Industrial Equipment Maintenance via Deep Learning

CSE SEM 7

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Guide:

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Outline

Introduction

Briefly introduce the project and its purpose.

Objective

State the specific goals the project aims to achieve.

Scope

Define the boundaries and limitations of the project.

Problem Statement

Clearly articulate the problem the project is addressing.

Proposed Approach

Describe the methodology and strategies to be used.

Tools & Technologies

List the software and hardware used in the project.

Timeline

Present a schedule of key milestones and deadlines.

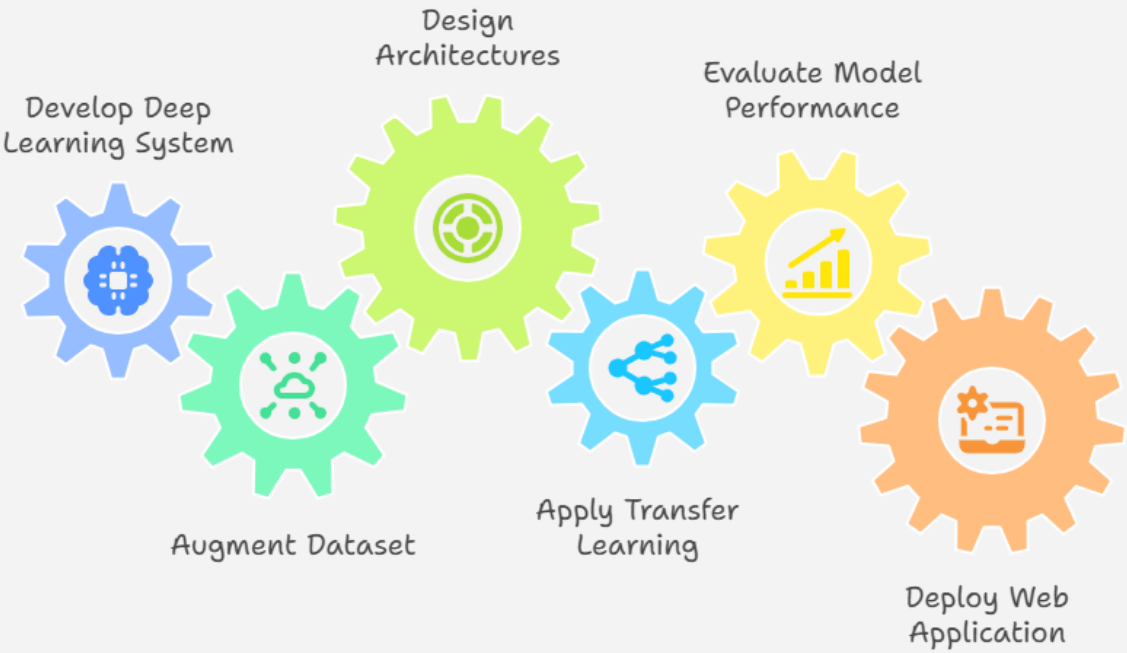
Conclusion

Summarize the project and its expected outcomes.

Introduction

- *Predictive Maintenance (PdM) uses data to forecast machine failures.*
- *My previous implementation used Random Forest with decent results.*
- *To improve, this project shifts to a Neural Network approach.*
- *The original dataset has ~10,000 records of sensor and operational data.*
- *Challenges: small dataset size, imbalanced data, failure type classification.*

Objective

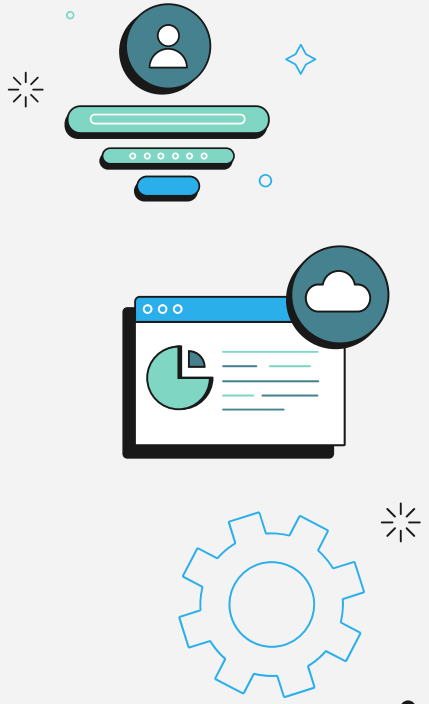

Develop Deep Learning System
Augment Dataset
Design Architectures
Apply Transfer Learning
Evaluate Model Performance
Deploy Web Application

Scope

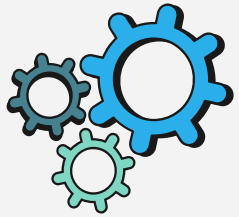
- ***Industrial Focus:*** *The project targets industrial machines such as generators, rotators, furnaces, machining tools, and quality control systems.*
- ***Data Types:*** *Sensor data including torque, temperature, rotational speed, and tool wear across different equipment types.*
- *Deep learning architectures for predictive modelling.*
- *Data augmentation methods for synthetic dataset expansion.*

Problem Statement

- *Industrial equipment such as generators, furnaces, rotators, and machining tools are subject to wear and unexpected failures that can disrupt operations, reduce efficiency, and increase maintenance costs.*
- *Traditional machine learning models like Random Forest provide decent predictions for machine failures but is tend to overfit, but they fall short when data is limited, imbalanced, or lacks generalization.*
- *With only ~10,000 rows of operational data, current models struggle to accurately predict both failure occurrence and type, especially under varying conditions.*

