User Guide: Visual Filter App

Introduction

The Visual Filter App is designed to help users to filter and process animal tracking data from the ATLAS system (Advanced Tracking and Localization of Animals in real-life Systems).

System Requirements

Software: R version 4.0 or higher (version 4.2.2. is the most recommended), RStudio (recommended)

Access: a working VPN connection to the ATLAS database server, and credentials to connect to the database.

R Packages:

- roxygen2
- crayon
- lubridate
- DBI
- RMySQL
- RSQLite
- Rcpp
- dplyr
- leaflet
- sf
- RColorBrewer
- htmltools
- leaflet.extras

Usage

Instructions for the first run

1. **Download the App Folder**

   1.1. Download the folder `Visual_Filter_App`

2. **Create a new R project**

   2.1. Open RStudio

   2.2. Go to File -> New Project -> Existing Directory

   2.3. Browse the `Visual_Filter_App` folder and click 'Create Project'.

   2.4. Now you should see the contents of the app's folder under the Files tab in RStudio

3. **Install the required packages**:

   3.1. open and run the script:

   `install_required_R_packages_visual_filter.R`

4. **Set the running configuration**:

   open the file `config_visual_filter.R` and modify the following sections as follows:

   4.1. **Data to retrieve**

      4.1.1. Choose your animal's name code, e.g.:

         4.1.1.1. Choose two English letters which represent the animal's name

         4.1.1.2. Example: `animal_name_code <- "BO"` for Barn Owl

      4.1.2. Insert the tag number and time range:

         4.1.2.1. `tag_number <- 972006000556`

         4.1.2.2. `start_time <- '2021-07-04 17:00:00'`

         4.1.2.3. `end_time <- '2021-07-06 05:00:00'`

   4.2. **Baseline Filter Settings**:

      4.2.1. set the values that apply to the animal you are working on

      4.2.2. Please annotate outliers in data of one animal and one tag at a time

   4.3. **Start and End times for the `AssignDayNumbers` function**

      4.3.1. The Visual Filter divides the data into day segments and assigns them DAY numbers (e.g. 1, 2, etc.)

      4.3.2. The function which does that is called `AssignDayNumbers`

4.3.3. If you want to see data **only within a specific time range** each day (e.g., 05:00–18:00), set:

4.3.3.1. `day_start_time <- "05:00:00"`

4.3.3.2. `day_end_time <- "17:00:00"`

4.3.4. Otherwise, leave as **full-day settings**:

4.3.4.1. `day_start_time <- "00:00:00"`

4.3.4.2. `day_end_time <- "00:00:00"`

4.4. **File Paths**

4.4.1. Create two folders:

4.4.1.1. One for the **raw ATLAS data (input)**

4.4.1.2. One for the **annotated data (output)**

4.4.2. Set the folder paths in the config file:

4.4.2.1. `raw_data_path <- "path/to/raw_data_folder/"`

4.4.2.2. `filtered_data_path <- "path/to/annotated_data_folder/"`

4.4.2.3. Make sure to include '`/`' at the end of the paths

4.5. **CSV Settings**

4.5.1. The **manual annotation** process requires raw data from the ATLAS server. Keep this setting:

4.5.1.1. `upload_gps_data_from_csv <- FALSE`

4.5.2. To **upload data later from CSV files for other uses**, set:

4.5.2.1. `upload_gps_data_from_csv <- TRUE`

4.5.3. To **save filtered data as CSV** in addition to the default SQLite storage:

4.5.3.1. `save_filtered_data_as_csv <- TRUE`

4.6. **Background Map Setting**-

4.6.1. choose the map provider:

4.6.1.1. `'Esri.WorldImagery'`

4.6.1.2. `'CartoDB.Positron'`

4.6.2. After using the app for the first time, if the colours of the location points on the map are not clearly visible, you can adjust them, and the colours of their connecting lines, in sections 6.2 and 6.3 of the configuration file.

4.7. **Credentials of the Harod ATLAS database**

4.7.1. In case the credentials change later, update them here

4.7.2. **Do not share these credentials** with unauthorized users or store them in Git or other unsecured cloud platforms.

