

Fishy Tracking user manual

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General information

Fishy Tracking is an application that allows the user to track multiple animals in video recording. Fishy Tracking can operate on Linux, Mac, and Windows systems.

Two mains features are implemented in the software:

- An automatic tracking algorithm that can detect objects and maintain objects identity.
- A manual review of the tracking where errors can be corrected rapidly and easily.

Getting started

Download

Stable versions of Fishy Tracking are released for Linux (as AppImage), MacOS (as dmg) and Windows (installer). The development version is accessible from source and can be compiled on Linux, Mac, and Windows (see the developer guide for more information).

1. Stable versions:
 - Download the right file for your system at <http://fishytracking.benjamin-gallois.fr/download.html>.
2. The development version:
 - Please refers to the developer guide at the link <http://fishytracking.benjamin-gallois.fr/API/index.html>.

Installation

1. For Windows:
 - Execute the installer and follow the provided instructions.
2. For Linux:

Allow FishyTracking.appimage to be executed:

- Right click on the AppImage file.
- Click on Properties.
- Click on Permissions.
- Tick “Allow executing file as program”.

3. For Mac:
 - Double click on the dmg file.
 - Drag the application from the dmg window into the Applications folder.

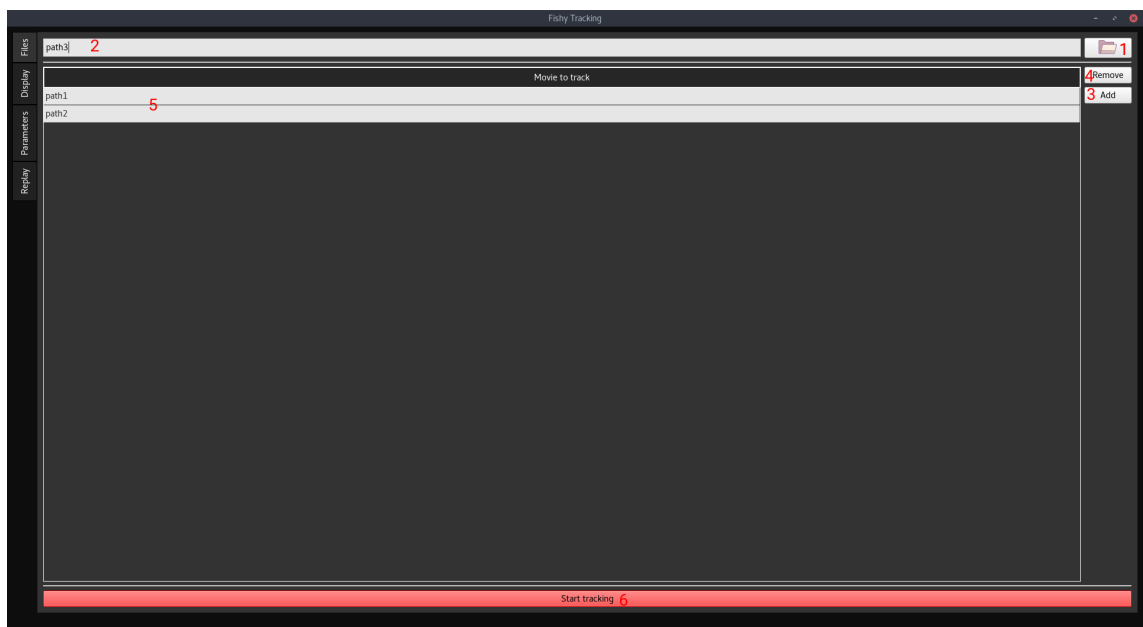
How to use Fishy Tracking

Start an analysis

How to add image sequences to analyze?

1. Click on the (1) open folder button to select a folder where an image sequence to analyze is stored. The path can directly be copied into the (2) path bar.
2. Click on the (3) add path button to add the path to the list of image sequences to analyze, visible in the (5) paths table.
3. The added path is now visible in the (5) table.
4. If necessary you can remove a path from the (5) paths table by clicking on the path, it will become highlighted in blue. Finally, click on the (4) remove path button to remove the path from the (5) paths table.
5. Start the analysis by clicking on the (6) button start. The path will be deleted from the (5) paths table when the tracking analysis is finished.

Figure 1. The files panel



1: Open folder button. 2: path bar. 3: Add path button. 4 Remove path button. 5: Paths table. 6: Start tracking button.

