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Faculty of Information & Communication Technology
Department of Artificial Intelligence

Data Gathering & Annotation

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Quick Introduction...

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What is Data Gathering?

The process of **collecting raw information** from various sources e.g., cameras, sensors or online datasets)

In AI projects, this step provides the **foundation for model training**.

What is Data Annotation?

The process of **labelling collected data** to **give it meaning and structure** for machine learning.

Each data sample is **tagged with relevant information** (e.g., bounding boxes, categories, or attributes).

Or More Simply...

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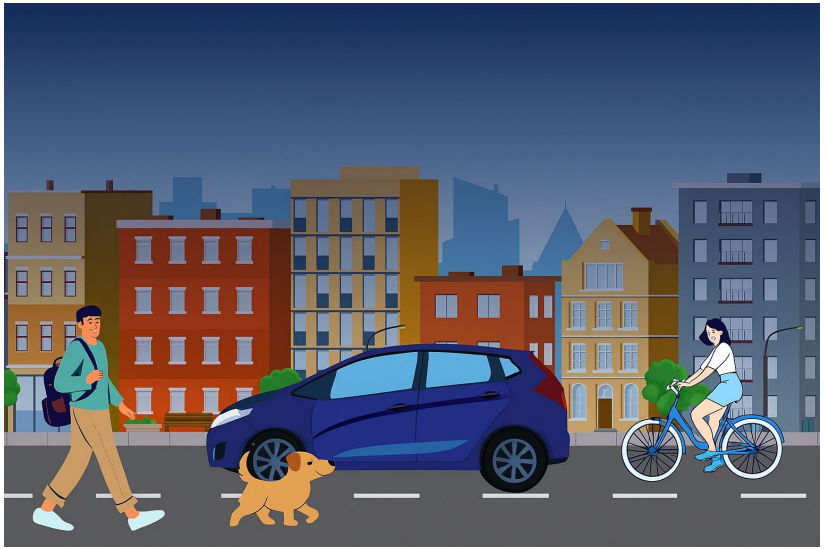
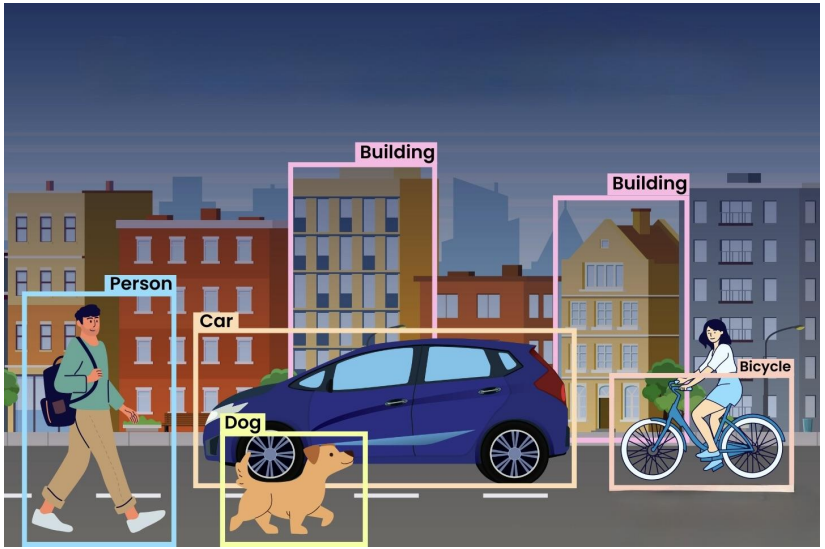
Data Gathering



Sourced from: www.projectpro.io/article/data-annotation-in-ai/1154

Data Annotation



NB: This is an incomplete annotation - not all buildings/people are annotated.

Types of Annotation

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1. Image Description

Provides a textual summary of the image.

Common in captioning datasets (e.g., “A red stop sign on a rural road”).

2. Box Annotation

Uses bounding boxes to mark specific objects.

Essential for object detection tasks (e.g., locating traffic signs).

3. Segmentation

Divides the image into pixel-level regions.

Used for precise object boundaries (e.g., segmenting a road sign’s exact shape).

4. Keypoint & Landmark Annotation

Marks specific points of interest (e.g., facial features, joints, or pole mounting points).

