BALL AND PLAYERS TRACKING IN PADEL MATCHES VIDEOS

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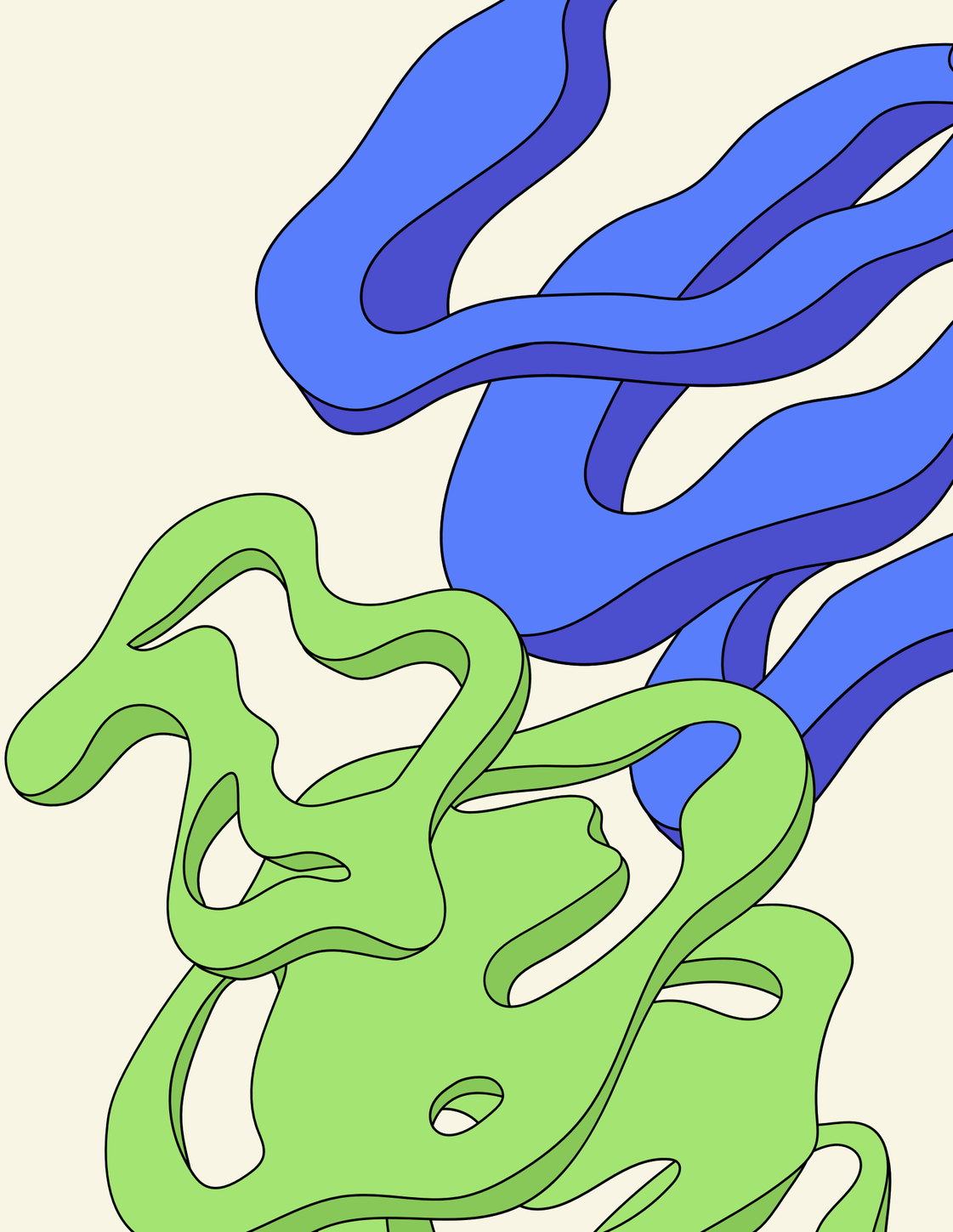

