FISH ANNOTATION REVIEW TOOL

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INDEX

Introduction

This tool is designed to assist users in reviewing annotations of fish images that were developed using machine learning algorithms. The tool displays detailed information such as bounding box coordinates, class labels, confidence scores, and track IDs. The tool can be executed on a desktop or a laptop. It can upload CSV files generated by programs such as Video and Image Analytics for Marine Environments (VIAME) [the link of VIAME- https://www.viametoolkit.org/]. The tool allows the user to manage and update several features of annotation, which will be described below.

Purpose of the GUI

Detecting and classifying fish underwater can be challenging, even with the use of advanced models. Inaccuracies in annotation can significantly affect habitat analysis and evaluation. To enhance model accuracy, it is essential to meticulously review and correct annotations. The Fish Annotation Review Tool serves this purpose by allowing users to efficiently and accurately review annotations for fish in various images. It is specifically designed to support the Active Learning model, as such models require human intervention to provide feedback during the training process

Key Features

Filter Options	Customizable filtering options based on Class Labels, Confidence Thresholds, and Track IDs.
CSV Compatibility	Able to read CSV files generated by programs like VIAME.
Annotation Review	Easily review and verify annotations for each fish in the images.
Bounding Box Management	View and edit bounding boxes that highlight the location of fish in the images.
Class Labels	Check and modify the class labels assigned to each fish.
Create New Bounding box	Able to draw a new bounding box for a specific fish and add a class label with a confidence score of 1.
Delete Bounding box	Able to detect bounding boxes.
Track IDs	Able to manage track IDs for tracking individual fish across multiple frames or images. By selecting their ID's, all class labels belonging to this id can be changed easily.

This manual will guide you through the installation, usage, and features of the Fish Annotation Review Tool, ensuring you can effectively utilize it to improve the accuracy of your fish detection and classification models.

System Requirements

Operating System	Processor	RAM
• Windows 10 or later (64-bit operating system recommended)	• 1.6 GHz or faster processor	• Minimum: 4 GB • Recommended: 8 GB or more for better performance, especially if working with large datasets.

Installation

Prerequisites	• Python 3.x • PyQt5- PyQt5 is cross-platform GUI toolkit, a set of python bindings for Qt v5. • Pandas- Pandas is a Python library used for working with data sets.
Python IDE	You can choose any of the following- • Spyder • PyCharm • Visual Studio Code
Install Anaconda	• Download the Anaconda installer for Windows from Anaconda Downloads(recommended for managing Python environments and packages). • Run the installer and follow the installation instructions.
Install the required Python packages using pip / conda	• conda create --name myenv (conda environment name- myenv) • conda activate myenv (Activate the environment) • conda install python=3.12 • conda install pip • pip install spyder (spyder use as an IDE) • pip install pandas • pip install pyqt5

At the time of GUI development, these installed packages with specific versions are used-

pip	24.0
pandas	2.2.2
pyqt5	5.15.10
Python	3.12.3
spyder	5.5.4

CSV Files

The Fish Annotation Tool requires a CSV file to load images and their associated annotation data.

CSV File Structure

Figure 1 illustrates the column structure of the CSV file used for building the GUI:

Track ID	In column 1, the ID is used to track individual fish across multiple frames or images.
Image Name	In column 2, the name of the image file.
Bounding Box Coordinates	In columns 4 – 7, the coordinates of the bounding box for the fish.
Class Name	In column 10, the class label for each fish.
Confidence Score	In column 11, the confidence score for each detection.

Columns not listed here are not used in developing the GUI.

