Diffusion of innovation within an agent-based model: Spinsons, independence and advertising

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Introduction and motivation

Diffusion of innovations is a theory that seeks to explain how, why, and at what rate new ideas and technology spread.

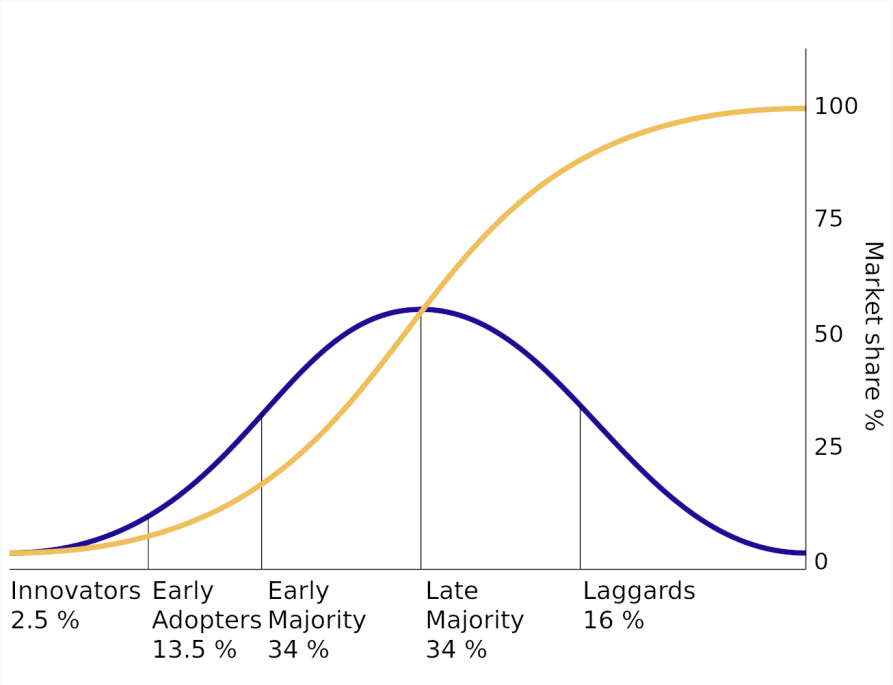


Figure 1: The diffusion of innovations according to E.Rogers. Source: `https://en.wikipedia.org/wiki/Diffusion_of_innovations#/media/File:Diffusion_of_ideas.svg`

Diffusion of innovation model

Model presentation

Model parameters

- Conformity p
- Independence f
- Advertising h

Conformity

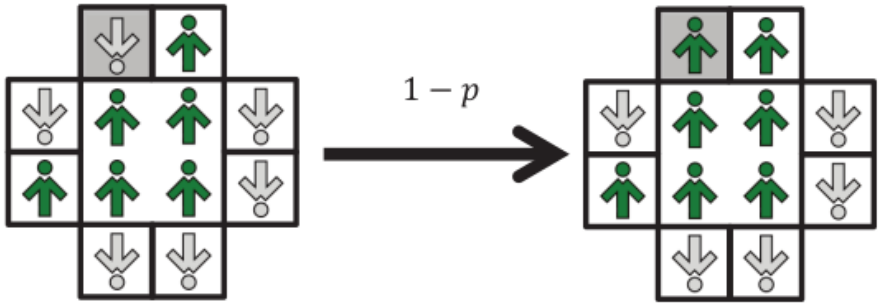


Figure 2: Schema of conformity p. Source: [1].

