

# Dashboard Interaction Guide

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# Table of Contents

<b>Home Page</b>	<b>3</b>
<b>Initial Review</b>	<b>4</b>
<b>Video Editor</b>	<b>5</b>
<b>Dashboard</b>	<b>7</b>
Layout	8
Video Player Card	8
Track Card	8
Player Card	9
Interactions	9
On Page Load and Updating	9
Video Navigation	9
Track Video Visualization	10
Track Radio List Selection and Visualization	11
Player Radio List Selection and Visualization	12
Track Assignment, Deletion and Trimming	13
Manual Annotation	14
Add Track	15
<b>Add Track</b>	<b>16</b>
Layout	17
Video Player Card	17
Bounding Box Submit Card	17
Interactions	18
Initializing the Tracker	18
Reviewing the Track Output	18
Accepting or Denying the Track	19
Returning to the Dashboard	19
<b>AWS</b>	<b>20</b>
Elastic Beanstalk	20
Configuration	20
Instance Type	20
Instance Modification	20
Auto-Scaling	20
<b>Information for Future Teams</b>	<b>22</b>

# Home Page

General NavBar

HOME ▾

Sports Science AI Home Page

Game Collapse

Game ID	Team 1 Name	Team 2 Name	Date Played	Process State
0	Tottenham Hotspur	Liverpool	2000-01-01	0
1	Liverpool	Barcelona	2000-01-01	0