Good vs Bad Annotation

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Bounding boxes **TIGHTLY FIT** around objects.

Correct labels are applied.

Consistent style across images (same criteria, naming, and labelling precision).

All visible instances are annotated - none are missed.

Why This Matters?

Poor annotation leads to misleading training data, causing models to learn incorrect patterns and perform unreliably in real-world conditions.

Annotation platforms

What are Annotation Platforms?

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Annotation platforms are **software tools** designed to label and manage datasets for ML.

They allow users to **draw boxes**, masks, or keypoints on images, assign class labels, and **export data in standard formats**.

These platforms streamline the process of preparing high-quality, structured data for training CV models.

Examples:

- Label Studio, CVAT (CV Annotation Tool) or Roboflow

NB: For your assignment, you must use Label Studio.

Export Annotation Formats?

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COCO Format

- Stores *images*, *annotations*, and *categories* in one file.
- Used by YOLOv8, TensorFlow, etc.

YOLO Format

- One `.txt` per image: `class x_center y_center width height`.
- Compact, normalised (0–1), ideal for real-time detection.

Label Studio / JSON

- Keeps full metadata and attributes.

Conversion

- Libraries like **Ultralytics** or **custom scripts** convert between formats.
- **Always check coordinate systems after conversion**.

```
{
      "id": 3,
      "image_id": 2,
      "category_id": 1,
      "bbox": [
        124.06,
        86.66,
        90.61,
        85.87
      ],
      "area": 7780.68,
      "iscrowd": 0,
      "attributes": {
        "view_angle": "Front",
        "mounting": "Pole-mounted",
        "condition": "Good",
        "sign_shape": "Circular"
      }
    }
```

(COCO Annotation Sample)

Gathering Good Data

Good vs Bad Data Gathering

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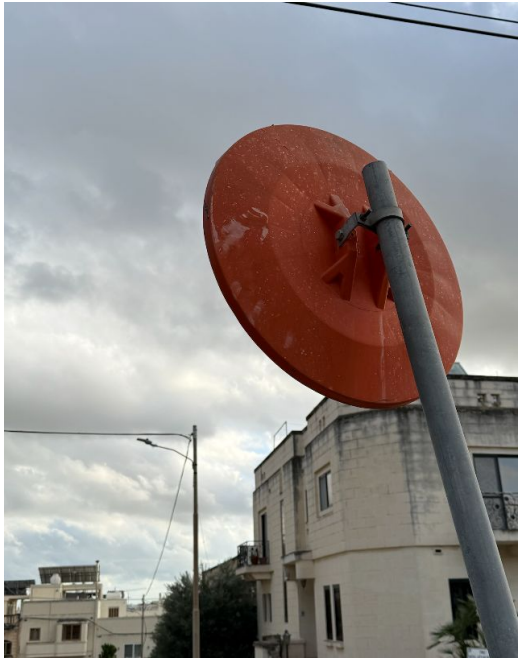
Front

Side



Back

Good vs Bad Data Gathering

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Front

Side

Back

Case: Sign not installed correctly

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Front

Side

Back

Case: Sign not installed correctly

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Front

Side

Back

Case: Sign not installed correctly

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Front

Side

Back

Poor data gathering, such as capturing visible number plates or unclear sign views, violates GDPR standards and reduces dataset quality. Signs should be clearly visible (even if not centred).

Setting-Up Label Studio

Please follow the demonstration.

Getting Started: Installation

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Ensure you have Python (up to version 3.12) & pip/brew installed on your system.