Independence

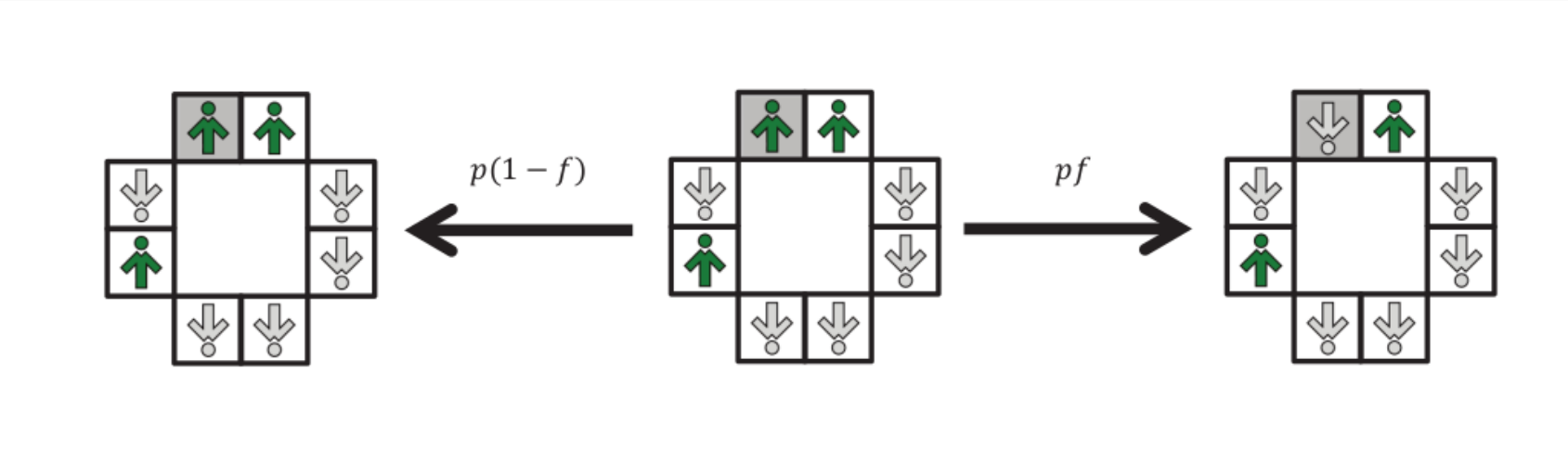


Figure 3: Schema of independence f. Source: [1].

Advertising

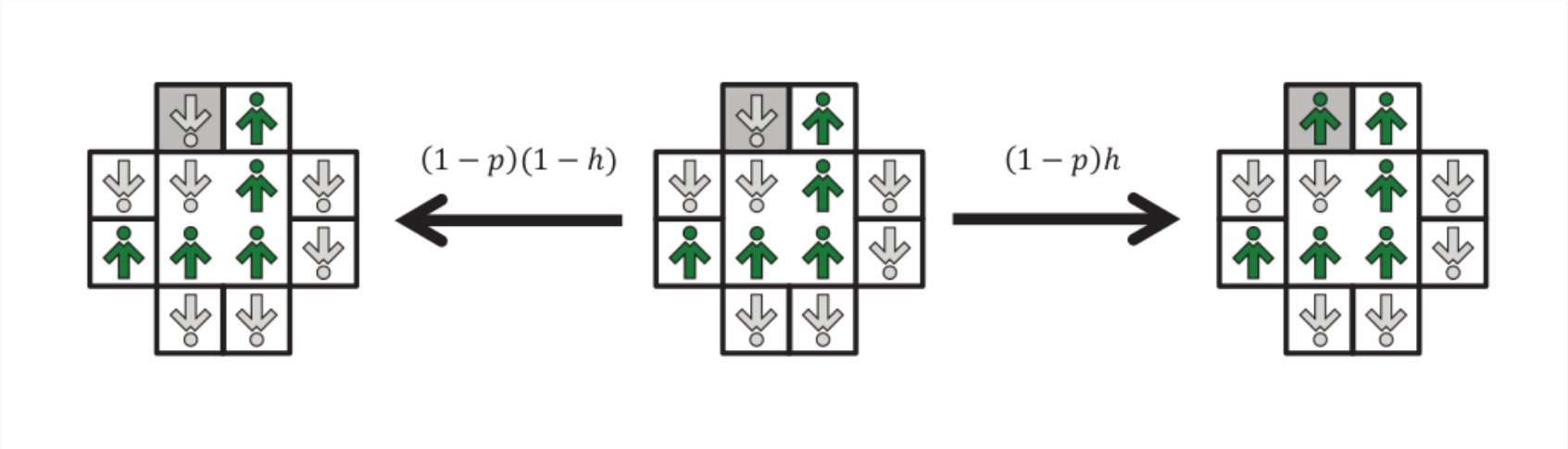
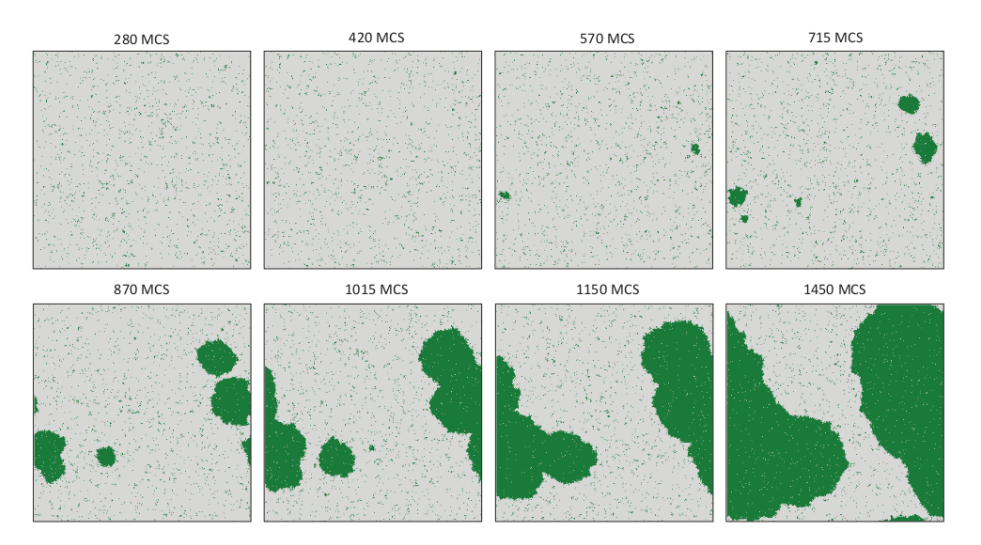