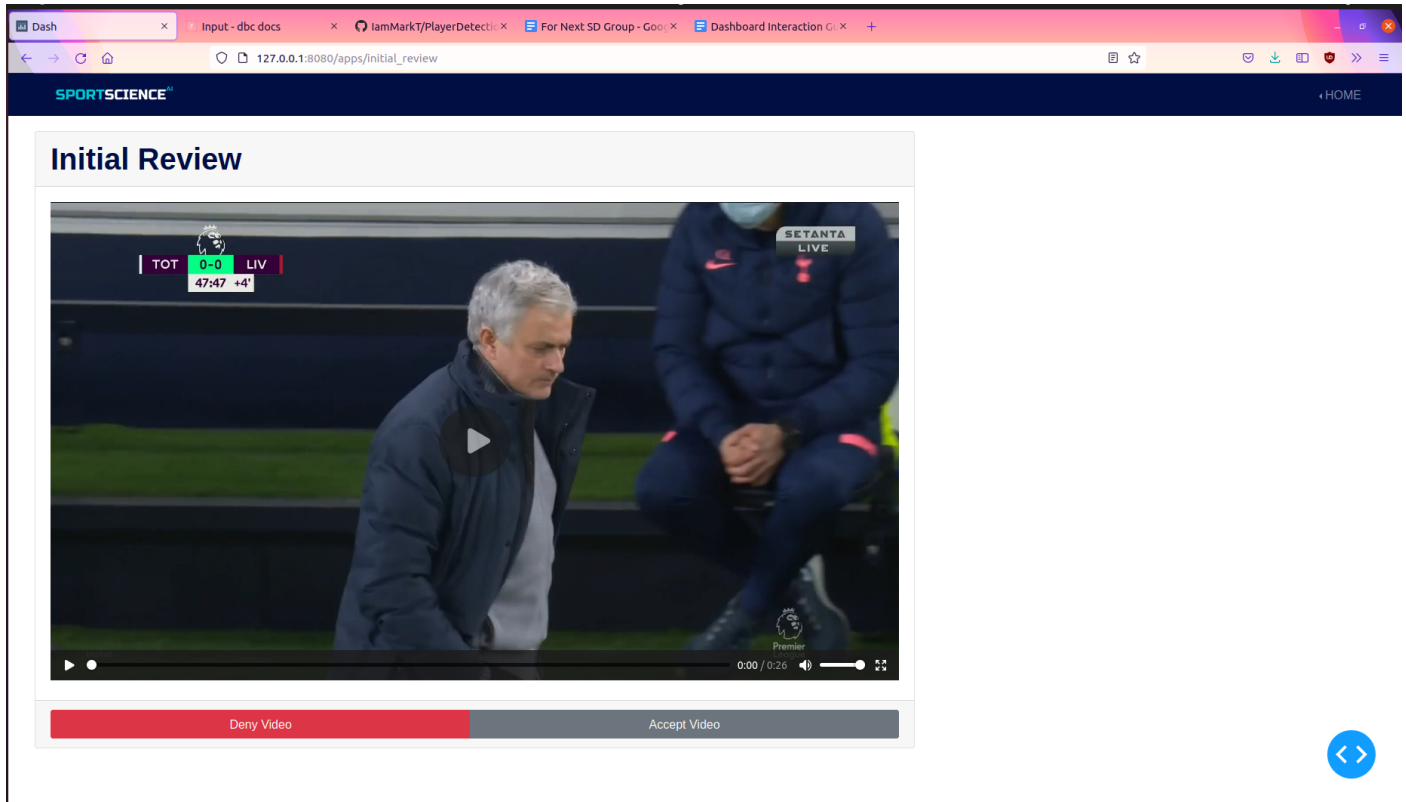
Game ID

Select Game

<>

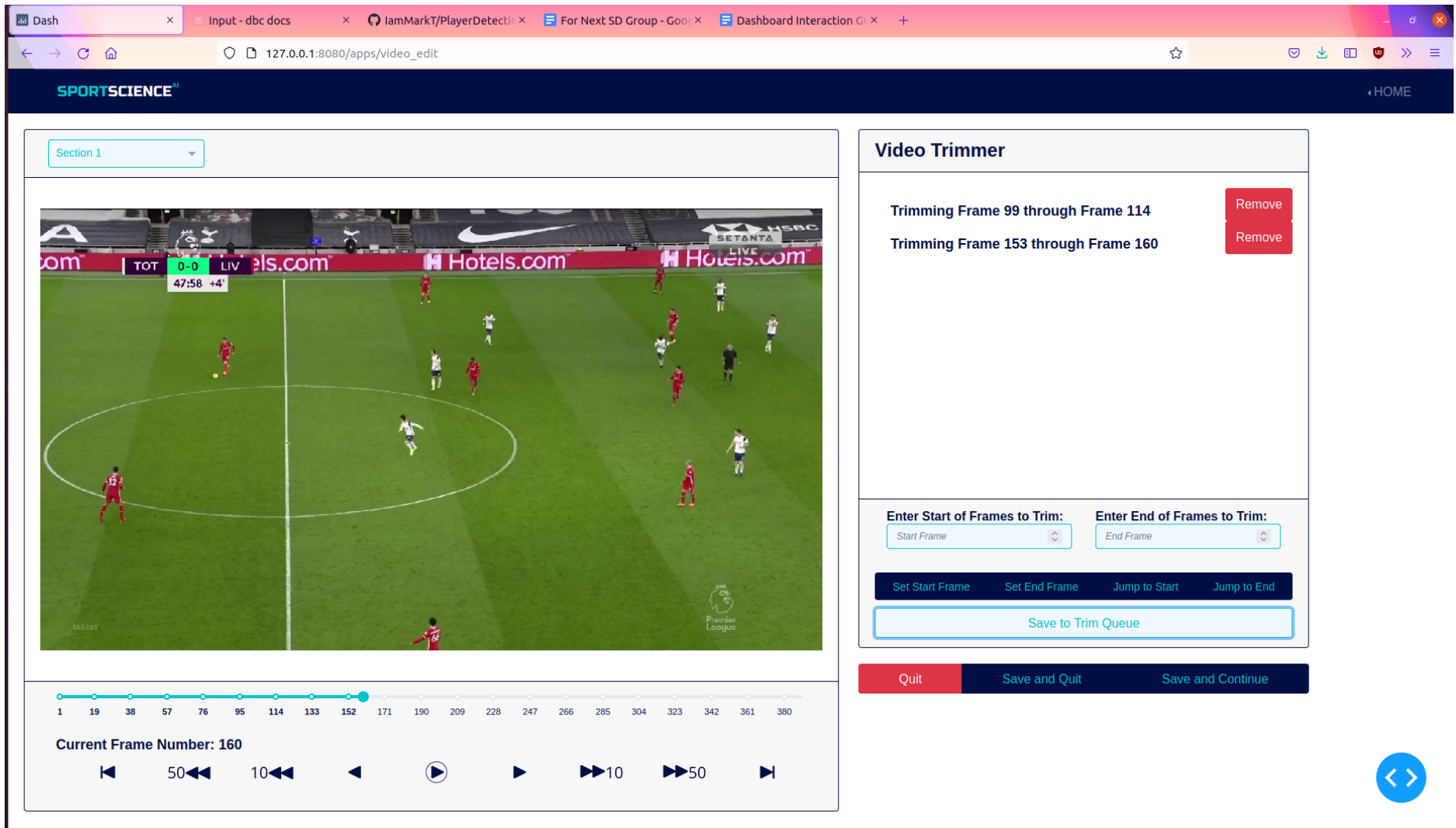
The home page is very simplistic and easy to use. The game table is hidden within a collapse and that shows all of the currently input games and their game ids. You can input a game id into the input on the right and click select game to choose that game as the game who's data is loaded. This function would also download and replace the video mp4 file with proper game from aws and name it game\_0.mp4 (that name is currently hardcoded).