# 1: Detection or Track-id	2: Video or Image Identifier	4-7: Img-bbox(TL_x	TL_y	BR_x	BR_y)	10: Repeated Species	11: Confidence Pairs or Attributes
1	762101180_cam3_3	345.2744	286.3634	577.5318	373.78067	SERIOLAFASCIATA-170113	0.900234282
1	762101180_cam3_5	1.2566185	215.94844	268.31445	344.02942	LUTJANUSCAMPECHANUS	0.986200511
1	762101180_cam3_7	1294.6077	309.76044	1611.7527	443.23294	SERIOLAFASCIATA-170113	0.910572946
1	762101180_cam3_11	1530.4498	468.85135	1794.7771	552.7343	SERIOLAFASCIATA-170113	0.527241826
1	762101180_cam3_12	1418.1399	471.79782	1668.3049	552.3082	SERIOLAFASCIATA-170113	0.715265214
1	762101180_cam3_13	1331.1307	469.8145	1552.7457	547.18774	SERIOLARIVOLIANA-17011	0.547737956
1	762101180_cam3_15	310.2953	205.40387	591.85864	318.13327	SERIOLAFASCIATA-170113	0.605344415
1	762101180_cam3_16	149.9179	183.71423	501.02457	315.5429	SERIOLAFASCIATA-170113	0.829946697
1	762101180_cam3_17	6.228633	147.65768	348.95932	270.40894	SERIOLARIVOLIANA-17011	0.85142684
1	762101180_cam3_18	910.8174	482.17136	1083.3508	549.25476	SERIOLARIVOLIANA-17011	0.639284551
1	762101180_cam3_21	649.7868	493.40195	869.068	555.1185	SERIOLARIVOLIANA-17011	0.652411759
1	762101180_cam3_22	595.3829	487.95044	791.1824	557.8645	SERIOLARIVOLIANA-17011	0.554641485
1	762101180_cam3_23	505.9854	496.81754	707.68726	558.9194	SERIOLARIVOLIANA-17011	0.857947469
1	762101180_cam3_24	402.55347	493.4927	625.40234	570.6612	SERIOLARIVOLIANA-17011	0.601157606
1	762101180_cam3_27	120.76894	527.9669	332.11185	604.0329	SERIOLAFASCIATA-170113	0.539174914
2	762101180_cam3_27	188.7685	599.19037	411.1996	677.18524	SERIOLAFASCIATA-170113	0.534188032
1	762101180_cam3_30	485.70602	584.3723	693.188	657.7986	SERIOLAFASCIATA-170113	0.912707388
1	762101180_cam3_32	686.6566	573.44385	876.8183	641.9666	SERIOLAFASCIATA-170113	0.786720812
1	762101180_cam3_33	146.86119	596.1322	471.45944	725.9379	LUTJANUSCAMPECHANUS	0.821085989

Fig 1: Overview of the CSV File

Class Label Management

A single .txt file named **predefined_classes** contains all the species names. To add or remove species, you must edit this .txt file directly. Ensure that this file is kept in the same folder as the Python code to enable the species names to appear correctly in the GUI. Without this file in the correct location, the species names will not display properly in the application.

User Interface Overview

Main Window

The Fish Annotation Review Tool provides an intuitive interface to review and manage fish annotations.

Components (Figure 2)

Image Label	Displays the current image and supports custom context menus.
Image and Track Count Label	Displays the number of images loaded and related track id count.
Navigation Buttons	"Next" and "Previous" buttons for navigating through images.
Uploading CSV File Button	Button to upload a CSV file containing image data and annotations.
Merge Tracks Button	Button to merge tracks, a feature specific to managing annotations.
Image List Widget	List of images loaded from the CSV file.
Filter Areas	Scroll areas for class, confidence, and track filters.

Images and Annotations

1. Upload CSV
2. All images are generated from CSV.
3. Displays the image in the main area.
4. Displays image and track count.
5. Fish species are highlighted with bounding box, class label, and the confidence score.
6. Use the "Next" and "Previous" buttons to navigate