See current analysis

The display panel shows the current analysis process by displaying the binary image (1) and the tracking image (2). Note that the tracking can be extremely fast, to review the tracking please see the section called "Tracking review".

Change parameters

The tracking parameters can be changed in the Parameters panel. Note that the number of objects can't be changed during analysis.

We recommend finding a set of parameters by changing parameters one by one and controlling their effects in the display panel. When an optimal set of parameters is found, restart the analysis. An interactive help to determine some parameters is available by clicking on the help button (1).

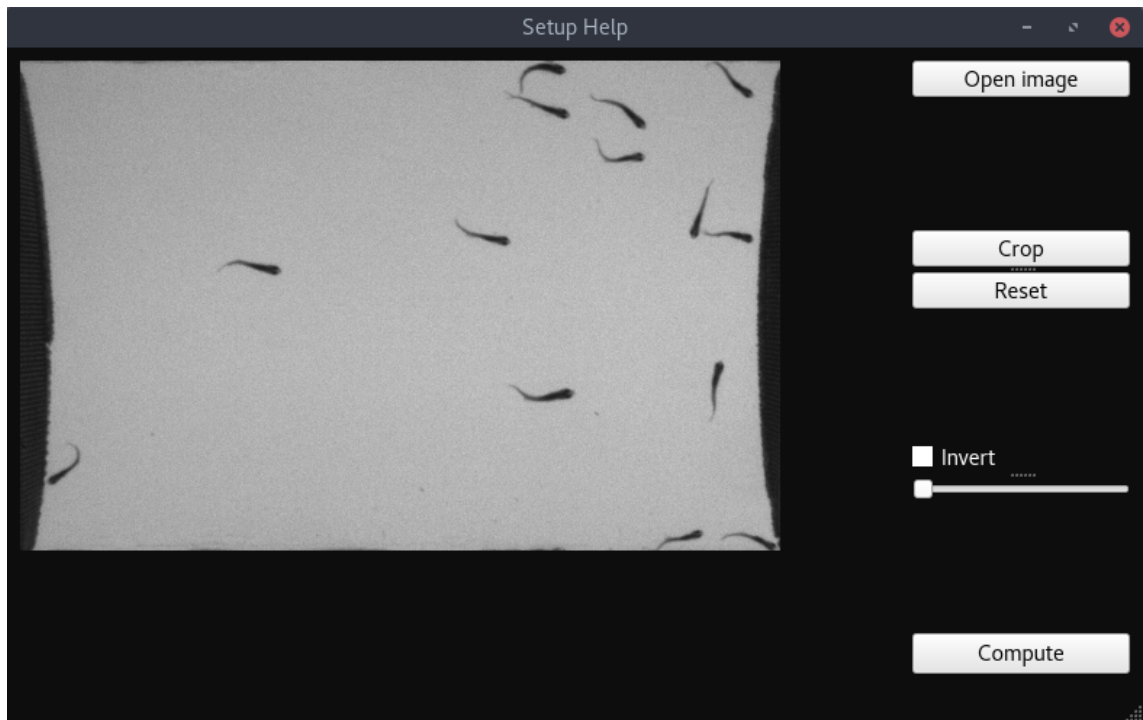
Parameter	Range	Description
Dilatation	0 to inf	Dilates the image. Sets to 0 for no dilatation.
Registration	yes, no	Sets to yes to activate registration.
Light background	yes, no	Sets to yes if objects are dark on light background. Sets to no if objects are light on dark background.
ROI bottom y	0 to image height	Bottom corner y coordinate of the region of interest. Sets to 0 for keeping the full image.
ROI bottom x	0 to image width	Bottom corner x coordinate of the region of interest. Sets to 0 for keeping the full image.
ROI top y	0 to ROI bottom y	Top corner y coordinate of the region of interest. Sets to 0 for keeping the full image.
ROI top x	0 to ROI bottom x	Top corner x coordinate of the region of interest. Sets to 0 for keeping the full image.
Number of images background	1 to number of images in the image sequences	The number of images averaged to compute the background.
Arrow size	0 to inf	Size of the arrow in the tracking display.
Maximal occlusion	0 to inf	The maximum assignment distance in pixels. Only objects that have moved less than this value between two images are considered for the matching phase.
Weight	0 to 1	Closer to one the cost function used in the matching phase will be more sensitive to change in distance, closer to zero it will be more sensitive to change in direction.
Maximal angle	0 to 360	The maximal change in orientation in degrees of an object between two consecutive images.
Maximal length	0 to inf	The maximal displacement in pixels of an object between two consecutive images.
Spot to track	0, 1, 2	The part of the object used for the matching. 0: head, 1: tail, 2: full body.
Binary threshold	0 to 255	The threshold value (0 to 255) to separate objects from the background.
Minimal size	0 to maximal size	The minimal size of an object in pixels.
Maximal size	minimal size to inf	The maximal size of an object in pixels.
Object number	1 to inf	The number of objects to track.

