Comparing Vessel Trajectories using Geographical Domain Knowledge and Alignments

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Introduction

Moving objects, for instance vessels, exist in spaces with geographical concepts, such as harbors and anchorages.

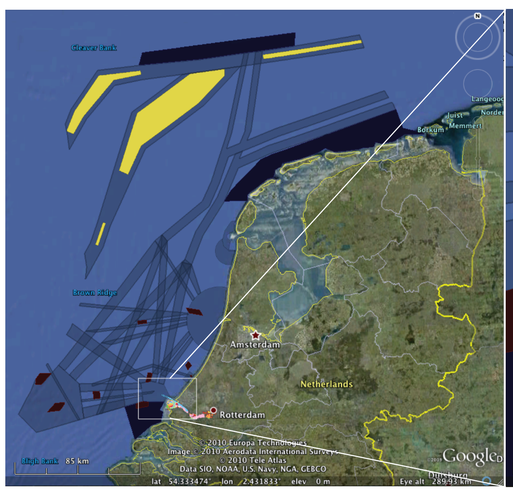
Incorporating this domain knowledge in a trajectory similarity measure improves performance on clustering and classification tasks.

Domain Knowledge

Two domain ontologies in RDF, following GeoNames:

- **Anchorages & Clear Ways**, anchorages, clear ways, shipping lanes, etc.
- **Harbors**, liquid bulk, general cargo, passenger terminal, etc.

Anchorages & Clear Ways

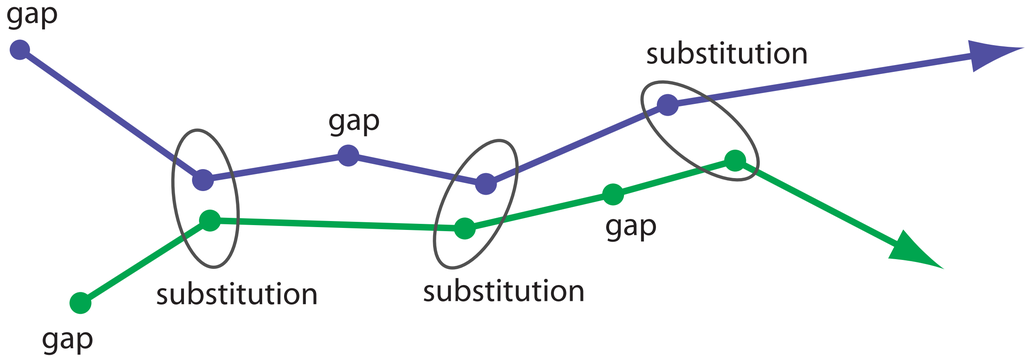


Harbors

Trajectory Similarity

Edit distance based alignment kernel for:

- **Raw trajectory**, K_{traj}
- **Sequence of Geo-labels**, K_{lab}
  created using the two ontologies



K_{start} and K_{end} for start and end of trajectories, combined into:

$$K_{all} = w_1 K_{traj} + w_2 K_{lab} + w_3 K_{start} + w_4 K_{end}$$

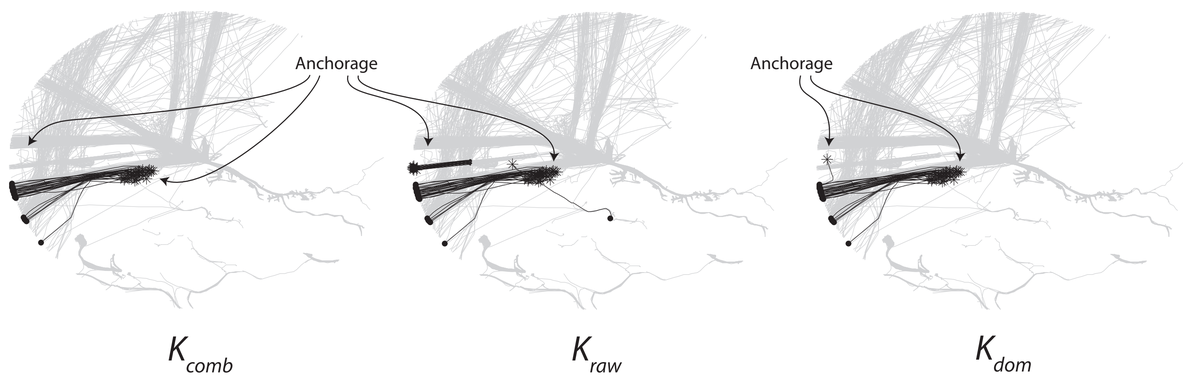
Experiments

Dataset of 1917 trajectories around the Port of Rotterdam.