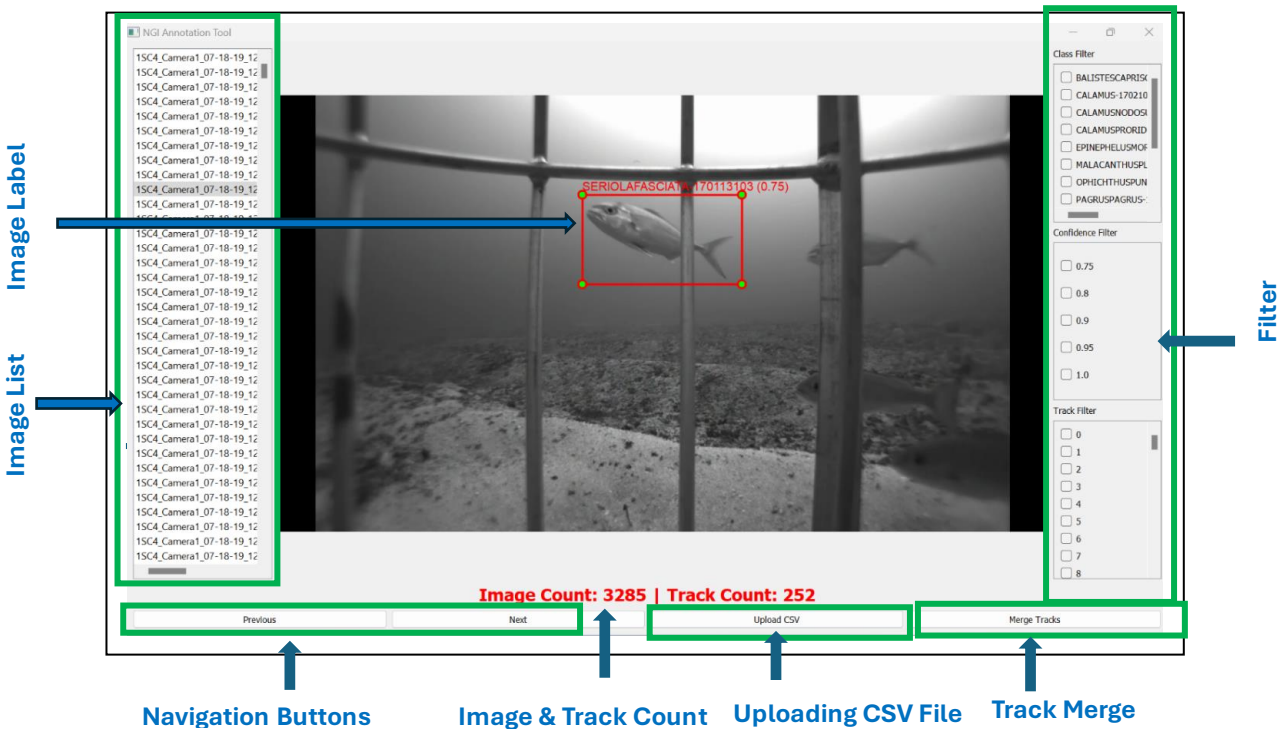

Fig 2: GUI of Fish Annotation Review Tool

Filtering Annotations

On the right-hand side, you will find filters for class, confidence, and track, stacked vertically.

Class Filter	Confidence Filter	Track Filter
Check or uncheck boxes to filter images based on the class labels of the fish species.	Use the checkboxes to filter images based on the confidence scores of the annotations.	Check or uncheck boxes to filter images based on track IDs.

Operations

Uploading the CSV File

1. Click on the "Upload CSV" button in the GUI.
2. Select the CSV file from your computer.
3. The tool will load all the images and annotation data from the CSV file.

Populating the Image List

After uploading the CSV file, the image list is populated on the left side of the GUI.

Populating Filter Options

After uploading the CSV file, filter options are populated. This method creates checkboxes for each unique class, confidence score and track id.

