ifgi
Institute for Geoinformatics
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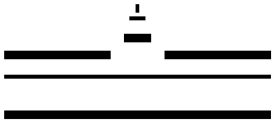

Westfälische
Wilhelms-Universität
Münster

Cluster size analysis on a distance-weighted city growth model

by Diego Rybski et al. (2013)

Geosimulation Modelling
February 2018

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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 (NxN), iteration (i) and occupation probability (p)?

We will reproduce Fig. 1

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

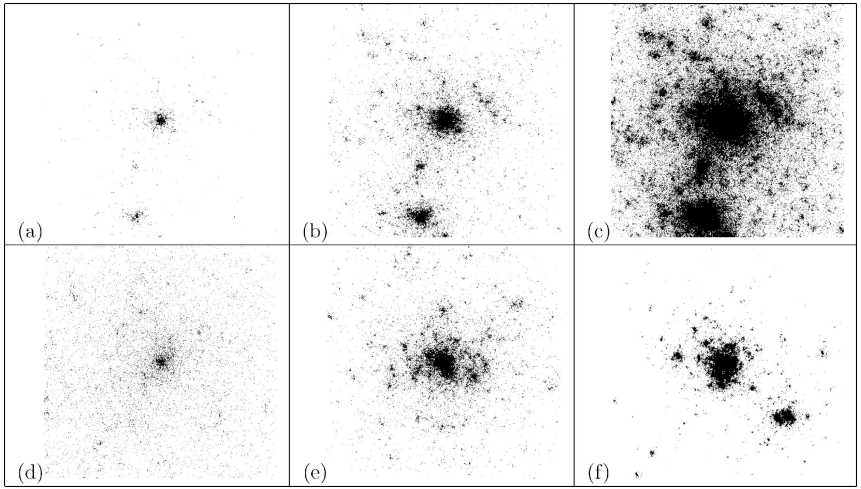


Fig. 1

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

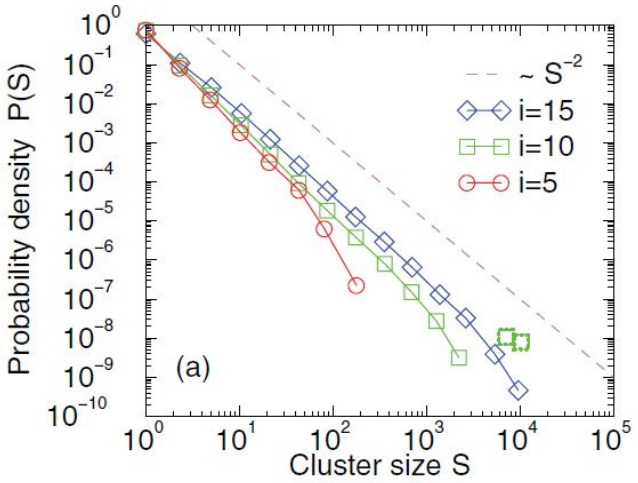
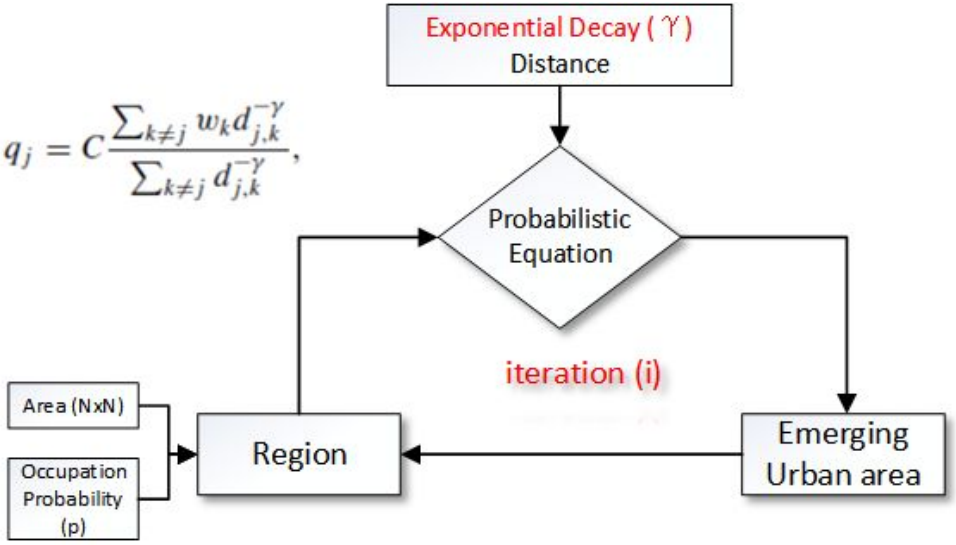