For more information visit: https://labelstud.io/

Step 1: Create a New Project

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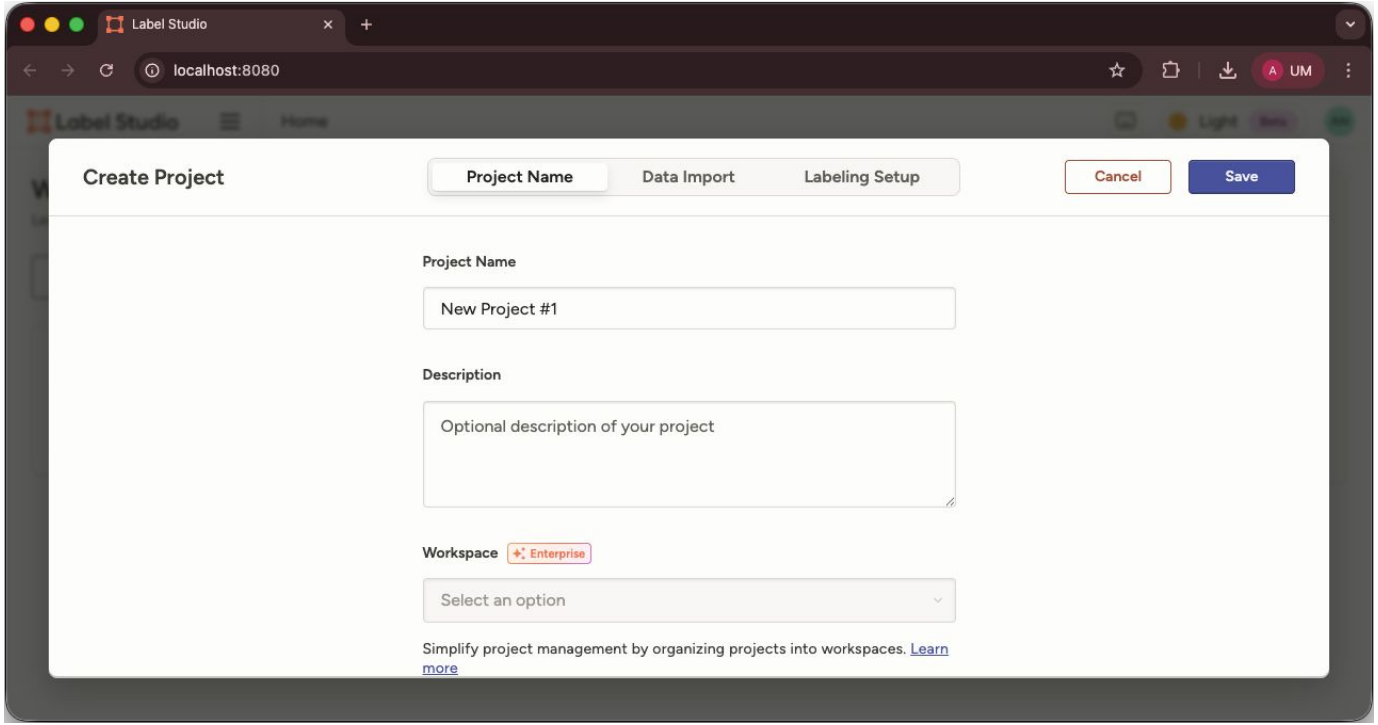

After starting Label Studio (at http://localhost:8080 - by default), click "Create Project".

