

**PREDICTION OF INDUCTION MOTOR FAULTS USING MACHINE  
LEARNING**

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**JULY, 2023**

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LEARNING**

**BY**

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**A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE  
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DEPARTMENT OF ELECTRICAL AND INFORMATION ENGINEERING,  
COLLEGE OF ENGINEERING, COVENANT UNIVERSITY, OTA, OGUN  
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**JULY, 2023**

## **ACCEPTANCE**

This is to attest that this dissertation is accepted in partial fulfillment of the requirements for the award of the degree of Master of Engineering in Electrical and Electronics Engineering, Department of Electrical and Information Engineering, College of Engineering, Covenant University Ota Nigeria.

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## **DECLARATION**

I, **ANYIM, JUSTUS TOCHUKWU (21PCK02297)**, declare that this research was carried out by me under the supervision of Dr. Ademola Abdulkareem of the Department of Electrical and Information Engineering, College of Engineering, Covenant University, Ota, Nigeria. I attest that the dissertation has not been presented either wholly or partially for the award of any degree elsewhere. All sources of data and scholarly information used in this dissertation are duly acknowledged.

**ANYIM, JUSTUS TOCHUKWU**

**Signature and Date**

## **CERTIFICATION**

We certify that this dissertation titled “**PREDICTION OF INDUCTION MOTOR FAULTS USING MACHINE LEARNING**” is an original research work carried out by **ANYIM, JUSTUS TOCHUKWU (21PCK02297)**, in the Department of Electrical and Information Engineering, College of Engineering, Covenant University, Ota, Ogun State, Nigeria under the supervision of Dr. Ademola Abdulkareem. We have examined and found this work acceptable as part of the requirements for the award of Master of Electrical and Electronics Engineering.

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## **DEDICATION**

This dissertation is dedicated, first and foremost, to the Almighty God for His mercies, grace, wisdom, and grace throughout the Masters' program. It is especially dedicated to my parents Chief and Mrs. Stanley Anyim, and my lovely siblings Dozie, Excel, Ijeoma, Ifunanya, Ikechukwu and Kelechi.

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# TABLE OF CONTENTS

| <b>CONTENT</b>   | <b>PAGES</b> |
|--|--------------|
| <b>ACCEPTANCE</b>  | iii          |
| <b>DECLARATION</b>   | iv           |
| <b>CERTIFICATION</b>   | v            |
| <b>DEDICATION</b>  | vi           |
| <b>ACKNOWLEDGMENTS</b>   | vii          |
| <b>TABLE OF CONTENTS</b>   | viii         |
| <b>LIST OF FIGURES</b>   | xi           |
| <b>LIST OF TABLES</b>  | xii          |
| <b>LIST OF ABBREVIATIONS</b>   | xiii         |
| <b>ABSTRACT</b>  | xiv          |
| <b>CHAPTER ONE</b>   | 1            |
| <b>INTRODUCTION</b>  | 1            |
| 1.1 Background to the study  | 1            |
| 1.1.1 Overview of Induction Motors.  | 1            |
| 1.2 Statement of the Problem   | 2            |
| 1.3 Aim and Objectives.  | 3            |
| 1.3.1 Objectives   | 3            |
| 1.4 Scope of the Study   | 3            |
| 1.5 Justification of the Study.  | 3            |
| 1.6 Limitation of Research   | 4            |
| <b>CHAPTER TWO</b>   | 5            |
| <b>LITERATURE REVIEW</b>   | 5            |
| 2.1 Preamble.  | 5            |
| 2.2 Overview of induction motors and faults.   | 5            |
| 2.2.1 Common fault types of induction motors.  | 7            |
| 2.2.2 The following are the early induction motor defect identification and diagnosis. | 9            |
| 2.3 Traditional methods for induction motor failure identification and diagnosis.      | 10           |
| 2.4 Evolution of induction motor maintenance.  | 17           |
| 2.4.1 Corrective Maintenance.  | 17           |
| 2.4.2 Preventive Maintenance.  | 18           |
| 2.4.3 Predictive Maintenance.  | 20           |
| 2.5 Machine Learning Approach for Predictive Maintenance.                              | 21           |
| 2.5.1 The application of ML algorithms for fault prediction and diagnosis.             | 25           |
| 2.5.2 Common ML Algorithms Used for Induction Motor Fault Prediction and Diagnosis.    | 27           |
| 2.6 Evaluation Metrics in Machine Learning   | 35           |
| 2.6.1 Accuracy   | 36           |
| 2.6.2 Precision  | 36           |
| 2.6.3 Recall   | 36           |

