A Methodology to Transform Non-Image Data into Image for Convolutional Neural Network Architecture

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Understanding complex temporal patterns within time series data is vital for informed decision-making in diverse finance, healthcare, and environmental science domains. In this study, we present a novel algorithm designed to transform non-image time series data into images suitable for convolutional neural network (CNN) classification. Unlike traditional methods relying on numerical features, in our approach, we created a recurrence matrix from the dataset. We applied a difference operation to generate a 2D image, harnessing the capabilities of a CNN classifier for further analysis. The image generated captures intricate patterns and dependencies. The images serve as inputs for CNNs, enabling effective feature extraction and classification. We assessed our approach using four open available multivariate datasets from UCI Machine Learning Repository. Our method exhibited substantial enhancements in classification accuracy, F1 score, recall, precision, and AUC-ROC, outperforming existing techniques in these metrics. The research introduces a novel approach to time series analysis, enhancing how data is represented and improving CNN models' interpretability and predictive capabilities. The proposed algorithm shows potential in applications like anomaly detection, predictive modeling, and pattern recognition, indicating promising avenues for future research in machine learning and data science.

Keywords: Time Series Classification, Data Transformation, Recurrence Matrix, Difference Operation, Feature Extraction, Convolutional Neural Network, Machine Learning, Data Science.