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Anomaly Detection in Financial Markets Using Tucker Decomposition

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Abstract : The financial markets have a multifaceted, intricate environment, and enormous volumes of data are produced every day. To find investment possibilities, possible fraudulent activity, and market oddities, accurate anomaly identification in this data is essential. Conventional methods for detecting anomalies frequently fail to capture the complex organization of financial data. In order to improve the identification of abnormalities in financial time series data, this study presents Tucker Decomposition as a reliable multi-way analysis approach. We start by gathering closing prices for the S&P 500 index across a number of decades. The information is converted to a three-dimensional tensor format, which contains internal characteristics and temporal sequences in a sliding window structure. The tensor is then broken down using Tucker Decomposition into a core tensor and matching factor matrices, allowing latent patterns and relationships in the data to be captured. A possible sign of abnormalities is the reconstruction error from Tucker's Decomposition. We are able to identify large deviations that indicate unusual behavior by setting a statistical threshold. A thorough examination that contrasts the Tucker-based method with traditional anomaly detection approaches validates our methodology. The outcomes demonstrate the superiority of Tucker's Decomposition in identifying intricate and subtle abnormalities that are otherwise missed. This work opens the door for more research into multi-way data analysis approaches across a range of disciplines and emphasizes the value of tensor-based methods in financial analysis.

Keywords : tucker decomposition, financial markets, financial engineering, artificial intelligence, decomposition models
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