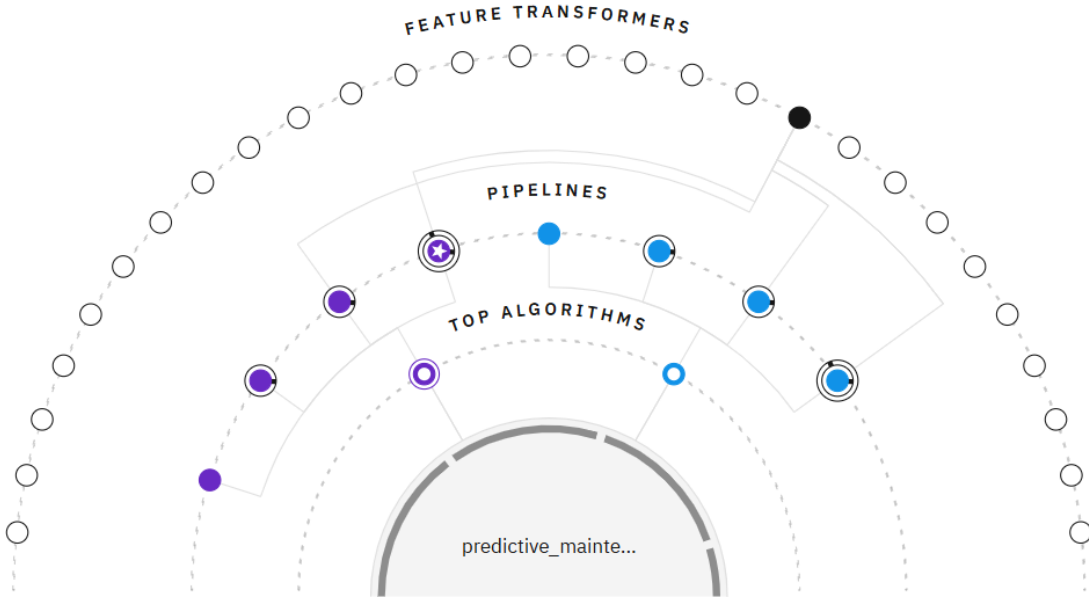
Projects / Industrial Machinery Predictor / Fault\_predict

Experiment summary


Pipeline comparison

★ Rank by: Accuracy (Optimized) | Cross validation score

Relationship map ⓘ  
Prediction column: Failure Type



Progress map  
[Swap view ↺](#)



Experiment completed 🟢  
8 PIPELINES GENERATED  
8 pipelines generated from algorithms. See pipeline leaderboard below for more detail.  
Time elapsed: 3 minutes

[View log](#)

[Save code](#)

Pipeline leaderboard 🔍

# RESULT

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Experiment summary

Pipeline comparison

★ Rank by: Accuracy (Optimized) | Cross validation score

Progress map ⓘ

Prediction column: Failure Type

```
graph LR; A[Read dataset] --> B[Split holdout data]; B --> C[Read training data]; C --> D[Preprocessing]; D --> E[Model selection]; E --> F[Snap Random Forest Classifier]; E --> G[Snap Decision Tree Classifier]; F --> H[Hyperparameter optimization]; H --> I[Feature engineering]; I --> J[Hyperparameter optimization]; J --> K[P1]; K --> L[P2]; L --> M[P3]; M --> N[P4]; G --> O[Hyperparameter optimization]; O --> P[Feature engineering]; P --> Q[Hyperparameter optimization]; Q --> R[P5]; R --> S[P6]; S --> T[P7]; T --> U[P8]; U -.-> V[P9];
```

Relationship map

Swap view ↕

Experiment completed ✓

8 PIPELINES GENERATED

8 pipelines generated from algorithms. See pipeline leaderboard below for more detail.


Time elapsed: 3 minutes






View log

Save code



# RESULT

Pipeline leaderboard 

	Rank 	Name	Algorithm	Specialization	Accuracy (Optimized) <u>Cross Validation</u>	Enhancements	Build time	
★	1	<a href="#">Pipeline 4</a>	 Snap Random Forest Classifier		0.995	HPO-1 FE HPO-2	00:00:41	<a href="#">Save as</a>
	2	Pipeline 3	 Snap Random Forest Classifier		0.995	HPO-1 FE	00:00:32	
	3	Pipeline 8	 Snap Decision Tree Classifier		0.994	HPO-1 FE HPO-2	00:00:30	
	4	Pipeline 2	 Snap Random Forest Classifier		0.994	HPO-1	00:00:08	

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Deployment spaces / fault\_dep / P4 - Snap Random Forest Classifier: Fault\_predict

Deployments

Model details

Search

New deployment

Name	Type	Status	Tags	Last modified	
 dep2	Online	 Deployed		21 seconds ago Keerthana Muruganantham (You)	

Items per page: 20

1-1 of 1 items

1 of 1 pages

Name

P4 - Snap Random Forest Classifier: Fault\_predict

Description

No description provided.

Asset Details

Type: wml-hybrid\_0.1  
Model ID: a6a98b3c-a71e-49...  
Software specification: hybrid\_0.1  
Hybrid pipeline software specifications: autoai-kb\_rt24.1-py3.11

Tags

Add tags to make assets easier to find.

Source asset details

Last modified  
43 seconds ago by Keerthana Muruganantham  
Created on  
Aug 1, 2025 by Keerthana Muruganantham

# RESULT

## Prediction results

Prediction type

Multiclass classification

Prediction percentage



■ No Failure

Confidence level distribution

Display format for prediction results

☒ Table view ☐ JSON view

☒ Show input data ⓘ

	Prediction	Confidence
1	No Failure	100%
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

Download JSON file

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# CONCLUSION

- Predictive maintenance minimizes downtime by using sensor data and classification algorithms (e.g., Random Forest, XGBoost) to accurately forecast failures and trigger timely alerts for better efficiency

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## FUTURE SCOPE

- Develop a mobile app for maintenance alerts
- Integrate with ERP systems for automated maintenance requests

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# REFERENCES

- Scikit-learn documentation: <https://scikit-learn.org/>
- Kaggle: Predictive Maintenance datasets
- Research papers on predictive maintenance in IEEE Xplore
- TensorFlow: <https://www.tensorflow.org/>
- Python Flask for Deployment:  
<https://flask.palletsprojects.com/>

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**THANK YOU**