

**Department of Computer Science**

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Developing a Transformer-based Deep Learning Model to Investigate the Effect of Sentiment and Emotions in Finance-related News Articles on Cryptocurrency Portfolio Performance

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**ABSTRACT**

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**ACKNOWLEDGEMENTS**

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**CHAPTER 1: Introduction**

**1.1 Background**

The market for cryptocurrencies has experienced substantial expansion ever since the first Bitcoin was released in 2009 (Farell, 2015), and has seen a remarkable value increase that has surpassed the most significant historical bubbles over the last three centuries (Naeem, Mbarki and Shahzad, 2021). The number of cryptocurrencies has increased from just one in July 2010 to 2419 by February 2020 (Anamika, Chakraborty and Subramaniam, 2023). As a result, both professional and academic researchers have shown a strong desire to comprehend the behaviour of these newly emerging assets (Naeem, Mbarki and Shahzad, 2021). In the present day, Both investors and speculators are increasingly interested in Bitcoin, which is emerging as the prevailing digital currency(Serafini *et al.*, 2020)**.**

It could be difficult to figure out the worth of cryptocurrencies because there is much debate about their nature, such as whether they are a currency, a financial bubble, or simply a digital asset. As a result, there is no agreement on which factors drive cryptocurrency prices. Consequently, cryptocurrency pricing is heavily reliant on widely disseminated opinions, sentiments, and emotions in finance related topics (Naeem, Mbarki and Shahzad, 2021). Furthermore, cryptocurrency prices behave differently than traditional currencies, making it extremely difficult to forecast their prices(Abraham *et al.*, 2018)**.**

In order to predict market movements, several methods have been applied, such as statistical analysis, pattern recognition, machine learning, sentiment analysis, and hybrid approaches. Statistics, as the oldest approach, is employed for data analysis. After that, pattern recognition is a visual strategy that has gained widespread adoption among traders. Recognizing trends and patterns in the stock market's data is required for this. Machine Learning, particularly with the advancements in deep learning tools, has gained significant popularity for predicting time-series data. The introduction of computer-based recognition through machine learning has further amplified the importance of pattern recognition theory. Sentiment Analysis takes a different route by analysing crowd-sourced data. It relies on the principle of "wisdom of crowds," considering the collective opinion of individuals as reliable as that of a single expert. This approach leverages news, current events, public releases, and social media to make market forecasts. In the Hybrid method, a combination of the mentioned approaches is utilized. This comprehensive approach amalgamates statistical analysis, visual pattern recognition, machine learning techniques, and sentiment analysis to enhance market analysis and prediction.(Serafini *et al.*, 2020)

**1.2 Research aim and objectives**

The aim of this study is to develop a hybrid method by integrating a Transformer-based deep learning model with sentiment analysis methodologies to investigates the impact of sentiment and emotions expressed in finance-related news articles on cryptocurrency portfolio performance. Through the application of deep learning techniques and sentiment analysis methodologies, this research seeks to explore the correlation between sentiment and emotions found in online forum comments and the performance of cryptocurrency portfolios. The following objectives will be pursued as part of the research in order to accomplish the stated goals:

1. 1) To study sentiment analysis, deep learning, and cryptocurrency portfolio performance literature. Gain significant insights, develop a basis for the study, and choose the best data science methodology based on the literature.
2. To search for and acquire an open-source dataset that includes cryptocurrency prices over time, as well as sentiment and emotional comments from online forums. This dataset will be used for training and testing the developed model, requiring thorough exploration of diverse sources and repositories.
3. To explore the relationship between sentiments, emotions in online forum comments, and cryptocurrency portfolio performance using a Transformer-based deep learning model. Analyse sentiments and emotions for correlations with portfolio performance.
4. To carry out exhaustive testing, evaluation, and discussion of the research findings. This will expand the field's understanding and provide new research avenues.

**1.3 Research approach**

Data science projects can profit from project management and process methodologies. Such methodologies work as a success factor (Schröer, Kruse and Gómez, 2021).

As CRISP-DM (CRoss Industry Standard Process for Data Mining) is one of the project management and process methods that offers a framework for executing big data projects which is independent of both the industry sector and the technology employed, it is one of the project management and process methodologies. This model is intended to make large data mining initiatives less expensive, more trustworthy, repeatable, easier to organize, and quicker(Wirth and Hipp, 2000). Accordingly, we will use CRISP-DM as the process methodology that includes the following steps: 1) Business Understanding, 2) Data Understanding, 3) Data 4) Preparation, 5) Modelling, 6) Evaluation, and 7) Deployment.

**1.4 Dissertation outline**

* The evaluation of the literature will look at the various models and sentiment analysis methodologies employed in these investigations, as well as their accuracy and potential for boosting the profitability of cryptocurrency portfolios. By combining these insights, we hope to identify crucial insights and knowledge gaps that will help us design our own deep-learning model.
* Afterward through the proposed methodology for this research, we will follow the CRISP-DM process model, which provides a framework for carrying out big data projects. The five steps of CRISP-DM methodology will be clarified.
* In the part on data analysis, our primary focus is on the creation of a deep learning model that is based on the Transformer. This article investigates the methods that was applied in order to analyse the data and construct the model. The process of data analysis initiates with the collection of relevant datasets, continues with the pre-processing of the data, then moves on to the training of the deep learning model, and finally concludes with the evaluation and testing of the model.
* In the discussion section, we will thoroughly analyse and interpret the results gained from the data analysis. This section offers a comprehensive examination and interpretation of the findings, highlighting their relevance within the framework of the research objectives and aims. Moreover, it addresses any limitations or challenges faced during the research and presents an assessment of the implications arising from the findings.
* The conclusion acts as a comprehensive summary of the entire dissertation and serves as the last component of the dissertation. This is accomplished by presenting a summary of the most important findings from the data analysis and the debate, as well as by highlighting the most important contributions made by the research. This part offers a comment not just on the research method but also on its implications for the overarching topic of study. In addition to this, it indicates prospective topics for future research and development, providing paths for further exploration and enhancement.

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