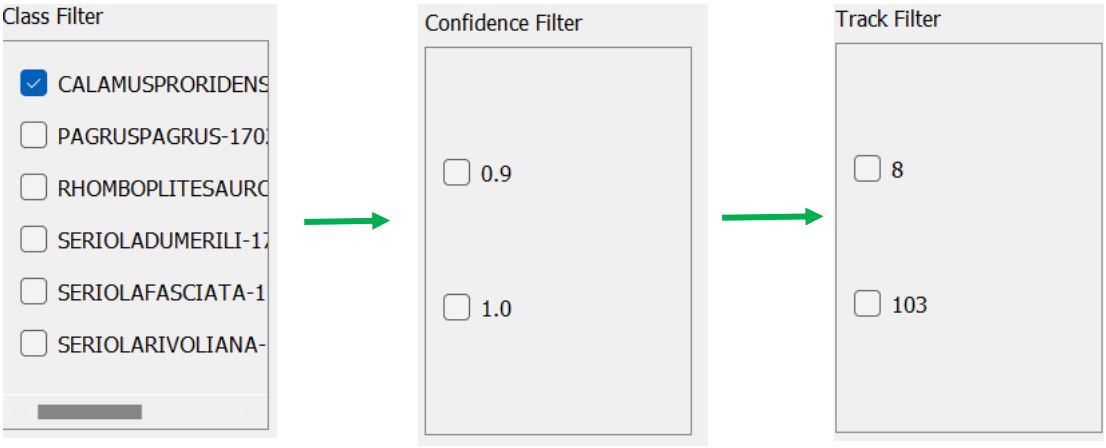

Fig 3: Confidence & Track Id are filtered based on the selection of class label

Applying Filter on Class Labels (Figure 3)

1. Select a class label for filtering images.
2. Choose confidence levels to filter resulting images based on the confidence scores.
3. Select track IDs to filter remaining images based on the track IDs.
4. The images that match the selected filters will be shown on the left side of the GUI

Dynamic Filter Update: Based on the selected class filter, the tool will dynamically update the available confidence and track filters. Only the relevant confidence scores and track IDs for the selected class will be displayed, allowing for more precise filtering

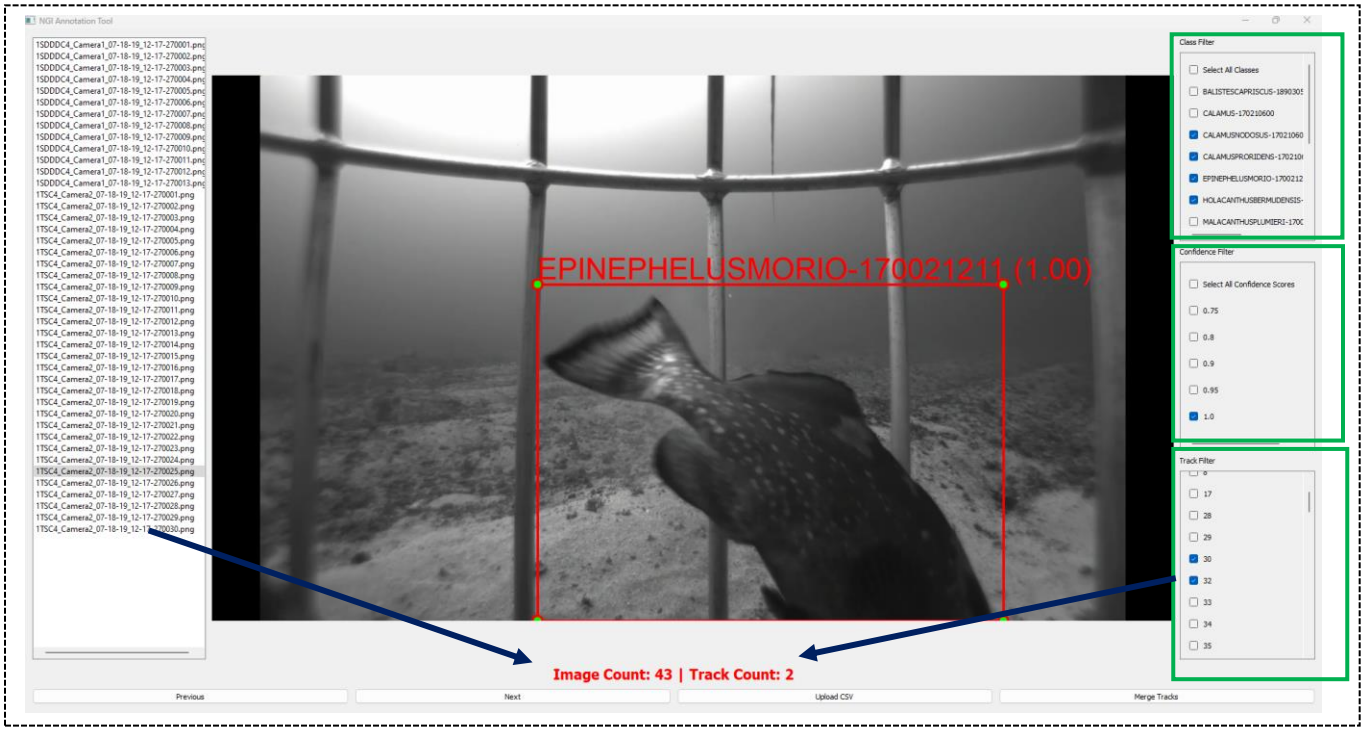

Fig 2: Display of fitlered images and counting of Image & Track

Example Workflow (Figure 4)