# Initial Review



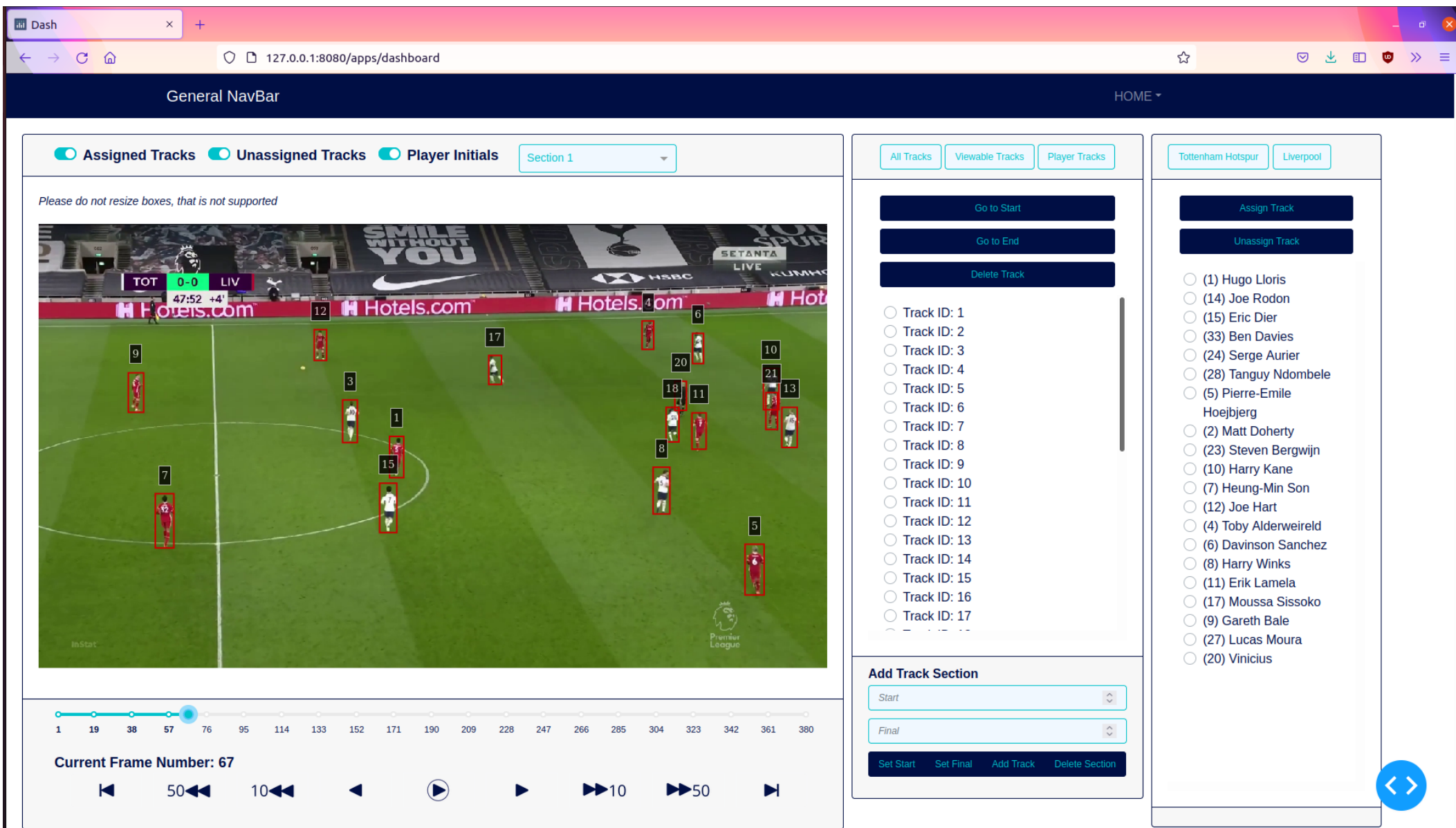
This page allows for quick review of a game to make sure it's a valid upload. If its a valid upload then it can be accepted, otherwise it can be denied.

