Proposal LLM AI System for Esports Research

Contacts

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Proposed

Description of the Problem

Esports teams face significant challenges in optimising player performance and strategies due to a lack of funding for coaching. Additionally, traditional coaching methods are limited in their ability to process the vast amounts of data generated during gameplay. Teams need tools to analyse game logs, player behaviour, and strategic decisions efficiently, delivering actionable insights to improve outcomes in highly competitive environments. Teams risk falling behind in a rapidly evolving and data-driven esports ecosystem without these tools.

Processing gameplay data on the other hand, is limited by the ability to adequately study games on a process level; what happens from moment to moment and why. Conventionally, these descriptions are largely qualitative; gut-feeling, observations which often don't provide enough depth or resolution and any quantitative methods need to be either video-annotated or time-stamped by the game itself in some way such as scripted events. Furthermore, the large amounts of data when collected on a process level will need to be analysed in an efficient and feasible way.

However, with the advent of highly versatile and accurate video annotation this becomes possible; couple that to the structural collection of weekly esports training data and from commonly. According to the IMO system, there are 3 data streams, namingly contextual, behavioural and physiological.

What's the aim of this project?

The primary goal is to structurally develop a multi-modal AI system that analyses and annotates the context using game data; mainly audiovisual gameplay footage), player behaviour, and team strategies. That output will then be combined using traditional AI

techniques as an outcome variable for behavioural and physiological data, providing insights in why certain things occurred in the game context. Thereby, this system will enhance the performance of Breda Guardians' esports teams and act as a training bed for third year ADS&AI students. The project will require the structural, automated collection of data from esports training and match session to provide a steady stream of training data.

Intended Contribution of the Project

The project will enhance esports performance through tailored, data-driven insights for players and coaches. Thereby.

1. offering BUas students hands-on experience coaching in a data-driven way;
2. offering BUas students & staff a tool to study game analytics and experience. Thereby, taking a more quantitative approach to research and design;
3. Allow BUas to build a high-quality multi-modal dataset of contextual, behavioural and physiological data; the full-cognitive loop of human information processing;
4. developing techniques to integrate large language models and multi-modal analytics in real-world game applications.

Why are you doing this project?

This project seeks to:

- address the growing demand for innovation in esports training and insights in player and team performance;
- showcase Buas as a leader in game research and applications;
- provide practical tools for Breda Guardians to improve their competitive edge;
- provide a prototype for a data science tool which could grow to help the game development community in and around Buas to improve their competitive edge;
- contribute to scientific knowledge in esports analytics and game-research.

Services

Link with Buas Education and Services

This project aligns with several key areas of BUas' mission:

1. **Educational Excellence**: It involves Buas students in real-world applications, providing hands-on learning experiences that bridge the gap between cutting-edge research and industry.
2. **Community Support**: Enhances the performance of the Breda Guardians, a BUas-affiliated esports team, promoting institutional pride and visibility. Enhances the capabilities of BUas to do game research and provide education and support to it students, staff and the game ecosystem around Breda/
3. **Data-Driven Transformation**: Supports BUas goal to become a data-driven educational institution. By leveraging AI to analyse and utilise data for improving esports performance this project not only showcases data analytics in action but also sets a precedent for how data-driven tools can enhance decision-making and efficiency across various domains within BUas such as game, media or another form of experience design.
4. **Attracting Students**: Highlighting BUas's focus on technology can attract students to its innovative programs, positioning them as forward-thinking and appealing to tech-savvy prospects.

Engagement

Who benefits from this Project?

1. **Breda Guardians**: Improved training methods and performance through AI-driven insights
2. **Year 3 ADS&AI students** will have hands-on involvement in the project's development phases as this project will be a recurring one for the specialisation projects taught the entire academic year.
3. **Year 2 ADS&AI students** Certain tasks associated with the project, such as predictive modelling on a cleaned dataset or fine-tuning Large Language Models will be transformed into educational challenges developed by students during weeks 9 and 10 of the first block of the ADS&AI program
4. **BUas Students**: Opportunities for practical, project-based learning in AI and game development by using a data-driven toolkit to analyse experiences and esports performance
5. **Research and teaching staff**: Will benefit from the access to a data-driven toolkit to analyse experiences and esports performance.
6. **Esports Community**: Access to new methods of performance analysis and coaching, potentially influencing industry standards.

