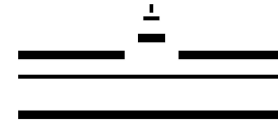




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Cluster size analysis on a distance-weighted city growth model

by Diego Rybski et al. (2013)

Geosimulation Modelling
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Outline

- Introduction
- Conceptual model
- Methodology
- Comparison of results
- Conclusions

Introduction

- City Growth
- Probabilistic model
- Spatial distribution of the urban regions
- Relation between parameters and properties of the urban clusters

Introduction

How a city growth based on parameters such as exponential decay (γ), size of the study area ($N \times N$), iteration (i) and occupation probability (p)?

We will reproduce Fig. 1

$$q_j = C \frac{\sum_{k \neq j} w_k d_{j,k}^{-\gamma}}{\sum_{k \neq j} d_{j,k}^{-\gamma}},$$

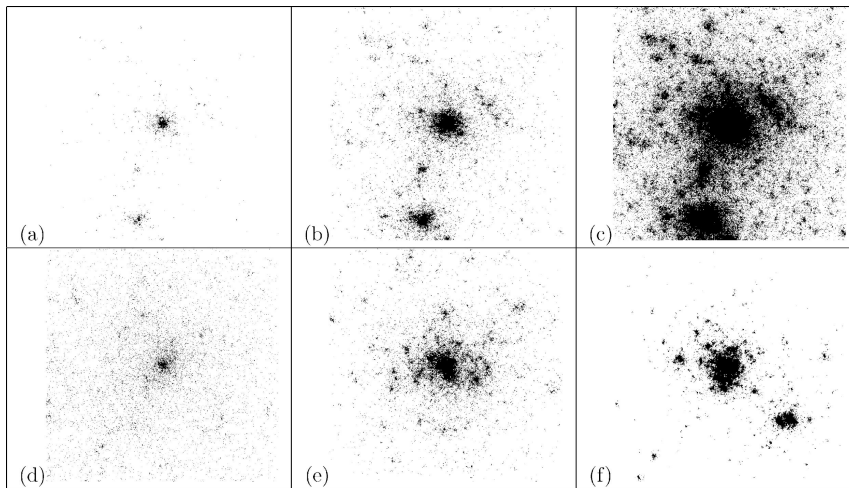


Fig. 1

Introduction

Find emerging clusters of urban areas and visualize the relationship between the cluster sizes (S) and their Probability Density P(S)

