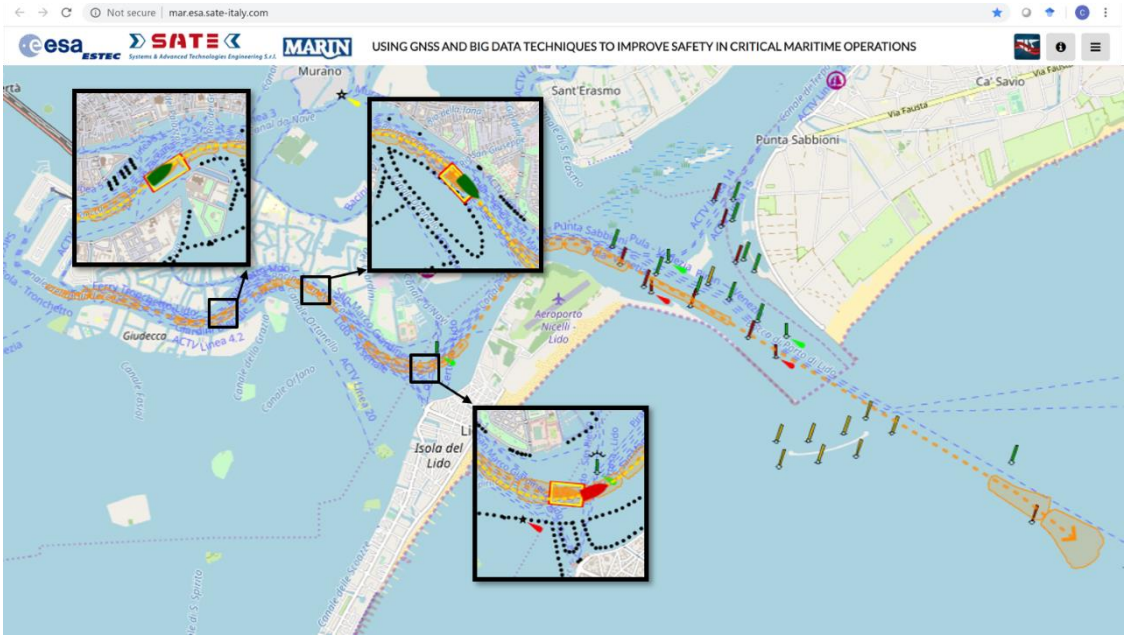
Systems & Advanced Technologies Engineering S.r.l.

MathWorks Partner

TRA-Miner – Trajectory Miner



OVERVIEW

TRA-Miner (*TRAjectory Miner*) is an advanced software tool for the extraction of typical vessels trajectories from historical GNSS datasets. The tool exploits the availability of GNSS position data acquired by the ships on-board AIS system and collected through the AIS base stations network of the national coast guards.

TRA-Miner pre-processes and analyses AIS data in a selected (densely navigated) area to extract "preferred routes" or groups of similar trajectories, which are also evaluated based on ships characteristics (e.g. length, beam, ship type) and environmental conditions (e.g. wind strength and direction, tide, tidal currents).

The extracted typical routes can be used by surveillance operators to monitor traffic, suggest routes to ships entering or exiting a port and optimise traffic flows, reducing the risk of collision.

The "preferred routes" extracted by ***TRA-Miner*** provide not only spatial but also temporal information, through a sequence of waypoints characterised by tolerances in space and time.

Indeed, the availability of the temporal information implies that "preferred routes" could also be used to forecast the future positions of ships leading to safer operations.

This approach allows also optimising traffic inside the port, because the use of "preferred routes" allows to know in advance the position of the ship in a given route, enabling improvements in routes planning and exploiting at the best the waters that may be navigated in terms of space and time under certain environmental and traffic conditions.

FIELDS OF APPLICATION

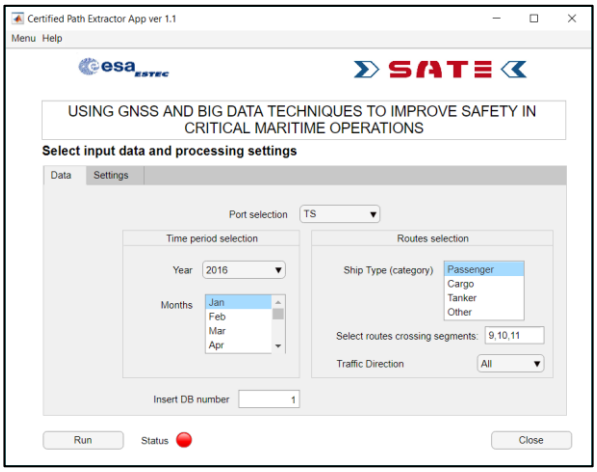
TRA-Miner aims at contributing to the implementation of the *e-navigation* concept, with primary focus on the navigation in regions where the traffic congestion can create conditions for accidents or inefficient operations.

