iSEA User Manual: Exploring the Deep Sea with Intelligence

Complete Guide to Underwater Image Annotation

Welcome to iSEA (Intelligent Seafloor & Animal Image Annotator), a tool for annotating underwater images. This manual will guide you through the software's features and functionality, allowing you to make the most of its capabilities.

Overview

iSEA is an application designed to facilitate annotation and object detection in images. Equipped with artificial intelligence, it enables automatic object detection and offers tools for manual annotation, real-time annotation, and custom model training.

Key features

- **Automatic object detection:** Uses YOLO models to identify and track objects.
- **Manual annotation:** Provides tools for you to create your own annotations.
- **Live mode:** Connects to a camera for visualization and real time annotation.
- **Video recording:** Allows you to record videos directly from the live camera.
- **Model training:** Trains custom models using manual annotations and exports datasets in YOLO format.
- **Annotation export:** Exports annotations in CSV format.

1. User interface

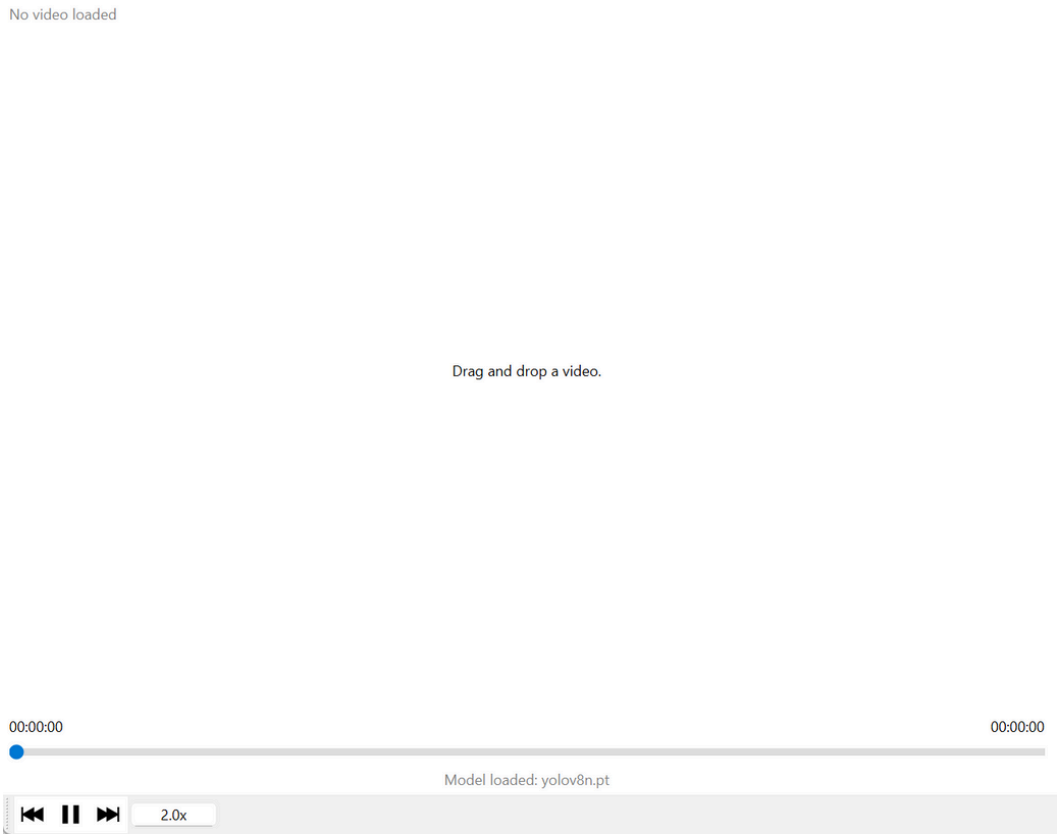
Top menus

- **File:** Load video, load and unload models, and save annotations.
- **View:** Toggle between detection history view modes and activate dark mode.
- **Annotation:** Perform frame-by-frame detection, activate continuous detection, and enable manual annotation.
- **Train:** Create and export training datasets, train models.
- **Language:** Change the interface language.
- **Help:** Display shortcuts and information about the software.