1. Check the box for a specific class label (e.g., "Seriolafasciata").
2. The confidence and track filters will update to show only the relevant options for "Seriolafasciata ".
3. Choose a confidence level (e.g., confidence scores above 0.8).
4. The list on the left will update to show only images of " Seriolafasciata " with confidence scores above 0.8.
5. Select a track ID (e.g., track ID 5).
6. The images displayed will now only include " Seriolafasciata " with confidence scores above 0.8 and track ID 5.

Applying Filter on Track IDs (Figure 5)

Track ID filtering (same as class label filtering) allows users to check if multiple fish species are present under a single track and identifes classes with low confidence scores for further review.

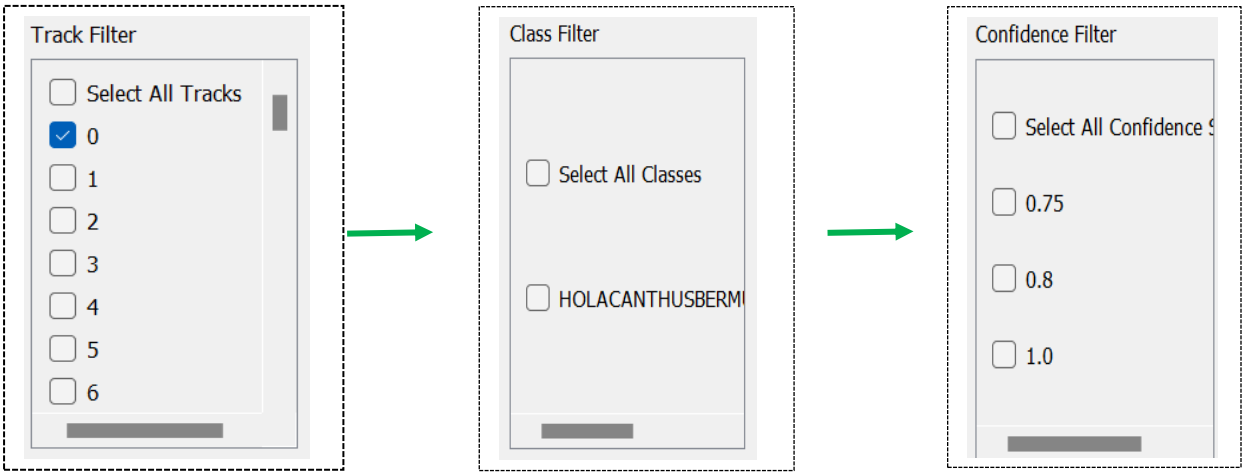

Fig 5: Class labels & Confidence score are filtered based on the selection of track id

Fig 6: Display of images and of Image & Track count

Image and Track Count (Figure 6)

The image and track count at the bottom of the displayed image will also update based on the applied filters. This provides an overview of the number of images and tracks that match your filter criteria.

Track Merge (Figure 7)

The Fish Annotation Tool includes a powerful feature for merging multiple track IDs into a single track ID. This is particularly useful when multiple track IDs represent the same species but need to be unified for better data consistency. This section explains how to merge tracks.

1. Select multiple track IDs from the track filter list that you wish to merge. For example, if track IDs 1 to 5 represent the same species and you want to merge them, select these track IDs.
2. Press the "Merge Tracks" button in the GUI.
3. The tool will merge all the selected track IDs into a single track ID. By default, the smallest track ID among the selected ones will be used for the merged track. For example, if track IDs 1, 2, 3, 4, and 5 are merged, the new track ID will be 1.
4. After merging, all images previously associated with the selected track IDs will now be under the smallest track ID (e.g., track ID 1).
5. The track filter will update to reflect the new, unified track ID, and the list of images on the left side of the GUI will display images with the merged track ID.

