

# Application of Machine Learning and Artificial Intelligence in Smart Manufacturing Systems

Rakesh Kumar Rajak<sup>1</sup>, Rahul Kumar<sup>2</sup>, Ranu Srivastava<sup>3</sup>,  
Rahul Kumar<sup>4</sup>, Navasheen<sup>5</sup>, Shravan Kumar Gupta<sup>6</sup>

Assistant Professor, Mechanical Engineering, Govt. Engineering College, Madhubani<sup>1-5</sup>

Assistant Professor, Mechanical Engineering, Darbhanga College of Engineering Darbhanga<sup>6</sup>

rakesh02nitjsr@gmail.com, rahuliit76@gmail.com

ranusrivastava157@gmail.com, krahul623@gmail.com

navasheen4@gmail.com, skgmce@gmail.com

**Abstract:** “Artificial intelligence” and “machine learning” are important components of smart “manufacturing systems” that maximize operational efficiency and minimize unanticipated equipment breakdowns. This study examines how “machine learning” models can be used to predict maintenance based on the “Machine Predictive Maintenance Classification” dataset. Diagnostic variables that include “air temperature”, “process temperature”, “rotational speed”, “torque”, and “tool wear” are computed to forecast machine failure. Before training the model, data preprocessing, exploratory analysis, and feature scaling are carried out. Three classification algorithms, such as “Logistic Regression”, “Random Forest”, and “Support Vector Machine”, are applied and compared. The experimental results show that “Random Forest” has the highest performance of 0.98 accuracy and 0.965 ROC AUC, which is a high predictive maintenance ability in smart manufacturing settings.

**Keywords:** Smart Manufacturing, Predictive Maintenance, “Machine Learning”, “Random Forest”, “Support Vector Machine”, “Logistic Regression”, Machine Failure Prediction.