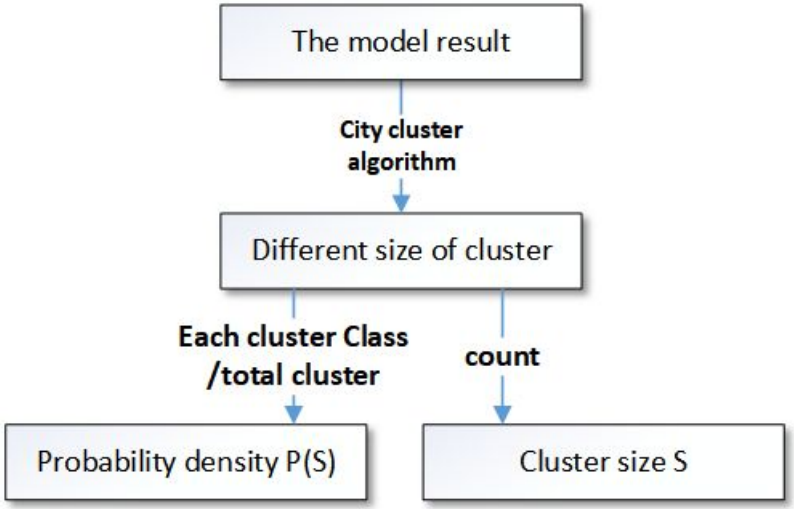
Fig. 2

Conceptual model

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



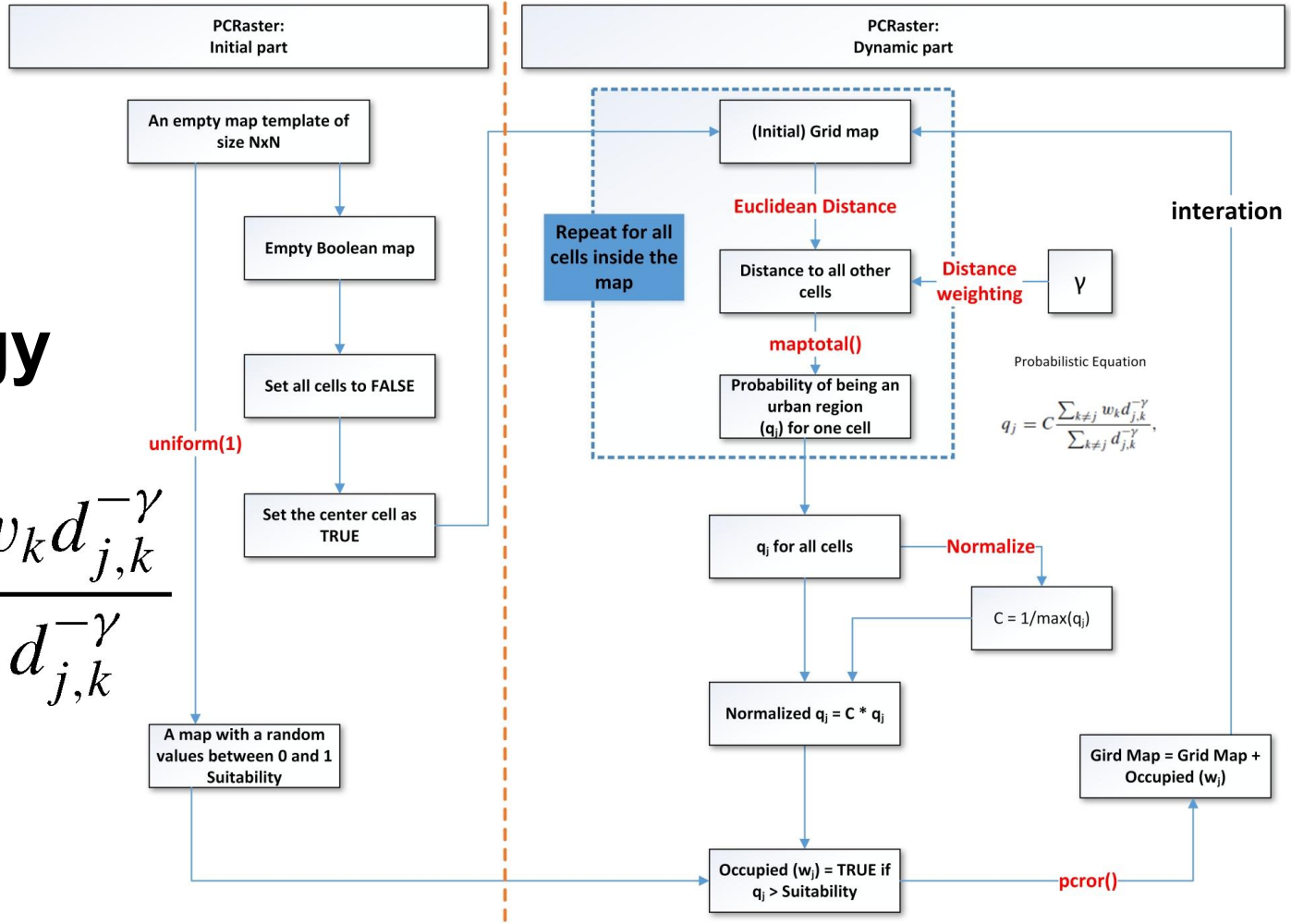
Urban growing



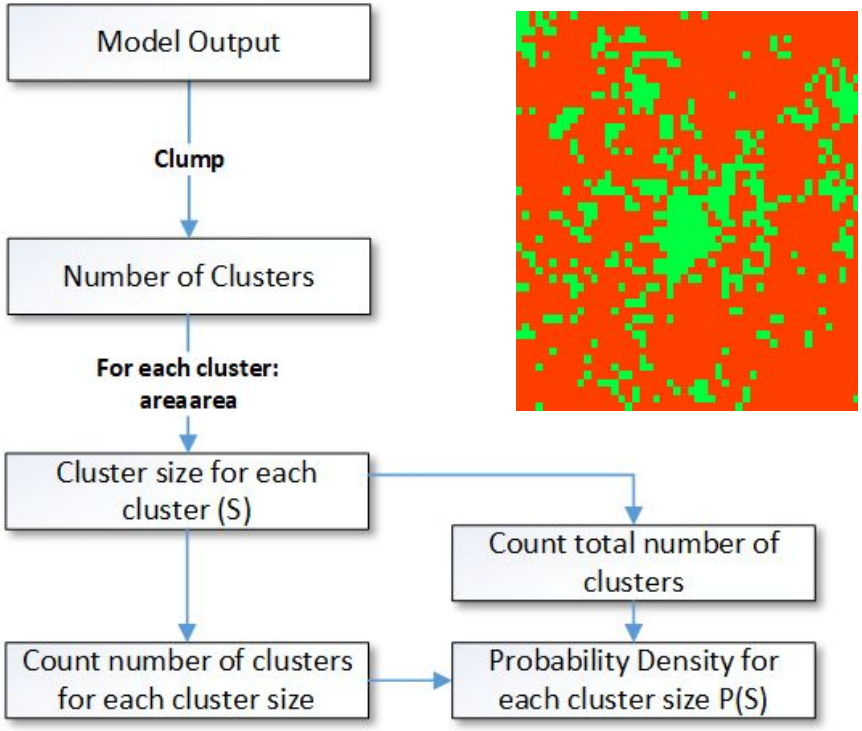
Urban cluster

