

Trajectory Recovery API Documentation

1 Preliminaries, Dependencies

The source code is available at the [GitHub repository](#). The `trajectory_recovery` Python module provides an interface for evaluating datasets on the trajectory recovery algorithm proposed by Xu et al. in [1]. This document contains the API documentation for the `TrajectoryRecovery` class. The dependencies of this module, excluding the Python standard library, are:

- `numpy` [2]
- `pandas` [3]
- `matplotlib` [4]
- `scipy` [5]
- `geopy` [6]
- `tqdm` [7]

Throughout, we will use the following abbreviations:

- N : The number of trajectories in the dataset.
- M : The number of locations in the dataset.
- T : The number of time steps in the dataset.
- D : The number of time steps that can occur in 24 hours.

If you notice any bugs or inconsistencies with the module or this document, please create an issue on the [GitHub repository](#).

2 API Documentation

`TrajectoryRecovery()`, the constructor, expects all of the following arguments (unless otherwise specified) in the given order:

- `aggregated_dataset`: *pandas.DataFrame*

The aggregated dataset with exactly N rows and M columns. Rows must appear in chronological order. The dataset must begin at 00:00. The order of columns (locations) from left to right is used for the below.

- `grid`: *dict*

Location information that maps i , (the i -th location above) to a *tuple* representing its location in space. They may be mapped to cartesian coordinates, or given as latitude and longitude coordinates.

- `num_trajectories`: *int*

N , the number of trajectories in the dataset.

- `num_locations`: *int*

M , the number of locations in the dataset.

- `num_timesteps`: *int*

T , the number of time steps in the dataset.

- `num_intervals_per_day`: *int*

D , the number of time steps that can occur in 24 hours.

- Optional: `cartesian`: *bool*

Indicates whether the locations in the grid are mapped to cartesian coordinates, or are latitude and longitude coordinates. If this is not provided, then this is set to *True*.

`TrajectoryRecovery.run_algorithm()`

Runs the algorithm on the initialised aggregated dataset.

Returns *None*.

`TrajectoryRecovery.evaluate(truth_dataset)`

Evaluates the current predictions on a given truth dataset.

Returns a *dict* containing accuracy, recovery error, and top- k uniqueness metrics for the predicted and true datasets, for all $1 \leq k \leq 5$. It also contains a list of tuples where each (i, j) means that the i -th predicted trajectory was matched with the j -th true trajectory.

- `truth_dataset`: *list*[*list*]

A 2D *list* of N true trajectories. The order of rows (trajectories) is not important, but each trajectory must be a *list* of T locations in chronological order. Each location is a *tuple* expressing the location.

`TrajectoryRecovery.visualise(timestep_range)`

Plots all the matched predicted and associated true trajectories within the given time step range.

Returns a *list* of *matplotlib.pyplot* figures.

- `timestep_range`: *tuple*[*int*, *int*]

The range of time steps to plot, left-inclusive and right-exclusive. If no time step range is given, then the range of $[0, \min(T, D))$ is used.

`TrajectoryRecovery.gain(trajectory_1, trajectory_2)`

Calculates the gain of two trajectories.

Returns a *float* of the calculated gain.

- `trajectory_1` : *list*
- `trajectory_2` : *list*

Each trajectory is expressed as a *list* of locations. The representation of locations (e.g. by *int* or *tuple* of coordinates) is not important, as long as it is consistent.

`TrajectoryRecovery.uniqueness(data, k)`

Calculates the top- k uniqueness of a dataset.

Returns a *float* of the calculated gain.

- `data` : *list*[*list*]

A 2D *list* of N trajectories. Each trajectory is expressed as a *list* of T *tuples*, representing sequential locations. The representation of locations (e.g. by *int* or *tuple* of coordinates) is not important, as long as it is consistent.

- `k` : *int*

`TrajectoryRecovery.get_predictions()`

Returns a 2D *list* of the N predicted trajectories, where each trajectory is a *list* of T locations.

`TrajectoryRecovery.get_results()`

Returns a *dict* containing the results of the most recent evaluation, including accuracy, recovery error, and top- k uniqueness metrics for the predicted and true datasets, for all $1 \leq k \leq 5$. It also contains a *list* of *tuples* where each (i, j) means that the i -th predicted trajectory was matched with the j -th true trajectory.

References

- [1] F. Xu, Z. Tu, Y. Li, P. Zhang, X. Fu, and D. Jin, “Trajectory recovery from ash: User privacy is not preserved in aggregated mobility data,” in *Proceedings of the 26th International Conference on World Wide Web*, WWW ’17, International World Wide Web Conferences Steering Committee, Apr. 2017.
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- [3] T. pandas development team, “pandas-dev/pandas: Pandas,” Feb. 2020.
- [4] J. D. Hunter, “Matplotlib: A 2d graphics environment,” *Computing in Science & Engineering*, vol. 9, no. 3, pp. 90–95, 2007.
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- [6] GeoPy Contributors, “GeoPy: Python Geocoding Toolbox.” <https://geopy.readthedocs.io/>.
- [7] Casual Programmer’s Incremental Developments, “tqdm: A Fast, Extensible Progress Bar for Python.” <https://github.com/tqdm/tqdm>.