Towards AI Driven Sport Analytics: Basketball as a Case Study

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1. Abstract

We have built an end to end platform that allows coaches and sport experts analyze sport videos uploaded, through a pipeline of computer vision & NLP algorithms, giving them actionable insights into the sport match for improving athletes' technical performance level, reducing sports injuries, enhancing game viewing, attracting fans, and promoting the development of basketball-related industries. Our work is much focused on young / growing basketball teams or clubs, with some experimental implementation on dynamically changing camera views.

1. Introduction

Artificial Intelligence and machine learning has opened unprecedented possibilities in the field of analytics with no exception to sports. AI is beginning to find its way into sports such as basketball, football due to the relative ease with which data is collected. There is already open source work done around action tracking, player detection and ball detection. Here, we present RectSports, an AI analytic platform for automating sport highlights. It enables accurate player tracking with real time visualization of the exact coordinates of each player on the court to provide insights that event data cannot provide. With the advance of AI, analytics has been relied on for: evaluation and development of players, contract negotiations, in-game decision making, selecting draft picks, trades, infusing practice, advancements and trainings of referees, player health management, tanking, fan engagement, odds making for gambling industry and broadcasting[2].

2. Literature Reviews

Basketball happens to be a complex game in terms of player's postural movements and tactics, the current research is mainly conducted using two ways of analysis; one is based on player trajectories, and the other is using postural movement analysis[3]. Overtime, researchers have been able to apply the use of convolutional neural networks with one-dimensional convolutional kernels to model the trajectory characteristics of players according to the game, and these characteristics are extracted implicitly for the recognition of events [4]. Further research has demonstrated the extension of posture movement analysis into better analyzing players performance in the court based on the actions they carry out. Quo Vardis et al demonstrated a generic implementation of Action modeling [5]. Action based spatio-temporal modeling had to evolve into more localization methods that could better solve human action based on multiple

interactions. In this work, we put all this into demonstrating an end to end sport analytics platform that feeds on sport video data's (basketball) and generates analytical sport results, with some level of modeling optimization. This platform is called RectSports.
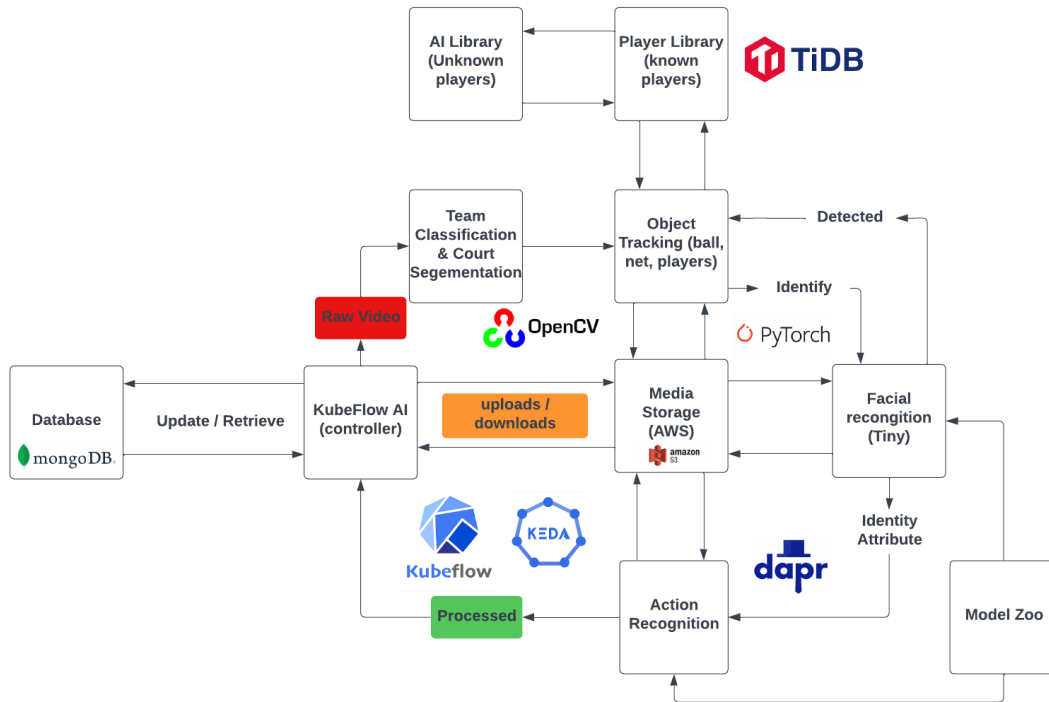
3. Methodology

Fig 1: AI Architecture

Our system has been built such that the controller takes in raw video footage that needs to be analyzed, performs segmentation of players within the court from those outside the court, then moves on to executing clustering algorithms so as to identify players into 2 distinct teams. The segmented players are then tracked using StrongSort [7], alongside the ball and the net by the algorithm (considering if they could be identified based on their detected faces [8] or jersey numbers). Finally, with the help of our trained action recognition algorithm, we are able to perfectly account for instance-based action carried out by each unique player.

4. Results

Having conducted the above experimental workflow, Table 1 basically showed a metric evaluation of the system based on our test / use cases.

