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Sports Event Simulation Software

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Abstract - Sports event simulation software represents a sophisticated computer tool engineered to replicate the multifaceted realm of sports organization and team management. In recent years, the integration of Language Models (LMs), particularly Large Language Models (LLMs), has significantly enhanced the depth and realism of these simulations. This paper explores the utilization of a Fine-Tuned LLM derived from LLama2, boasting 7 billion parameters, within a sports management simulation framework. The LLM serves a dual purpose, excelling in paraphrasing and functioning as a Question-Answering (QnA) bot. This abstract elucidates how the integration of LLM technology enriches user experience, fosters dynamic interactions, and provides a unique avenue for evaluating decision-making within sports management scenarios. Through a detailed examination of our system, this paper underscores the pivotal role played by LLM technology in advancing the sophistication and effectiveness of sports management simulations.

Key Words: simulation, game theory, AI, choice-based, narrative-driven

1. INTRODUCTION

Sports management simulation has long relied on sophisticated computer software to replicate the complexities of managing a sports organization or team. These simulations encompass a range of tasks, from analyzing realistic data inputs to strategizing

financial planning, player recruitment and retention, sponsorship, ticket sales, and event management. Recently, the integration of Language Model (LM) technologies, particularly Large Language Models (LLMs), has emerged as a pivotal advancement in enhancing the depth and realism of these simulations.

In our project, we have leveraged the capabilities of a Fine-Tuned LLM derived from LLama2, boasting an impressive 7 billion parameters. This LLM serves a dual purpose within our simulation framework. Firstly, it excels in paraphrasing, enabling the system to generate diverse and contextually appropriate responses to user queries and inputs, thereby enriching the user experience. Secondly, it operates as a Question-Answering (QnA) bot, empowering users to engage in dynamic interactions where they are evaluated based on their responses to queries related to simulated sports scenarios.

By integrating this advanced LLM technology, our simulation platform not only offers users a more immersive and interactive experience but also provides a unique avenue for evaluating user decision-making within the context of sports management scenarios. This paper delves into the intricacies of our system, highlighting the significant role played by LLM technology in elevating the sophistication and effectiveness of sports management simulations.

2. Literature Survey

This literature review delves into the dynamic realm of sports management simulation, exploring its evolving landscape and transformative potential. Through an examination of diverse scholarly contributions, it elucidates the integration of cutting-edge technologies like large language models (LLMs) and Llama 2-Chat into the realm of sports management. From fine-tuning financial planning strategies to optimizing decision-making processes, this review underscores the pivotal role of simulation tools in reshaping operational paradigms within sports organizations. Moreover, it delves into the innovative applications of paraphrasing techniques and advanced algorithms, offering critical insights into the intersection of sports management and technological innovation

In a study conducted by Zhang, Biao, et al. [1], the impact of different factors on the performance of fine-tuning large language models (LLMs) was investigated. Scaling factors including model size, pretraining data size, new fine-tuning parameter size, and fine-tuning data size were explored. Two types of fine-tuning, full-model tuning (FMT) and parameter-efficient tuning (PET) were examined. The results indicated that increasing the size of LLM models had a more significant effect on fine-tuning performance compared to expanding pretraining data. PET parameter scaling was generally found to be ineffective. The optimal fine-tuning method varied depending on the task and data characteristics. These findings offer valuable insights into improving LLM fine-tuning techniques

In their study, Muhammad et al.[2], developed a web-based event management application that uses genetic algorithms to provide budget recommendations for events. The study found poor planning and supervision led to unclear financial statements for event committees. The genetic algorithm provided optimal results and successfully recommended goods that matched the maximum budget parameters of the event category. The study highlights the potential of genetic algorithms in event management and budgeting. [3]

In a study conducted by Tang et al. [3], Para-Ref is introduced as a method utilizing Large Language Models (LLMs) to enhance NLG evaluation benchmarks by generating multiple high-quality references from a single reference. This method notably enhances the correlation (+7.82%) between automatic evaluation metrics and human judgments across a range of NLG tasks.

