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# Big Data Analytics for Intelligent Temperature Prediction in CNC Machining using PCA and AI

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Abstract. Temperature prediction is crucial in CNC machining to prevent overheating, tool damage, and surface finish quality. This study presents a big data analytics framework for intelligent temperature prediction in CNC machining using Principal Component Analysis (PCA) and Artificial Intelligence (AI). The following methodology has been followed during the CNC machining of EN18 Steel: data collection from laboratory CNC machining, normalization of the collected data to ensure consistency and comparability, application of PCA to the preprocessed data to reduce dimensionality, training of AI models (ANN, ANFIS and Random Forest) using PCA-extracted features and temperature data, performance evaluation of the AI models using mean absolute error and coefficient of determination, utilization of the trained AI model to predict temperature values for new, unseen data, comparison of the AI model results to those of the traditional Linear Regression Model. The proposed approach predicts temperature with high accuracy of above 95%. The results show improved prediction performance compared to the traditional linear regression method, demonstrating the effectiveness of intelligent big data analytics and AI in CNC machining. This research contributes to the development of Industry 4.0 technologies, enhancing manufacturing efficiency, productivity, and product quality.
Keywords: Big Data analytics, Principal Component Analysis (PCA), Artificial Intelligence (AI), Temperature Prediction.

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