4.8. **ATLAS time information**

4.8.1. No changes needed

5. **Connect to the TAU VPN server (GlobalProtect)**

5.1. Ensure you are connected to the TAU VPN before running the app.

6. **Run the app**

6.1. Open `visual_filter_shiny_app.R` and click on **'Run App'** in RStudio.

7. **Annotate outliers and save the data**

7.1. Instructions in the next section

8. **Upload and plot the filtered data**

8.1. Open `upload_and_plot_filtered_data.R`

8.2. Set the file name and path you want to upload, for example:

```
file_name <- "BO_0556_from_2021-07-04_17-00-03_to_2021-07-04_23-59-58_filtered.sqlite"

file_path <- "PATH/TO/YOUR/ANNOTATED/FILES/Annotated_data_test/"
```

9. **Validate the outliers annotation**

10. **Submit the .sqlite files of the annotated data**

Instructions for runs with modified parameters

1. Modify parameters in `config_visual_filter.R`

To retrieve data for a different **animal**, **tag number**, or **time range**:

1.1. Set the Data to Retrieve:

Open `config_visual_filter.R` and update the following variables:

1.1.1. `animal_name_code <- "BO"`

1.1.2. `tag_number <- 972006000556`

1.1.3. `start_time <- '2021-07-04 17:00:00'`

1.1.4. `end_time <- '2021-07-06 05:00:00'`

1.2. Adjust the baseline filter thresholds (if needed)

1.2.1. Speed in m/s: `speed_threshold_baseline_filter <- 20`

1.2.2. Standard Deviation: `std_threshold_baseline_filter <- 15`

1.2.3. Number of participating Base Stations:

```
nbs_threshold_baseline_filter <- 3
```

1.3. Modify the Start and End times for the `AssignDayNumbers` function (if needed)

1.3.1. `day_start_time <- "00:00:00"`

1.3.2. `day_end_time <- "00:00:00"`

(If you want to filter data within a specific time window each day, change these values accordingly.)

2. **Run** `visual_filter_shiny_app.R`
3. **Annotate outliers and save the data**

   3.1. Instructions in the 'App Features' section
4. **Upload and plot the filtered data**

   4.1. Open `upload_and_plot_filtered_data.R`

   4.2. Set the file name you want to upload, for example:

```
file_name <- "BO_0556_from_2021-07-04_17-00-03_to_2021-07-04_23-59-58_filtered.sqlite"

file_path <- "PATH/TO/YOUR/ANNOTATED/FILES/Annotated_data_test/"
```

5. **Validate the outliers annotation**
6. **Submit the .sqlite files of the annotated data**

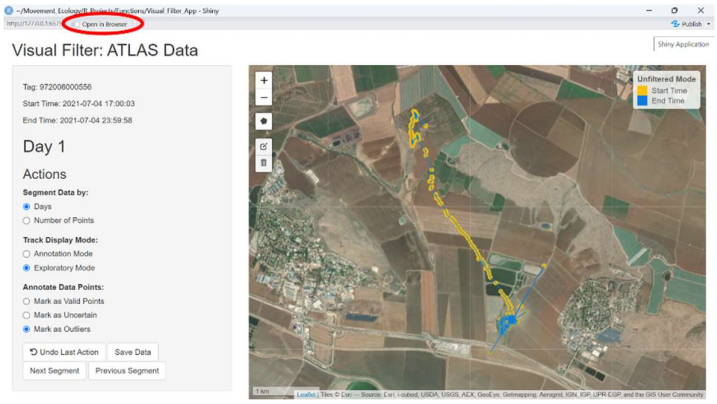
Combine and save the annotated data for your future research

- Open `merge_sqlite_data_to_csv.R`
- Define the folder in which the annotated sqlite files are saved (`sqlite_folder`)
- The column '**Outliers**' in the generated csv file indicates the annotation of each location point:
  - **0 = Valid Point**
  - **1 = Outlier**
  - **2 = Uncertain Point**