7. **BUas** showcases its commitment to educational innovation by integrating advanced AI technology.

Key Needs Addressed

- For **Players and Coaches:** Tool for analysing and improving gameplay strategies.
- For **BUas Students**: Real-world experience with cutting-edge AI technologies and contribute to technological innovations during their education. Have a competitive edge in knowledge & skills by being able to work in a data-driven manner when dealing with human factors such as behaviour and experience.
- For **Buas** as an **Institution**: Boosts reputation as innovator in AI and esports, as well as supports Buas goals to become data driven. Must demonstrate technological leadership and innovation to enhance its image and attract talented prospective students.
- **BUas Researchers:** The project contributes valuable insights into the study of esports gaming and game research, helping to solidify BUas's position as a leading game development and research institute.

Practical Value

- Esports Performance: Optimise competitive performance for the Breda Guardians with tools to analyse game data, player behaviour, and strategies, enhancing performance through data-driven insights.
- Education and Job Prospect: Offers BUas students' practical opportunities to learn and apply AI and data analytics skills in real-world esports applications, preparing them for industry challenges in the world of ADS&AI or Leisure and Events.
- Data Collection and Utilisation: Enables structural, automated data collection from gameplay, building a comprehensive dataset that includes contextual, behavioural, and physiological data for esports. Scientific contribution to esports analytics and AI applications.
- Development of AI Prototypes: Creates a prototype for a data science tool that has potential uses beyond esports, applicable to the wider game development and research community.

Impact

Advancements and Innovations

If adopted long-term, this project could:

- Establish AI-driven training as a standard in esports, game design practises and game research methodology.
- Inspire new AI applications in esports analytics and player development through providing the infrastructure and a toolkit as a backbone.
- Demonstrate BUas's commitment to cutting-edge educational innovation, enhancing its reputation as a leader in game research, AI integration, and data-driven approaches.
- Support BUas's affiliated esports team (Breda Guardians), enhancing the capabilities of students and staff, and strengthens BUas's visibility and pride within the esports community.
- Support for Data-Driven Transformation at BUas: The project aligns with BUas's goal to become a data-driven educational institution. By leveraging AI and data analytics in esports, the project demonstrates how data-driven tools can enhance decision-making and efficiency in other domains, including media and experience design.

Possible Risks

The project concerns a existing project which has a successfully, automated data-collection method in place on a but needs more infrastructure to start collect effectively on scale:

- The effectiveness of AI models relies on quality training data. If data collection is inconsistent or the volume is insufficient, it could lead to inaccurate insights or failed models. Therefore, the system should be intuitive and easy to use.
- Collecting detailed contextual, behavioural, and physiological data may raise privacy concerns. Improper handling of this sensitive information could lead to data breaches. Therefore, the modular system should come with a hardware setup as to be able to store data from an esports or research organisation within the organisation.
- Coaches and players may resist adopting data-driven insights if they feel it undermines their expertise or adds complexity to their routines. Having a modular system which comes with its own server makes the solution easily scalable to other esports organisation as it allows for the storage and local data analyses of matches played by the deployed toolkit.

Furthermore, the development of a multi-modal AI system involves complex integration of different data streams (contextual, behavioural, and physiological). Technical challenges may delay the project or result in inaccuracies. Robust testing and iterative development of such a toolkit is required, which can be offered by it being a recurring project in the third-year specialisation projects of ADS&AI students.

Ethical Considerations

- Privacy: Player data will be securely stored on the server of Breda Guardians or future esports organisations. Data can be accessed through the ADS&AI server for analyses according to the permission agreed upon by the organisation and the project leader.
- Bias: AI models may inherit biases present in the training data, leading to unfair or inaccurate assessments of player performance. Rigorous testing will ensure AI recommendations are fair and accurate.
- Human Interaction: Coaches and players may resist adopting data-driven insights if they feel it undermines their expertise or adds complexity to their routines. So, care is needed to design and communicate that the AI tools will complement, not replace, human coaching.