Interactive parameters help

A semi-automatic help is provided to help the user to set up the size of tracked objects. Open the Setup Help window by clicking the (1) help button.

- Open an image by clicking on the Open image button.

Figure 2. Open an image



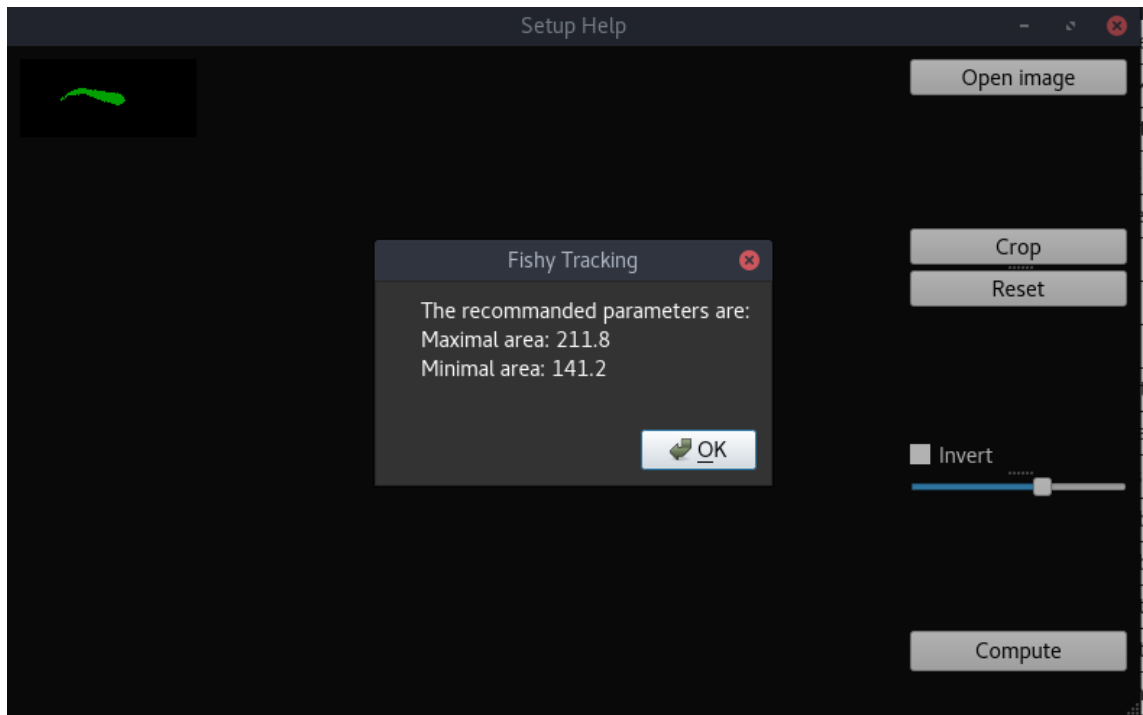
- Select a typical object by clicking and dragging the mouse to enclose the object in the green rectangle.
- Click on the Crop button to crop the image.

Figure 3. Select an object



- Threshold the object by displacing the slider.
- Tick/untick the Invert tick-box to have a white object on a black background.
- Click on the Compute button to display the recommended maximal and minimal area parameters.

Figure 4. Binarize and compute the optimal parameters



Tracking review

The replay panel allows the user to open and see the result of a tracking analysis and to correct the tracking if errors are detected.

Open a tracking analysis

1. Click on the (1) open folder button to open a folder where an image sequence previously analyzed is stored (if no tracking data are detected, the software will display only the image sequence). Be careful to open the image sequence folder and not the tracking_result folder.
2. The image sequence is displayed in the (6) display screen and can be played by clicking on the (5) play button or by moving the (7) play cursor. The frame rate can be chosen with the (7) fps box.
3. You can change the display options with (2) options boxes.

