

Modeling isolation of communities

MNJB projekt

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January 9, 2015

- 1 Project challenges
 - Implementing models
 - Finding clusters
 - Algorithms design
- 2 Results
 - Key interests
 - Visualization

Isolated communities

Introduction

Project was meant to recreate model of isolated communities described papers in bibliography

- create a model base
- create model evolution
- detect isolated clusters
- experiment with different amounts of species
- experiment with external bias

Project challenges

Model

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Model

Chain

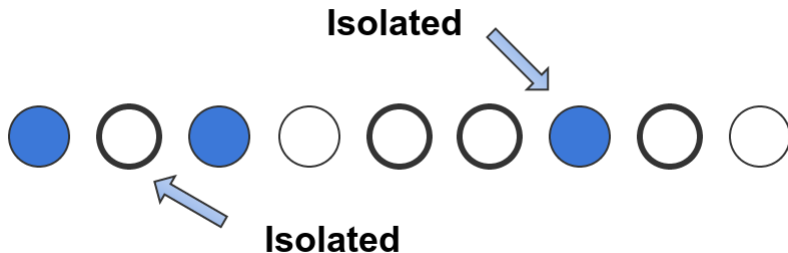


Figure: Chain Model - two species can isolate each other and create isolated nodes or clusters

Model

Lattice

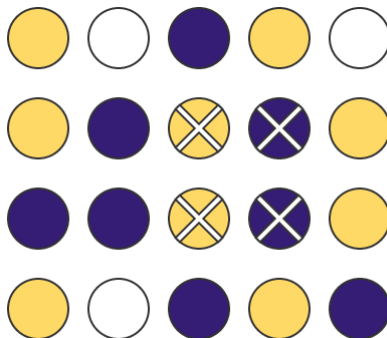


Figure: Lattice Model - isolated nodes are crossed. We use Von Neumann Neighbourhood

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Project challenges

Finding clusters

How to count clusters in the general case? What kind of algorithm to use?

- able to count clusters of frozen chain/lattice
- able to count during model evolution
- fast and efficient
- extendable

Project challenges

Finding clusters - algorithm design

Two algorithms for two different cases

- detection and counting during evolution
- detection and counting in frozen state

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Finding clusters - algorithm design

Main Ideas behind the algorithm:

- breadth first search

http://en.wikipedia.org/wiki/Breadth-first_search

- inserting a specie in empty space can turn clusters of nodes into isolated clusters if they contain a neighbour of new node

Project challenges

Finding clusters - algorithm design

Start simple:

- chain model
- check it and analyze results of simulations
- make similar model for lattice

Project challenges

Visualization of results

Papers about community isolation illustrate analytical predictions for model with simulations result.

- recreate figures
- compare curves and trends
- check if simulation agrees with prediction

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Key Interests

- trends of increasing number of isolated nodes, how curves look like
- t_c critical time when appears first isolated cluster
- observing the impact of bias, bias is the difference between probabilities of creating new node of the given specie (more about bias in bibliography)

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Visualization of number of isolated nodes changing in time

Chain

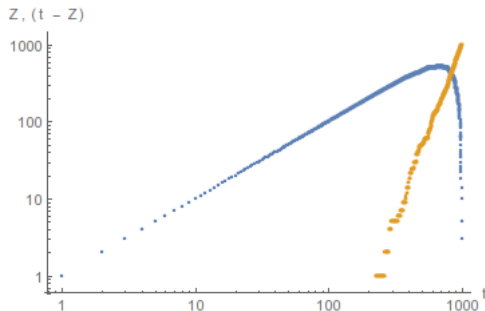


Figure: Number of isolated nodes (dashed lines) and not isolated nodes of each specie (solid lines) versus time for chain size $N = 1000$