# Video Editor



- This page is intended to remove any footage that doesn't contain relevant gameplay.
- In general, sections of the video are added to the trim queue and once all sections are added the video is saved.
  - Save and quit should recompile the video but not change the state.
    - Recompile the video, but more work to do on this page.
  - Save and continue should recompile the video and progress the state.
    - Recompile the video, ready to run the detection algorithms.
- Sections of the video are added to the trim queue by using the start and final frame inputs.
  - These can be input manually or scrolling to specific place in the video and clicking on set start or set end frame.
  - The frame inputs are inclusive with the number entered there.
  - Once two valid frames are set just click save to trim queue to add the frame selection to the queue.

# Dashboard



The dashboard is the core of the entire application. This is the page where the user will be spending most of their time and has some of the most complex and detailed interactions.

## **Layout**

### **Video Player Card**

The video player card is everything contained within the large, leftmost card on the screen. More specifically, the video player card includes:

- The assigned/unassigned track box toggles
- The video section dropdown
- The image in the center
- The slider at the bottom
- The play/pause and other navigation buttons at the bottom

Generally speaking, this part of the application is used to:

- Navigate the video
- Provide a way to visualize and inspect the track detections
- Allow the user to manually annotate the video.

### **Track Card**

The track card is everything contained within the middle card. More specifically, the track card includes:

- The three track visualization buttons at the top
- The go to start, go to end, and delete track buttons
- The radio list of tracks in the middle
- The add track section at the bottom with:
  - A start frame and final frame input
  - The set start, set final, add track and delete section buttons

Generally speaking, this part of the application is used to:

- See a list of tracks for the entire video, the current frame, or for a certain player
- Select a track
- Choose a section of frames to add a new track to



## Player Card

The player card is everything contained within the rightmost card. More specifically, the player card includes:

- The two team buttons at the top
- The assign track button
- The radio list of players

Generally speaking, this part of the application is used to:

- Choose which team of players to view on the radio list below
- Select a player
- Assign a selected track to a selected player

## Interactions

### On Page Load and Updating

It is recommended that upon the page loading the user waits for the tab at the top to no longer say “updating”. Many of the features of the application, including the video player, will be non-functional while the application is updating and initializing all of the data.

There are also many other times the application will be updating and this is apparent through the tab displaying “updating”. During these times the app is receiving or transmitting info to the database or is otherwise busy and it’s recommended to wait until it’s finished and the updating message disappears.

### Video Navigation

There are five main methods for video navigation that are as follows:

1. The play/pause button
  - a. Clicking the play/pause button allows the user to play or pause the video. The playback is relatively slow, however this can actually be to the user’s benefit as the purpose of the dashboard isn’t to play the video back at full speed, but instead inspect each and every frame and the detections on it.
2. The video slider

- a. The video slider allows the user to click and drag in order to instantly skip to any point in the current section of the video.
3. The next/previous frame buttons
  - a. These buttons, along with the 10 and 50 frame versions, allows the user to skip forwards or backwards through the video in predefined increments.
4. The go to start/end (of a track) buttons
  - a. The functionality of these buttons are tied to which track is currently selected. If no track is selected then these buttons will not function.
  - b. Clicking on go to start or go to end will take the video player to the first or final frame that the currently selected track appears on.
5. The video section dropdown and next/prev section buttons
  - a. These components allow for navigation between different sections of the video. The dropdown lets the user select from the entire list of sections, meanwhile the next and previous section buttons will take the video to the next or previous section relative to the current one.

## Track Video Visualization

As the video is played it should be noted that red rectangles with a black and white number above them are appearing as an overlay on top of the current frame. These rectangles are referred to as “bounding boxes”. They represent individual detections by the object detection machine learning algorithm that was run prior to accessing the dashboard. The number above each bounding box corresponds to the detection track that the detection belongs to. A detection track will have many individual detections that together make up the entire track.