Figure 4: Schema of advertising h. Source: [1].

2D Lattice simulation



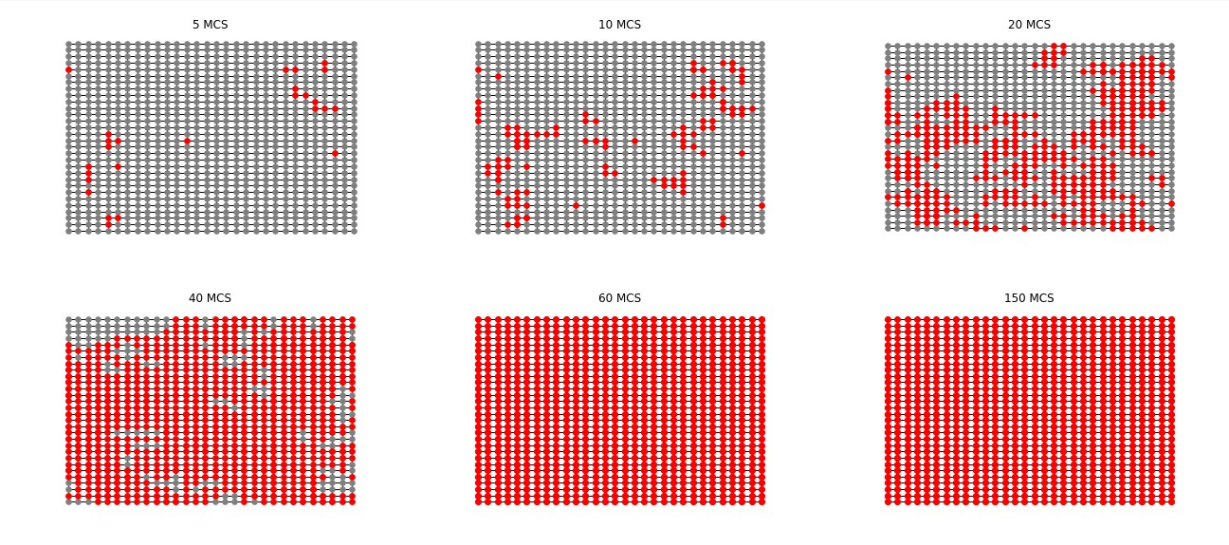


Figure 5: Up - publication; down - ours.