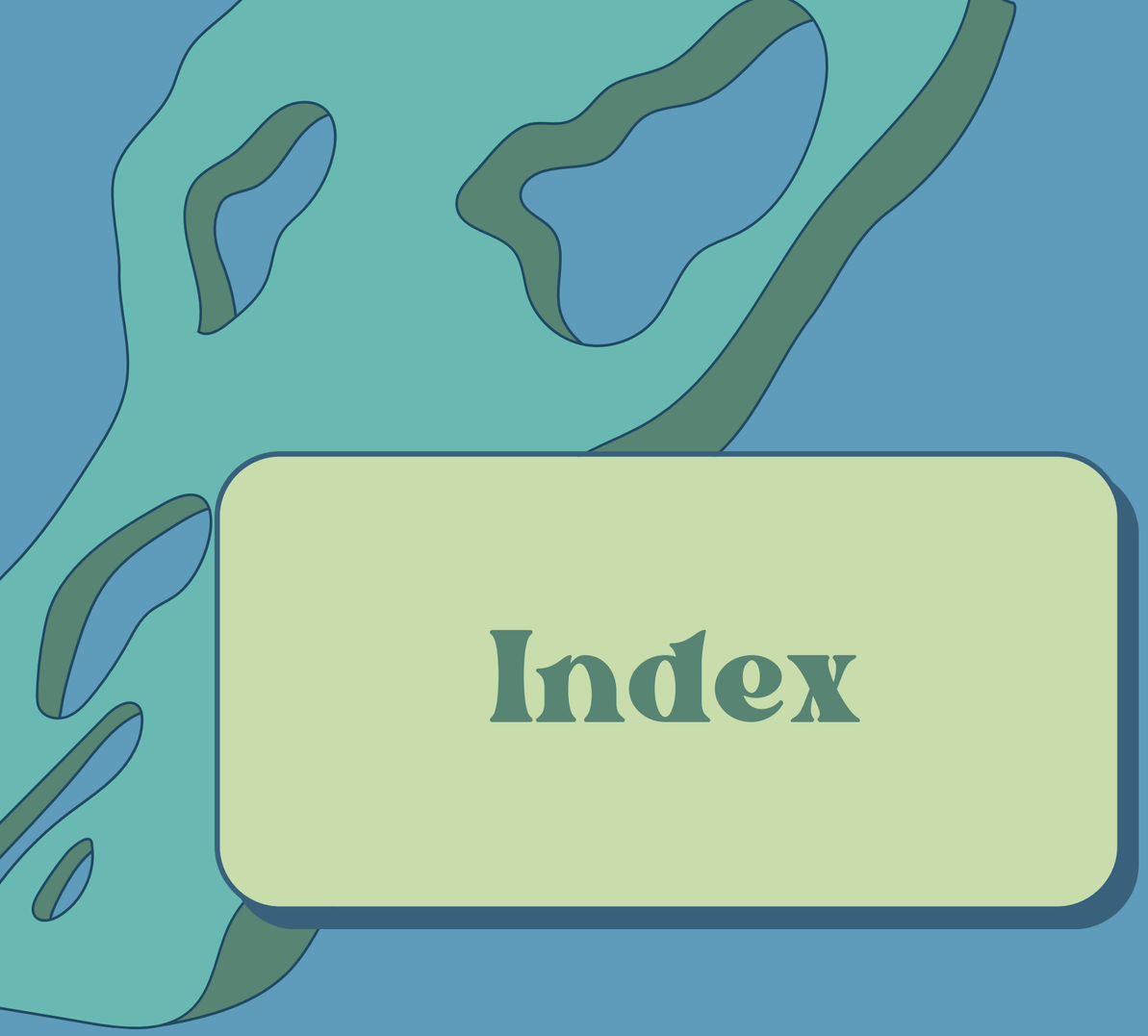

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Scope & Value

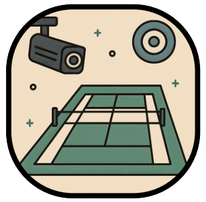
Target focus

Problem

Solution

Dataset

100,000 frames



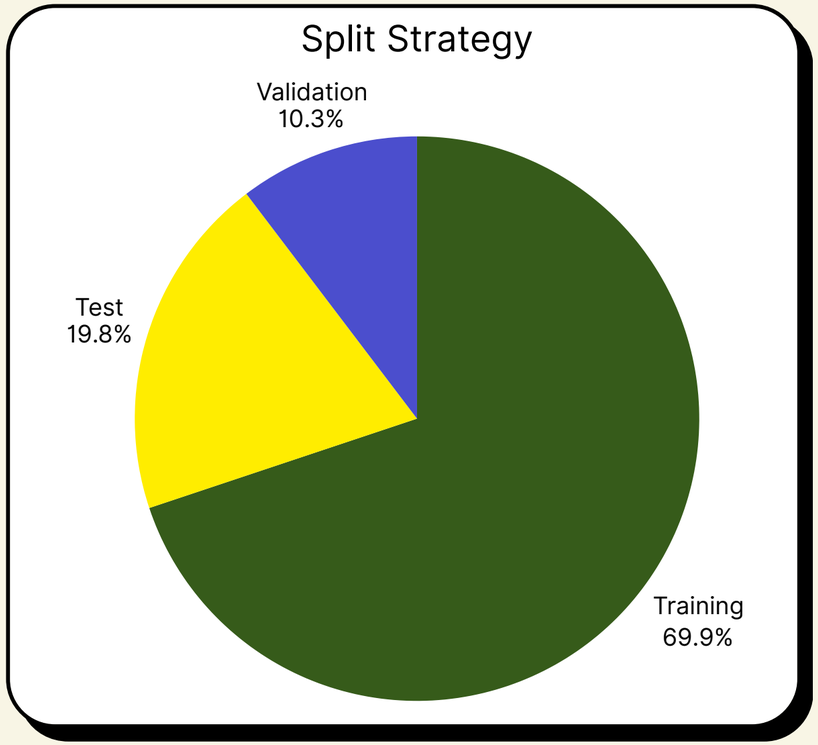
Single, fixed camera angle

Frame-level annotations

zenodo

PadelTracker100: A Dataset for Intelligent Player and Ball Tracking in Padel Sports