The bounding box and the text above it will actually change depending on whether or not the track has been assigned to a player:

- If the track HAS been assigned to a player
  - Bounding box color = red
  - The text will represent the track number
- If the track has NOT been assigned to a player
  - Bounding box color = blue
  - The text will represent the player's initials

In addition to the box and text changing, there is another method to visually distinguish between assigned and unassigned tracks. There are two toggles above the video player labeled “Assigned Track Boxes” and “Unassigned Track Boxes”. These can be turned

on or off to hide or unhide the boxes that are or aren't assigned to player, allowing for a total of four states to visualize the tracks:

- View assigned and unassigned tracks
- View only assigned tracks
- View only unassigned tracks
- View no tracks

## Track Radio List Selection and Visualization

The track card allows for three different methods of viewing the radio list of tracks:

- All Tracks
  - By clicking on all tracks the radio list will populate with every track for the entire game.
  - Generally speaking this is the least useful of the three track views.
    - Useful for finding a track again when you already know its track id.
- Viewable Tracks
  - By clicking on viewable tracks the radio list will only show the tracks that are viewable in the current frame.
  - When selected, this list will dynamically update as the video is played to always reflect the currently viewable tracks.
  - The most useful of the track views.
    - Eliminates all of the excess of the all tracks view.
- Player Tracks
  - This view will display all the assigned tracks of a selected player. If there is no player selected no tracks will appear and the user will be asked to select a player.
  - Like viewable tracks, while player tracks is selected it will dynamically update. However, instead of changing with the current frame it will update when a different player is selected.

To select a track just click on the radio list item corresponding with the track. Once a track is selected, the following interactions become available:

- Go to Start
  - Sets current frame equal to the first frame the selected track appears on.
- Go to End
  - Sets current frame equal to the last frame the selected track appears on.
- Delete Track

- Deletes the entirety of the selected track.
- Delete Section
  - To be used in conjunction with the start and final frame inputs.
  - Will delete any of the selected track's detections found within the start and final frame inputs.
    - If that track doesn't appear on a frame within the range then that frame will be skipped.
- Assign Track
  - To be used in conjunction with the player radio list buttons.
  - This will assign the selected track to the selected player.

## **Player Radio List Selection and Visualization**

The player card allows for two different methods of viewing the players:

- Team A and Team B
  - Each of the above represent two different buttons for each of the teams in the current game.
    - On startup they will display as Team A and Team B. However, once the app is fully loaded they will each update to display their respective team names instead.
  - By clicking on one of these buttons the player radio list for that respective team will be populated in the space below.

To select a player just click on the radio list item corresponding with them. Once a track is selected, the following interactions become available:

- Assign Track
  - To be used in conjunction with the track radio list buttons.
  - This will assign the selected track to the selected player.
- Player Tracks
  - This is one of the three options for viewing the track radio list.
  - When a player is selected this view will show all tracks assigned to the player.

## Track Assignment, Deletion and Trimming

### Assigning a track:

- In order to assign a track three components must be interacted with:
  - First, the track to be assigned to a player should be selected.
  - Next, the player we want to assign the track to should be selected.
    - Note: the above two steps can be done in either order.
  - Lastly, once both player and track are selected clicking the assign track button will assign the track to the player.
- After the button is clicked it is advised to wait until the process is complete. This is indicated by the spinner below the button that is active while track assignment is in progress.
- A track that is assigned to a player can be assigned to a different player if the process is repeated with the same track and different player.

### Deleting a track:

- A track with mostly bad detections or that is otherwise unuseful can be completely removed using the delete track button.
- In order to delete a track all that needs to be done is to select the track and then click the delete track button.
  - After this operation is completed the radio list will automatically update and the deleted track will no longer appear.

### Trimming a track:

- This interaction is useful for when most of a track is usable but there is a large section or sections that are faulty and should be removed..
- This interaction is done through four components:
  - The track radio list to select which track to trim.
  - Then the start and final frame inputs (along with their corresponding get start and get final buttons) to set the inclusive start and end frames for the section that needs trimming.
  - Finally, the delete section button can be used to actually execute the trim.