Step 2: Import Your Data

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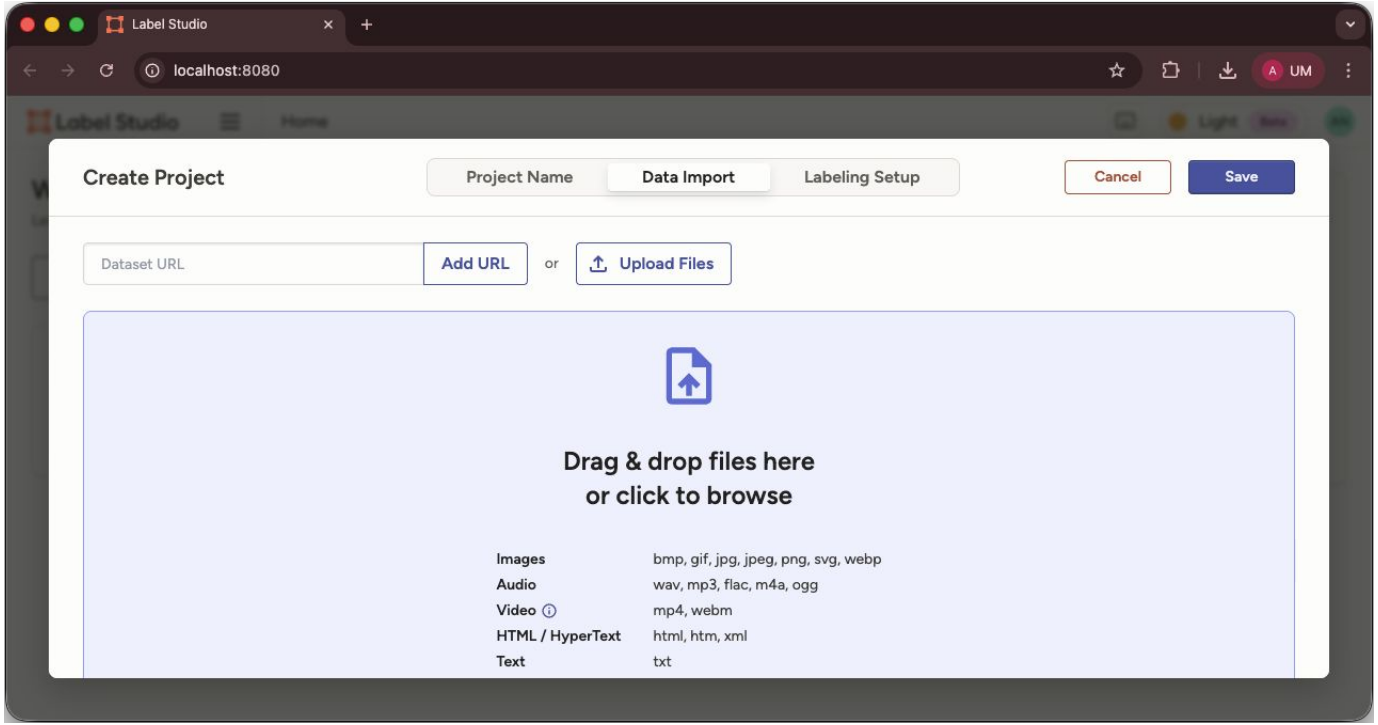

You can upload files (images, text, CSVs) directly from your computer, or you can connect to cloud storage.

Step 3: Set Up Labeling Interface

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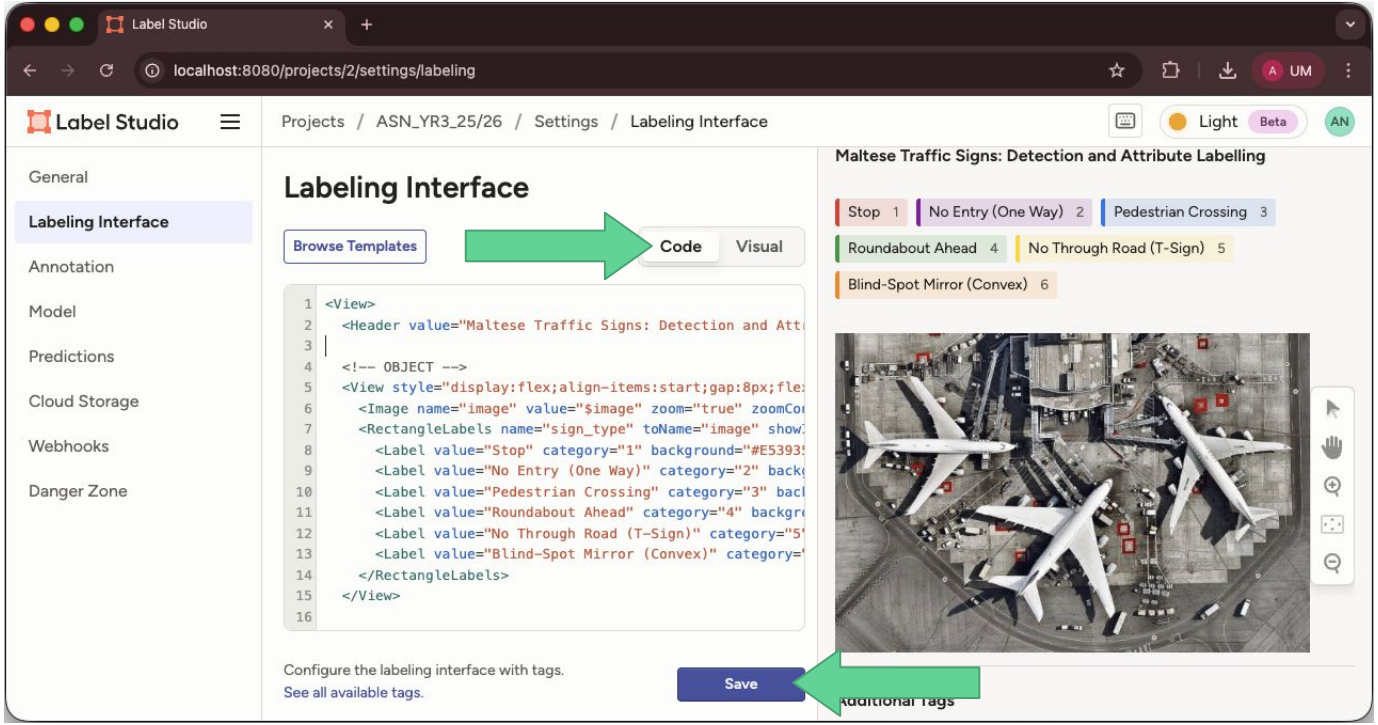