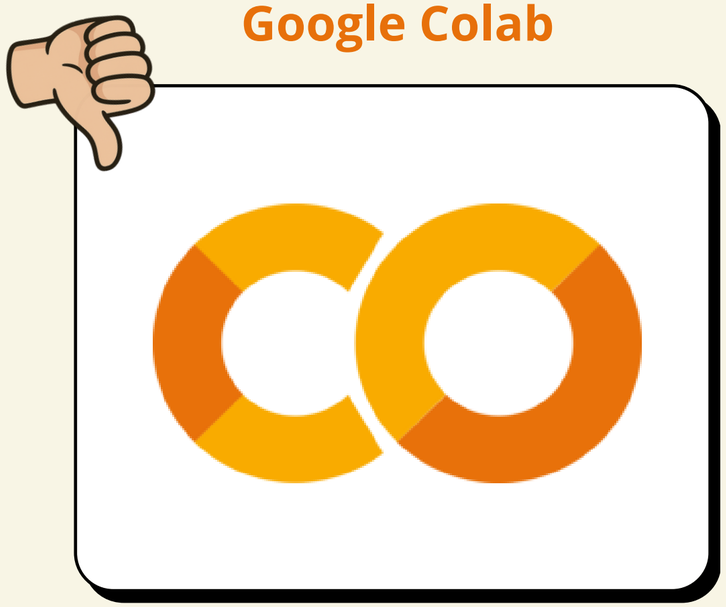
Author:	Bada-Nerín, Roberto; Paula Rodríguez; Kreibel, Denis; Teodoro Rodríguez, Joao Víctor; Pedrayes, Oscar D.; Usamentiaga, Ruben; Fontenla-Seco, Yago; Ben Lestón, Pablo; Rodríguez Trillo, Sebastián; Lozano García, Nicolás; Mosquera Bonasorte, Franco
Published:	2025
Source:	Zenodo



Hardware

Q: Where do we store and process this large amount of data?

Google Colab



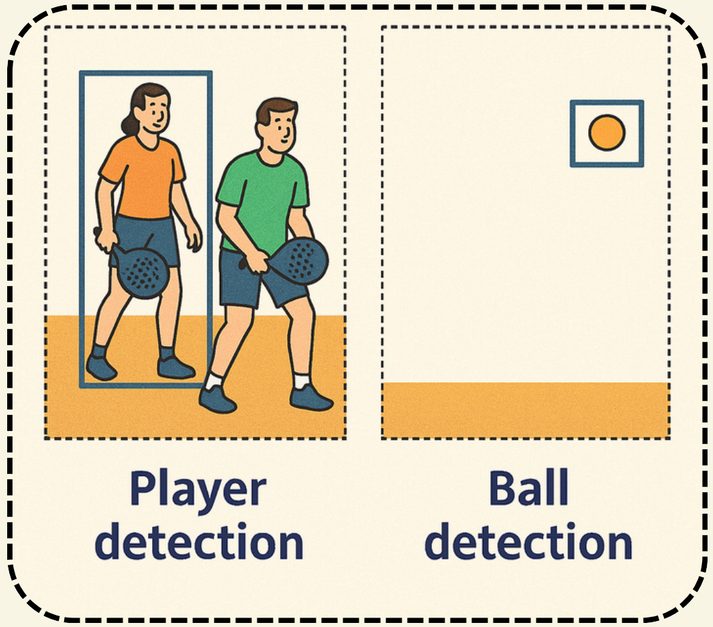
Limited disk storage capacity, GPU memory and runtime constraints

LINKS Asgard

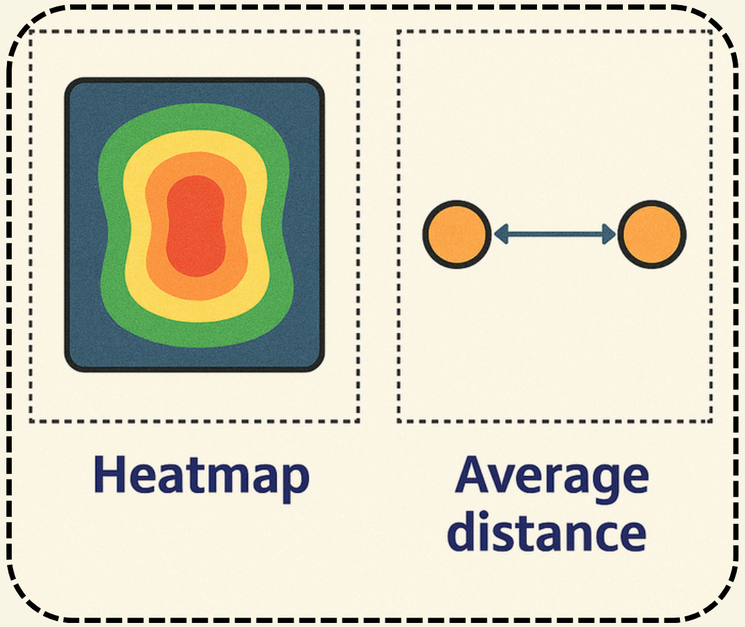
Large scale storage, dedicated high-memory GPUs, stable environment

