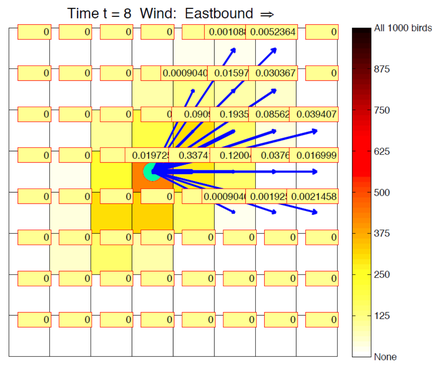
BirdCast:
Learning a Latent Dynamical Model from Count Data

Motivation

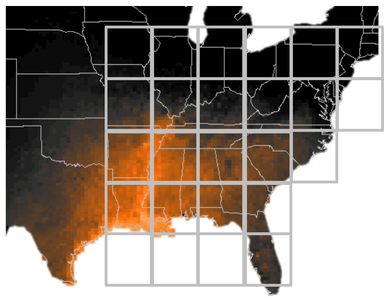
We often need to learn a model of a dynamical process in cases where we cannot directly observe the state of the process. Bird migration is a poorly understood dynamical process in which biologists wish to model how birds decide when to migrate, how far to fly each night, where to stop over, and when to resume flying. The data are collected by volunteer bird watchers and consist of the presence of a bird species at a particular place and time.

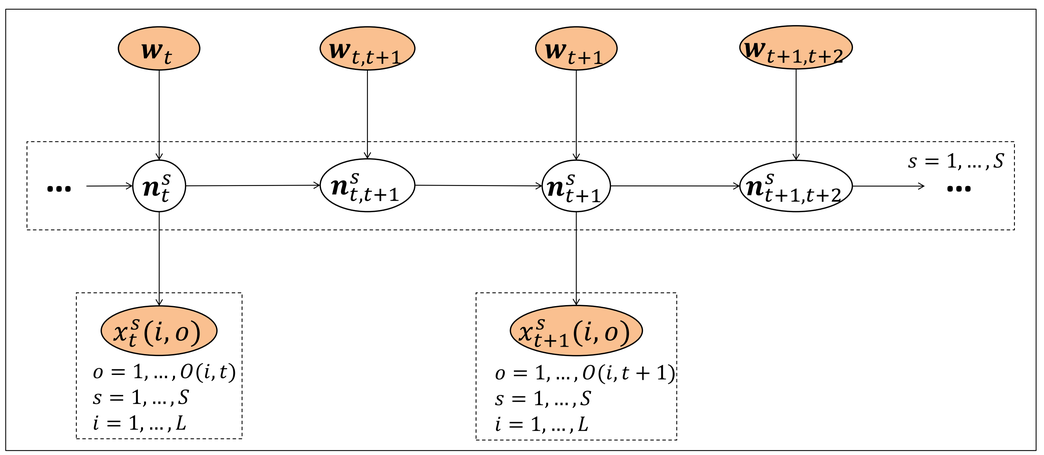
Simulated Dynamic Environment

In Year 1, we will work with simulated data for a single species. In subsequent releases, we will extend this to multiple species and to noisier observation models.
In Year 3, we will provide real data collected by participants in the eBird citizen science project.



Latent Dynamical Model





$\boldsymbol{n}_t^s$ is a vector of counts whose ith element is the number of birds of species s in cell i on day t. Input features: $\boldsymbol{w}_t$ and $\boldsymbol{w}_{t,t+1}$ describe the habitat in each cell i and the weather conditions (wind speed, direction, air temperature, humidity, etc.) that might influence bird migration. s indexes the species, o indexes the observers

Evaluation

We propose to assess performance on the following metrics (to be refined in subsequent discussions):

1. Near-term predictive accuracy (24 and 48 hours into the future)
2. Reconstruction of bird population flows. We will measure relative squared error.
3. Recovery of correct model parameter values for the latent dynamical model. We will measure relative squared error.
4. Coverage of confidence intervals or posterior credible intervals for the population flows and model parameters.

References

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