For your assignment, the XML file will be provided to you.

Step 4: Start Labeling

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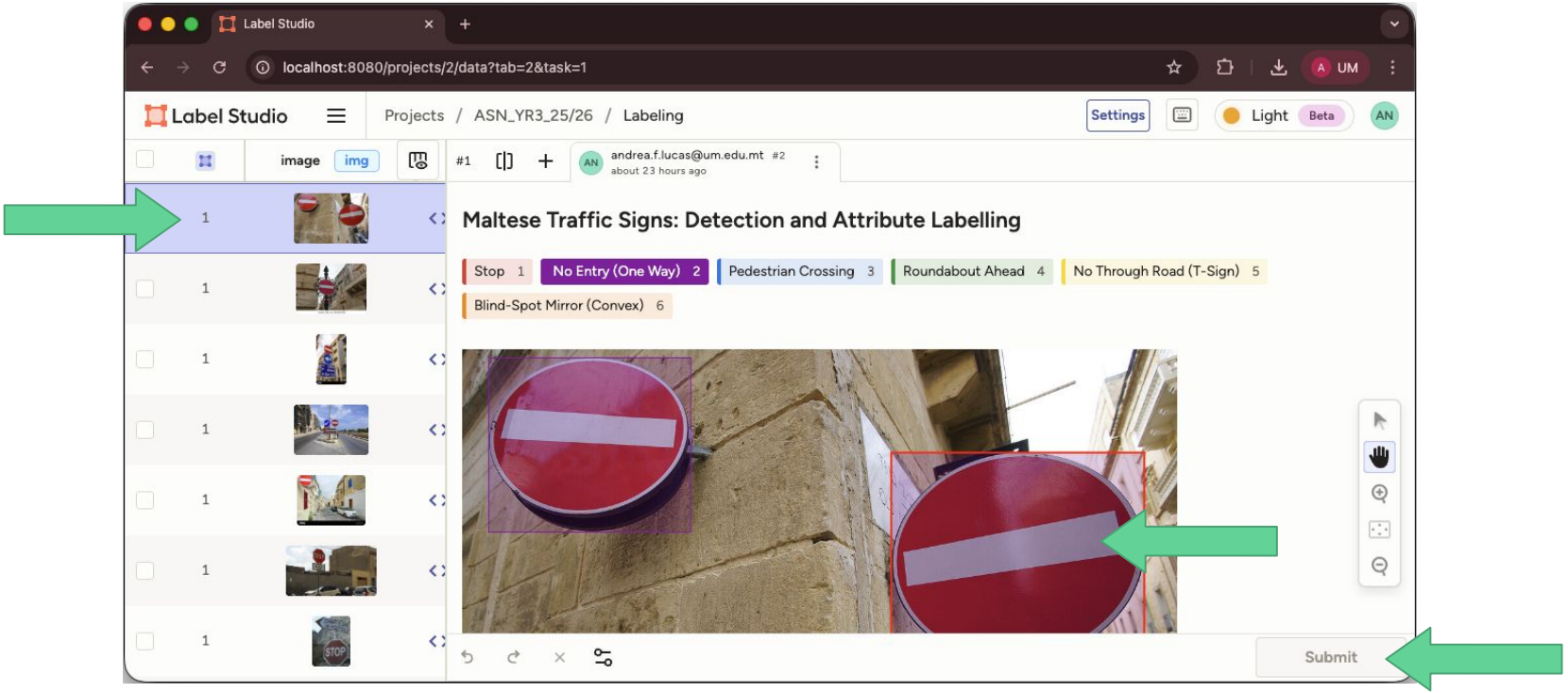

Click "Label All Tasks" from the project dashboard begin. Select your labels (e.g., click "No Entry") and press "Submit".

