Lack of confidence?

Effects of estimating sampling uncertainty to animal social network analysis

# Introduction

# Material and methods

# Results

# Conclusion

# Acknowledgment

# References

# Math context and rationale

## Definition of empirically-inspired ground-truth adjacency matrix

Let the weighted adjacency be the one of a network with nodes and sampling effort from the ASNR R package and its original published paper, with:

|  |  |  |
| --- | --- | --- |
| , |  |  |

from which we wish to derive a matrix of probability as follows:

|  |  |  |
| --- | --- | --- |
| , |  |  |

which we approximate in our simulation with:

|  |  |  |
| --- | --- | --- |
| , |  |  |

This way, boundaries of depend on the "sampling resolution" , reflecting the confidence one can have in a zero or a in the original matrix .

We then recreate a ground truth weighted adjacency matrix through the simulation and sum of binary adjacency "snapshots" as follow:

|  |  |  |
| --- | --- | --- |
| , |  |  |

with:

|  |  |  |
| --- | --- | --- |
| ,  , |  |  |

Thus, , and .

## Simulating empirical group-scan sampling method

We define as a matrix of probability of observing an edge (whether it be 0 or 1) at each snapshot :

|  |  |  |
| --- | --- | --- |
| ,  , |  |  |

thus setting:

|  |  |  |
| --- | --- | --- |
| ,  , |  |  |

Therefore, the weighted adjacency matrix is defined as follows:

|  |  |  |
| --- | --- | --- |
| , |  |  |

with , .

For instance, one can define in the case of a systematic chance of missing any edge.

## Simulating empirical focal-scan sampling method

We define as a vector of probability of having a node being sampled during snapshot so that:

|  |  |  |
| --- | --- | --- |
| ,  ,  , |  |  |

Therefore, the weighted adjacency matrix is defined as follows:

|  |  |  |
| --- | --- | --- |
| , |  |  |

with , .

For instance, one can define in the case of a random choice of focal at each snapshot.

## Simulation simplification, notably for rare events

Let's consider the case where , thus . We therefore expect many where , and consequently .

We note hereafter:

and:

One can note and are mutually exclusive and exhaustive events, *i.e.*:

and thus:

that we note

Therefore, let be defined as follows:

|  |  |  |
| --- | --- | --- |
| , |  |  |

As mentioned before, in the case of rare events, and thus when . Therefore, we first simulate a distribution , and only calculate , , and for , considering: