Project Report: Motor Fault Diagnosis using Wavelet Transform and Machine Learning

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Tools:

Python, NumPy, PyWavelets, scikit-learn, matplotlib, pandas

Project Overview

This project focuses on diagnosing motor faults using synthetic signals, extracting features via wavelet transform, and applying machine learning to classify healthy and faulty conditions.

3. Workflow

Step 1: Signal Generation: Simulated normal and faulty motor signals using a combination of sine waves and noise.

Step 2: Wavelet Feature Extraction: Applied discrete wavelet transform to compute energy and entropy at each decomposition level.

Step 3: Dataset Creation: Compiled extracted features into a labeled dataset for classification.

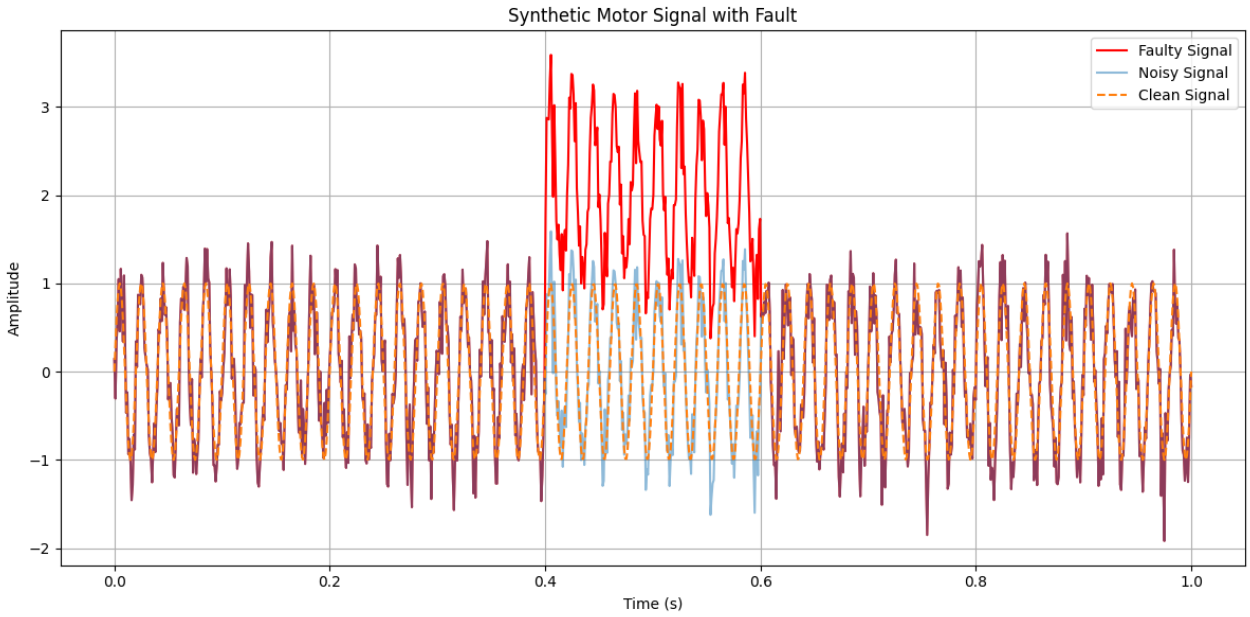
Step 4: Model Training: Trained a Random Forest classifier and evaluated its performance.

