TED UNIVERSITY

CMPE 491

Senior Design Project I

VENATOR

Project Specifications Report

SECTION 1 - GROUP 6

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1 Introduction

1.1. Description

Venator aims to detect and track the components of a football match, specifically players, goalkeepers, referees and the ball, and compute statistics about these components with the help of computer vision techniques that are applied to the video recordings of the matches provided by stakeholders or captured by us.

1.2. Constraints

Project constraints concerning Venator are stated as follows:

- Hardware and software costs may bring the development and the maintenance of the project to a standstill, as the training of the project's algorithm may require significant computation power.
- Devices and processes used in the computation process may impact the environment negatively if the energy requirement for the operation of the project is exceptionally high.
- The project must comply with the current laws that are related to video recording and data collection activities during sport events (specifically, a football match).
- Different stadiums and the difference of levels of play between different leagues may be challenging in terms of training an efficient and accurate algorithm that works independently of these constraining factors.

1.3. Professional and Ethical Issues

Professional and ethical issues concerning Venator are discussed as follows:

Professional issues:

- High level understanding of computer vision, machine learning, and data analysis is essential when it comes to developing a detect & track project like Venator.
- Keeping in touch with the latest technologies of computer vision and machine learning is needed in order to maintain the efficiency and the accuracy of the final product.

Ethical issues:

- Venator should compute the statistics for each player without adding developers' personal biases due to the players' race, gender, religion, etc. into the algorithm of the project.
- The project should operate in an informed and consented environment. All the components (players, goalkeepers, referees, etc.) that the project detects, tracks and computes some statistics for should be informed of the features and the range of operations of the project.
- The project should serve the statistics to the customers in a transparent manner, that is, it should not provide untrue/uncalculated statistics and the algorithm should not favor a player/customer over another player/customer.

2 Requirements

Some of the statistics that are calculated for the components of the matches form the initial project requirements for Venator. The aforementioned initial requirements include:

- Venator must find, localize and track the players.
- Venator must give unique IDs to each detected player.
- Venator must compute the distance coverage of each player.
- Venator must compute the average position for each player.
- Venator must compute a heat-map of each player.
- Venator must compute a predicted location of the ball.
- Venator must compute the ball possession duration of each team.
- Venator must differentiate the players of the two opposing teams of the football match.
- Venator may identify each detected player and associate ID-based data with the real player.
- Venator may compute percentage of attack in different zones.
- Venator may detect action events such as pass, goal, corner, out, throw-in, offside, etc. and count the number of action events for each team.

3 References

1. *ACM Code of Ethics and Professional Conduct*. (n.d.). Association for Computing Machinery. https://www.acm.org/code-of-ethics
2. *IEEE Code of Ethics*. (n.d.-b). Institute of Electrical and Electronics Engineers. https://www.ieee.org/about/corporate/governance/p7-8.html