Visualization of number of isolated nodes changing in time

Lattice

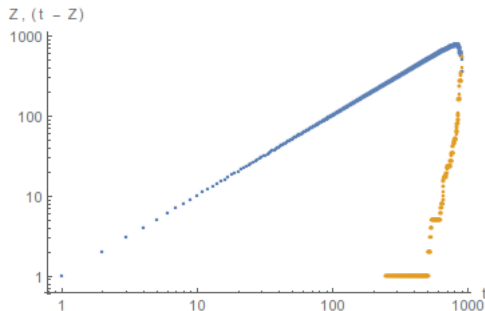


Figure: Number of isolated nodes (dashed lines) and not isolated nodes of each specie (solid lines) versus time for lattice size $N \times N$, $N = 30$

Isolated vs non-isolated for different chain sizes

Chain

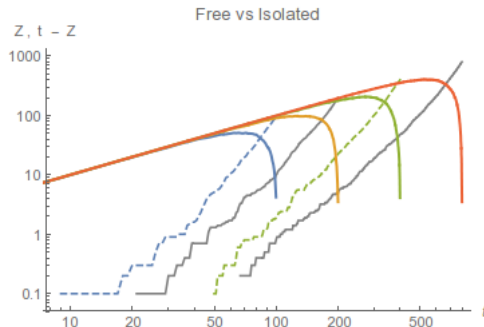


Figure: Number of isolated nodes (dashed lines) and not isolated nodes of each specie (solid lines) versus time for different chain sizes N , sizes are from left to right: 100, 200, 400, 800

Isolated vs non-isolated for different chain sizes

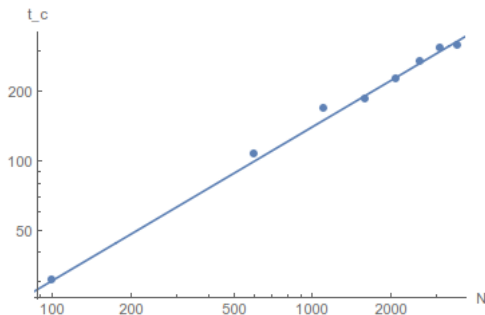


Figure: The critical value of time t_c versus the chain size N , $m=2$. Values are from numerical simulations (Mean of 40 for each size) and solid line is fitted curve ($2/3$)

Critical time values for different numbers of species

m: 2, 4, 8

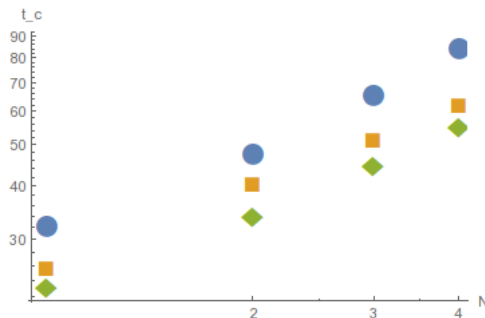


Figure: The critical value of time t_c versus different numbers of species m : 2, 4, 8 from top to bottom. Values are from numerical simulations (Mean of 40 simulations for each size)

blocked nodes for bias values,

ϵ ; $1/20, 2/20 \dots 9/20$

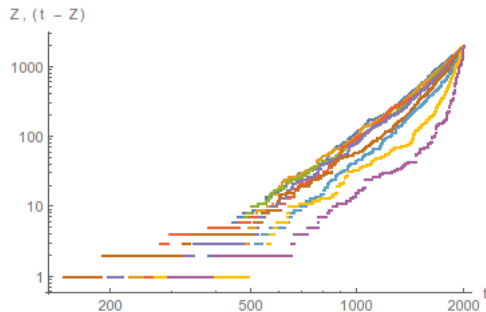


Figure: Number of blocked nodes for bias values, ϵ ; $1/20, 2/20 \dots 9/20$

- Results look similar to those in the papers.
- My work isn't exhaustive, but gives some insight into the model



Julian Sienkiewicz and Janusz A. Holyst

Nonequilibrium phase transition due to communities isolation.

2009



Julian Sienkiewicz , Grzegorz Siudem, and Janusz A. Holyst

External bias in the model of isolation of communities

2010