Concentration in time

Concentration

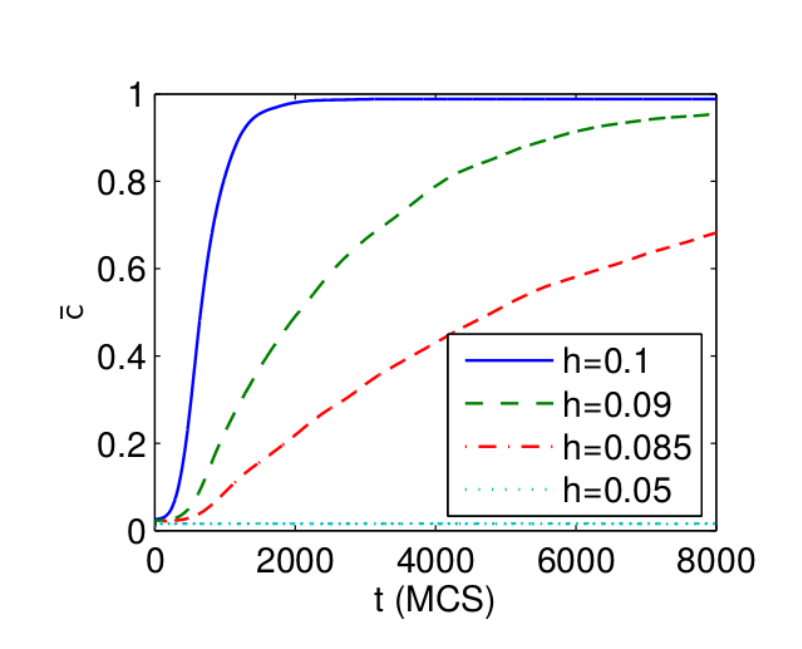
Concentration

$$c_t = \frac{N_{\uparrow}(t)}{N}$$

where

- $N_{\uparrow}(t)$ - number of adopted people, i.e. spinsons with opinion $= 1$
- N - number of people in network

2D Lattice results



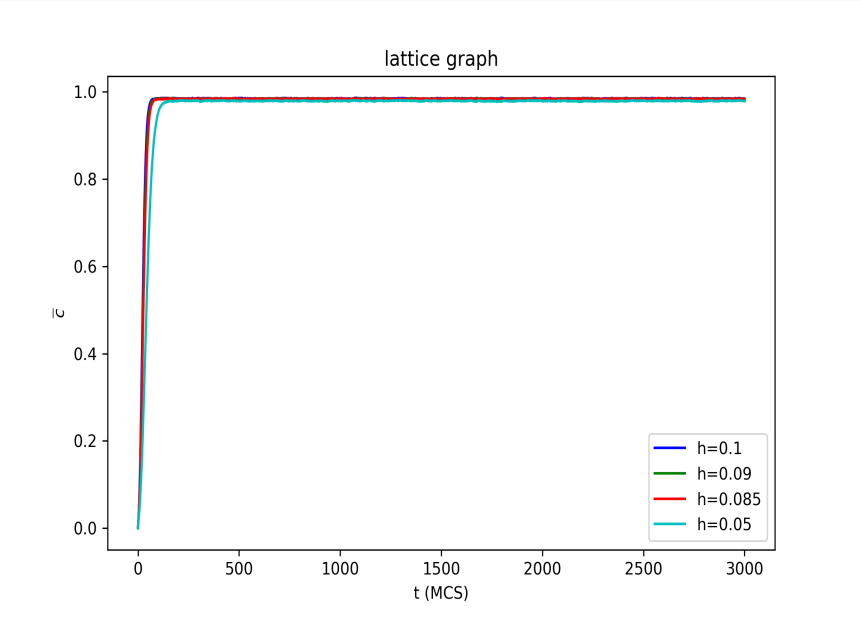
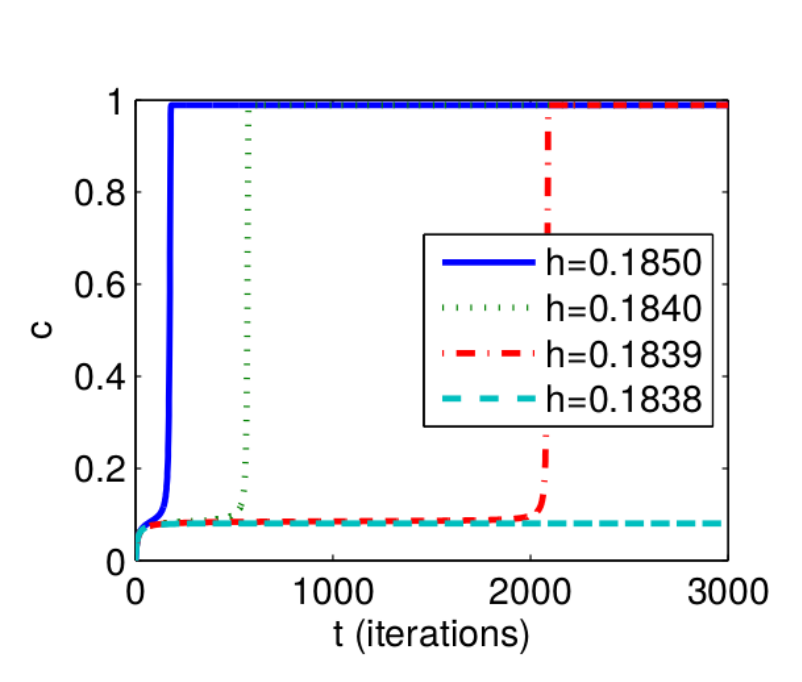


