Model Formalisms for Seabird Trajectory Simulation

March 2021

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Dataset

Foraging Trips of SV

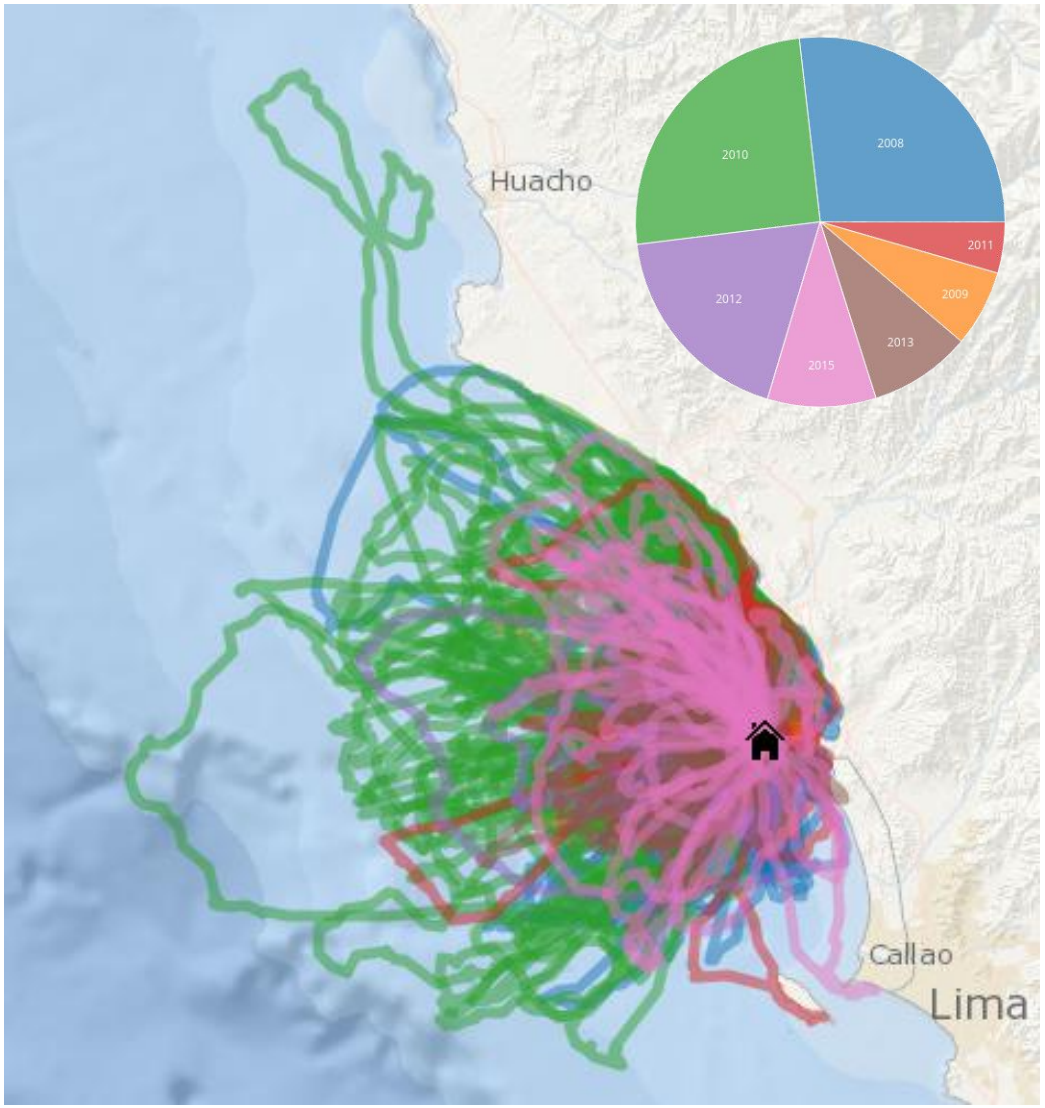
- 1 species
- 7 fieldworks
- 179 deployments
- 560 trips

Data Formatting

- round trips only
- no night-long resting
- 15s re-interpolation
- diving probabilities estimation