We will be able to reproduce Fig. 2

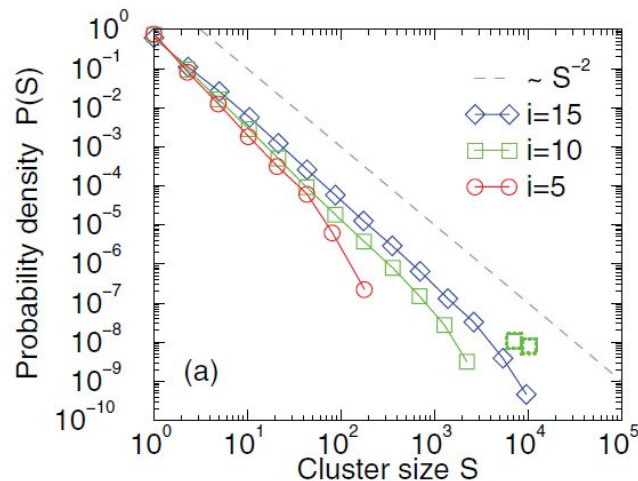
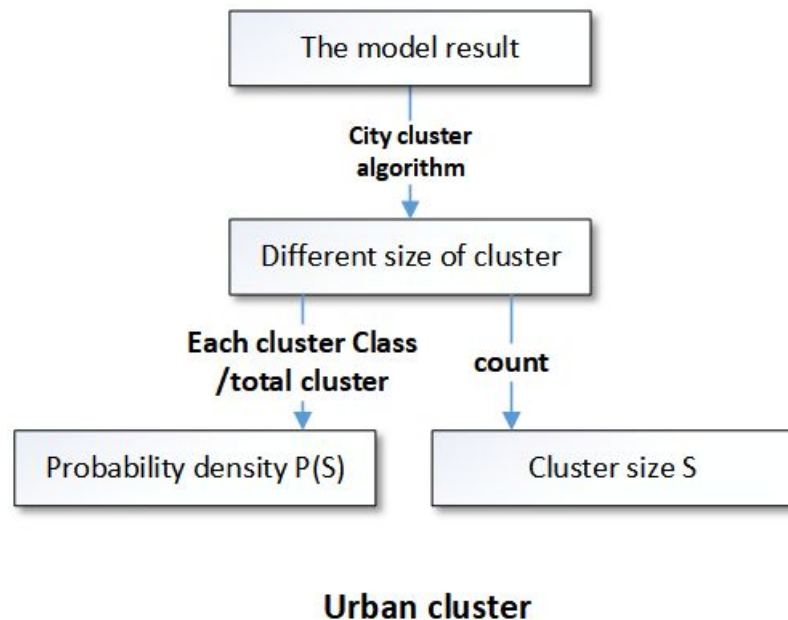
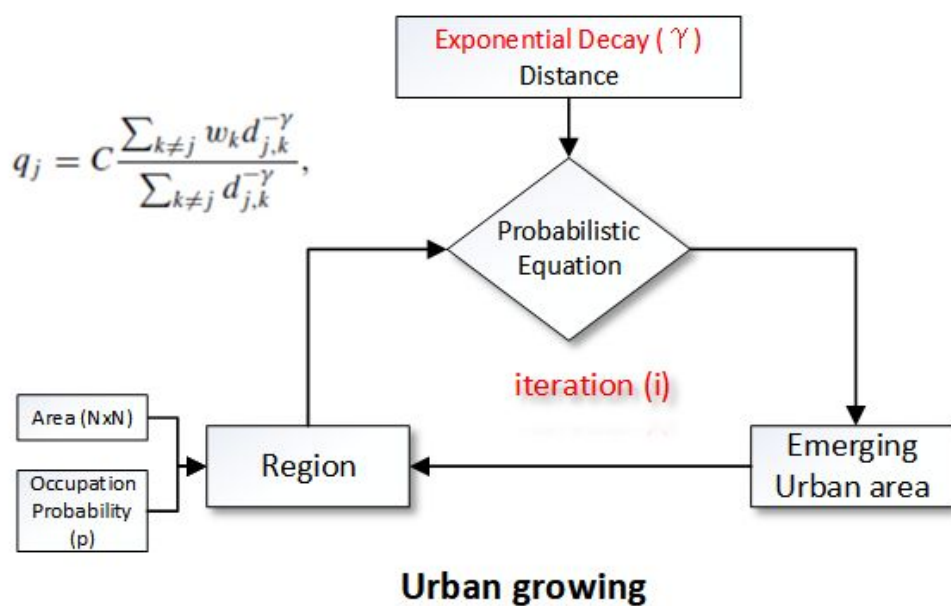