Figure 6: Left - publication; right - our simulation with 3000 MC steps and 100 independent runs on a grid lattice with 900 nodes. .

Complete graph results



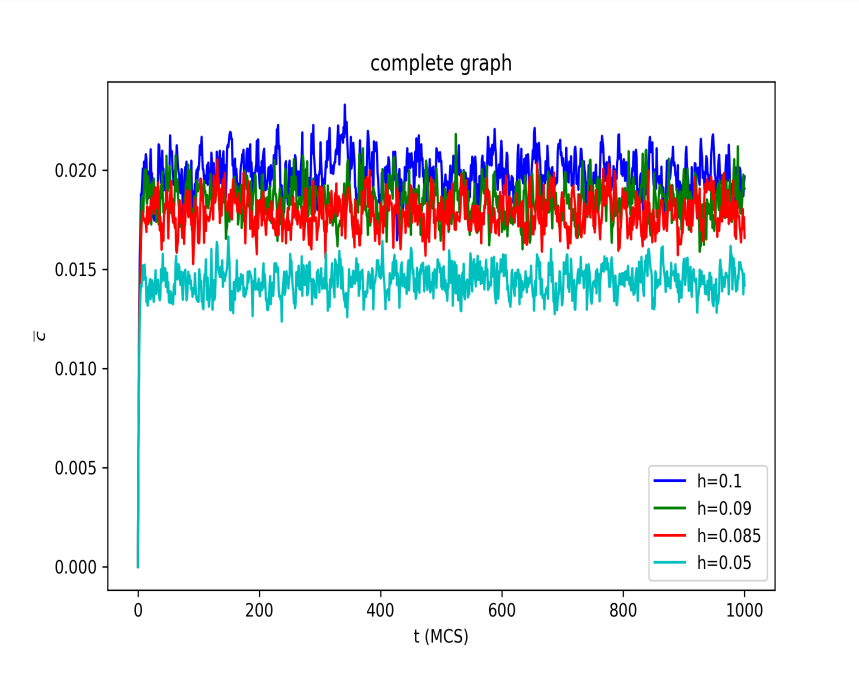


Figure 7: Left - publication; right - our simulation with 1000 MC steps and 100 independent runs on a complete graph with 400 nodes.