## Manual Annotation

Manual annotation comes in two main parts: adding a detection box and deleting a detection box. These are both operations that can only add or remove one box at a time and are primarily used for fixing small mistakes where add track or delete section may take too long for such a small result. The primary method of interaction for these operations is actually the current frame itself.

### Add Box:

- When adding a detection box it will be assigned to a player rather than a track. This means to add a detection box the player you want to add the track to must first be selected.
  - Each player has a hidden negative track id associated with them that these detections are added to. Performing a delete track operation on this negative track will completely wipe any manual assignments in the current video section.
- Now that a player has been selected a box can be drawn on them by clicking and dragging. Once let go the input will be taken in and the result will be automatically updated shortly thereafter.
  - It's inadvisable to try and draw or delete another box until the first one has finished.

### Delete Box:

- To delete a detection box simply click on the outline of the box to be removed and click on the Erase Active Shape button in the top right corner of the image.
  - After the box disappears the id above the box will linger for a moment while the deletion is executed. A successful deletion can be inferred from the id also disappearing afterwards.

## Add Track

Add track is an operation that takes place across two pages. Here the first part (dashboard side) of the process will be explained.

How to use:

- Select the player that the track is to be assigned to.
- Then use the start and final frame inputs (along with their corresponding get start and get final buttons) to set the inclusive start and end frames for the section to add a track to.
- Finally, click add track which will generate a button to take the user to the add track page.
  - Of note, changing the information such as the frames or selected player will require the user to click add track again to actually record the information. Changing information and going to the next page without clicking add track again will not use any of the changed information.

Tips for use:

- Any individual detections created by add track will not be committed to the database if the player already has a detection assigned to them on this frame. This means that if there are multiple gaps in assignments to a player the add track can be used to fill in those gaps. This is achieved by creating a new track that covers the section with gaps. The new track won't overwrite the preexisting detections, however detections from the new track will be used to fill in the gaps.
  - Of note, this won't work if the tracks with gaps aren't assigned to the player beforehand. This only works by finding gaps in assignments to the player, so if the track isn't assigned then add track will just see one large gap and commit the track like usual.

## Add Track

**Bounding Box Submit Area**

Intended player is Hugo Lloris with jersey #1

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**Instructions (Part 1):**

- The video player is locked at the start frame until the tracker is finished running.
- Click and drag to draw an annotation bounding box around the intended player on the image.
- An already existing box can be interacted with by clicking on it's edges.
  - It can then be modified by dragging one of the corners.
  - It can then be deleted by clicking "Erase active shape" in the top right corner above the image.
- Ensure there is only one bounding box around the intended player.
- Click "Start Tracker" below and wait for it to finish running.
- Don't press the button while the tracker is running.
- Once the tracker is finished, proceed to the area below.

Start Tracker

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**Instructions (Part 2):**

There are now three primary options for using the detection track:

- If there are no errors with the detections you can click "Save Detection Track" to finish.
- If part of the track is correct you can input a start and end frame below before saving the detection track to only save the frames within that window.
- If you'd like to remove the detections all together and start over you can reset the tracker and try again.

Start ⌵ ⌶

Final ⌵ ⌶

Set Start Frame

Set Final Frame

Save Detection Track
Reset Tracker
Quit

Current Frame Number: 203

50 ◀◀
10 ◀◀
◀
▶
▶▶ 10
▶▶ 50



# Layout

## Video Player Card

The video player card is everything contained within the large, leftmost card on the screen. More specifically, the video player card includes:

- The assigned/unassigned track box toggles
- The image in the center
- The slider at the bottom
- The play/pause and other navigation buttons at the bottom

Generally speaking, this part of the application is used to:

- Navigate the video
- Draw the box to initialize the tracking algorithm

## Bounding Box Submit Card

The track card is everything contained within the rightmost card. More specifically, the submit card includes:

- The name and jersey number of the player that was selected on the dashboard
- Instructions for how to start and use the tracker
- The button to start the tracker
- Instructions for how to review and use the output detections
- A start and final frame input
- A button to save the detection track
- A button to reset the tracker
- A button to quit back to the dashboard

Generally speaking, this part of the application is used to:

- Submit the tracker box input
- Select a section of the track to save
- Save or reset the tracker
- Quit back to the dashboard

## **Interactions**

The interactions on this page are all intended to be done in a certain order detailed here.