App Features: Manual Annotation of Outliers

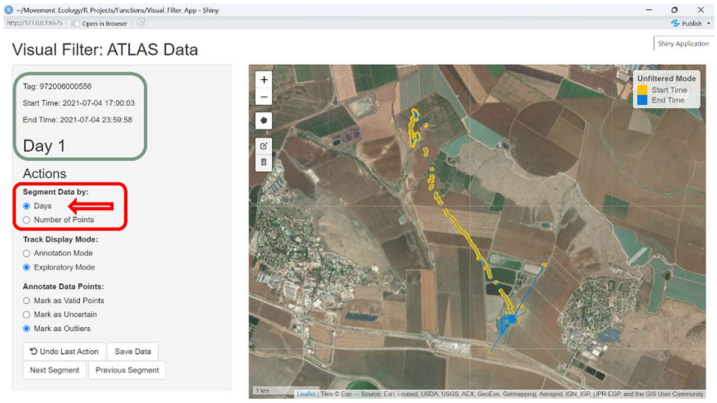
Running the App in a Web Browser

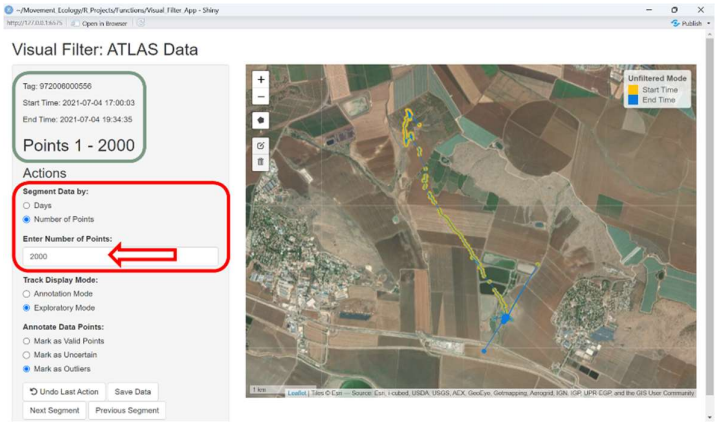
- Click **"Open in Browser"** to launch the app in your web browser:



Data Display Options

- The data can be displayed in **daily segments** (as assigned by the `AssignDayNumbers` function) or in **custom-sized chunks** (set by the user):

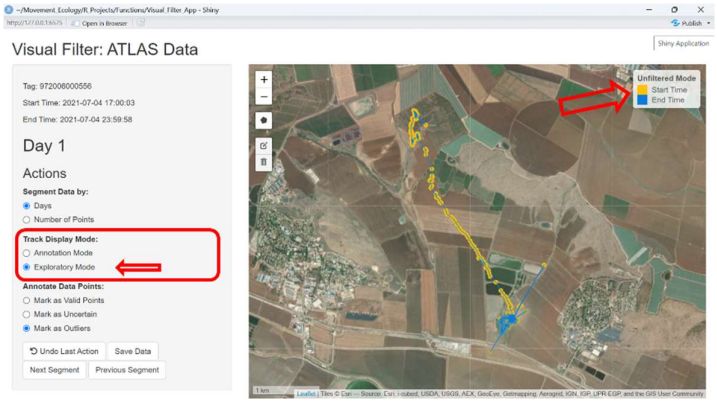




Viewing the Track

- For each segment, you can choose between two display modes:

1. **Exploratory Mode** – Displays the entire track without outliers annotation:



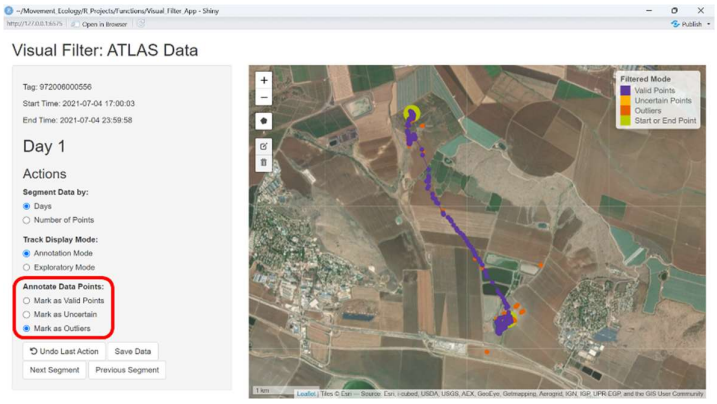
2. **Annotation Mode** – Displays valid points, outliers, and uncertain points based on the baseline filter thresholds set in the config file. The beginning and end points of the entire track are highlighted with larger markers:

