

Hidden Markov Movement Modelling with Irregular Data

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Abstract : Hidden Markov Models have become popular for the analysis of animal tracking data. These models are being used to model the movements of a variety of species in many areas around the world. A common assumption of the model is that the observations need to have regular time steps. In many ecological studies, this will not be the case. The objective of the research is to modify the movement model to allow for irregularly spaced locations and investigate the effect on the inferences which can be made about the latent states. A modification of the likelihood function to allow for these irregular spaced locations is investigated, without using interpolation or averaging the movement rate. The suitability of the modification is investigated using GPS tracking data for lion (*Panthera leo*) in South Africa, with many observations obtained during the night, and few observations during the day. Many nocturnal predator tracking studies are set up in this way, to obtain many locations at night when the animal is most active and is difficult to observe. Few observations are obtained during the day, when the animal is expected to rest and is potentially easier to observe. Modifying the likelihood function allows the popular Hidden Markov Model framework to be used to model these irregular spaced locations, making use of all the observed data.

Keywords : hidden Markov Models, irregular observations, animal movement modelling, nocturnal predator

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