Development

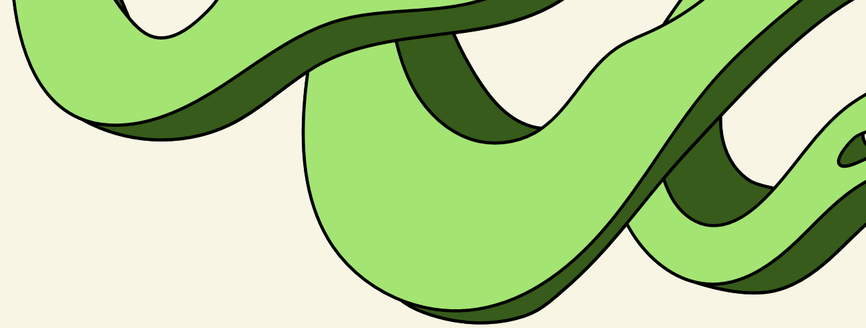
Models



Statistics



Models



1.Model selection based on our computational capabilities.

2. Inference: apply pre-trained model to the dataset.

3. Model comparison

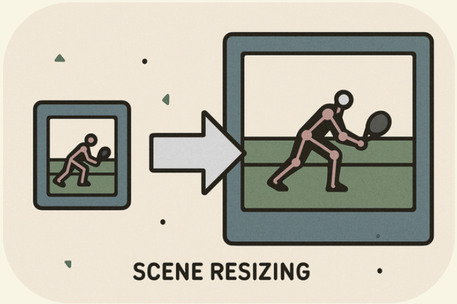
Recall: among all the actual positive cases, how many the model was able to find

Precision: among the cases marked as positive by the model, how many are actually correct

Models

yolo 11n
yolo 10n
yolo 9t

model comparison



640
960
1280

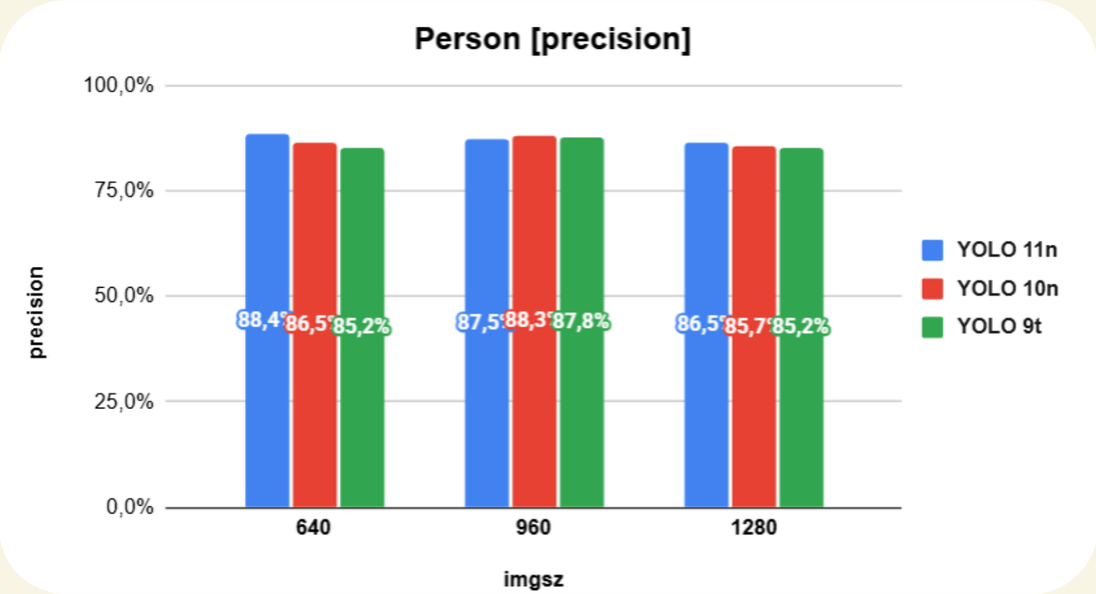
imgsz hyperparameter

What is imgsz?