Toolbar

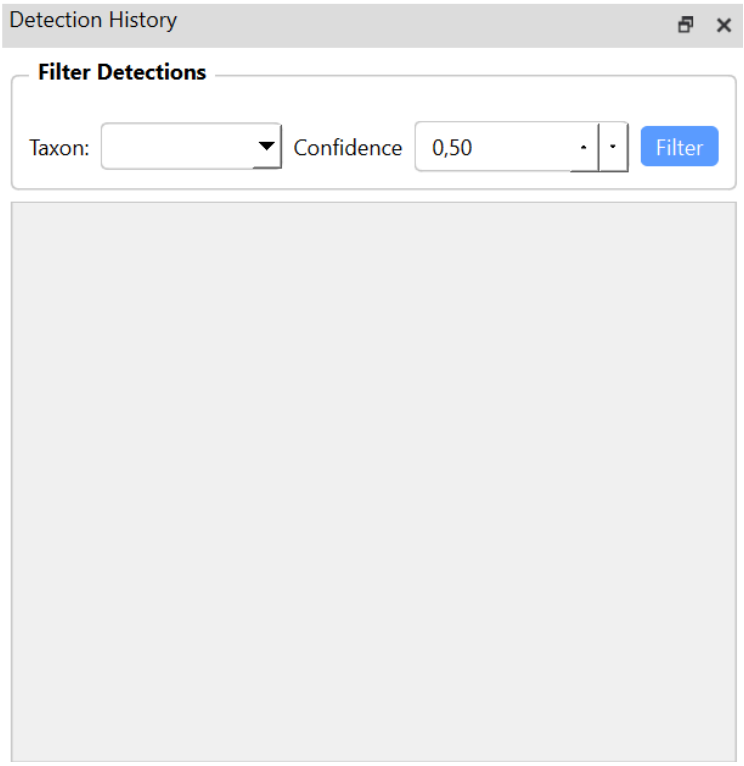
- **Load video:** Loads videos for annotation.
- **Live mode:** Activates/deactivates live mode.
- **Continuous detection:** Activates/deactivates continuous detection on video.
- **Frame-by-frame detection:** Performs object detection on a single frame.
- **Manual annotation:** Activates/deactivates manual annotation.
- **Export annotations:** Exports annotations and detections in CSV format.
- **Export frame:** Exports frames in JPG format.
- **Georeferencing:** Merges annotation CSV with georeferencing CSV.

Image display area



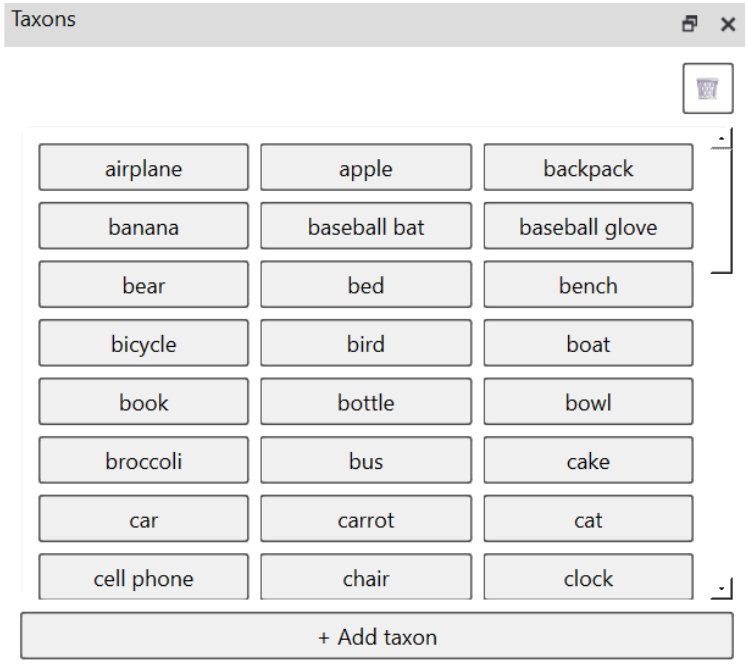
- Displays the loaded video or live camera feed.
- Allows viewing current annotations and interacting with them.
- Draggable playback menu at the bottom.
- 2x Speed:
  - Continuous detection disabled: doubles the video FPS.
  - Continuous detection enabled: doubles video FPS + detects at spaced intervals, discarding the current frame if it's similar to the previous frame.

Detection history



Draggable box where detections and manual annotations appear, with option to filter by taxon or confidence level.

Taxon grid



The grid starts with YOLOv8 default classes, in alphabetical order, and is automatically updated when a custom model is loaded. To annotate:

a. Activate "Manual Annotation".
b. Click on the desired taxon.
c. Draw the box over the organism in the image.

Delete taxons: click the icon (top right corner), select the taxons to be removed, and confirm by clicking the trash again.