Methodology

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



Methodology

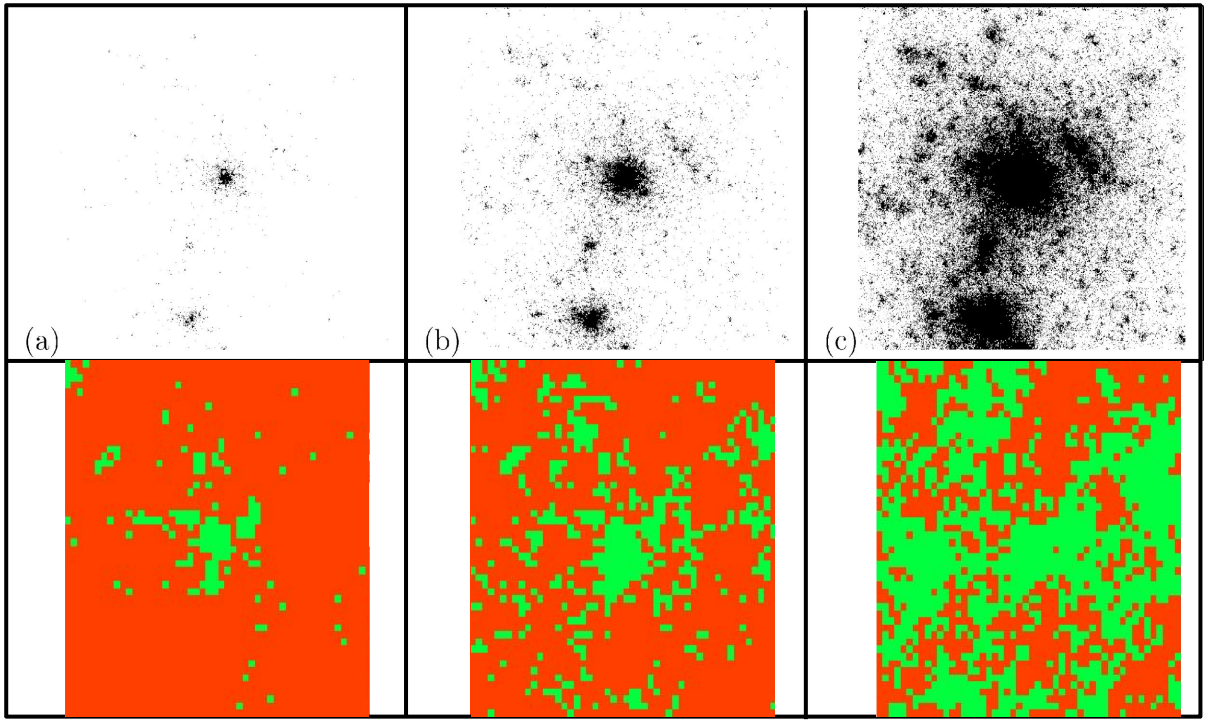


Urban cluster model

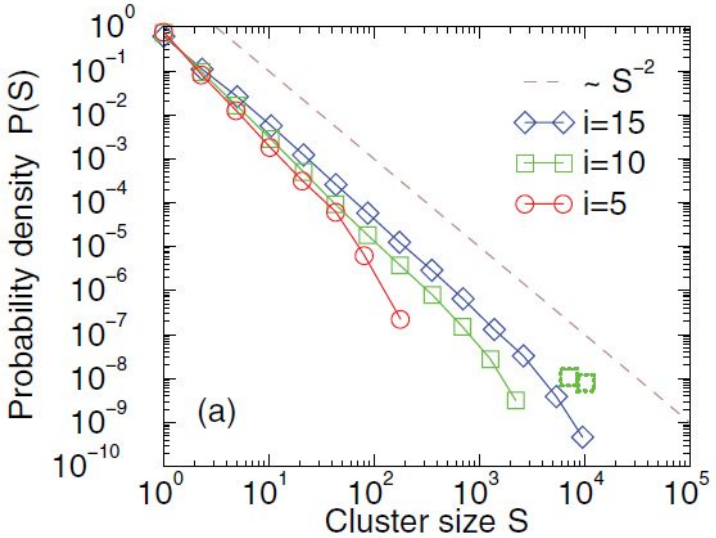
Comparison of results

Result from paper