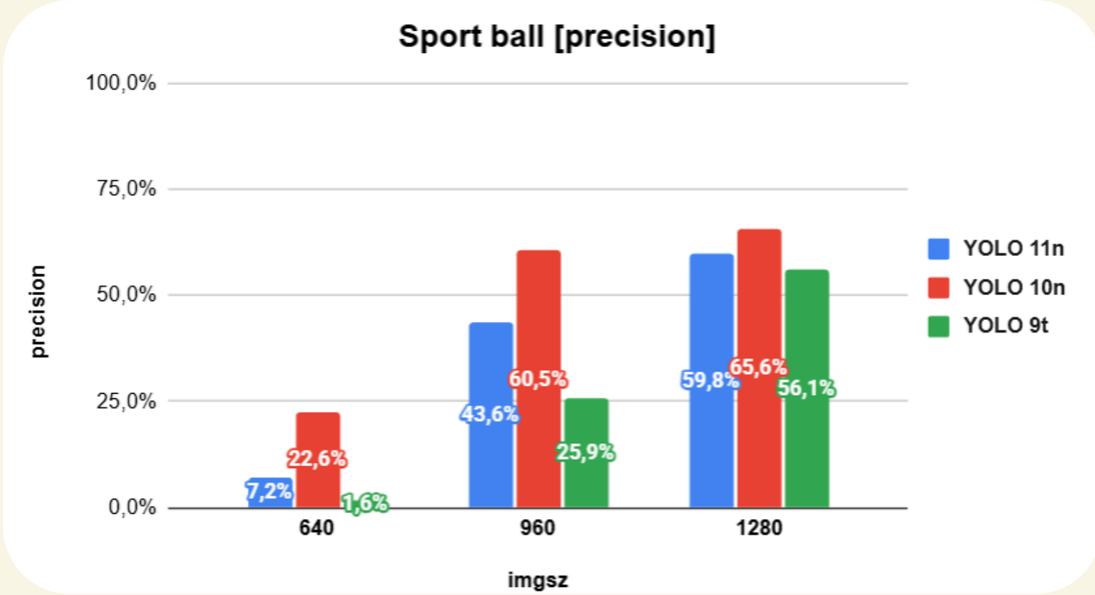
Defines the size to which images are resized before being processed by the YOLO model.

- Default value: 640 pixels
- Effect: Larger images = higher precision in detecting small objects, but greater memory usage and computation time

Effect of imgsz | Precision

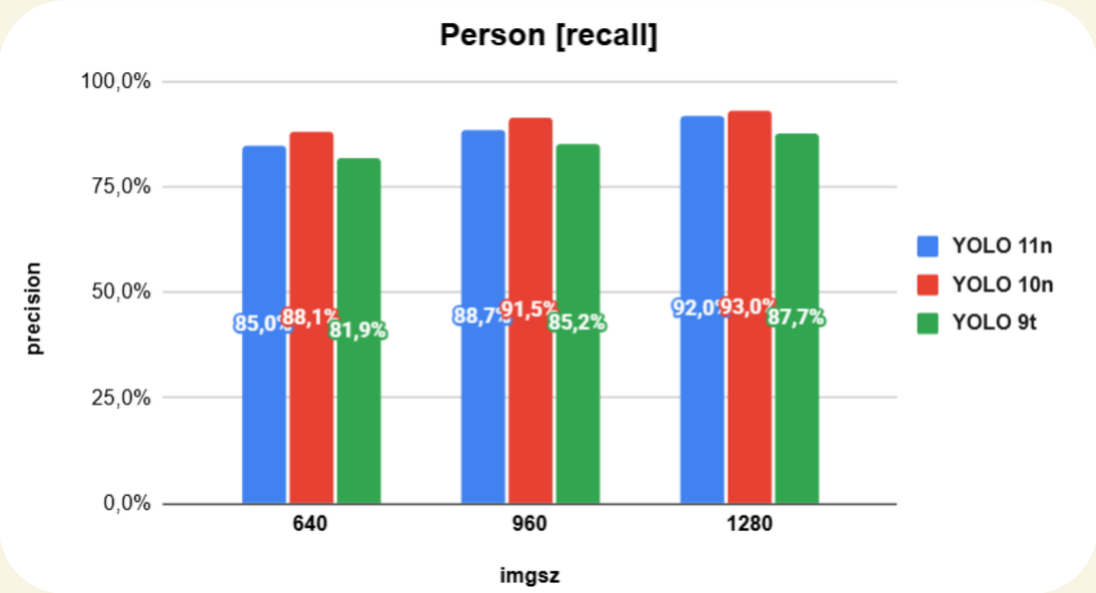


- All models maintain **high precision >85%** at all resolutions.
- The differences between the models are minimal; no clear winner emerges.