Table 1: Inference model result

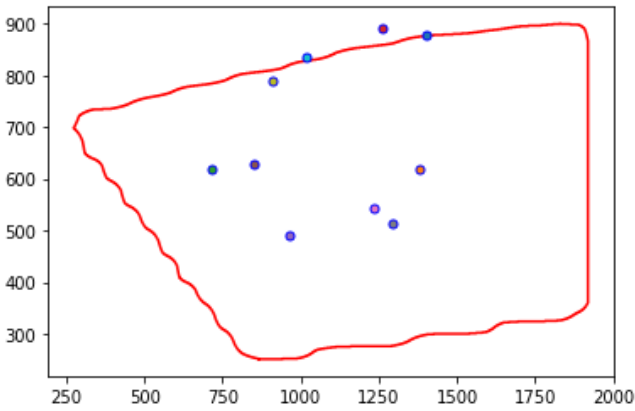| s/n	Model	Metric
1	Court Segmentation	84%
2	Team Classification	75%
3	Object Tracking	93%
4	Face Recognition	65%
5	Jersey Recognition	55%
6	Action modeling	76%

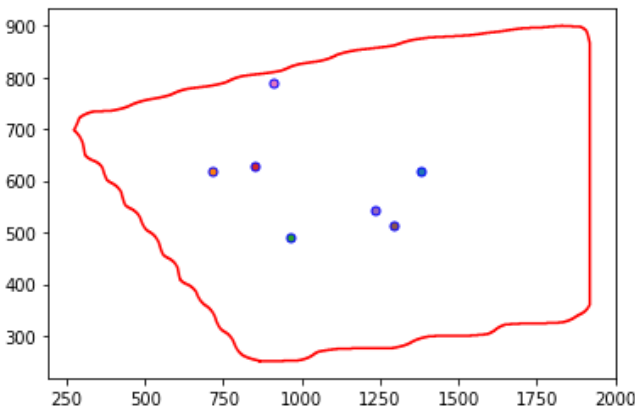Fig 2: Court Segmentation (Segmented / unsegmented players)

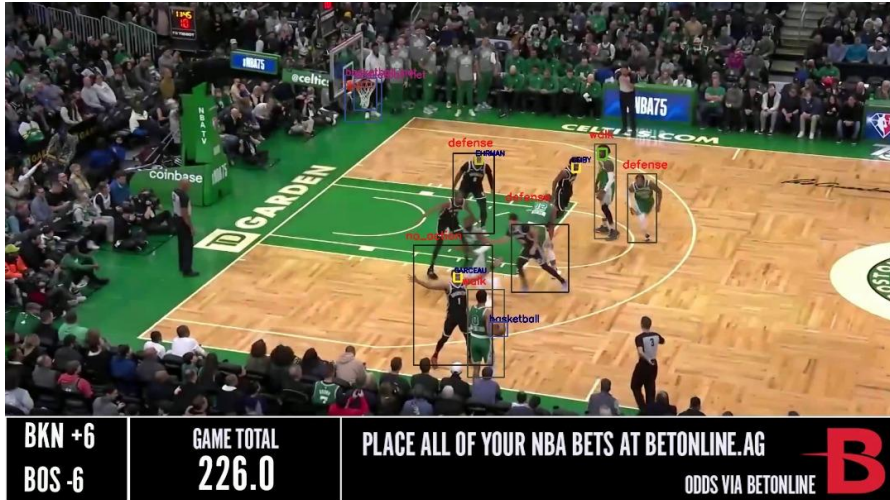Fig 3: Court Segmentation (Segmented players)

Fig 4: Face Detection / Action recognition & Tracking

Fig 5: Team Classification (Jersey color)

5. Conclusion/ Summary

Basketball is among the most popular sports in the world and its counterparts have reaped a huge economic impact / benefits. It is important to state that the application of AI technology in Basketball is still in its infancy and it's still currently being studied extensively. The Analytics / inference drawn so far has proven the feasibility of AI in analyzing performance of teams, players, game results, predicting injuries, shoots, betting, teaching and all. We do believe that AI technology would strongly promote the development of basketball.

References

[1]   Li Bin, Xu Xinyang. Application of Artificial Intelligence in Basketball Sport. Journal of Education, Health and Sport. 2021;11(7):54-67. eISSN 2391-8306. DOI http://dx.doi.org/10.12775/JEHS.2021.11.07.005

[2]   NBA Analytics: Definitive Guide to Moneyball in Basketball

[3]   Peng Yao, "Real-Time Analysis of Basketball Sports Data Based on Deep Learning", Complexity, vol. 2021, Article ID 9142697, 11 pages, 2021. https://doi.org/10.1155/2021/9142697

[4]   A. Kumar and A. Jaiswal, "Deep learning based sentiment classification on user-generated big data," *Recent Advances in Computer Science and Communications*, vol. 13, no. 5, pp. 1047–1056, 2020.

[5]   J. Carreira and A. Zisserman, "Quo Vardis, Action Recognition? A New Model and the Kinetics Dataset," *Deepmind, Department of Engineering Science, University of Oxford*, Quo Vadis, Action Recognition? A New Model and the Kinetics Dataset

[6]   Simone Francia, "Classification of Basketball Actions through Deep Learning Techniques," *Department of Engineering, University of Modena and Reggio Emilia*, (PDF) Classificazione di Azioni Cestistiche mediante Tecniche di Deep Learning

[7]   Yunhao Du, Yang Song, Bo Yang, Yanyun Zhao, "Strong SORT: Make DeepSORT Great Gain," *Beijing University of Post and Telecommunication*, https://arxiv.org/pdf/2202.13514v1.pdf

[8]   Peiyun Hu, Deva Ramanan, "Finding Tiny Faces," *Robotics Institute Carnegie Mellon University*, https://arxiv.org/pdf/1612.04402v2.pdf