Step 5a: Export Your Annotated Data

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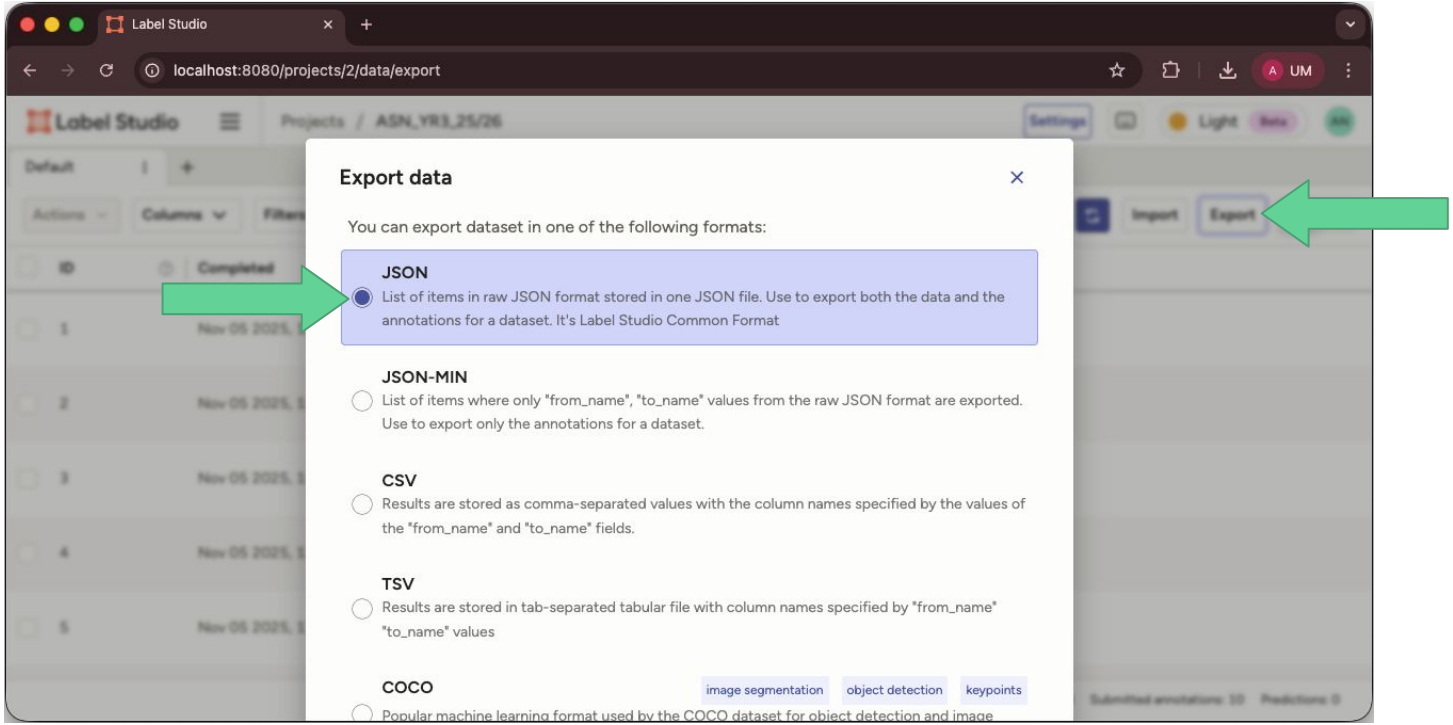

Once you've labeled your data, click the "Export" button on the project page & choose your desired format.