A data management plan according to BUas's regulations is in its first draft and an application for the ethics review board has been prepared.

Capability

Technical System Utilised

This project will leverage existing advancements in multi-modal AI analytics to enhance esports performance, rather than developing entirely new models from scratch. We will evaluate several pre-trained models such as Llama 3.2, Gemini and GPT4o. Firstly, we will evaluate their suitability as video annotation tools. Secondly the multi-modal capacity to integrate other behavioural, physiological and contextual data streams. Thirdly, low operating cost both financially and computationally will be prioritised.

This toolkit will be used to analyse gameplay footage, player behaviour, and strategic decisions. To tailor the system to the specific requirements of Breda Guardians and maximise its effectiveness, we will explore various training approaches such as multi-modal data integration, traditional supervised learning; and design for continuous learning, and reinforcement learning techniques to optimise the model's capacity for delivering actionable insights.

Practicality

The project will utilise both the existing BUas hardware resources available and targeted new acquisitions. The data will be collected by the esports toolkit as developed under the Growth Project which is a collaboration of BUas, Breda Guardians and Tilburg University. The data collection consists of recorded gameplay data, control input, facial expression and emotion, eye-tracking, heart-activity and electrodermal-activity. The

data collection is already being taken care of and therefore not mention in the proposal but instead demonstrated here shortly, and in length over here. Finally, the ADS&AI department has an existing card-scanning application which can be utilised to manage play sessions & players correctly.

The processing power of the ADS&AI server will be harnessed for computationally intensive tasks, such as multi-modal data processing and AI model training. A dedicated data collection system will be implemented to ensure automated, consistent gathering of esports training and match data. To facilitate smooth data processing and model deployment, the project will require a dedicated on-site server for local model execution and provide the data-driven insight through the dashboard and match-review tool.

We will also explore the integration of existing game analytics platforms to visualise and interpret player performance data, ensuring a cohesive approach to analysing gameplay, behaviour, and physiological data streams. Additionally, the project will investigate the potential for integrating predictive models and fine-tuning AI to enable accurate player performance forecasting, enhancing the coaching and training experience for the Breda Guardians.

Skills and Experience of Team

- Bram Heijligers (Project Lead): Lecturer Data Science & AI, PhD-candidate. Project will be part of project leaders PhD project.
- ADS&AI and Leisure and Events Students: Providing technical, organisational, communicative or managerial support under expert supervision of the Project Lead and Breda Guardians staff as interns or as part of the ADS&AI specialisation projects.

Outcomes

Showcasing Results

The outcomes will be shared via:

- Toolkit Dissemination: providing access to Breda Guardians, BUas researchers & students to the toolkit
- Presentations: Showcasing project results to the projects stakeholders (Game Lab Tilburg University, University Twente, HAN Nijmegen), esports community and internal stakeholders such as educator or researchers within BUas; primarily AGM.
- Videos: Demonstrating the AI system in action during the training sessions and by generating more marketing material with the marketing department.

- Journal articles & conference articles: find suitable venues of journals and conferences to share the findings of the research & development through technical papers and case studies.

Timeline and Funding

Proposed Timeline

Milestone	2025				2026			
	Winter	Spring	Summer	Autum	Winter	Spring	Summer	Winter
First Iteration Analytical Toolkit (descriptive modelling)								
Continue & expand Data Collection								
Tutorials, Conducting User Studies, Presentations								
LLM Annotation & Modelling (predictive modelling)								
Academic Output								

Funding Requirements

1st Priority:

- ASUS NUC 14 Pro RNUC14RVHI300002I: € 456
- 2x16GB RAM DDR5 6500Mhz: € 75
- 2x16TB Seagate Ironwolf: € 660
- Orinoco 5-Bay Enclosure: € 150
- NFC Card Reader: € 30

2nd Priority

- Credits for using OpenAI's, Google's or Meta's models: € 2000. (Meta's Llama comes in free version with good enough performance and building blocks as a back-up)

3rd Priority

- Journal fees/Conference registration and travel costs: € 3.000

Total: € 6,371