Watts-Strogatz results

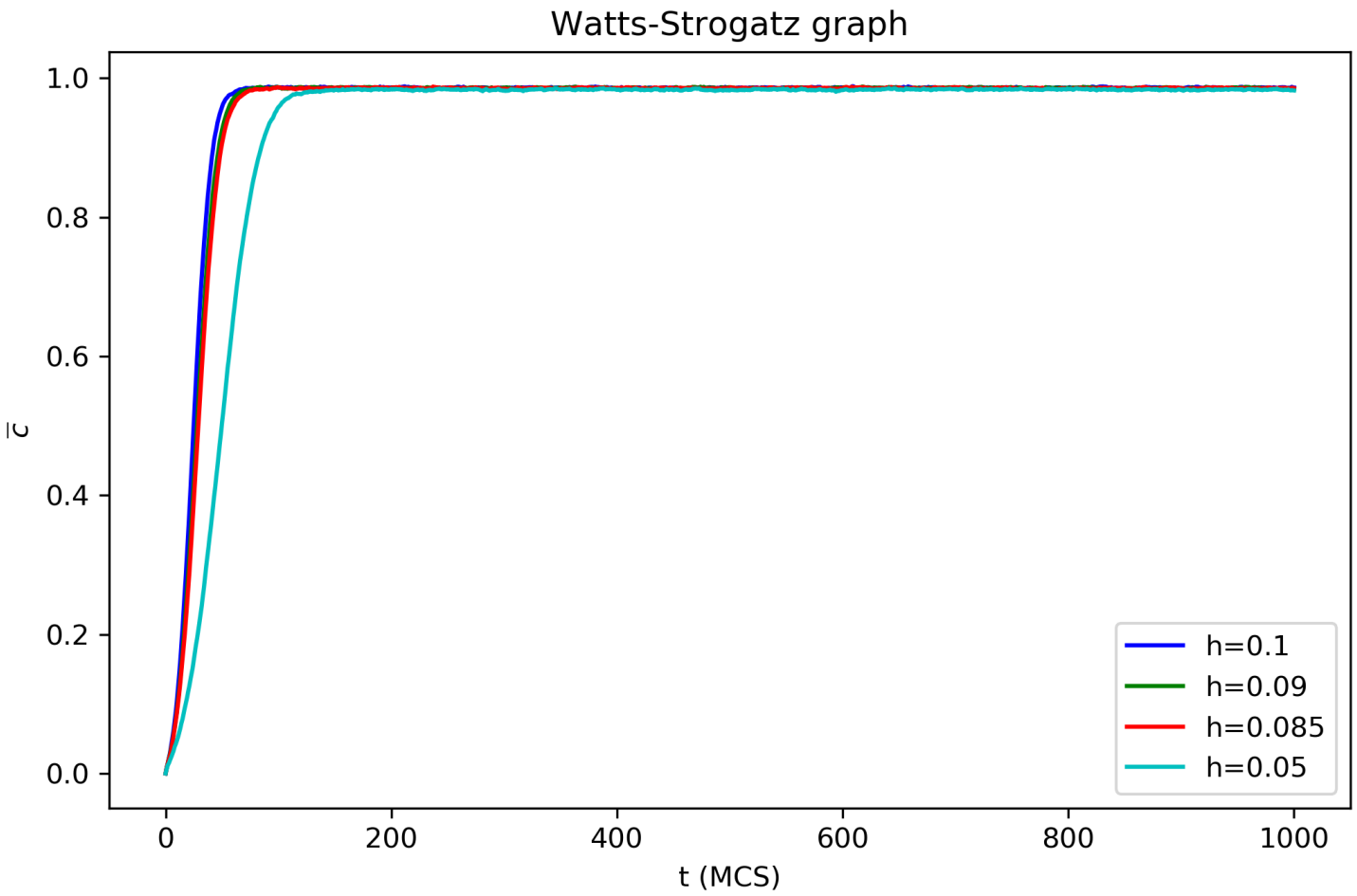


Figure 8: Our work - simulation with 1000 MC steps and 100 independent runs on a Watts-Strogatz (k=4,p=0.3) graph with 400 nodes.