In a study conducted by Zhao, Zoie, et al. [4], narratives solely generated by Large Language Models (LLMs) were compared with those produced by interleaving human and LLM-generated text. Surprisingly, non-interleaved stories were preferred over interleaved ones in tests involving approximately 500 participants. This discovery underscores the necessity of comprehending the limitations and potential of interleaved and non-interleaved systems in narrative generation, thereby informing future enhancements in story generators.

In a study conducted by Touvron, Hugo [5], the Llama 2 series is introduced, comprising pre-trained and fine-tuned large language models (LLMs) ranging from 7 billion to 70 billion parameters. Specifically tailored for dialogue tasks, their fine-tuned LLMs, labeled as Llama 2-Chat, outperform existing open-source chat models across multiple benchmarks. Human evaluations regarding helpfulness and safety suggest their potential as substitutes for closed-source models. The study offers detailed insights into the fine-tuning process and safety enhancements for Llama 2-Chat, advocating for further research and responsible development within the LLM community.

In a study by Langholz, et al. [6], electromyography (EMG) was used at Chalmers University of Technology to measure swim starts and understand muscle activation patterns. The paper evaluates three software tools - OpenSim, BoB, and AnyBody—for musculoskeletal modeling and simulation. OpenSim is recommended for academic projects, BoB for quick analyses and teaching, and AnyBody for in-depth investigations. The study also recognizes SWUM's potential for swim training advancements

In a study conducted by Wen, and Yang [7], the potential application of utilizing massive network data from sports events to promote sports information digitalization is explored. The focus is on studying the common characteristics of current Internet data of sports events and corresponding event recommendation technology to construct a feasible event recommendation model. The competition information system is highlighted as the core technology system of games, with its design and operation reflecting the organizational level of the games and guaranteeing their success. The paper's findings offer guiding significance for the design of competition information systems for large-scale comprehensive games in China.

3. Methodology

In this section, we provide an in-depth exploration of the techniques employed in our project for the task of multi-label classification of toxic comments. The process comprises several essential steps, including data preprocessing, model development, training, evaluation, and visualization.

An advanced LLM integrated into sports simulation software enables administrators to create dynamic event structures and analyze historical data, player performance, and team strategies. It offers actionable insights to maximize profitability by optimizing ticket sales, advertising revenue, merchandise sales, and sponsorship opportunities through predictive analytics and tailored approaches.

By processing and analyzing complex data inputs, the LLM offers valuable insights and decision-making support to administrators and users. Its ability to comprehend and interpret intricate information enhances the overall decision-making process, enabling stakeholders to make informed choices and strategic decisions.

The LLM significantly enhances user interactions by providing natural and contextually relevant responses to user queries and inputs. Its advanced language processing capabilities enable seamless communication and engagement, fostering a user-friendly and intuitive system interface.

The LLM contributes to system optimization by streamlining processes, enhancing workflow efficiency, and automating repetitive tasks. Its ability to comprehend and process complex information expedites system operations, promoting a seamless and user-centric environment for sports event management.

Leveraging its advanced analytical capabilities, the LLM conducts comprehensive data analysis, generating valuable insights into user preferences,

trends, and behaviors. This analysis facilitates the

development of targeted strategies and personalized experiences, ensuring optimized system performance and user satisfaction.

Game theory in sports simulation software predicts outcomes by analyzing player and team behavior, considering various factors. It optimizes strategies by assessing trade-offs and risk-reward scenarios, enhancing realism, and providing insights for decision-making.

