

The background features a dark blue gradient with faint, semi-transparent technical diagrams on the left side, including circular gauges with numerical scales (e.g., 150, 160, 170, 180, 190, 200, 220, 230, 240, 250, 260) and arrows. At the bottom, there is a silhouette of a mountain range under a starry night sky.

# **PREDICTIVE MAINTENANCE FOR HYDRAULIC SYSTEMS USING MACHINE LEARNING**

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# PROJECT OVERVIEW

- 1. Objective:** Develop a machine learning model to predict hydraulic system failures using sensor data.
- 2. Key Focus:** Real-time deployment feasibility and high accuracy and computational efficiency.
- 3. Visual:** Flowchart showing the project pipeline (data → preprocessing → modeling → evaluation).



# PROBLEM STATEMENT

## Current Challenges:

1. Reactive maintenance leads to costly downtime
2. Manual inspections are time-consuming
3. Unexpected failures disrupt operations

# RELATED WORK

## Prior Research:

1. Machine learning models (Random Forests, SVMs, LSTMs) for failure prediction
2. Feature engineering techniques (PCA, time-series analysis)



# RELATED WORK

## Gaps in Research:

1. Need for interpretable and lightweight models.
2. Limited real-time deployment applications.

# PROPOSAL WORK

## Proposed Solution:

1. Predictive maintenance using machine learning.
2. Real-time monitoring and failure prediction.



# EVALUATION

## **Classification Metrics:**

1. Accuracy, Precision, Recall, F1-score

## **Model Efficiency:**

1. Training time and inference speed

# PROJECT TIMELINE

1. Week 1: Dataset exploration and preprocessing.
2. Week 2-3: Implement baseline models (Decision Trees, XGBoost).
3. Week 4: Experiment with time-series models (LSTM, ARIMA).
4. Week 5: Evaluation and performance comparison.- Week 6: Final report writing and refinements.



# DATA PREPROCESSING

1. **Handling Missing Values**
2. **Feature Engineering**

Extracted statistical features for each sensor per cycle

# Model Training and Evaluation

## Random Forest Classifier

Random Forest, an ensemble learning method, trained using 80% of the dataset and evaluated on the remaining 20%.

**Accuracy: 99.77%**



# Model Training and Evaluation

## XGBoost Classifier

XGBoost, a gradient boosting algorithm, was used to compare against the Random Forest model. XGBoost is known for handling complex relationships in data efficiently.

**Accuracy: 99.09%**

The background is a gradient of deep purple and blue, filled with numerous out-of-focus circular light spots (bokeh) in various shades. Overlaid on the left side are several faint, white circular patterns. One prominent pattern is a large circle with a degree scale ranging from 150 to 260, with tick marks every 10 degrees. Other smaller circles and arcs are scattered around, some with arrows indicating a clockwise direction. The overall aesthetic is modern and technical.

THANKS!