Correct errors

To correct a tracking error (mismatching between two objects):

1. Get to the frame where the error occurs:
 - By playing the image sequence and visually identify errors.
 - By clicking on (4) occlusion buttons to go to the previous and the next occlusion event where mismatchings are the most probable to occurs.
2. Left click on the first object or select the number of the first object in the (3) swap boxes. The box displays the number and the color of the selected object.
3. Left click on the second object or select the number of the second object in the (3) swaps boxes. The box displays the number and the color of the selected object.
4. Right click on the (6) display screen or click on the (3) swap button to swap the two objects from the image displayed to the end of the image sequence.

Correct rapidly a tracked image sequence

Mouse and keyboard shortcuts are provided to rapidly correct errors. The user can move inside the image sequence and review all occlusion events with the keyboard shortcuts and correct the tracking by swapping objects with the mouse.

For AZERTY keyboard:

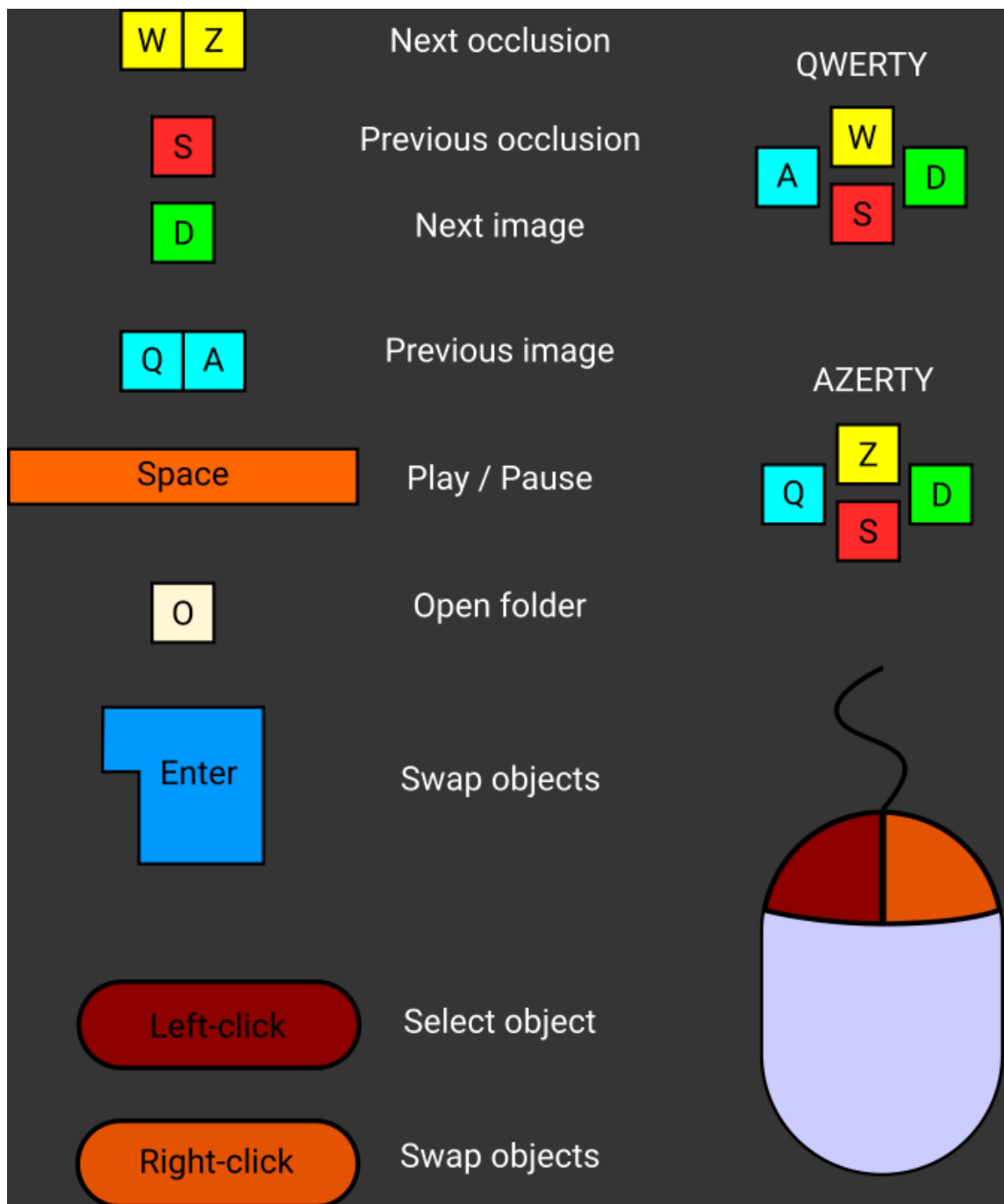
- Next image: Z
- Previous image: S
- Next occlusion: Q
- Previous occlusion: D
- Play: Space

For QWERTY keyboard:

- Next image: W
- Previous image: S
- Next occlusion: A
- Previous occlusion: D
- Play: Space

Mouse shortcuts:

- Left click to select objects.
- Right click to swap objects.