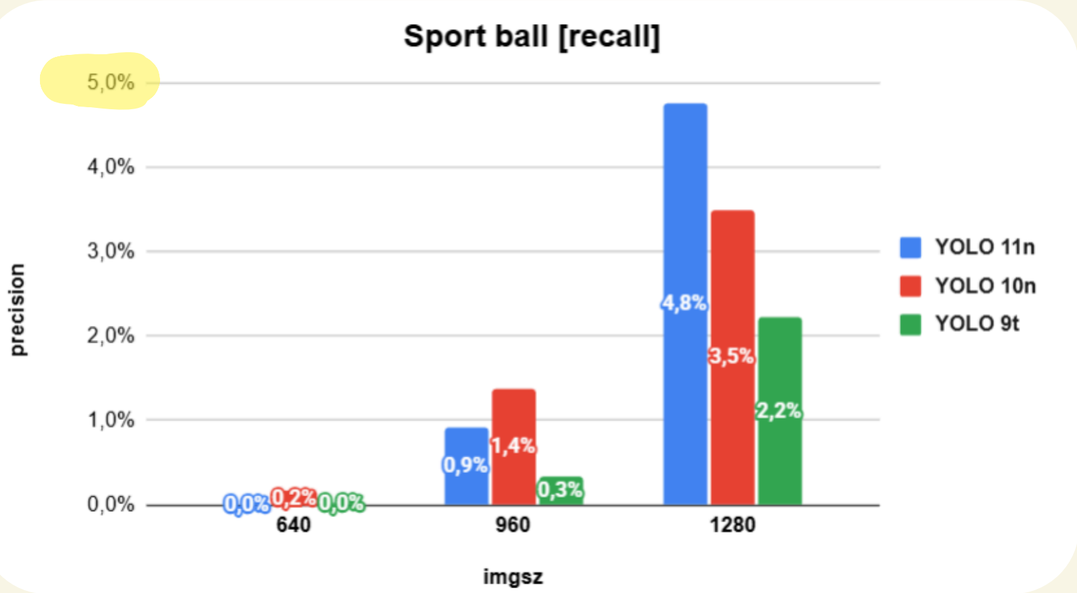


- **Precision increases as imgsz grows**.
- At imgsz = 1280, YOLO 10n achieves the highest precision on sport ball objects.

Effect of imgsz | Recall



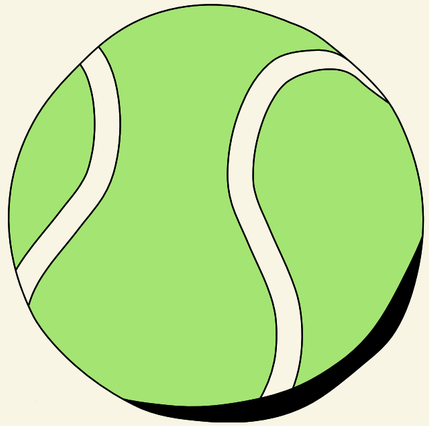
- All models maintain high **recall >80%** at all resolutions
- YOLO 10n at imgsz = 1280 achieves the highest recall
- The recall gain compared to imgsz = 640 is about 5 percentage points



- Results are **very poor** for all models and resolutions (**<5%**)
- At imgsz = 640, recall for sport ball is insignificant
- Recall improves as imgsz increases, but remains very low overall

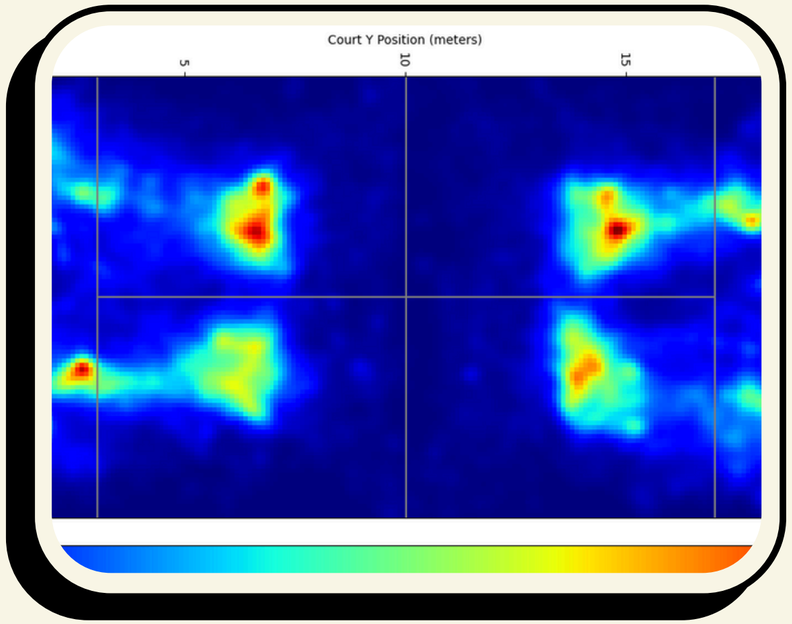
Performances

Results are already **very good** for both **precision** and **recall**. What we expect from fine-tuning is to achieve near-perfect performance on this class.