Results

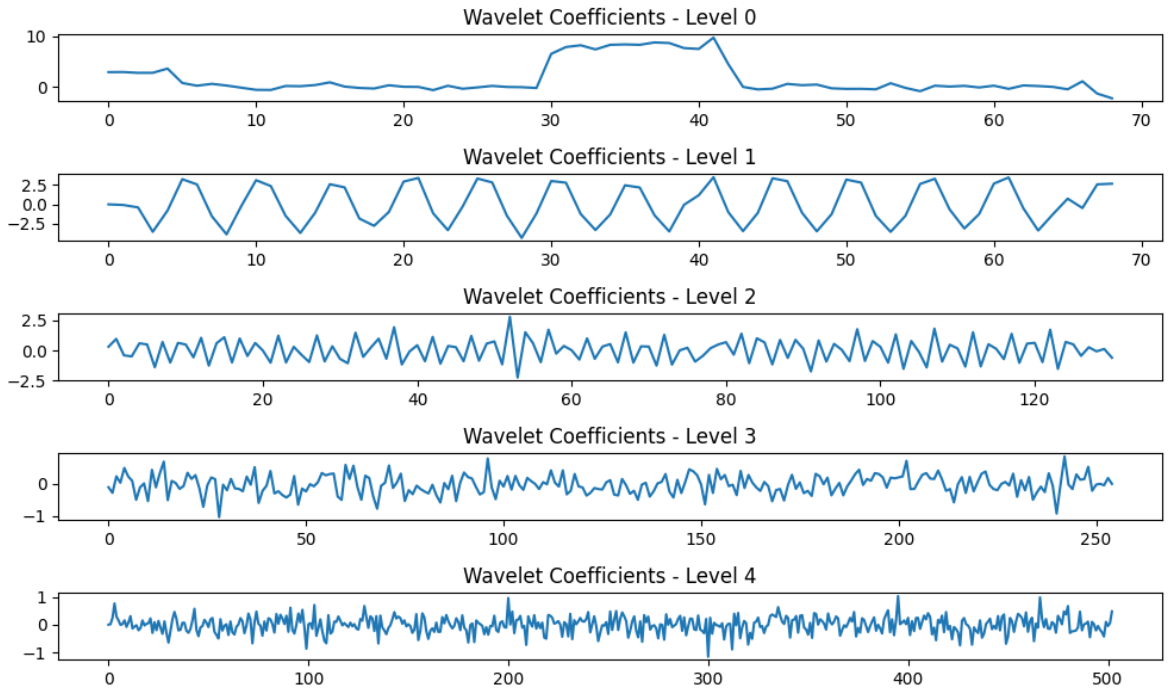
- Model Accuracy: 100%
- Confusion Matrix:
    - 4 healthy samples → correctly classified
    - 4 faulty samples → correctly classified
    - No false positives or negatives

Figures

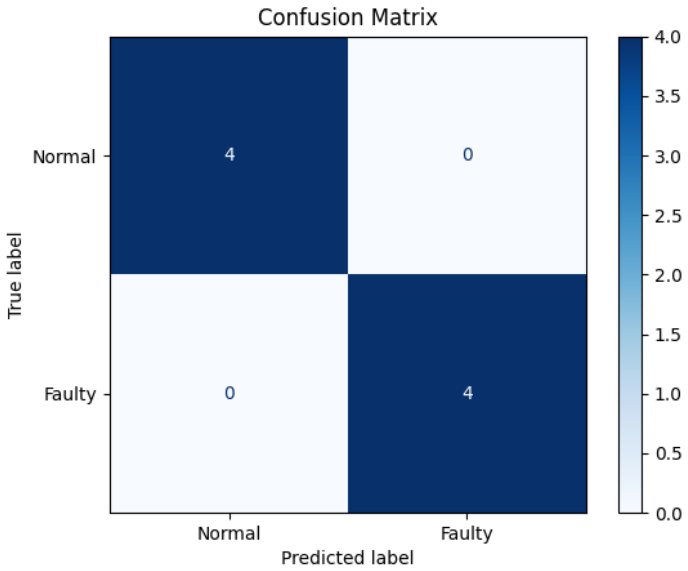
1. Generated Motor Signals



2. Wavelet Coefficients Plot



3. Confusion Matrix



Conclusion

This project successfully demonstrated a simple yet effective approach for detecting motor faults using wavelet-based features and machine learning.

The model achieved 100% classification accuracy on a small synthetic dataset, proving the method's potential.

Future Work

To further enhance this project:

- Use real motor vibration or current data instead of synthetic signals
- Test with multiple fault types (bearing, broken rotor, imbalance, etc.)
- Compare performance of various classifiers (SVM, XGBoost, LSTM)
- Apply time-frequency feature extraction techniques like STFT or Hilbert-Huang Transform