Figure 5. Keyboard shortcuts

Save a tracking movie

The result of a tracking can be saved in a video file. Select the display options and the frame rate desired and click on the (8) save button. The movie will be saved in a .avi container with the MJPEG codec. In case of errors, check that you have the MJPEG codec available on your system.

Figure 6. The replay panel



1: Open folder button. 2: Option boxes. 3: Swap boxes and swap button. 4: Occlusion buttons. 5: Play button. 6: Display screen. 7: Fps box. 8: Save button. 9: Play button. 10: Keyboard shortcuts help.

Input files

Fishy Tracking analyzes only image sequence with zeroes padding naming convention. “pgm”, “png”, “jpeg”, “jpg”, “tiff”, “tif”, “bmp”, “dib”, “jpe”, “jp2”, “webp”, “pbm”, “ppm”, “sr”, “ras”, “tif” image formats are supported.

If you have a recording in a video format, you need to convert it into an image sequence.

1. For Linux, Windows, and MacOS in command lines:
 - Install ffmpeg.
 - In a terminal type: `ffmpeg -i video.webm image-%03d.png`
2. For Linux, Windows, and MacOS in graphical:
 - Use Handbrake: <https://handbrake.fr/> or ImageJ.

Output files

When an analysis is started, Fishy Tracking creates a folder named Tracking_Result containing:

- tracking.txt containing the tracking data (in the frame of reference of the full image with the origin in the top left corner) as follows:

xHead	yHead	Angle	xTail	yTail	Angle	xBody	yBody	Angle	Curvature	ImageLength	headMajorAxisLength	tailMajorAxisLength	tailMinorAxisLength
x coordinate of the head. Object 1	y coordinate of the head. Object 1	Angle of the head. Object 1	x coordinate of the tail. Object 1	y coordinate of the tail. Object 1	Angle of the tail. Object 1	x coordinate of the body. Object 1	y coordinate of the body. Object 1	Angle of the body. Object 1	Curvature of the body. Object 1	ImageLength of the head. Object 1	Length of the minor axis of the head. Object 1.	Length of the major axis of the tail. Object 1.	Length of the minor axis of the tail. Object 1.
x coordinate of the head. Object 2	y coordinate of the head. Object 2	Angle of the head. Object 2	x coordinate of the tail. Object 2	y coordinate of the tail. Object 2	Angle of the tail. Object 2	x coordinate of the body. Object 2	y coordinate of the body. Object 2	Angle of the body. Object 2	Curvature of the body. Object 2	ImageLength of the head. Object 2	Length of the minor axis of the head. Object 2.	Length of the major axis of the tail. Object 2.	Length of the minor axis of the tail. Object 2.
x coordinate of the head. Object 1	y coordinate of the head. Object 1	Angle of the head. Object 1	x coordinate of the tail. Object 1	y coordinate of the tail. Object 1	Angle of the tail. Object 1	x coordinate of the body. Object 1	y coordinate of the body. Object 1	Angle of the body. Object 1	Curvature of the body. Object 1	ImageLength of the head. Object 1	Length of the minor axis of the head. Object 1.	Length of the major axis of the tail. Object 1.	Length of the minor axis of the tail. Object 1.
...			

Note: if you want to extract the data for a particular object: $data_i = (objectNumber) * imageNumber + objectNumber$ with objectNumber the object number {1, 2, 3, ...}, imageNumber the image number {0, 1, 2, ...}.

- parameters.txt containing the set of parameters at the beginning of the analysis, changes during the analysis are not saved.

For developers

A complete API and developer documentation is available. It can be generated for the latest version of Fishy Tracking by executing `./generateDocumentation.sh`. A folder `Documentation` is created with the developer documentation.

Performance

The performance can vary with the selected parameters. Registration and dilatation can cause a loss of 50% in performance. The number of objects influences the performance as the cube of the object number.

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