Large Language Model - Based Conversational Recommender System for Personalizing Long-term Cryptocurrency Portfolio Recommendation

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***Abstract*—The growth of cryptocurrencies in the last 10 years as an investment option has increased. However, the volatile prices often make investors panic and lose money. The cryptocurrency portfolio recommender system built in previous research is still limited to historical prices and trends and does not focus on user preferences and understanding in natural language conversation. Therefore, we propose the development of a Conversational Recommender System (CRS) using a Large Language Model (LLM) to personalize long-term cryptocurrency portfolio recommendations. We use the prompt engineering and fine-tuning approach on LLM to match user preferences and make the CRS more tailored to the cryptocurrency domain. This method can overcome the system's shortcomings in understanding user preferences, impacting recommendations' personalization. Accuracy evaluation results show that our proposed system has an Item Coverage of 39.62%, an Expected Popularity Complement (EPC) value of 0.9405, an Average Recommendation Popularity (ARP) value of 0.0595, and a Fine-Tune Training Loss value of 0.4415. Meanwhile, our CRS has a positive response of 81% on satisfaction evaluation. The results show that our CRS has a deeper understanding of the conversation's context and delivers more interactive recommendations for cryptocurrency portfolios, providing investors peace of mind when investing.**

***Keywords*—large language model, conversational recommender system, cryptocurrency portfolio, fine-tuning, prompt engineering**

I. Introduction

Cryptocurrency is a digital currency built on a blockchain network, a digital ledger used to record financial transactions or an object that has intrinsic value [1]. The first cryptocurrency was invented by Satoshi Nakamoto in 2009, called Bitcoin [2]; within a decade, more and more people are using cryptocurrency as a transaction tool. In addition, many investment managers, individual investors, and stock brokers have chosen cryptocurrency as their investment asset. [3].

The volatile price movements of cryptocurrencies often make investors panic and end up with losses. On September 5, 2018, the prices of the top 95 cryptocurrencies dropped for 24 hours, creating massive sales known as The Great Crypto Crash [4]. Therefore, creating a system that can recommend which cryptocurrencies are suitable to invest in is essential. A good portfolio recommender system can increase user's confidence to invest according to their preferences.

Cryptocurrency portfolio recommender systems have been made using various methods and algorithms, including the Fuzzy Approach and Association Rule Mining (ARM) [5], [6], which focuses on historical cryptocurrency price data and forecasting cryptocurrency trends. Although previous research [7], [8] can maximize investment returns, there is no recommender system tailored to the user's investment style, so the resulting investment is often not in accordance with the user's needs and goals. In addition, the use of a Conversational Recommender System (CRS) to recommend cryptocurrency portfolios is still limited.

This research proposes utilizing the Large Language Model (LLM) as a more interactive user preference extractor in a CRS to recommend cryptocurrency portfolios. The preferences obtained are used to generate portfolio recommendations that match the user's interests and goals. We use OpenAI's GPT-4o as the LLM model to ask questions and provide recommendations in a conversational form, thus providing a more intuitive experience and diverse recommendations for users [9]. We fine-tune the model using various cryptocurrency data, e.g., type, market capitalization, inventor, industry sector, and price history. LLM also collects investor data, e.g., age, gender, occupation, investment goals, and income. Allows the LLM model to provide more specific recommendations to users.

This paper consists of 5 sections. Section I contains general information about this paper. Then, section II discusses previous research on the usage of LLM, CRS utilization, and the development of cryptocurrency portfolio recommender systems. Next, section III contains the methodology and architecture used in this research. Section IV discusses the series of evaluations to measure the performance of our proposed system. Finally, we provide conclusions and future work in section V.