Manual Annotation of Data

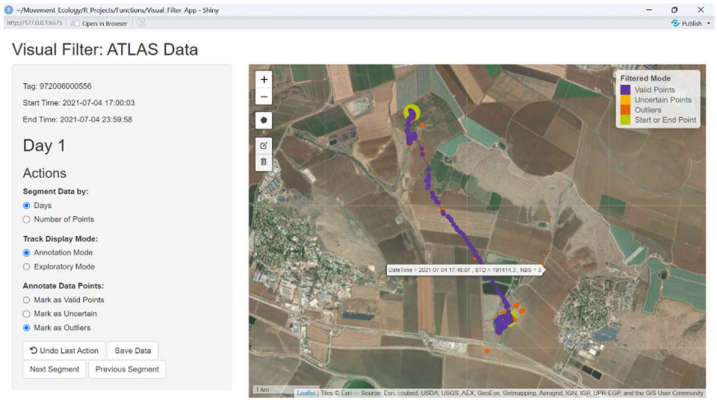
- To manually annotate the data, ensure that you are in **"Annotation" Display Mode**.

Annotating Individual Points

- In **"Annotation" Display Mode**, you can manually **toggle** the classification of **single points** (valid, outlier or uncertain) by choosing their annotation on the radio buttons under "**Annotate Data Points**" and clicking on them.



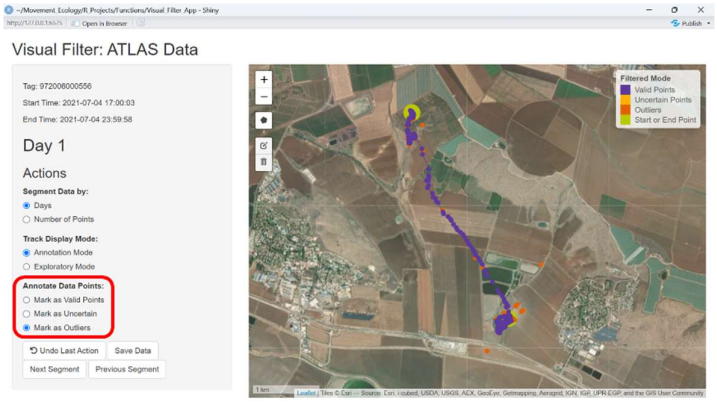
- By hovering over a point, a popup will appear, which includes the date, time, standard deviation (STD), and number of participating base stations (NBS):



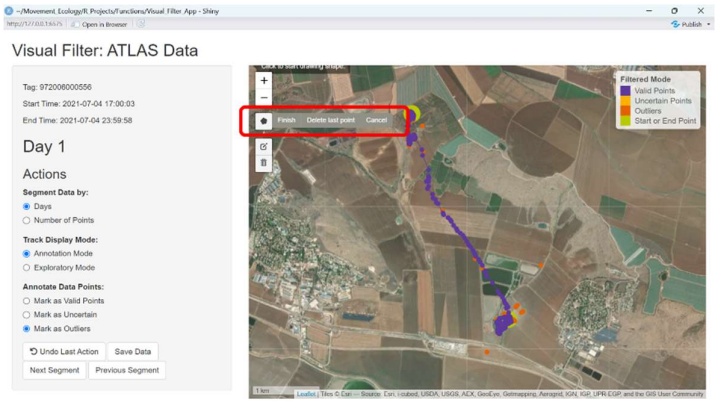
Annotating Points by Polygon Selection

- You can mark multiple points using a **polygon selection tool**:

1. In the **" Annotate Data Points"** menu, choose whether to classify selected points as **Valid Points**, **Uncertain Points**, or **Outliers**:



