Simulate fake data differently.

My animal moves in a given trajectory. At every step, I determine the amount of time it took to traverse by drawing from a gamma distribution. Covariates change in a very coarse scale (i.e., large pixels). I record the results at fixed time intervals.

Estimation

In my model, I assume that:

In this model, and capture how the mean changes as a function of and and the number of pixels being summed. The issue with this expression is that will not change because is constant. For this reason, I don’t think that is estimable.

Therefore, when fitting this model, perhaps we can assume that:

If , then we have . If , this shows how the time per pixel changes as a function of . This is like in disease risk mapping where we rely on an internal standardization.

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Let be the set of parameters that only influence the marginal distribution of X.

Prospective likelihood

Retrospective likelihood

Notice that, in this expression, is fixed and is random (similar to a case-control design in epidemiology). We can further modify this expression in the following way:

If we are only interested in , then:

Notice that

Look at how Mueller and Roeder solve this problem.

M¨uller, P. and Roeder, K. (1997). A Bayesian semiparametric model for case-control studies with errors in variables.*Biometrika* **84**, 523**–**537

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We could model the number of pixels traversed within a particular time frame as a function of the characteristics of these pixels. We could just use average pixel characteristics, but this might be over-simplistic.

An easy model would be something like:

where is the average speed, perhaps modeled as .

This is not quite a generative model because, to calculate , we would need to know .

It is not entirely clear that you can just take an average of the covariates. However, this procedure should be ok if there is strong spatial autocorrelation in covariates, time steps are relatively short, and covariates are relatively coarse.

Can be zero? I believe so if the animal has not moved to another pixel.

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If I do not want to rely on the Poisson assumption, we could model using an ordinal model. This would enable us to use B-splines and BMA to understand non-linear relationships

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Assume that at each time step, a particular distance is traveled. If we assume a Poisson distribution, then we have that:

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Our response variable consists of the average time per pixel, given by .

Let be the time taken to traverse pixel j in time segment i. If we assume that , then we have that:

Finally, we assume that:

The problem with this approach is that it is not a generative model. In other words, it is not clear how to generate fake data for this in such a way that is random and is fixed.