|                                  |   |           |
|----------------------------------|---|-----------|
| 2.6.4                            | F1-score  | 37        |
| 2.6.5                            | The confusion matrix                                  | 37        |
| 2.7                              | Data collection and processing techniques             | 38        |
| 2.8                              | The list of similar works.                            | 42        |
| 2.9                              | Summary of gaps identified                            | 49        |
| <b>CHAPTER THREE</b>             |   | <b>50</b> |
| <b>MATERIALS AND METHODOLOGY</b> |   | <b>50</b> |
| 3.1                              | Preamble  | 50        |
| 3.2                              | Materials Used.                                       | 50        |
| 3.3                              | Data Collection, Preprocessing                        | 51        |
| 3.3.1                            | Identifying data sources                              | 51        |
| 3.3.2                            | Data collection techniques                            | 52        |
| 3.3.1                            | Data Tagging and Integration.                         | 53        |
| 3.3.2                            | Data preprocessing.                                   | 54        |
| 3.3.3                            | Data Cleaning.  | 54        |
| 3.3.4                            | Data transformation.                                  | 55        |
| 3.3.5                            | Feature selection.                                    | 56        |
| 3.3.6                            | Data splitting.                                       | 57        |
| 3.4                              | Model training.                                       | 57        |
| 3.4.1                            | Algorithm selection.                                  | 58        |
| 3.4.2                            | Model training.                                       | 61        |
| 3.5                              | Model evaluation.                                     | 62        |
| <b>CHAPTER FOUR</b>              |   | <b>65</b> |
| <b>RESULTS AND DISCUSSION</b>    |   | <b>65</b> |
| 4.1                              | Preamble  | 65        |
| 4.2                              | Data collection                                       | 65        |
| 4.3                              | Data loading and Preprocessing                        | 65        |
| 4.3.1                            | Loading the raw data                                  | 66        |
| 4.3.2                            | Data Tagging  | 66        |
| 4.3.3                            | Data Integration or Combination                       | 67        |
| 4.3.4                            | Data visualization                                    | 68        |
| 4.3.5                            | Handling Missing Values                               | 71        |
| 4.3.6                            | Identifying and Treating Outliers                     | 71        |
| 4.3.7                            | Normalization and Standardization                     | 72        |
| 4.4                              | Model Selection and Training                          | 73        |
| 4.4.1                            | Decision tree Classifier                              | 73        |
| 4.4.2                            | Random Forest Classifier                              | 75        |
| 4.4.3                            | K-Nearest Neighbor (k-NN) Classifier                  | 77        |
| 4.4.4                            | Artificial Neural Network (ANN) Sequential Classifier | 78        |
| 4.5                              | Performance Evaluation Results                        | 81        |
| 4.5.1                            | DT Model  | 81        |
| 4.5.2                            | RF Model  | 81        |
| 4.5.3                            | k-NN Model  | 81        |
| 4.5.4                            | ANN Model   | 82        |
| 4.6                              | Benchmarking with existing works                      | 82        |

|                                       |    |
|---------------------------------------|----|
| 4.7 Discussion of Results.            | 83 |
| <b>CHAPTER FIVE</b>                   | 85 |
| <b>CONCLUSION AND RECOMMENDATIONS</b> | 85 |
| 5.1 Conclusion                        | 85 |
| 5.2 Contribution to knowledge         | 85 |
| 5.3 Recommendations                   | 86 |
| <b>REFERENCES</b>                     | 87 |