The analyses which can be performed using the ***TRA-Miner*** software tool can be useful to:

- Monitor the traffic in harbours and restricted waterways as well as in the open sea or in anchorage areas, and to optimise logistics and pilots operations;
- Measure the variability of routes in both geographical and timing terms and optimise traffic flows;
- Compare the behaviour of ships against the typical behaviour of similar ships in similar environmental conditions from historical data (e.g. to evaluate contingencies and accidents);
- Extract unexpected situations;
- Identify critical areas in terms of safety of navigation;
- Provide alerts to ships that deviate significantly from the expected behaviour (space and time);
- Create a set of *paths to be followed* in view of unmanned ships navigation.

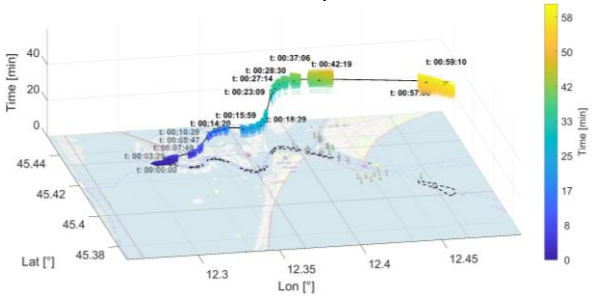
TRAJECTORY EXTRACTION

The analyses provided by ***TRA-Miner*** allows the investigation of AIS and environmental data, in order to extract sets of trajectories that characterise a selected area and may be typically performed by certain ship types under specific environmental conditions.



The tool allows to:

- Access the routes database and display the entire set of selected routes (raw and pre-processed data) in a geographical area on the map.
- Display the extracted relevant groups on the geographical map.
- Investigate each group of trajectories to evaluate its composition (in terms of number of different ships, number of trajectories grouped together, ship types, environmental conditions).
- Compute and display 3D plots of the "preferred routes" on the geographical map.
- Display statistical distributions of space and time variability of each preferred route waypoint.
- Save results for subsequent use in databases.



The software allows the user to select the area to be analysed, the time period and the ships types to be considered. It also allows setting algorithms and results visualisation parameters. It provides advances 3D views and navigable plots to investigate the trajectory data and groups composition and statistical features.

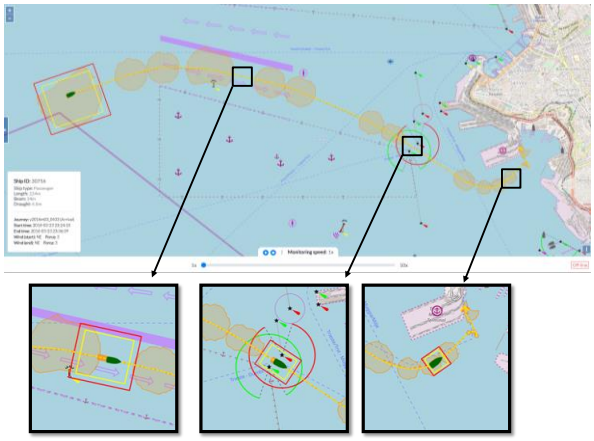
TRAJECTORY MONITORING

The extracted preferred routes can be used as input to the current monitoring tools used by maritime surveillance operators, as well as for the ships' on-board ECDIS systems.

Vessels' real-time AIS data can be checked against the compatible preferred routes and generate alerts in case of deviation from the expected behaviour (either due to routes differences in position or timing/speed). This may allow *automatizing* (i.e. improve the efficiency of) the maritime surveillance operations highlighting to the operators those situations that require attention.

Operators may also use preferred routes to forecast the position of the ships and plan communications and assess potential risks in advance.

Preferred routes may be periodically updated to take into account changes in the environmental aspect and conditions which can affect traffic flows (e.g. offshore constructions).



Patents pending.

TRA-Miner has been developed under a study carried out on behalf of ESA (European Space Agency) in collaboration with MARIN (Maritime Research Institute of the Netherlands). The view expressed herein can in no way be taken to reflect the official opinion of the European Space Agency.

S.A.T.E. Systems and Advanced Technologies Engineering S.r.l.

Santa Croce 664/a, 30135 VENICE (ITALY)

Tel.: +39 041 – 2757634 fax: +39 041 – 2757633

Email: info@sate-italy.com

www.sate-italy.com