Ecological question

- inter-annual variability

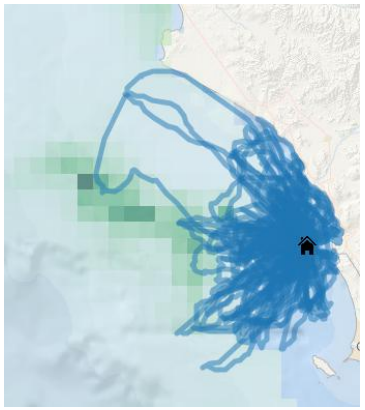


Environmental data

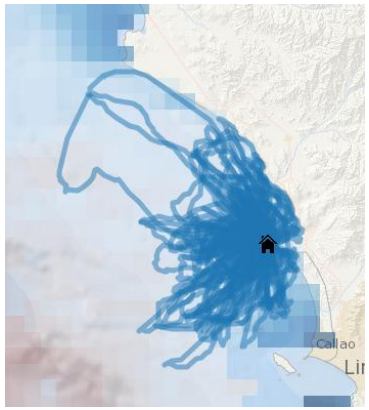
Satellital data

- Daily satellital observations
- Daily models for interp.

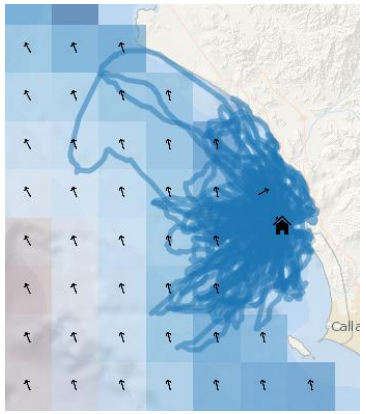
CHL - MODIS (0.04°)



SST - MODIS (0.04°)



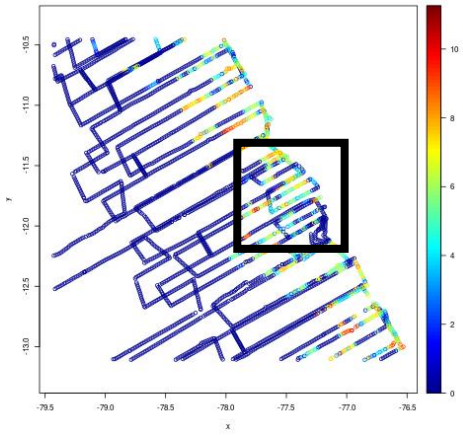
Wind - ASCAT (0.12°)

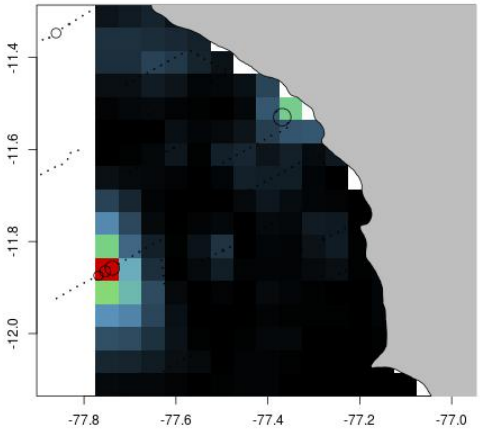


Acoustic data

- Yearly survey data

Acoutic survey data (raw + kriged)