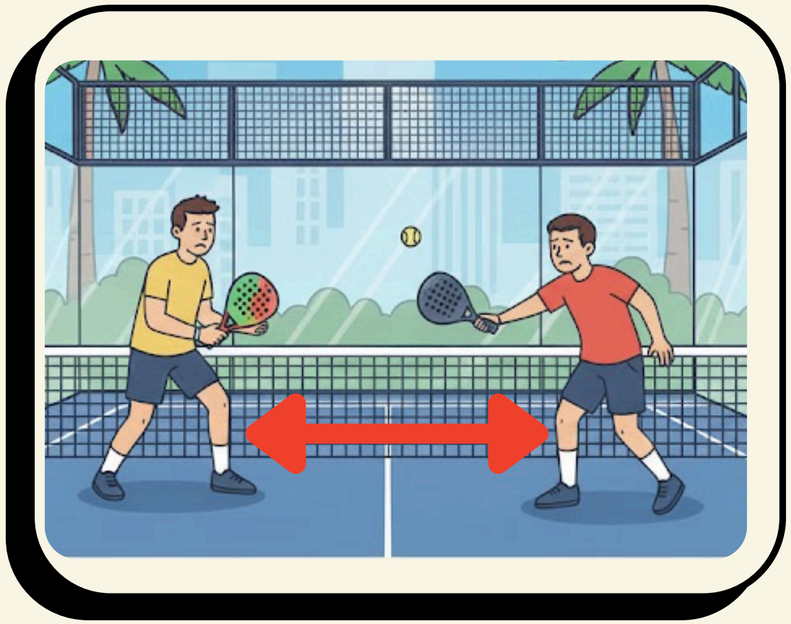


Precision results are **moderately good**, but **recall** remains **insignificant**. Our expectation is that fine-tuning will substantially improve recall.

Output Statistics



Heatmap

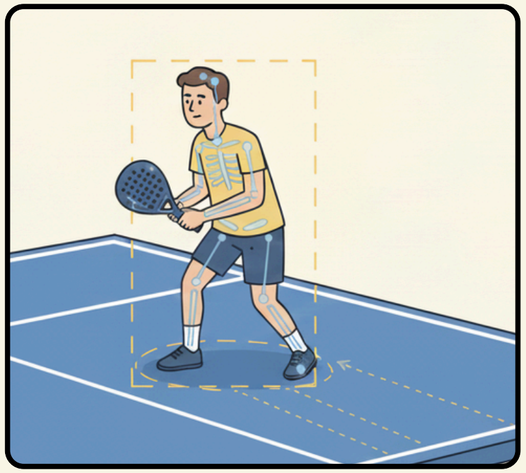


Avg. Distance

Challenges

- **Missing Detections**: This occurs when the object detection model fails to locate one or more players in a frame (due to occlusion, blur, etc).
- **Non-Continuous Video Processing:** In order to have a single-camera, fixed point of view, many portions of the original match recording have been cut.
- **Background Noise:** Sometimes more than 4 players are located in a single frame, this because figures in the background such as spectators, coaches, etc are labeled as players by the model.
- **Field Switch:** In padel, players switch sides of the court after the 1st, 3rd, and every subsequent odd-numbered game in a set.

Possible Solutions



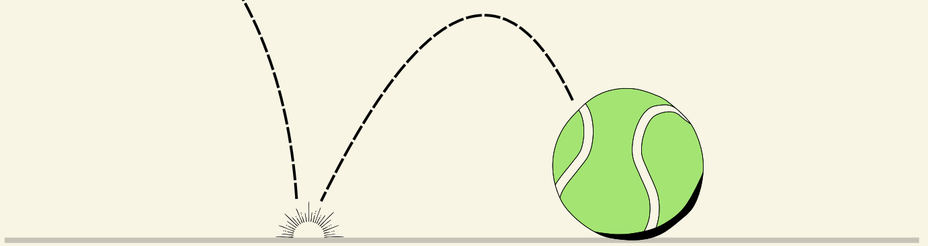
- **Rally-based Player Tracking**
- **Noise filtering through on-field projection**
- **Manually confirm field switches**

Next steps

Fine-Tune the pre-trained model (YOLO) to improve its performance within the context of a padel court.

Compare the results of the fine-tuned model with the benchmark obtained by standard pre-trained model.

Unify the pipeline in order to get the final statistics from the raw input video.



Management

Models

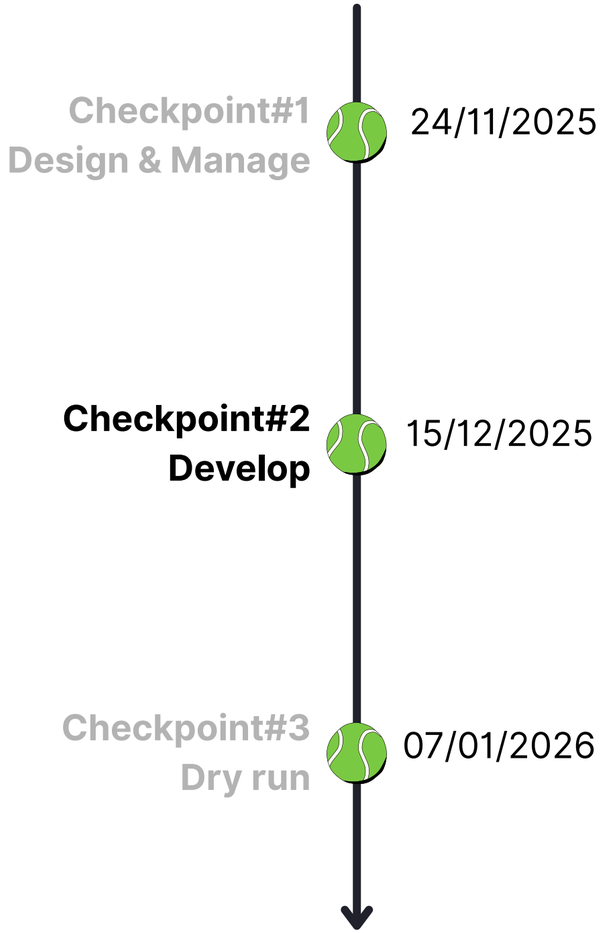
Worked on the model’s development.