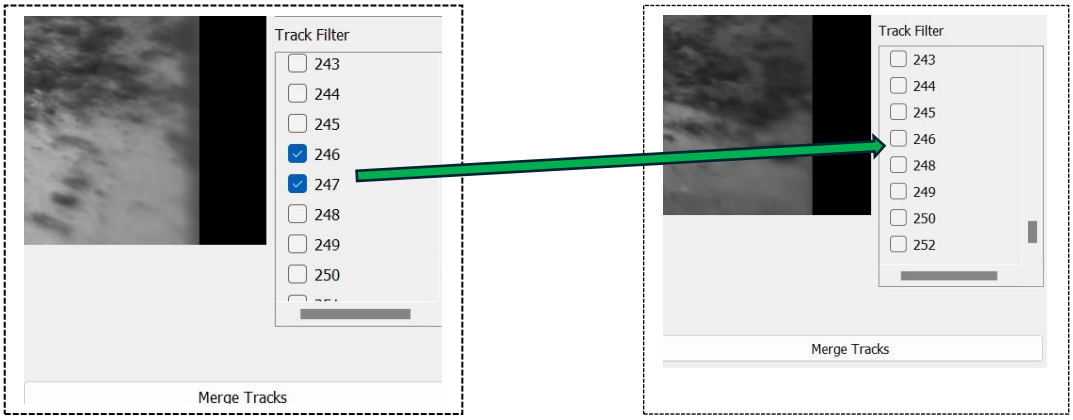

Fig 7: Procedures of merging track ids

Class Name Editing for Track IDs (Figure 8)

To change the class name for all images associated with a specific track ID:

1. Right-click on the image or track in the GUI.
2. Select Edit Class Name for Track ID.
3. Choose the desired track ID.
4. Select the new class name you want to apply.
5. Click OK to confirm the change.

Fig 8: Procedures of editing class name for track ids

Displaying Context Menu (Figure 9)

By pressing the right button of the mouse, there will be 4 options-

1. Edit Class labels
2. Edit Bounding Box
3. Add Bounding Box
4. Delete Bounding Box

Fig 9: Features of the GUI

Edit Class Labels

This allows you to easily change the class name (getting them from the predefined_classes.txt file) of a fish.

1. Right-click on the image and select the "Edit Class Labels" option.
2. Select between the two options:
   - " Edit Predefined Bounding Box Labels " for labels that are already saved in the GUI.
   - " Edit New Bounding Box Label " for labels that were just added and need to be updated.

Editing the Existing Bounding Box Label

1. Select "Edit Predefined Bounding Box Labels."
2. All existing class labels will appear in a drop-down box.
3. Update the desired class label by selecting it from the list.

Editing the Label of a Newly Drawn Bounding Box (Figure 10)

It allows you to edit the label of a newly drawn bounding box-

1. Right-click on the image
2. Select the "Edit Class Labels"
3. Select between the two options:
   - "Edit Predefined Bounding Box Labels"
   - "Select New Bounding Box Label."
4. Select the class which needs modification
5. Add the desired class label