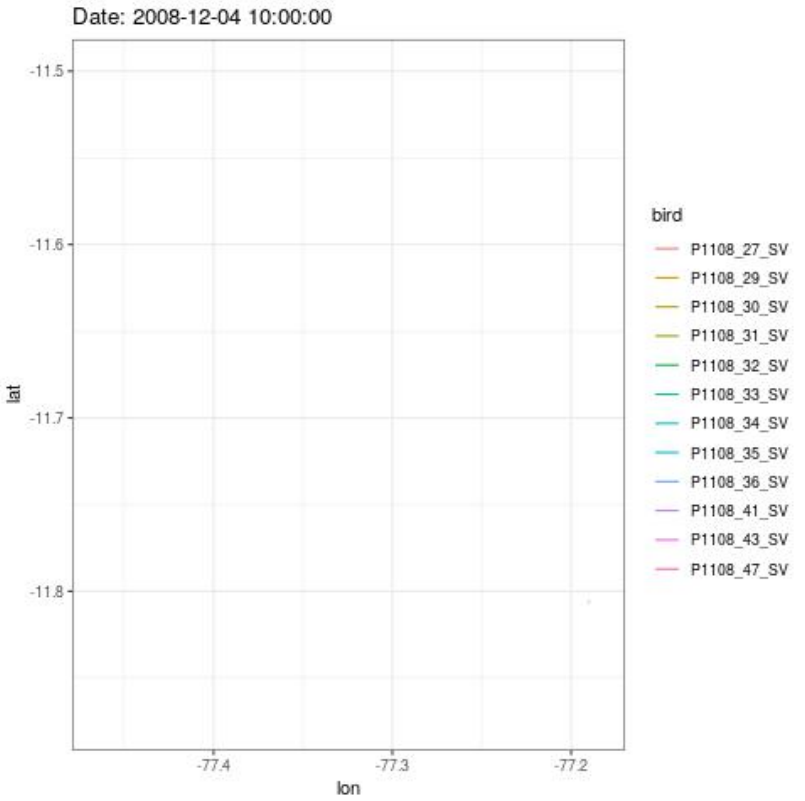
Social interactions

Simultanate deployments

- Few simultanate trips (max ~5)

- Very low proportion of real observable birds..

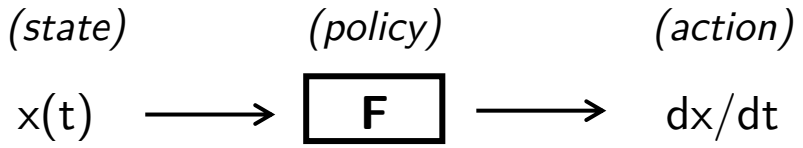
- Yet patterns in directions



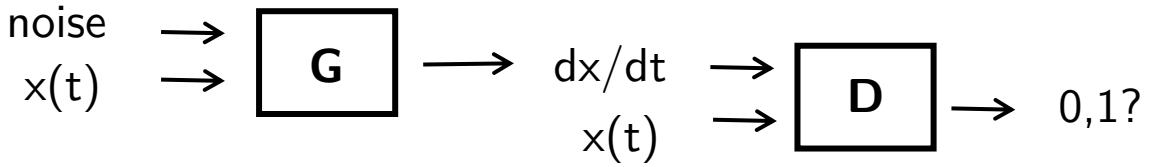
Problem formulation

1. Agent-based formulation

Behaviour Cloning
(supervized learning on state/actions pairs)



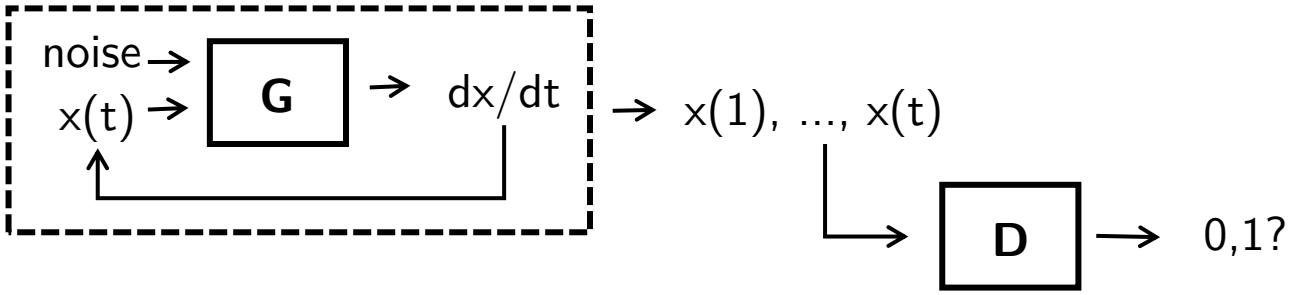
GAIL
(GAN for simulation of state/actions pairs)