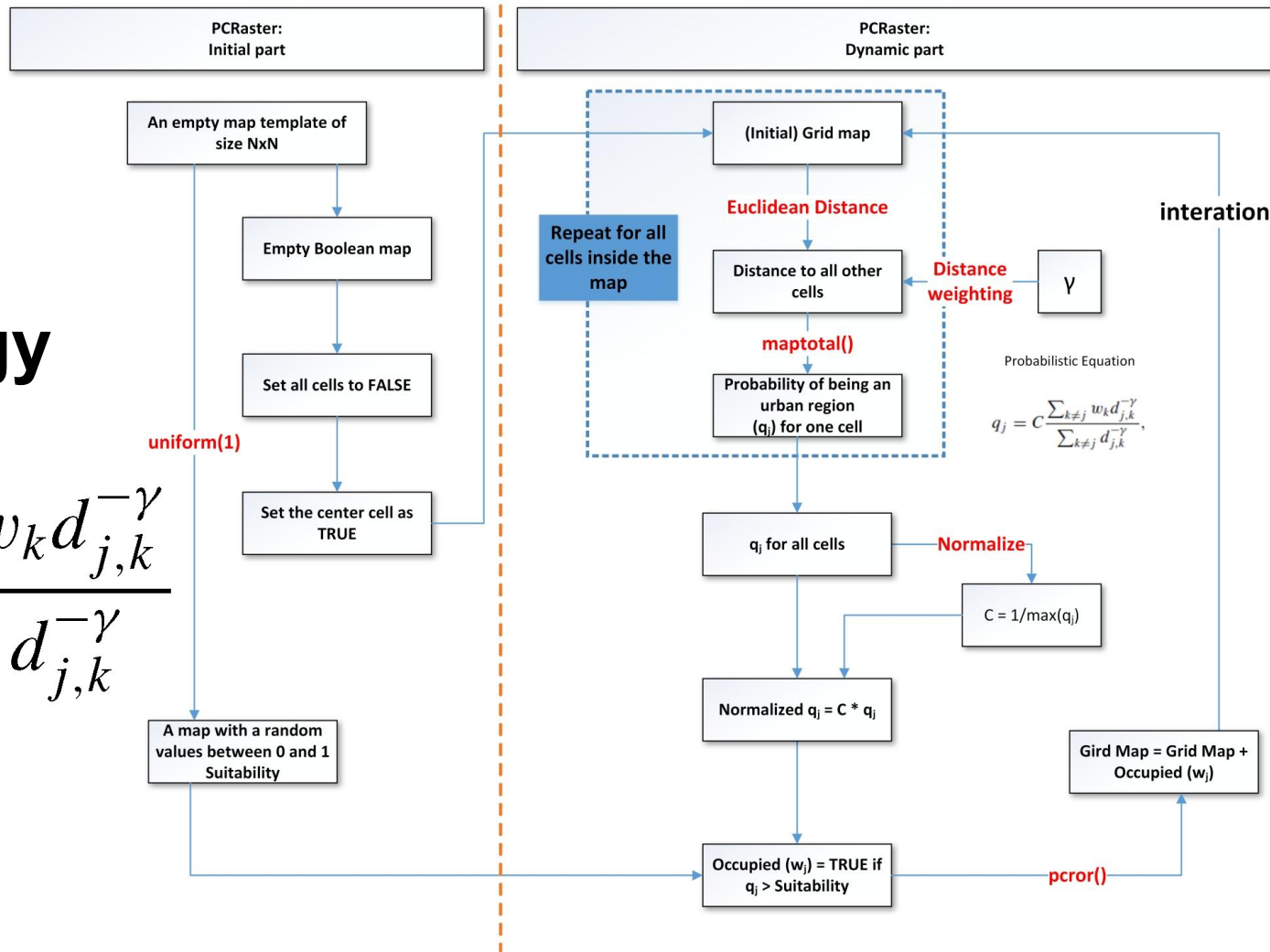
Fig. 2

Conceptual model

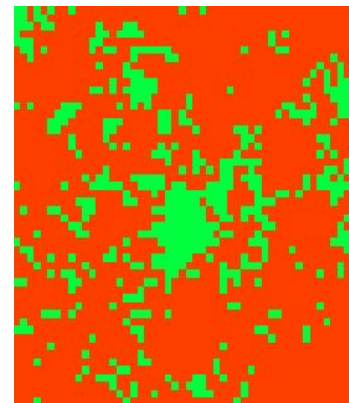
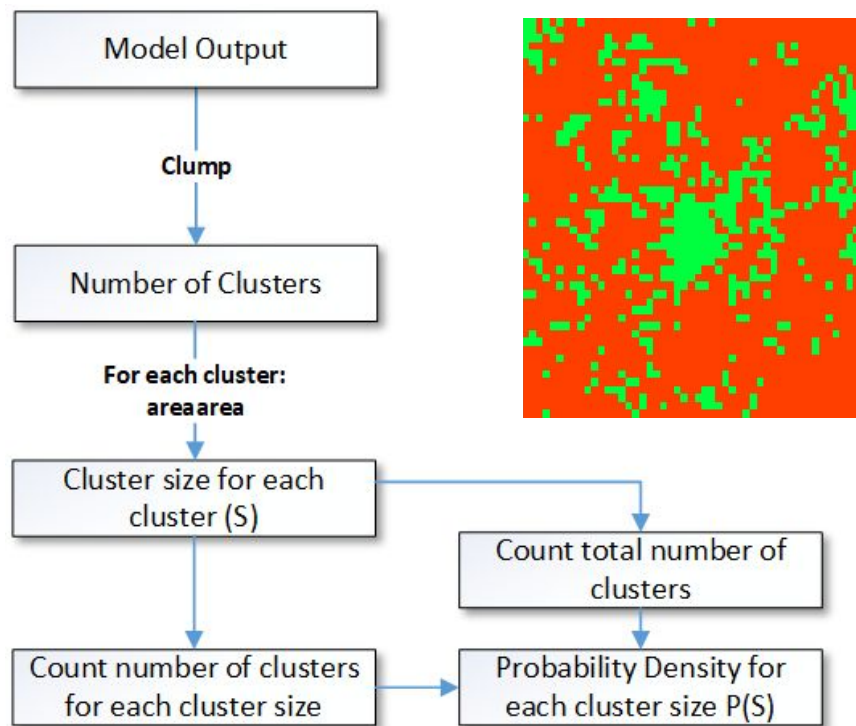


Methodology

$$q_j = C \frac{\sum_{k \neq j} w_k d_{j,k}^{-\gamma}}{\sum_{k \neq j} d_{j,k}^{-\gamma}}$$