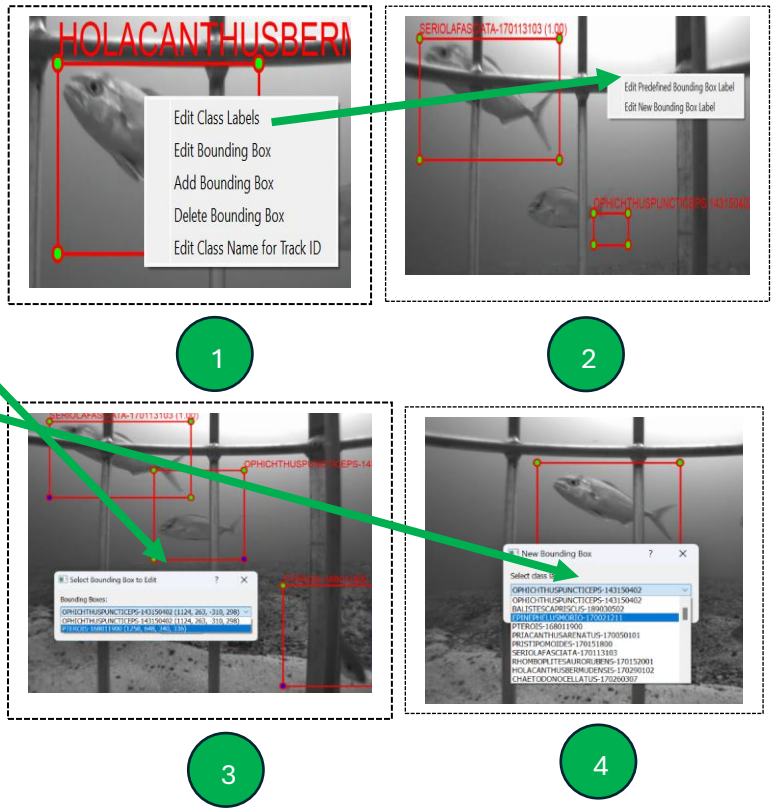

Fig 10: Procedure of Editing label for newly drawn bounding box

Edit Bounding Box (Figure 11)

Editing rectangles involves adjusting the size and position of bounding boxes in the GUI. This can be done for both existing and newly added bounding boxes.

1. Right-click on the image and select the "Edit Bounding Box" option.
2. Select between the two options:
   - "Existing Bounding Boxes" for boxes that are already saved in the GUI.
   - "New Bounding Boxes" for boxes that were just added and need to be repositioned.
3. Resize or Move the Bounding Box
   - To resize the box, click and drag the corners of the bounding box to adjust its size.
   - To move the box, click and drag the entire bounding box to the desired position.

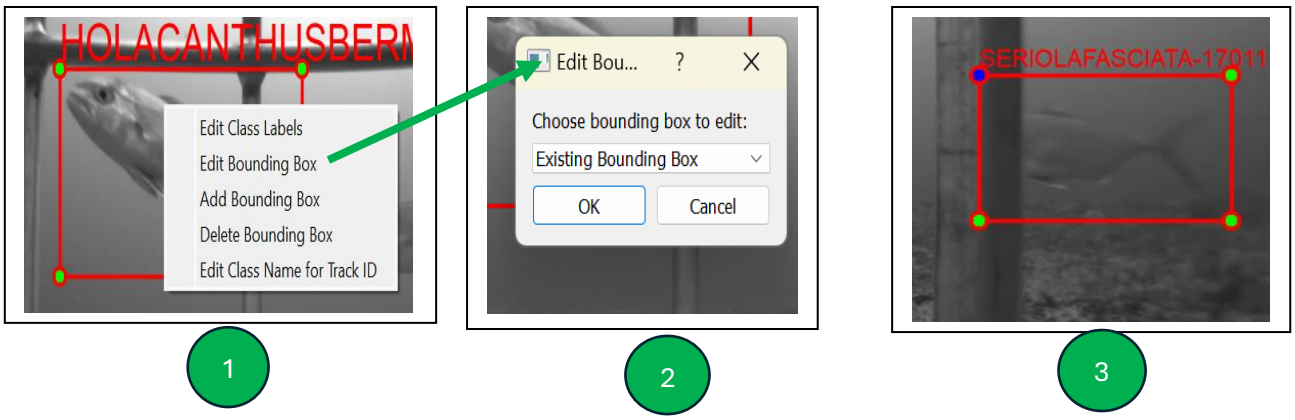

Fig 11: Procedure of editing bounding boxes

Add Bounding Box (Figure 12)

To draw a new bounding box and classify a specific fish-

1. Right-click on the image and select the "Add Bounding Box" option.
2. Draw a bounding box around the fish by clicking and dragging.
3. Choose the appropriate class label after drawing.
4. Confirm it by pressing "Yes" with confidence score 1.

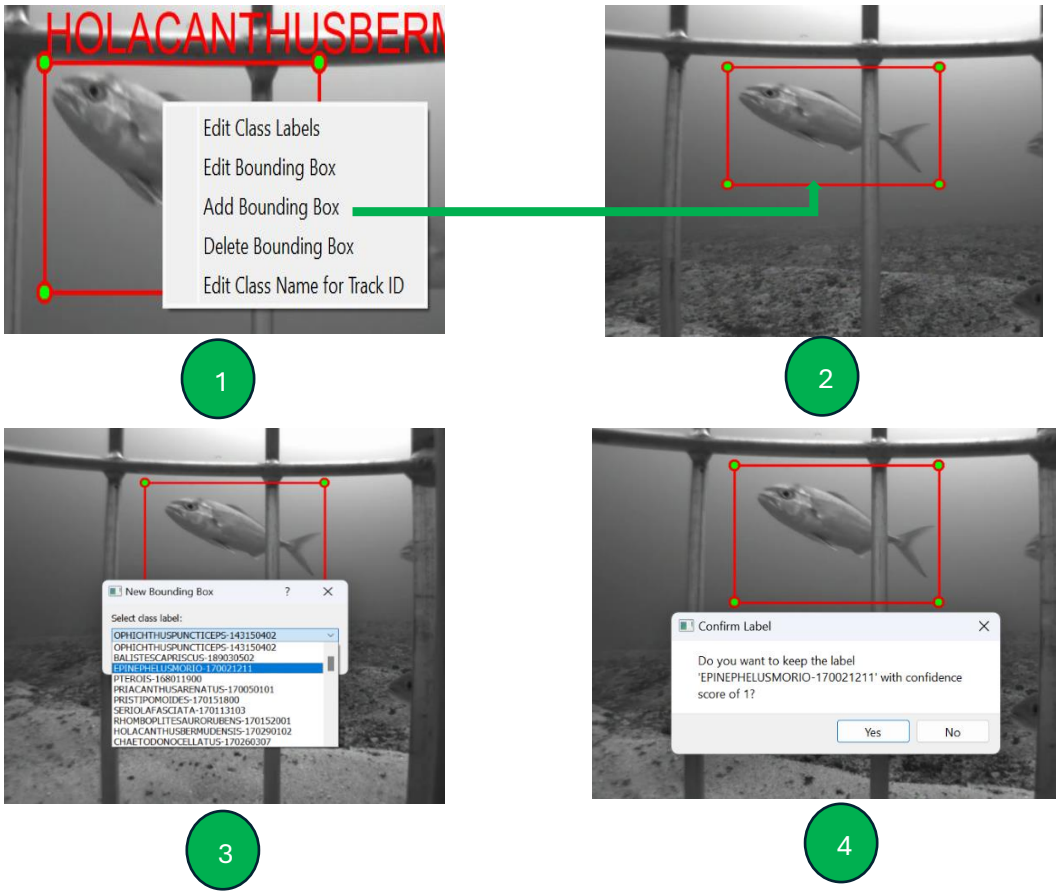

Fig 12: Procedure of adding new bounding box

Delete Bounding Box (Figure 13)

1. Right-click on the image and select the "Delete Bounding Box " option.
2. Select the Bounding Box
   - Choose the bounding box you wish to delete.
   - A confirmation option will pop up, asking if you want to delete the selected box.
3. Confirm the deletion by pressing "Yes

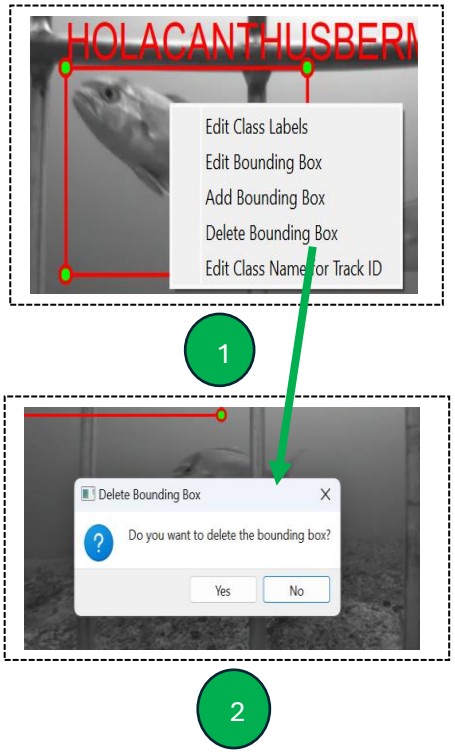

Fig 13: Procedure of deleteing bounding boxes