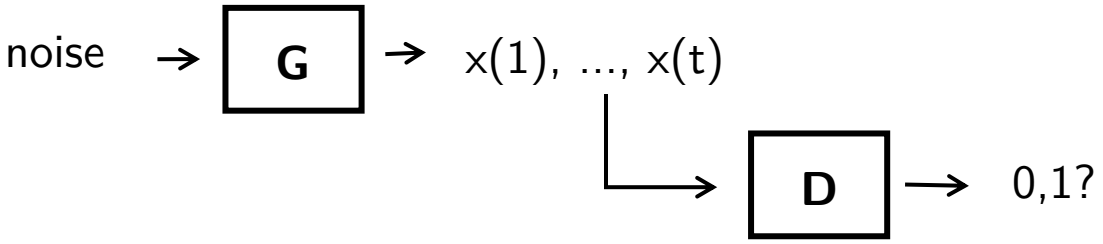
Problem formulation

2. Global formulation

Sequential Trajectory
(GAN)

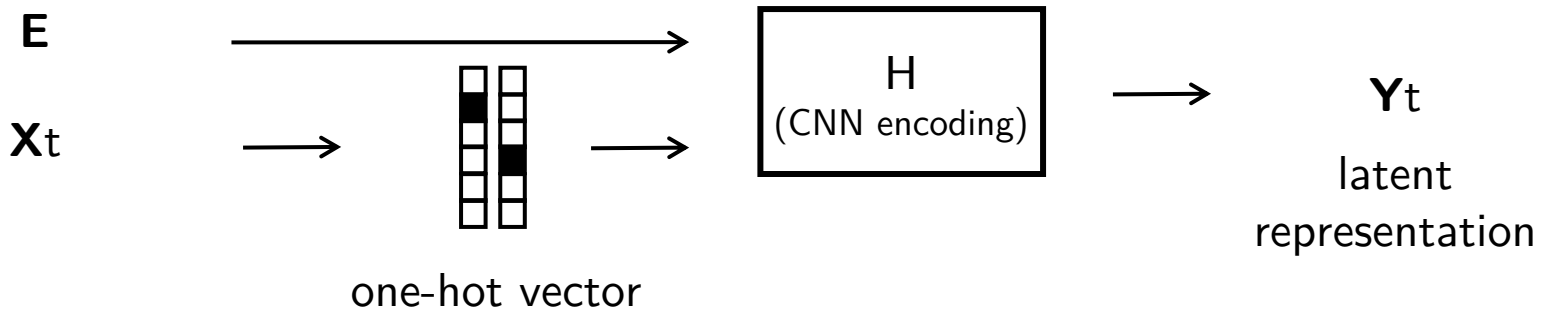


Global Trajectory
(GAN)



Latent Representation

- State **x(t) :** time-series of with window **n**
- Environmental conditions **E** fixed for a trajectory
- Positions coordinates **X**t



$$\mathbf{x(t)} = ((\mathbf{X}\text{t-n}, \mathbf{Y}\text{t-n}), ..., (\mathbf{X}\text{t}, \mathbf{Y}\text{t}))$$

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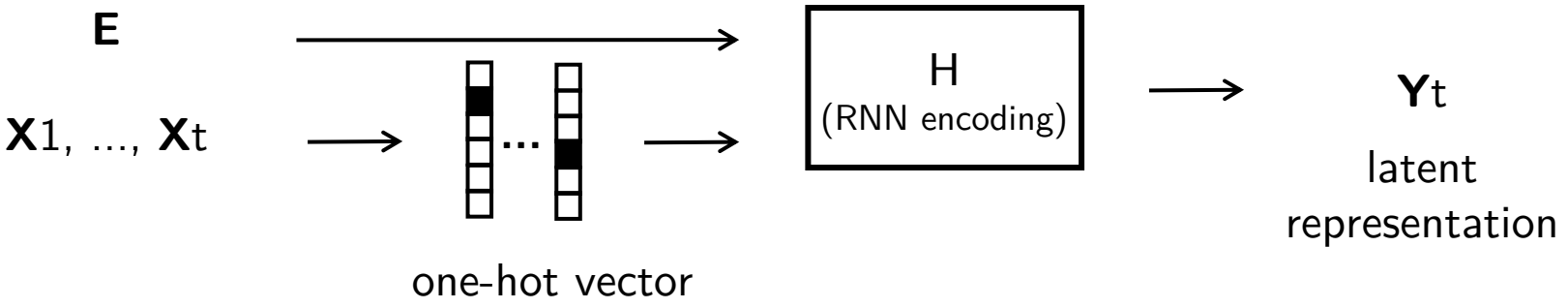

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Model Evaluation

Results

Discussion