Pseudo-code for simulating the Snapshot model

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Reminder: The method here implemented is the one described in general terms in Carrizo Vergara et al. (2024, Section 6.1). The underlying trajectory model is supposed to depend upon a parameter θ_X. The `R` function present in the repository is a vectorized implementation of this code, which can only be applied for square snapshot regions and for Brownian motion with advection underlying movement.

Algorithm 1 Algorithm to simulate the Snapshot model

Input: N, θ_X, p, the times of snapshot takes $t_1, ..., t_n$, and for every $k = 1, ..., n$, the disjoint regions $A_{k,1}, ..., A_{k,m_k}$ over which the snapshots are taken at time t_k.

for $j = 1, ..., N$ **do**
    Simulate the individual trajectory $(x_j(t_1), ..., x_j(t_n)) \sim \mu_{X(t_1),...,X(t_n)|\theta_X}$.
end for
Define $\boldsymbol{Q} = (\vec{Q}_k)_{k\in\{1,...,n\}}$ a list of n null vectors, each vector $\vec{Q}_k = (Q_{k,1}, ..., Q_{k,m_k})$ being of dimension m_k ($\boldsymbol{Q}$ can be a null matrix if $m_1 = ... = m_k$).
for $k = 1, ..., n$ **do**
    for $l = 1, ..., m_k$ **do**
        $Q_{k,l} \leftarrow \sum_{j=1}^{N} \mathbb{1}_{A_{k,l}}(x_j(t_k))$
        $Q_{k,l} \leftarrow Binomial(Q_{k,l}, p)$
    end for
end for
return $\boldsymbol{Q}$

References

Carrizo Vergara, R., Kéry, M., & Hefley, T. (2024). Movement-based models for abundance data. *arXiv preprint arXiv:2407.13384*.