BSc (Hons) Artificial Intelligence And

Data Science

Level 07

CM 4605

INDIVIDUAL RESEARCH PROJECT

**CricXpert:** A Hybrid Approach Employing Face Recognition, Spatio-Temporal Gait Analysis and Prompt-Engineered LLM for Enhanced Fielder Recognition and Stat Generation in T20i Cricket

**Project Proposal**

NADUN SHAMIKA SENARATHNE

IIT ID: 20210488

RGU ID: 2117538

Mr. PRASAN YAPA

Defining your Project

* 1. **Tentative Project title**

**CricXpert:** A Hybrid Approach Employing Face Recognition, Spatio-Temporal Gait Analysis and Prompt-Engineered LLM for Enhanced Fielder Recognition and Stat Generation in T20i Cricket

**1.2 Background and Research Gap**

Cricket, especially in the T20 International format, has seen significant advancements in gameplay strategies and technological integration. The introduction of day/night matches adds complexity with variable lighting conditions impacting player visibility and game dynamics. During the crucial final overs of these matches, the performance of fielders can be pivotal. Accurate and rapid fielder recognition using computer vision could greatly enhance real-time strategic decisions and viewer engagement.

Current technologies primarily rely on singular modalities such as face recognition or basic motion tracking for player identification and statistics gathering. These methods often fall short in complex scenarios where players have partial face visibility or when their gait is not distinctly visible due to long-distance camera angles and fluctuating environmental conditions. This highlights the need for a robust solution that integrates multiple identification technologies to improve both accuracy and reliability.

Furthermore, the surge in data-driven decision-making within sports has increased the demand for sophisticated statistical analysis tools. Although current systems offer extensive data, accessing specific player statistics during live games is often cumbersome and non-intuitive, typically requiring manual navigation through multiple filters and complex interfaces.

The research gap identified includes two main components: Firstly, the integration of facial recognition with spatio-temporal gait analysis into a hybrid model aims to enhance identification accuracy under diverse and challenging conditions. Currently, no models specifically combine these technologies to recognize fielders during the key moments of a T20i match. This model seeks to address issues such as variable lighting, occlusions, and distant camera angles that significantly impact the performance of traditional recognition systems. Secondly, the project proposes using large language models (LLMs) to interpret and convert natural language queries into SQL commands for fetching real-time statistics. This would bypass the cumbersome multi-step filtering process typical of existing systems, offering a more user-friendly and efficient means of interacting with statistical data during live matches.

By addressing these gaps, the project aims to revolutionize T20 cricket analytics by enhancing viewer experience through real-time, accurate player identification and statistical data; enabling coaches and strategists to make informed decisions during crucial game moments; and contributing to academic research by merging computer vision with natural language processing in a novel sporting context. This not only bridges existing technological gaps but also enhances the strategic and viewer aspects of cricket, marking a significant advancement in sports technology.

**1.3 Research Questions**

**Research Question 1: Player Recognition**

*“How effectively can a computer vision ensemble model employing face recognition and gait analysis using spatio-temporal features, recognise fielders in the outfield during the last four overs of a day/night T20 International cricket match?”*

**Research Question 2: Stat Generation**

*“How can a large language model be prompt-engineered to accurately translate natural language user-defined questions, with up to three conditions, into SQL queries for generating accurate and relevant statistics?”*

**1.4 Aim & Objectives**

Research Question 01:

**Aim:**

To develop and validate a robust computer vision ensemble model that effectively employs face recognition and spatio-temporal gait analysis for accurate fielder recognition during the critical final overs of T20 International cricket matches, enhancing the analytical capabilities under varying environmental conditions.

**Objectives:**

1. **Develop an Ensemble Model:** Construct a model that leverages both facial recognition and hybrid spatio-temporal gait analysis to identify fielders accurately. This model will integrate various analytical techniques to capture static and dynamic attributes of players.
2. **Data Collection and Preprocessing:** Gather a comprehensive dataset encompassing video feeds and images that reflect diverse lighting conditions and field settings typical of T20 matches. This data will be preprocessed to normalize variations and prepare for effective model training.
3. **Feature Engineering:** Identify critical features that significantly impact player recognition. This includes detailed analysis of gait patterns, player jerseys, and contextual environment settings.
4. **Model Training and Optimization:** Train the ensemble model using advanced machine learning techniques. Optimize the model for high accuracy and operational efficiency in dynamic, real-time match conditions.
5. **Validation under Various Conditions:** Evaluate model performance across different scenarios to ensure reliability and robustness. This involves testing under variable lighting, different player movements, and multiple field positions.

Research Question 02:

**Aim:**

To harness the capabilities of a prompt-engineered large language model for translating complex natural language queries into precise SQL queries, thereby enabling the generation of accurate and contextually relevant statistics for recognized players in T20 cricket matches, with an emphasis on optimizing interaction and query responsiveness under varying analytical demands.

**Objectives:**

1. **Selection of an Optimal Large Language Model (LLM)**:

Choose the most suitable LLM from available options such as ChatGPT, Gemini, and Lama, based on their capabilities to understand and process natural language queries effectively.

2. **Design of a Relational Database**:

Construct a robust and scalable relational database designed to store detailed player statistics. This database should support efficient real-time SQL queries and be capable of handling user-defined filters and recognition inputs, facilitating the retrieval of specific player data as required.

3. **Implementation of Prompt Engineering Techniques**:

Apply and refine prompt engineering strategies to train the selected LLM on accurately interpreting natural language queries. Optimize these prompts to improve the LLM’s ability to formulate SQL queries that are both syntactically correct and logically consistent with user intentions.

4. **Evaluation of Input Character Length on Filter Effectiveness**:

Assess how different filter configurations and the lengths of input characters affect the relevance and accuracy of the generated statistics, aiming to optimize the system for various analytical requirements.

**1.5 Data Requirement**

**Fielder Facial Data:**

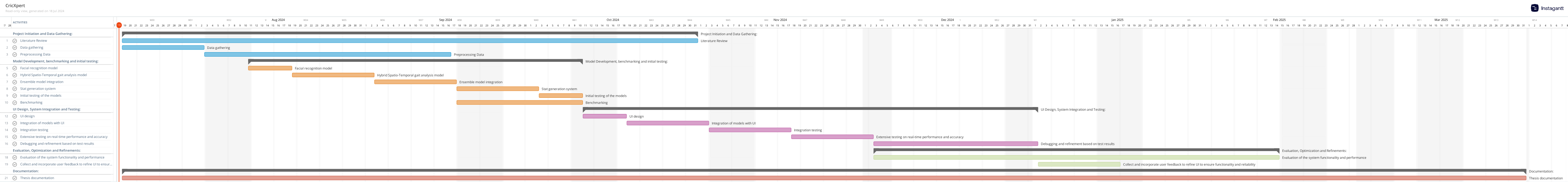
* **Purpose:** To train the model for facial recognition of fielders.
* **Collection Method:** A custom dataset will be developed, consisting of images captured of fielders during various matches. This will include diverse lighting conditions and angles to enhance the model’s accuracy in real-world scenarios.

**Fielder Gait Data:**

* **Purpose:** To analyze and recognize fielders based on their movement patterns.
* **Collection Method:** This dataset will also be custom-built, involving the collection of spatio-temporal gait data from video footage. The footage will capture different gait cycles from multiple angles to ensure comprehensive analysis capabilities.

**Fielder Stat Data:**

* **Purpose:** To provide statistical records for the recognized fielders, enabling detailed analytics and reporting.
* **Collection Method:** This data will be extracted from the ESPN website and organized into a custom dataset. This will support the SQL queries generated by the large language model for accurate and relevant stat retrieval.

**1.6 Project Plan**

**1.7 Bibliography**

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