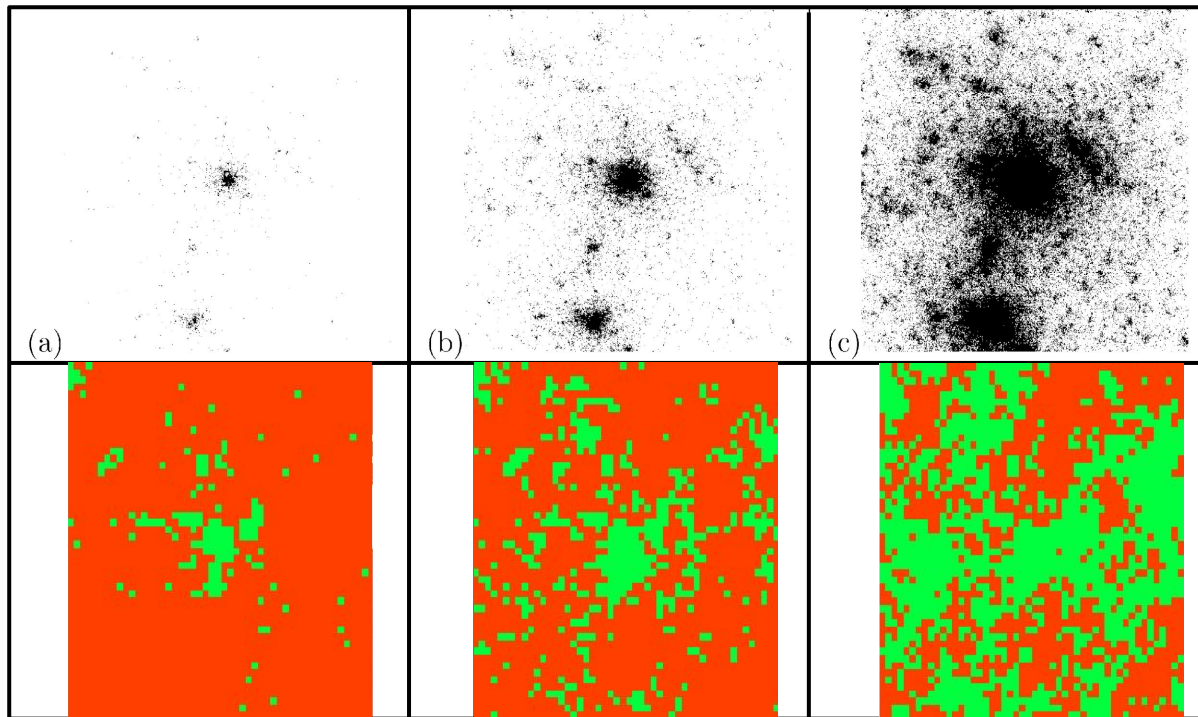
Methodology



Urban cluster model

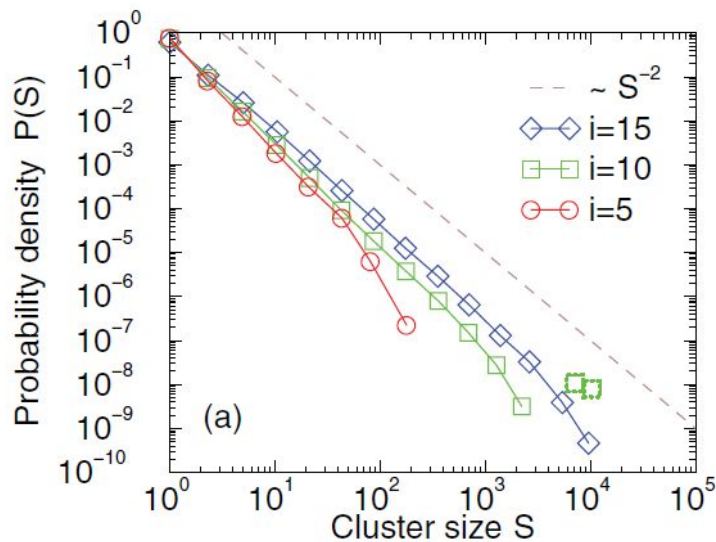
Comparison of results

Result from paper

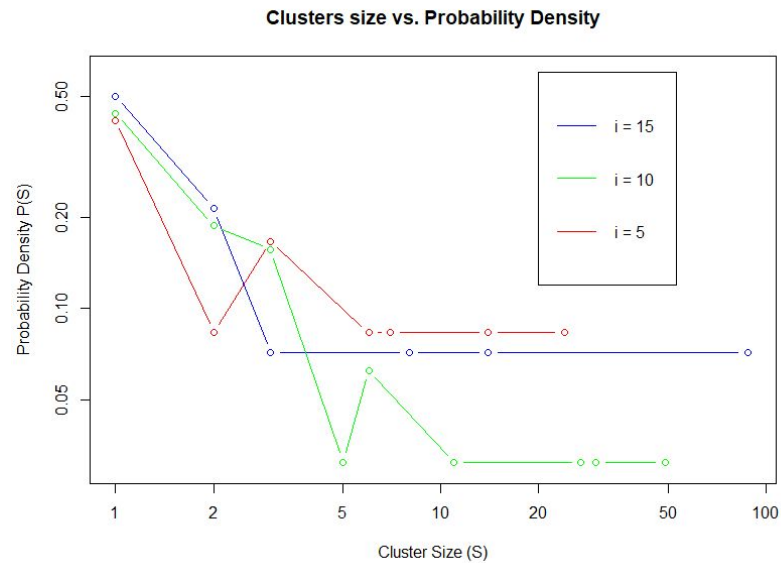


Result from
our model

Comparison of results



Result from paper



Result from our model

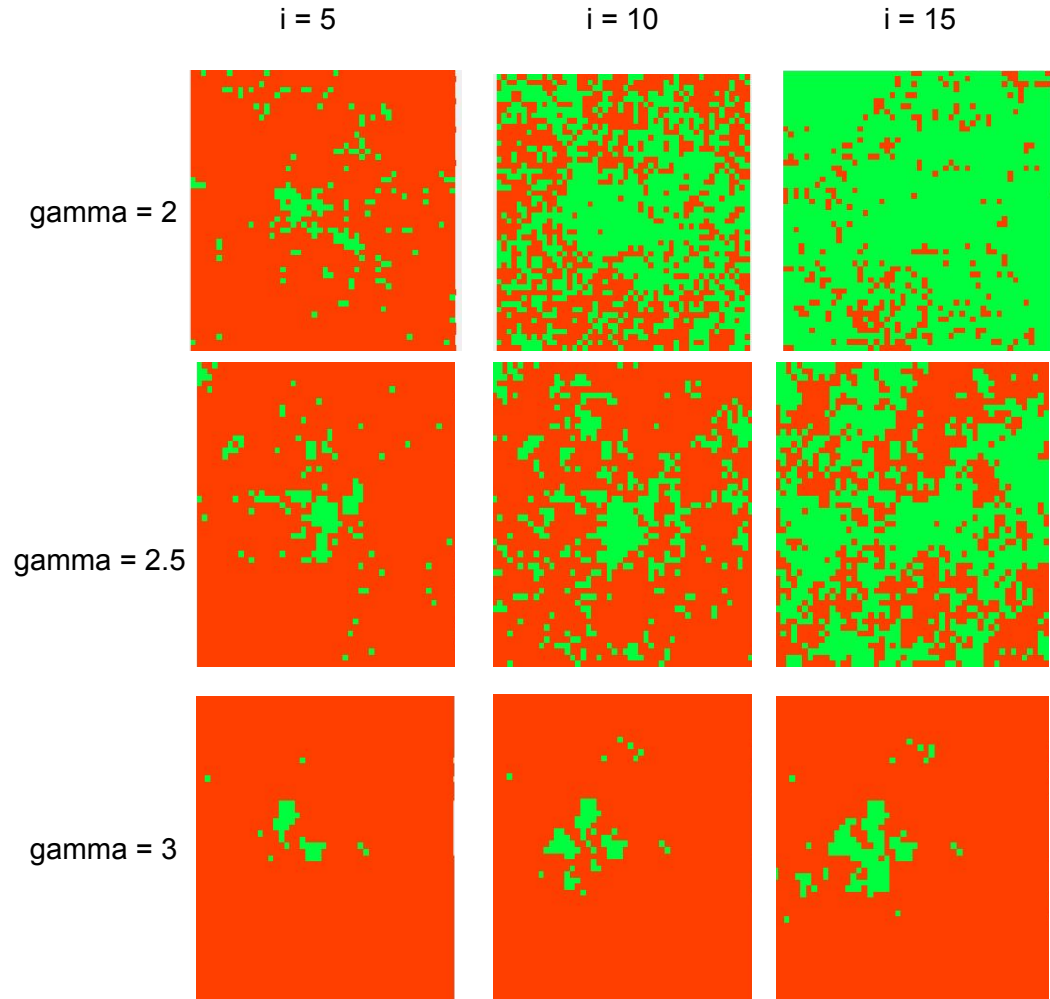
Conclusion

Discussion

- Role of gamma (γ) in the formation of clusters
- Applicability of the model to real-world cities

Limitations & Future Scope

- Computationally intensive
 - Pre-calculating distances using `spread()` improves the performance by reducing the number of nested loops from 4 to 2
- Validating the model on historical LULC maps of real-world cities having satellite townships
- Calculating γ based on other socio-economic factors
- Calculating the *inertia* (used `uniform(1)` here) for each cell based on existing government policies



References

1. H. D. Rozenfeld, D. Rybski, J. S. Andrade, Jr., M. Batty, H. E. Stanley, and H. A. Makse, Proc. Natl. Acad. Sci. USA 105, 18702 (2008).
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3. PCRaster documentation, 2017, Retrieved from <http://pcraster.geo.uu.nl/pcraster/4.1.0/doc/manual/index.html>
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An aerial photograph of Paris, France, showing the dense urban landscape, the Seine River winding through the city, and the Arc de Triomphe prominently in the foreground. The text "Thank you! Questions?" is overlaid in the center.

Thank you!
Questions?