Add new taxon: use the "+ Add taxon" button at the bottom of the grid.

2. **Manual annotation**

When activating manual annotation mode, the user can select a taxon from the taxon grid (located in the lower right corner; see item 1, User Interface) and then draw the bounding box directly on the image, indicating the position of the corresponding organism.

3. **Live mode**

Activates the connected camera for real-time annotation/detection.

With live mode on, use File > Start recording if you want to save the video.

4. **Automated detection**

a. Continuous detection.

b. Detection by frame.

There are two options for automated detection: the continuous detection and the detection by frame.

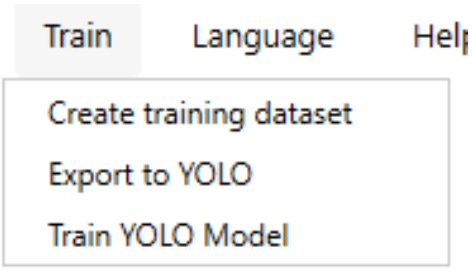
a. *Continuous detection*

Activates the loaded YOLO model, performing detection on all video frames continuously. However, if 2x speed is enabled, detection occurs at spaced intervals, discarding the current frame if it is similar to the previous frame.

b. *Detection by frame*

Activates the loaded yolo model but only in the current frame, pausing the video to show detected taxa.

5. **Training mode**



iSEA offers two flexible approaches for creating your own custom detection models:

1. Complete approach: Structured dataset creation

Ideal for new projects.

Step by step:

a. **Start Dataset: In the Training menu, select "Create Dataset."**
b. **Select data source:**

Option 1 - Image Set: Select multiple images that have already been captured.

Option 2 - Video extraction: Load a video as a source. Set the Extraction Factor (e.g., 1 frame every 10 frames). The program automatically extracts frames at regular intervals.

c. **Annotation:** Navigate between frames using the right/left arrows on your keyboard. Use the taxon grid to record all visible organisms. Continue until you have recorded all frames in the dataset.
d. **Final Processing:** Export to YOLO: Saves only the annotations in YOLO format (labels + images + dataset configuration file). Train YOLO Model: Exports the annotations and automatically starts training the model.

Advantages of this approach:

a. Organized and structured dataset since the beginning.
b. Precise control over which frames are included.
c. Ideal for creating balanced and representative datasets.

2. Direct approach: Annotation during normal analysis

Perfect for when you are already analyzing videos and decide to create a yolo model during the process.

Annotation in the main stream:

a. Upload your video to the platform as usual.

b. Enable Manual Annotation during your routine analysis.
c. Annotate organisms as they appear in the video (as you normally would).
d. Final Processing: Export to YOLO: Saves only the annotations in YOLO format (labels + images + dataset configuration file). Train YOLO Model: Exports the annotations and automatically starts training the model.

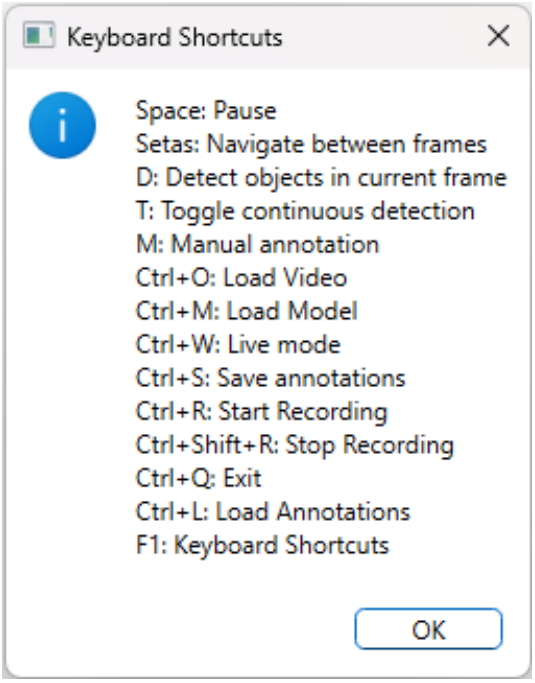
Advantages of this approach:

a. Don't interrupt your normal workflow.
b. Faster and more straightforward process.

6. **Export and georeferencing**

1. Export annotations in CSV format.
2. Export frames in PNG format.
3. Merge annotations CSV with georeferencing CSV.

7. **Shortcuts**



For additional information or support send an email to: raphaelaneves73@usp.br

Repository: GitHub - raoahela/iSEA