### **Initializing the Tracker**

From first arriving on the page (or having reset the tracker) the interactions are very limited. The video player is locked to the first frame and during this time the following two actions are expected to be taken in order:

- First, a bounding box should be drawn on the image surrounding the player chosen on the dashboard page.
  - The name and jersey number of the intended player is displayed on the right card near the top.
  - For the most accurate results when drawing the box it should be relatively tight around the player and extend from their head to their feet.
  - In case of a mistake the box can be resized or deleted and redrawn before going on to the next step.
- Second, with only one box drawn on the screen click on the start tracker button and wait for the tracker to finish running.

### **Reviewing the Track Output**

Once the tracker is finished the video player is unlocked to allow for review of the newly created detection track. This allows the user to search for possible errors or discrepancies and aid in the decision to keep all the track, a section of it, or reset it and try again.

## **Accepting or Denying the Track**

Now that the tracker is finished three actions become available:

1. Accept all of the track
  - a. If the entire track contains valid detections then simply clicking save detection track will complete the add track process.
2. Accept part of the track
  - a. If only part of the track contains valid detections then inputting a start and end frame before clicking save detection track will only save detections within those frames and complete the add track process.
3. Reset the tracker
  - a. If the entire track is invalid or the user wants to try for a better detection track, clicking reset tracker will set the state of this page back to how it was upon arrival.

## **Returning to the Dashboard**

At any time clicking quit will immediately navigate the application back to the dashboard.

# AWS

## Elastic Beanstalk

### Configuration

#### Instance Type

We need a minimum of 2 vCPU and 4 GiB for the Pysot module in the “Add Track” page. We **currently** are going with the Compute Optimized “c5.large” instance. Found in the “Capacity” tab.

#### Instance Modification

Root Volume (boot device) is **currently** changed to a General Purpose (SSD) with 16 GB. This is subject to change as this is used for installation of the requirements as well as downloading the videos to the application “local” device. Found in the “Instances” tab.

#### Auto-Scaling

Auto-Scaling is used for creating and deleting instances to balance load when needed. Found in the “Capacity” tab.

A. “Manual” Auto-Scaling:

- a. **Currently** based on the load that is needed we are using a single instance.

Environment type

Single instance ▼

Instances

Min 1

Max 1

- b. When needing to scale up we can allow a “Load balanced” environment type to allow multiple instances to run at once.

Environment type

Load balanced ▼

Instances

Min 1

Max 4

- c. If we need to “turn off” the instances without terminating the environment, we can set the “Load balanced” environment to have 0 instances running.

Environment type

Load balanced ▼

Instances

Min 0

Max 0

## B. “Automatic” Auto-Scaling

- a. We can also set up automatic scaling at specific times. **Currently** have it to turn off all instances at 2AM EST and turn back on at 8AM EST. This automatic scaling allows the application to reset and avoid additional costs at times users won’t be on.

<input type="checkbox"/>	Name	Min	Max	Desired	Next occurrence (local time)
<input type="checkbox"/>	turnOnInstances	1	1	1	2021-08-09 08:00:00 UTC-0400
<input type="checkbox"/>	turnOffInstances	0	0	0	2021-08-09 02:00:00 UTC-0400

# Information for Future Teams

To run the whole application

- Download github repository
  - <https://github.com/lamMarkT/PlayerDetectionApp>
- Set up conda environment with the requirements file
- Navigate to within the file "PlayerDetectionApp"
- While in the conda env run application.py and then follow the dash link on the terminal and the app will open in a webpage.
  - Link should look something like <http://127.0.0.1:8080/>

Future Work

- AWS Algorithms need to be linked with the application
  - Algorithm names
    - Detection and tracking algorithm
    - Homography algorithm
  - These algorithms are currently set up but not fully implemented on the main AWS account.
- Upload page is started and in a decent place
  - The upload page is for creating an entry in the game table, populating the player rosters for each team and uploading a video to AWS to be converted to 15 fps.
  - Upload page may want to be moved/copied to the client side of the application.

Bugs

- Video player bug(s)
  - Multiple people using the dash video player can slow down the image fetch time.
  - Fetching images from the video that are past a certain size (about 630 KB) can cause the video player to backlog until paused.
    - Basically the video freezes while the current frame number continues to climb.