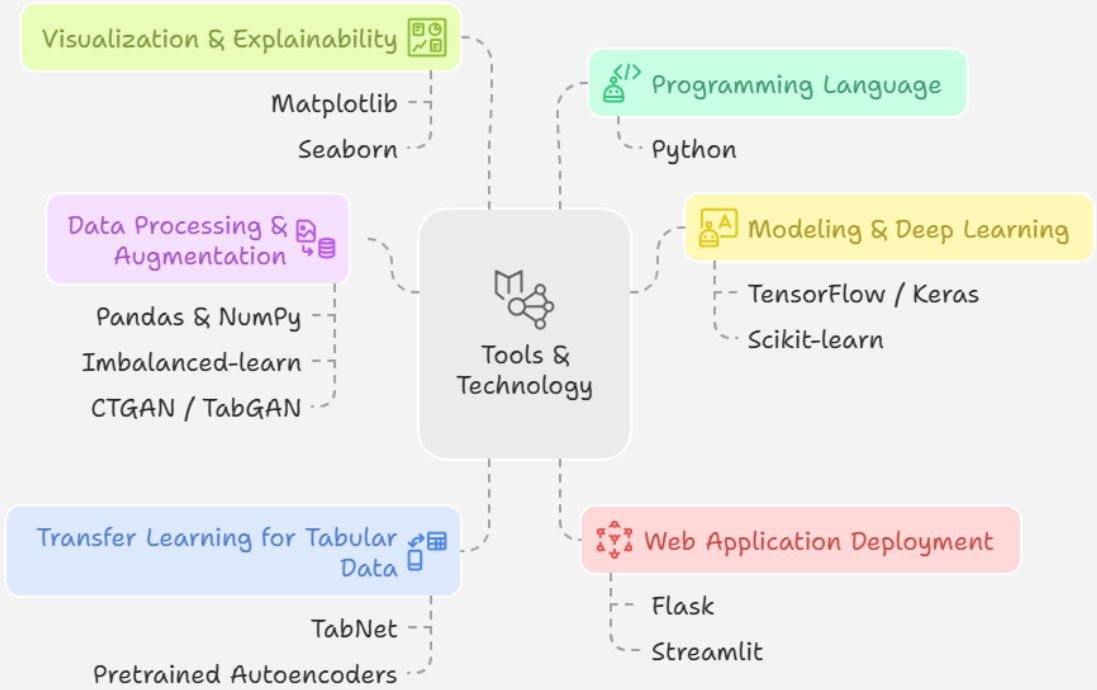


Proposed Approach

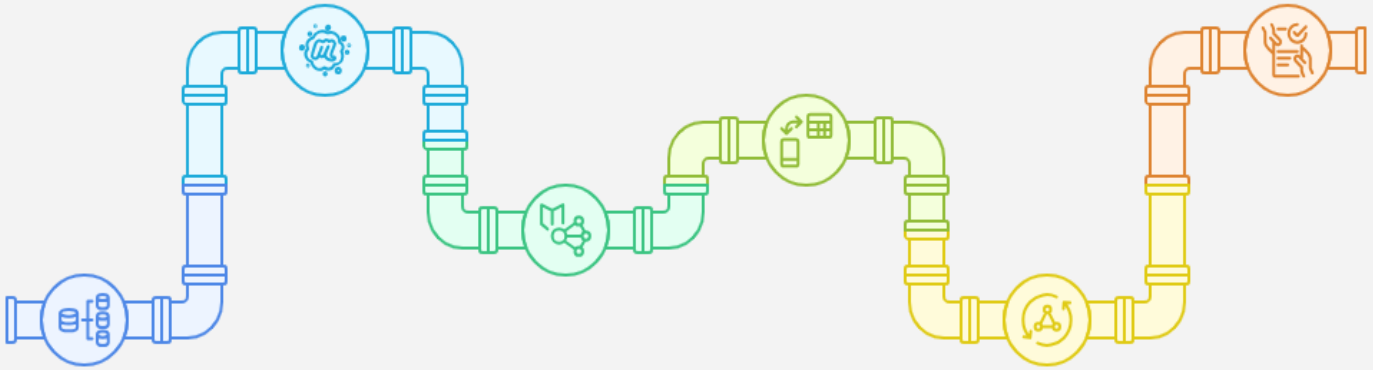


- *Preprocess data (drop IDs, encode categorical features).*
- *Apply data augmentation techniques (e.g., CTGAN, Synthetic data).*
- *Build a regularized Neural Network for classification.*
- *Apply transfer learning (TabNet, autoencoders – if suitable).*
- *Rebuild the web app using Flask or Streamlit for predictions.*

Tools and Technologies



Timeline



01

Data Preprocessing & Encoding

Initial data preparation and encoding

02

Apply Augmentation

Enhancing data with SMOTE and GANs

03

Build & Train Neural Network

Developing and training the neural network

04

Transfer Learning

Applying transfer learning techniques

05

Web App Redevelopment

Updating and improving the web application

06

Final Testing & Report Submission

Conducting final tests and submitting the report

Conclusion

- *The upgraded predictive maintenance system aims to overcome limitations of classical models.*
- *Neural networks and data augmentation provide better generalization and scalability.*
- *A full pipeline from raw data to a user-friendly prediction interface.*
- *Designed for real-world usability and deployment.*