National College of Ireland

Configuration Manual

MSc Research Project
M.Sc. Data Analytics

Joshua Jaymon
Student ID: x23314401

School of Computing
National College of Ireland

Supervisor: Eamon Nolan

National College of Ireland

MSc Project Submission Sheet

School of Computing

Student Name: ……. Joshua Jaymon ……

Student ID: ……x23314401……..……

Programme: ……MSc Data Analytics…… **Year:** ……..

Module: ……MSc Research Practicum…..……

Lecturer: ……Eamon Nolan……..……

Submission Due Date: ……11/08/2025……..……..……

Project Title: Virtual Coach: Personalized Training Recommendations for Football Players Using Machine Learning and enhance the players performance ……..……

Word Count: …1061…… **Page Count:** ……4……..……

I hereby certify that the information contained in this (my submission) is information pertaining to research I conducted for this project. All information other than my own contribution will be fully referenced and listed in the relevant bibliography section at the rear of the project.
ALL internet material must be referenced in the bibliography section. Students are required to use the Referencing Standard specified in the report template. To use other author's written or electronic work is illegal (plagiarism) and may result in disciplinary action.

Signature: ……Joshua Jaymon……..……

Date: ……11/08/2025……

PLEASE READ THE FOLLOWING INSTRUCTIONS AND CHECKLIST

Attach a completed copy of this sheet to each project (including multiple copies)	□
Attach a Moodle submission receipt of the online project submission, to each project (including multiple copies).	□
You must ensure that you retain a HARD COPY of the project, both for your own reference and in case a project is lost or mislaid. It is not sufficient to keep a copy on computer.	□

Assignments that are submitted to the Programme Coordinator Office must be placed into the assignment box located outside the office.

Office Use Only	
Signature:	
Date:	
Penalty Applied (if applicable):	

Virtual Coach: Personalized Training Recommendations for Football Players Using Machine Learning and enhance the players performance

Joshua Jaymon
Master of Science in Data Analytics-C
National College of Ireland
Dublin, Ireland X23314401

1. Introduction

Football has in the recent past been transformed by the advanced technology both in the identification of talents and improving on the strategies used in the game. Today, it is not about just having a gadget, but about a gadget that makes a monumental difference to the gameplay and its precision. It is valid to talk about non-substitutions as goal-line technology and Video Assistant Referee (VAR) system has affected decision-making mechanisms. In this project we are trying to build the same and similar kind of assistant system. This confg file will help you how to run the code and understand the code.

2. System Requirements

Notebook: Jupyter Notebook
RAM: 16GB
GPU: 12GB NVIDIA RTX 3010
Processor: Intel i9 12th Generation
Environment: Google and Anaconda

3. Setting Up the Environment

The first step in starting the implementation is to create the environment that includes installing the prerequisite software including Python, OpenCV, PyTorch and YOLOv5. After preparing the environment, download the Islamic Azad University Football Dataset (IAUFD) and make necessary changes in order to use it for training. The data is to be split into training and validation sets with the help of a data loader that will make the data processing easier during the training phase of the model.

```
#Datasets

!pip install roboflow

from roboflow import Roboflow
rf = Roboflow(api_key="8d9pP12PObhURtZQqY81")
project = rf.workspace("university-tboyn").project("iaufd-football")
version = project.version(1)
dataset = version.download("yolov5")
```

Figure 1: Code snippet for the code setup

4. Transfer Learning with YOLO models

There is also an option to transfer learn by importing YOLO with weights from pre-trained sources. Modify some of the characteristics of the model so as to reflect the types of labels available within the IAUFD set. This takes the form of modifying the model structure in regard to the count of classes present in the dataset. For this task, YOLO should be taken as the base model and then the model is fine-tuned on IAUFD dataset.

5. Model Training

YOLOv5, as opposed to IAUFD, train and exploit the model. Training the model to a determinant number of epochs under strict accuracy check in conjunction with loss values will ensure increased knowledge acquisition. The best model weights are stored to be used in real-time detection as the model is being trained.

6. Real-Time Detection

In OpenCV, train the YOLOv5 to recognize football in real -time. Launch the webcam that captures video in real-time and use YOLOv5 to identify referees, players, goalkeepers and balls in each frame. To display the result, the detections will be shown in form of bounding boxes and labels on the detected objects in the frames.

```
def detect(self, video_path):
    results = self.model.predict(video_path)
    detections = []

    for box in results[0].boxes:
        class_idx = int(box.cls[0])
        class_name = results[0].names[class_idx]
        xyxy = box.xyxy[0].cpu().numpy()
        detections.append({
            'class_name': class_name,
            'coordinates': xyxy # coordinates
        })

    return detections
```