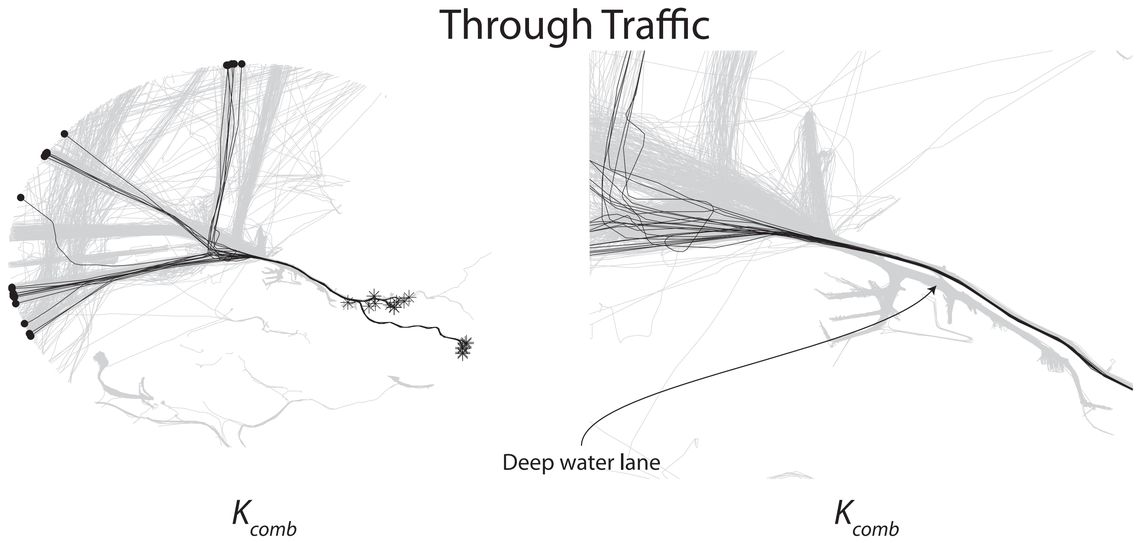
Clustering with:

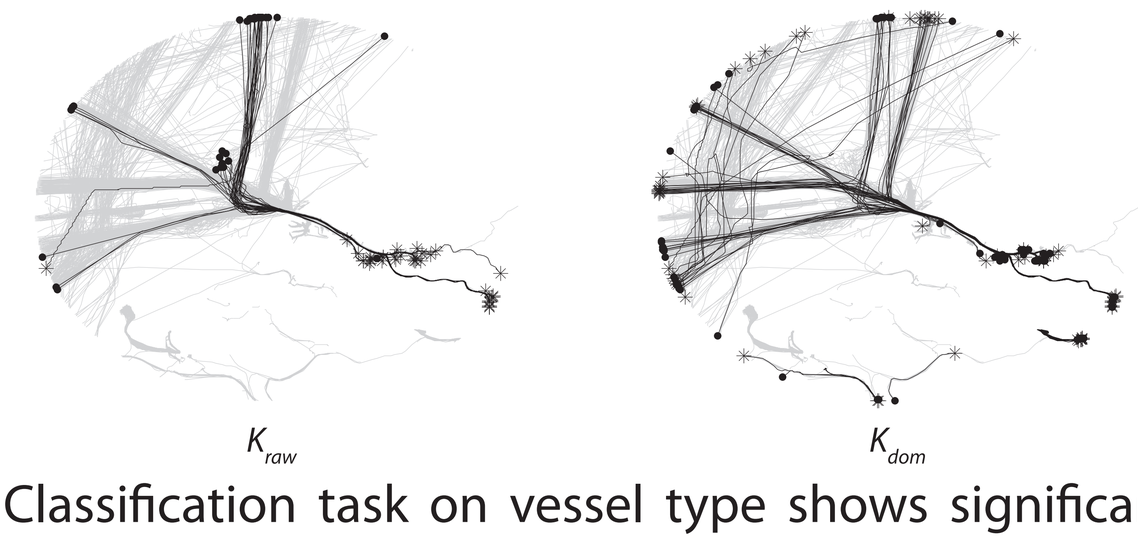
- K_{comb}, $w_1 = 1/2$, w_2, w_3, $w_4 = 1/6$
- K_{raw}, $w_1 = 1$, w_2, w_3, $w_4 = 0$
- K_{dom}, $w_1 = 0$, w_2, w_3, $w_4 = 1/3$

Anchoring



Through Traffic





Classification task on vessel type shows significantly better accuracy of K_{all} (*75.4 %*) over K_{raw} (*72.2 %*) and K_{dom} (*66.1 %*).

Conclusion & Future Work

Adding domain knowledge improves clustering and classification.

Application in outlier detection and generalization to tree/graph measure is future work.

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