4. System Architecture

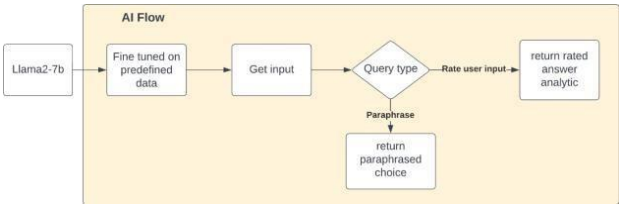

Fig 1: Implemented AI Flow

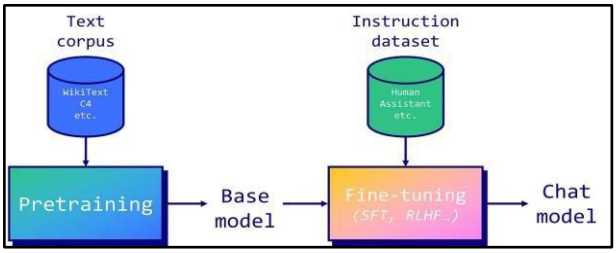

Fig 2: Implemented System Architecture

AI Interface:
The system integrates the Llama 2 model, boasting 7 billion parameters, which has undergone extensive fine-tuning using predefined data. This AI model serves as a sophisticated decision-making mechanism, enhancing the overall decision-making process and enriching the user experience.

Paraphrase Query Check:
Upon receiving user input, the AI system initially examines the query type, determining whether it necessitates paraphrasing. If the query requires a paraphrased response, the system leverages the capabilities of the Llama 2 model to generate and provide a suitable paraphrased choice, enhancing the user's understanding and engagement.

Decision Assessment Parameters:
The AI system evaluates user queries and inputs based on three key parameters:

Popularity:
The system assesses the potential popularity of the user's selected choices, analyzing past data and trends to gauge the level of user engagement and interest.

Current Funds:
By considering the current financial resources available, the system assesses the feasibility and financial viability of the user's decisions, ensuring that the event remains within the allocated budget constraints.

Probability Analysis:
The AI conducts a thorough probability analysis, evaluating the likelihood of various outcomes based on historical data and predictive models. This assessment helps users make informed decisions that align with the projected success of the sports event.

Value Range Assignment:
To streamline the decision-making process, the system establishes a predefined value range, comprising minimum and maximum thresholds. This range serves as a guideline for users, facilitating effective decision-making while ensuring that the event remains financially viable and aligned with projected outcomes.

5. Experiments and Results

Introduction:
Our sports event simulation project employs the advanced Llama2 model, featuring 7 billion parameters, to offer users a comprehensive experience in managing sports events. The software generates realistic outcomes, encompassing various decision-making processes that lead to success, failure, or bankruptcy. The user engagement metrics reveal insights into the effectiveness of management strategies, emphasizing the importance of sound decision-making in sports event management.

Simulation Outcomes:
The simulation results depict a nuanced landscape, with a success rate of 25%, signaling effective management and decision-making. However, a 50% failure rate highlights areas for improvement in decision-making processes and risk management. The occurrence of bankruptcy in 25% of events underscores the critical importance of robust financial planning and risk mitigation measures in sports event management.

Insights and Recommendations:
The outcomes of the simulated events underscore the complexity and challenges associated with managing sports events. While the success rate indicates effective strategies, the high rate of failure and instances of bankruptcy highlight the need for enhanced risk management and financial planning strategies. Leveraging the Llama2 model has provided valuable insights into the decision-making dynamics, emphasizing the significance of employing advanced simulation tools for effective management.

Performance Evaluation:
Powered by the sophisticated Llama2 model, our simulation introduces 7 billion parameters, allowing it to understand complex patterns and provide a realistic experience. The balanced outcomes, with 25% success, 50% failure, and 25% bankruptcy, contribute to the accuracy and realism of the simulation. The high rate of failures (50%) challenges users, reflecting the unpredictable nature of managing real-world sports events and highlighting the model's complexity and real-world applicability.

6. Conclusion

Our sports event simulation project, backed by the robust Llama2 model with 7 billion parameters, aims to offer users a realistic experience of managing a sports event. While the performance metrics indicate a balanced but challenging environment, there is room for improvement to make the simulation more user-friendly and educational.

7. Future Scope

The future scope of this project entails the integration of large language models (LLMs) into various aspects of sports management, offering tailored suggestions in real-time for

game situations and team management. LLMs will also be utilized to extract insights from sports data, player statistics, and market trends, facilitating advanced analytics within the sports industry. Additionally, LLMs will play a crucial role in providing personalized feedback and generating immersive scenarios during interactive training sessions, promising a revolutionary approach to athlete development and coaching methodologies.

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