Figure 2: real time detection

7. Ball Tracking

To enrich the system, introduce ball tracking which would be detection of the position of the ball within each frame in which it is captured by the cameras. Extrapolate the respective location of the ball and attempt to sketch through the ball path using the coordinate plane of the video frames. In that way, they are able to take the game dynamics, such as in case of free-kick and penalties.

```python
# Track ball positions
for detection in ball_detections:
    x1, y1, x2, y2 = detection['coordinates']
    center_x = int((x1 + x2) / 2)
    center_y = int((y1 + y2) / 2)
    ball_positions.append((center_x, center_y))

# Draw the ball trajectory
for i in range(1, len(ball_positions)):
    if ball_positions[i - 1] is None or ball_positions[i] is None:
        continue
    thickness = 6
    cv2.line(frame, ball_positions[i - 1], ball_positions[i], (0, 0, 255), thickness)

# Write the frame to the video file
out.write(frame)
```

Figure 3: Code Snippet for the ball tracking

8. Drive Location

Data: https://universe.roboflow.com/university-tboyn/iaufd-football
Code: https://drive.google.com/drive/folders/1SOxcWdb4AV-eOUBaydsxtnZKWTsu130C?usp=sharing

9. How to Run the Code

Step 1: Download the Data and put it in the Drive -> Or link the data in the colab file (Code is there)
Step 2: Open the Colab file
Step 3: Authenticate to provide access to the google drive and storage
Step 4: Run All
Step 5: Save the outputs

10. Conclusion and Future Work

The proposed application is intended to accommodate rural enthusiasts who are looking for means of self-betterment (in terms of their rockets) as well those consumers that are just genuinely passionate about the sport. It analyzes the angle of a shot, predicts its possible trajectory and adjusts tracking using real-time feedback. This method intended to allow users to increase their performance level by allowing them to diagnose and fix problems themselves, thereby improving the skill capacity of the user which would further resemble an ELO system meant for games.

References

Ait-Bennacer, F.E., Aaroud, A., Akodadi, K. and Cherradi, B., 2022. Applying Deep Learning and Computer Vision Techniques for an e-Sport and Smart Coaching System Using a Multiview Dataset: Case of Shotokan Karate. Int. J. Online Biomed. Eng., 18(12), pp.35-53.

Cui, J., Du, H. and Wu, X., 2023. Data analysis of physical recovery and injury prevention in sports teaching based on wearable devices. Preventive medicine, 173, p.107589.

de Leeuw, A.W., van der Zwaard, S., van Baar, R. and Knobbe, A., 2022. Personalized machine learning approach to injury monitoring in elite volleyball players. European journal of sport science, 22(4), pp.511-520.

Eckard, M. E., Padua, D. A., Hearn, D. W., Pexa, B. S., & Frank, B. S. (2017). The relationship between athletic performance measures and injury risk in soccer. International journal of sports physical therapy, 12(2), 576.

Ghosh, I., Ramamurthy, S.R., Chakma, A. and Roy, N., 2022. Decoach: Deep learning-based coaching for badminton player assessment. Pervasive and Mobile Computing, 83, p.101608.

Gouttebarge, V., Hopley, P., Kerkhoffs, G., Verhagen, E., Viljoen, W., Finch, C., ... & Schwellnus, M. (2017). A 12-month prospective cohort study of symptoms of common mental disorders among professional rugby players. European journal of sport science, 17(4), 479-487.

Gustafsson, E.F., 2024. Exploring Computer Vision-Based AI-Assisted Coaching for Youth Football Players.

Impellizzeri, F. M., Marcora, S. M., & Coutts, A. J. (2019). Internal and external training load: 15 years on. International journal of sports physiology and performance, 14(2), 270-273.

Malone, S., Roe, M., Doran, D. A., Gabbett, T. J., & Collins, K. D. (2017). High chronic training loads and exposure to bouts of maximal velocity running reduce injury risk in elite Gaelic football. The Journal of science and medicine in sport, 20(3), 250-254.

Mekruksavanich, S. and Jitpattanakul, A., 2022. Multimodal wearable sensing for sport-related activity recognition using deep learning networks. Journal of Advances in Information Technology, 13.

Meylan, C., Trewin, J., & McKean, K. (2017). Quantifying explosive actions in international women's soccer. International journal of sports physiology and performance, 12(3), 310-315.

Miah, J., Mamun, M., Rahman, M.M., Mahmud, M.I., Ahmad, S. and Nasir, M.H.B., 2022, December. Mhfit: Mobile health data for predicting athletics fitness using machine learning models. In 2022 2nd International seminar on machine learning, Optimization, and Data Science (ISMODE) (pp. 584-589). IEEE.

https://github.com/ultralytics/ultralytics

https://www.datacamp.com/blog/yolo-object-detection-explained