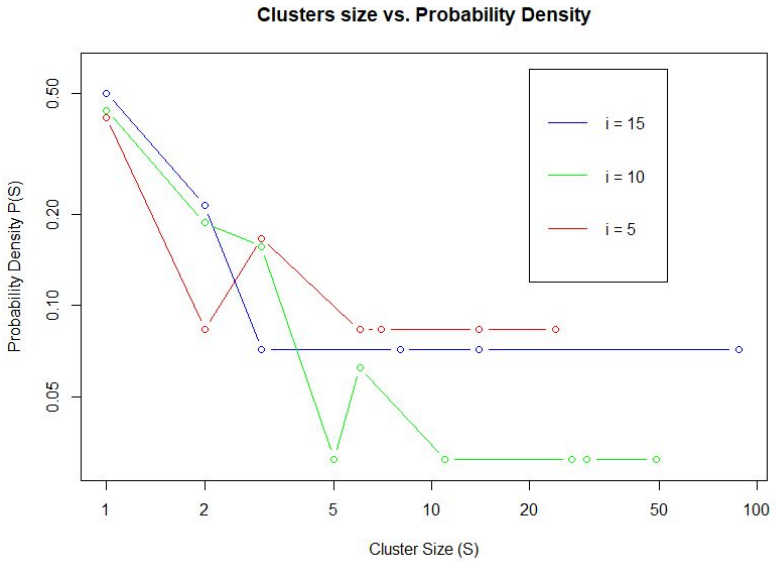
Result from our model



Comparison of results



Result from paper



Result from our model

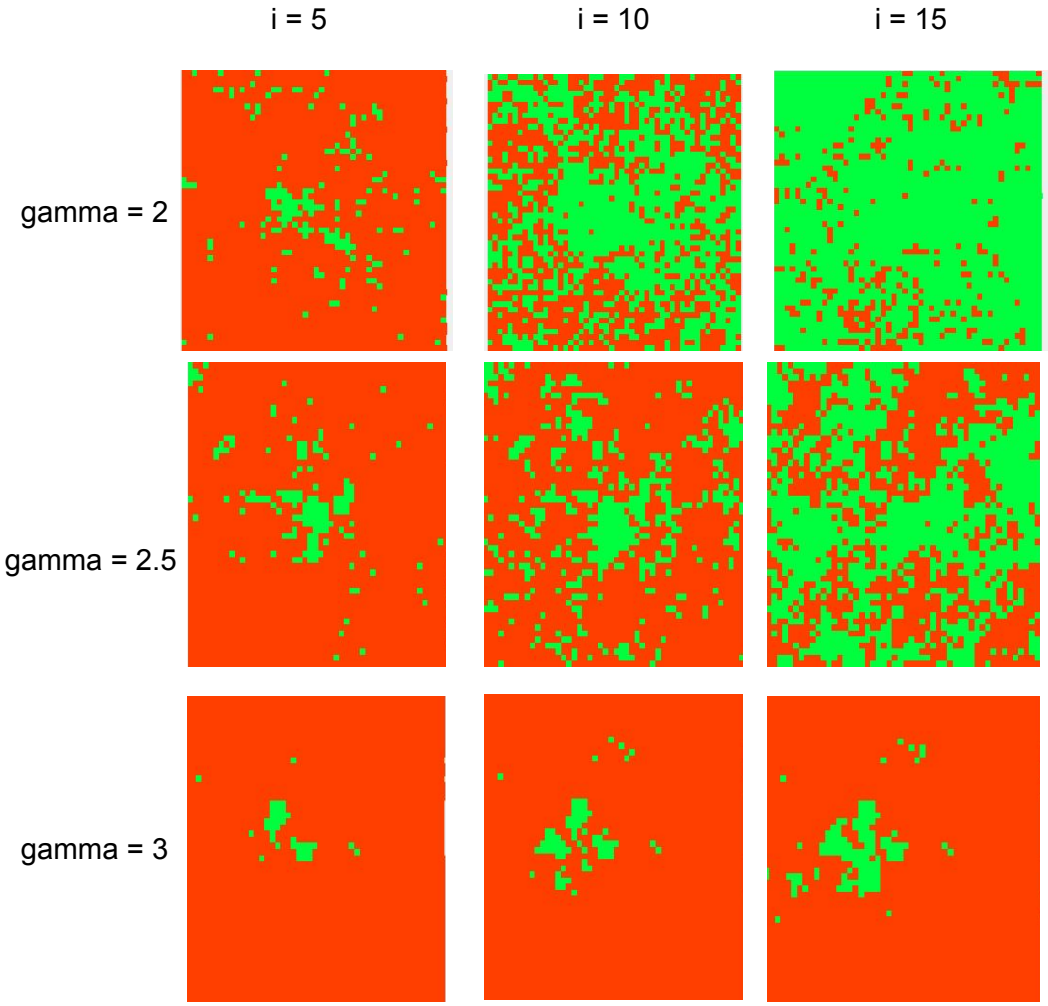
Conclusion

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

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2. H. D. Rozenfeld, D. Rybski, X. Gabaix, and H. A. Makse, Am. Econ. Rev. 101, 560 (2011).
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Thank you!
Questions?