## LIST OF FIGURES

| FIGURES | TITLE OF FIGURES  | PAGES |
|---------|---|-------|
|         | Figure 1.1: Rotating Magnetic Field generated in the Stator by AC supply (Electrical-info, 2013). | 6     |
|         | Figure 2.1: Classification of Induction Motor Maintenance Strategies (Li et al., 2016)            | 17    |
|         | Figure 2.2: Demonstration of Supervised Learning (Kamil, 2018)                                    | 22    |
|         | Figure 2.3: Demonstration of Unsupervised Learning (Kamil, 2018)                                  | 23    |
|         | Figure 2.4: Demonstration of Reinforcement Learning (Kamil, 2018)                                 | 24    |
|         | Figure 2.5: Classification and Regression Models (Kamil, 2018)                                    | 27    |
|         | Figure 2.6: A typical Neural Network neuron (Jaiswal, 2018)                                       | 28    |
|         | Figure 2.7: Neural Network (Vorontsova, 2019)   | 29    |
|         | Figure 2.8: Decision Tree components  | 31    |
|         | Figure 2.9: Random Forest Inference (Wood, 2017)  | 33    |
|         | Figure 2.10: Binary and Multiclass Confusion Matrix (Shaffi, 2021)                                | 37    |
|         | Figure 3. 1: Euclidean and Manhattan Distance Calculation (Gokte, 2021)                           | 35    |
|         | Figure 3.2: Flowchart of the Machine Learning Model training                                      | 64    |
|         | Figure 4.1: 3 phase Induction Motors on test bench with unbalanced weight and sensor attached.    | 65    |
|         | Figure 4.2: Data Tagging process  | 67    |
|         | Figure 4.3: Data Integration  | 68    |
|         | Figure 4.4: Visualization of X-axis data  | 69    |
|         | Figure 4.5: Visualization of the data's scatter plot matrix                                       | 70    |
|         | Figure 4.6: Histogram of the X, Y, and Z-axis data  | 70    |
|         | Figure 4.7: Filling missing values with the Mean  | 71    |
|         | Figure 4.8: Identifying and treating outliers.  | 72    |
|         | Figure 4.9: Data Normalization and Standardization  | 72    |
|         | Figure 4.10: Decision Tree Training and the Model Report  | 74    |
|         | Figure 4.11: DT Model's Confusion Matrix  | 75    |
|         | Figure 4.12: Random Forest Training and the Model Report  | 76    |
|         | Figure 4.13: RF Model's Confusion Matrix  | 76    |
|         | Figure 4.14: K-NN training and the Model Report   | 77    |
|         | Figure 4.15: k-NN Model's Confusion Matrix  | 78    |
|         | Figure 4.16: ANN training   | 79    |
|         | Figure 4.17: ANN model Classification Report  | 80    |
|         | Figure 4.18: ANN Model's Confusion Matrix   | 80    |

## LIST OF TABLES

| <b>TABLES</b> | <b>LIST OF TABLES</b>                        | <b>PAGES</b> |
|---------------|--|--------------|
| Table 2.1:    | The list of similar works is as shown below. | 42           |
| Table 3.1:    | Specification of Induction Motors used.      | 50           |
| Table 4.1:    | Showing the Performance of all the Models.   | 82           |
| Table 4.2:    | Benchmarking with existing works.            | 82           |

## LIST OF ABBREVIATIONS

|       |                                  |
|-------|----------------------------------|
| ML    | Machine Learning                 |
| AI    | Artificial Intelligence          |
| ANN   | Artificial Neural Network        |
| RF    | Random Forest                    |
| DT    | Decision tree                    |
| k-NN  | K-Nearest Neighbors              |
| AC    | Alternating Current              |
| r.p.m | Rotation per Minute              |
| MCSA  | Motor Current Signature Analysis |
| TP    | True Positives                   |
| TN    | True Negative                    |
| FP    | False Positive                   |
| FN    | False Negative                   |
| LDA   | Linear Discriminant Analysis     |
| PCA   | Principal Component Analysis     |

## ABSTRACT

Unplanned downtime in industries poses significant challenges, affecting production efficiency and profitability. To address this issue, companies strive to optimize operations and minimize disruptions that hinder meeting customer demands and financial targets. Predictive maintenance, utilizing advanced technologies such as data analytics, machine learning, and IoT devices, enables real-time monitoring and analysis of equipment data. This study focuses on training an adaptable machine-learning model for predicting faults in induction motors in industrial settings. By implementing such a model, proactive maintenance can be facilitated, leading to reduced downtime in industrial operations. A dataset containing healthy and faulty conditions of four 3 phase induction motors, along with relevant features for fault prediction, was obtained. Multiple machine learning algorithms were trained using this dataset, and they demonstrated promising performance. The RF model achieved the highest accuracy of 0.91, followed by the Ann and k-NN models with an accuracy of 0.9. The DT model achieved the lowest accuracy of 0.89. Further evaluation of the models was conducted using a confusion matrix, which provided a detailed breakdown of the model's performance for each class, indicating the number of correctly and incorrectly classified induction motor conditions. The outcome of the confusion matrix demonstrated that the models successfully classified the different states or conditions of the induction motors. To enhance the performance of the models, future work should involve refining the ANN and RF models, exploring transfer learning or ensemble methods, and incorporating diverse datasets to improve generalization.

***KEYWORDS: ANN (Artificial Neural Network) classifier, DT (Decision Tree) classifier, RF (Random Forest) classifier, k-NN (k Nearest Neighbor) classifier, Bearing fault, Induction motors, Predictive maintenance.***