Communication

Took care of the presentation’s structure and of the dataset split.

Output statistics

Worked on the statistics and output creation.



Thank you!

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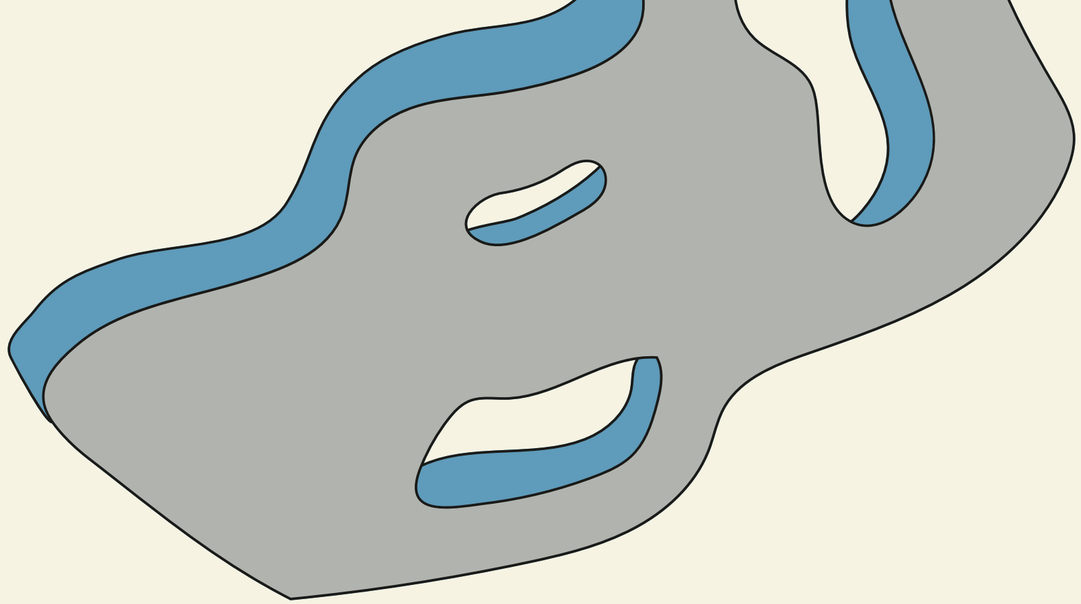

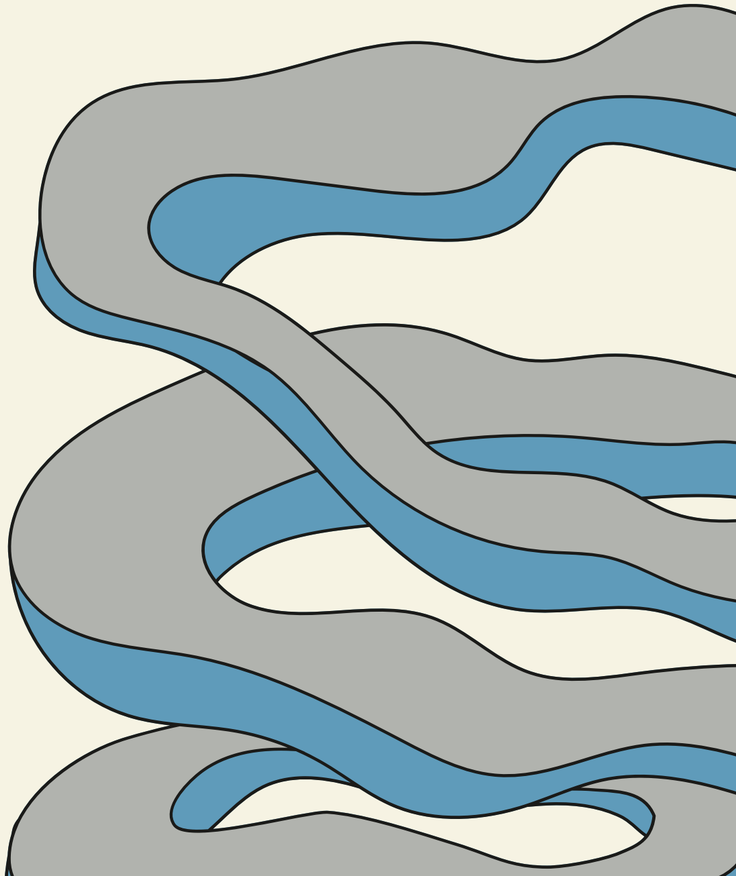

Appendix

SDG Goals