2. Click the **polygon button** on the map to activate polygon selection:



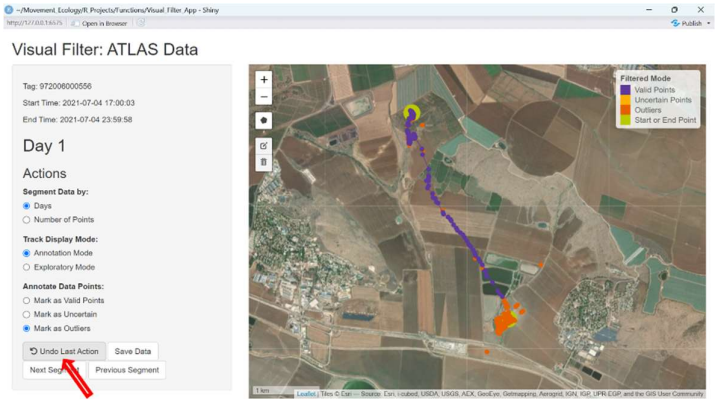
3. Click on the map to **place polygon vertices** and create the desired selection area:

Removing Marked Polygons

- To **clear marked polygons**, click **"Delete Layers"**, then select **"Clear All"**:

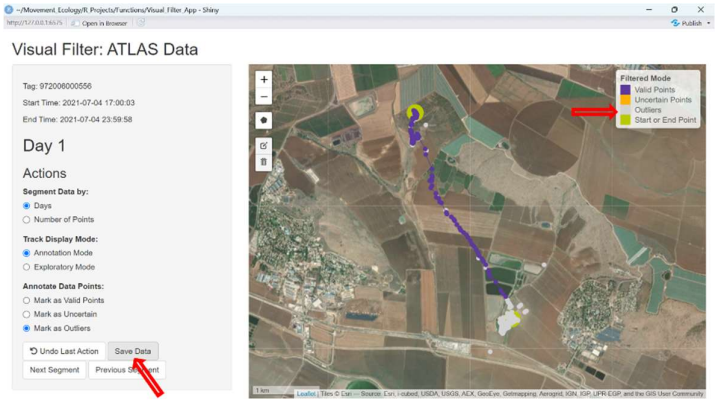
Undoing the last action

- To **Undo the last action,** click **“Undo Last Action”**:



Saving the annotated data

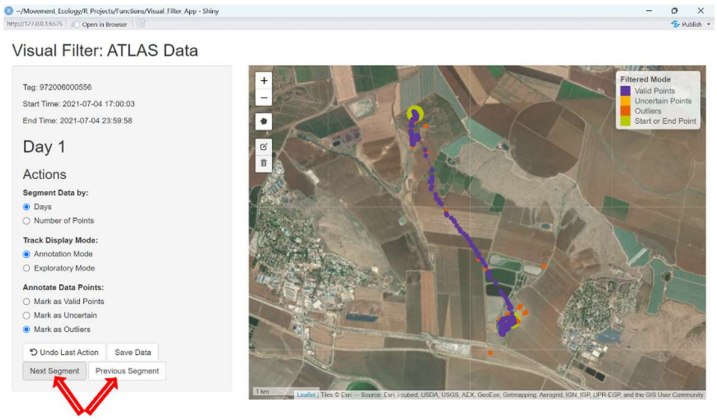
- To save the segment data when finished annotating, click **“Save Data”**:



- The Outliers will change their colour. If needed, you can keep toggling points and save again.

Navigating to the next or previous data segment

- To navigate to the next or previous segment, click **“Next Segment”** or **“Previous Segment”**:



- You will be asked if to save the data or not, even if you saved it already, in order to make sure the data is saved

Troubleshooting

Problem:

Error in .local(drv, ...) :

Failed to connect to database: Error: Can't connect to server on '132.67.132.47' (10060)

Solution:

Make sure you are connected to the ATLAS database server

Problem:

Warning: Error in <reactive:validate_data_for_days>: No DAY numbers were found in the provided data.

Solution:

Make sure that the tag number is correct and that there are data in the time range you chose.

Problem:

Error: Could not connect to database:

unable to open database file

Solution:

Make sure the paths you defined in the config file and the path of the working directory are correct

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Problem:

Warning: Error in wk_handle.wk_wkb: Loop 0 is not valid: Edge 2 crosses edge 5

Solution:

Run the app again and draw a polygon with no self-intersecting edges

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Contact Information

For support, contact:

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