Step 5b: Export Your Annotated Data

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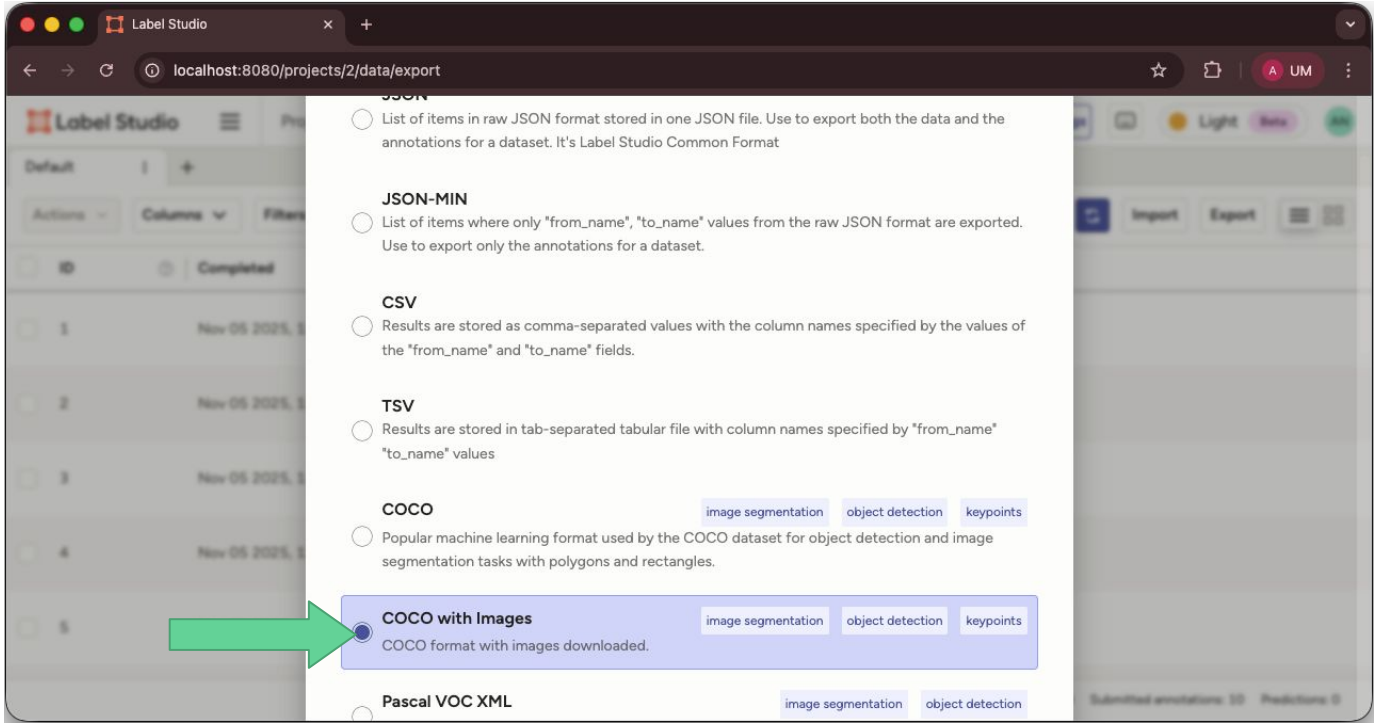

Scroll down and export using 'COCO with Images' to get the updated image filenames.

Important for your assignment: you need JUST the images folder from the COCO (with images) export and the JSON file from the Label Studio JSON export. Please follow the provided notebook carefully for the conversion to work correctly.

Step 6: Convert Annotations

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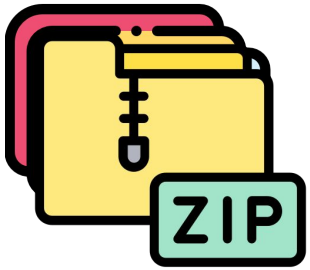
Input

JSON Export



Images Folder as .zip from COCO with Images

Conversion Script

Output

COCO.json

[sign_attribute].json

NB: Use the provided Jupyter notebook with the JSON annotations and corresponding images (as a .zip file) to generate the assignment's COCO-format annotations.

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Any Questions?

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Further Reading & Resources

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- https://labelstud.io/
- https://roboflow.com/
- https://www.cvat.ai/
- https://www.youtube.com/watch?v=R1ozTMrujOE *(Label Studio Tutorial)*
- https://blog.roboflow.com/how-to-use-label-studio/
- https://labelstud.io/learn/getting-started-with-label-studio/
- https://blog.roboflow.com/yolov11-how-to-train-custom-data/