Homework 2
Colorado CSCI 5314

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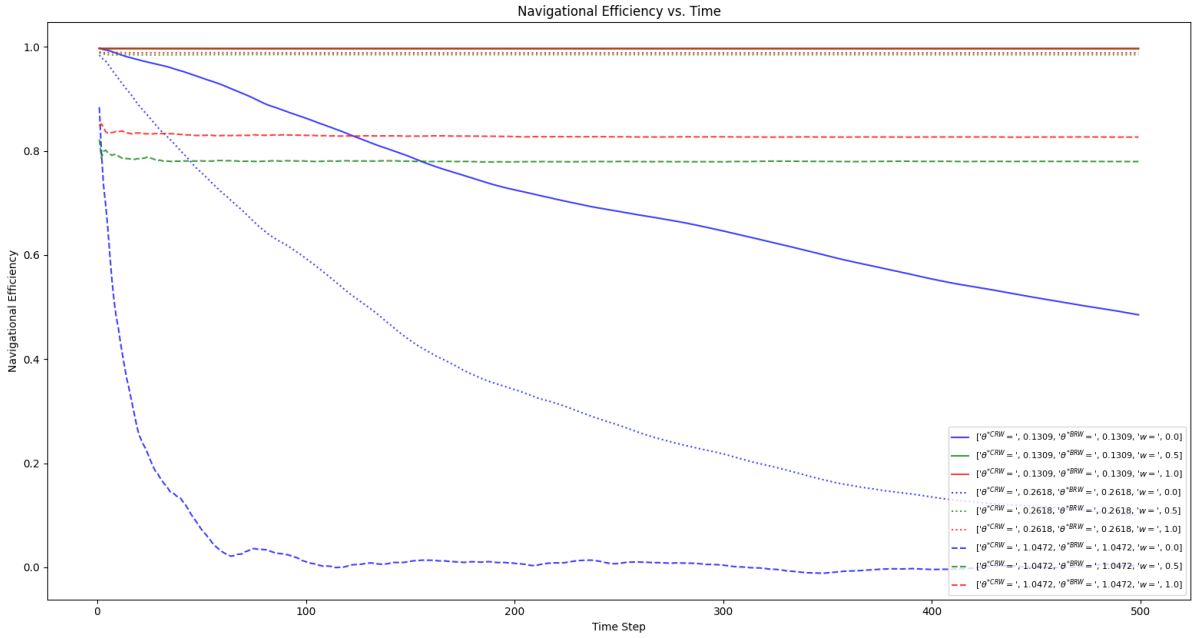
February 22, 2022

Simulation of Random Walks

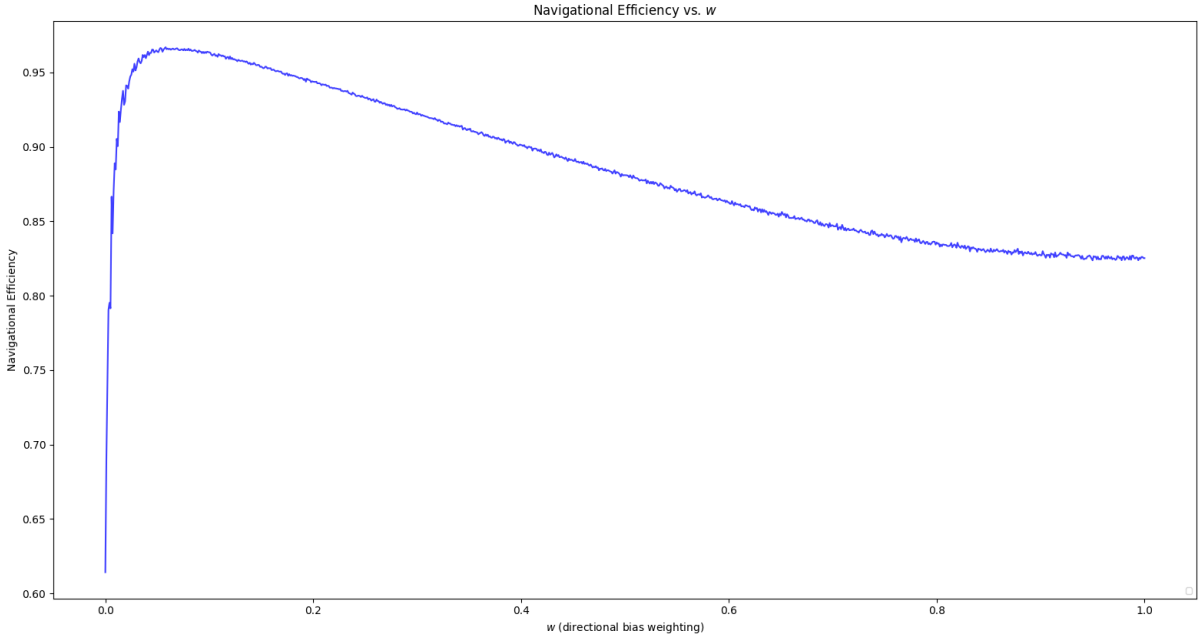
Below are the images from the simulations that were to be run, along with brief analysis. Code is available here.

(1)



As expected, higher values for $\theta^* = \theta^{*CRW} = \theta^{*BRW}$ yielded lower navigational efficiency, as the steps have the possibility of being more erratic with a higher turning angle distribution variance. $w = 0$ is shown to perform the worst, while $w = 1$ and $w = .5$ seem to perform fairly similarly.

(2)



The optimal navigational efficiency among the values sampled for w ($[0, 1]$ with a step size of .001) is roughly .9675 at w =.058. It seems that giving just a small weighting to the directional bias is favorable (giving zero weighting performs quite poorly, but giving increasingly large weighting sees degradation over time after the maximum).

Paper Review

Main Contribution

This paper is centered around the study of how animals move in their search for resources (food, mates, shelter, etc.). The authors aim to compare various random search techniques (Brownian walk, composite correlated random walk, correlated random walk, and truncated Lévy walk), and ultimately to determine if any of the explored techniques can accurately model animal search movement, evaluated using absolute fit.

Essential Principle Being Exploited

The authors use various random walk models, as it is expected that animals exhibit various degrees/styles of randomness in their search patterns, and thus a range of models must be explored. It's important to note that the models chosen vary in possible step size and multiphasic-ness, both of which seem to be key choices, covering as many bases as possible in terms of how animals may choose to move about their environments.

Major Strength

The authors do a great job in mentioning possible issues with their methods (both biological and methodological), and addressing the possible impacts those issues may have. It allows readers to gain awareness of said issues while avoiding dwelling on them as detractors from the importance of the findings of the paper.

Weakness

While many issues are mentioned (as described above as a strength), I feel that it could be very beneficial to find a way to remedy some of them. While addressing issues such as animal memory, sensory indicators, and geographical challenges may not be able to reasonably fit into a singular paper, having all information in one place and quelling concerns as they are addressed may make for a more cohesive reading experience.

Future Work Direction

Aside from remedying the aforementioned issues, I think it could be very interesting to extend this study to further species. Both inter- and intra-family species studies could make revelations that allow valuable comparisons between species (i.e. maybe big cats search in a different manner than other mammals, or pack animals search differently than those that go it alone, or birds search differently than land- or sea-bound animals due to vast geographical importance to lifestyle and movement).