Barabasi-Albert results

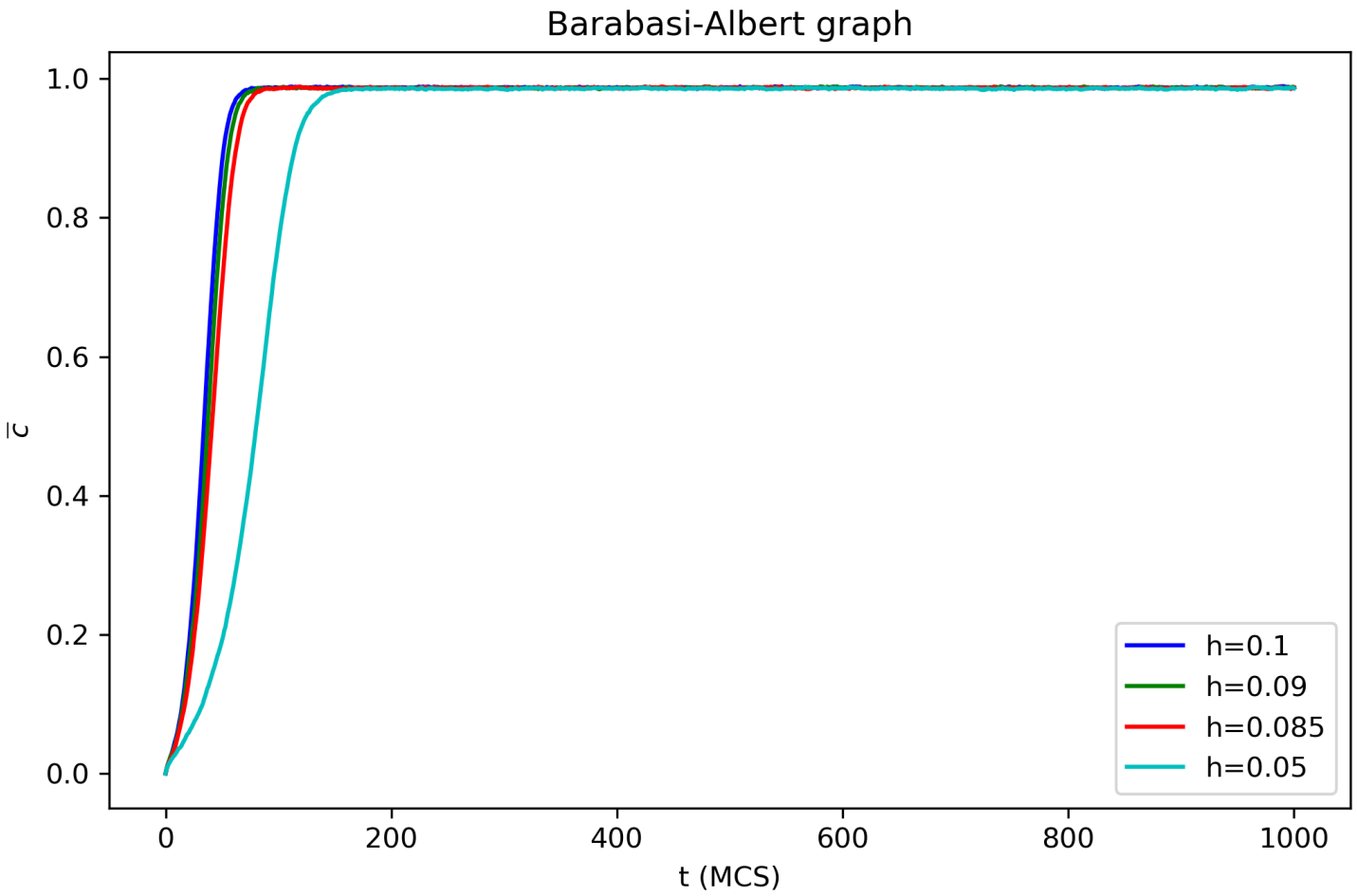


Figure 9: Our work - simulation with 1000 MC steps and 100 independent runs on a Barabasi-Albert (2) graph with 400 nodes.

Comparison of models

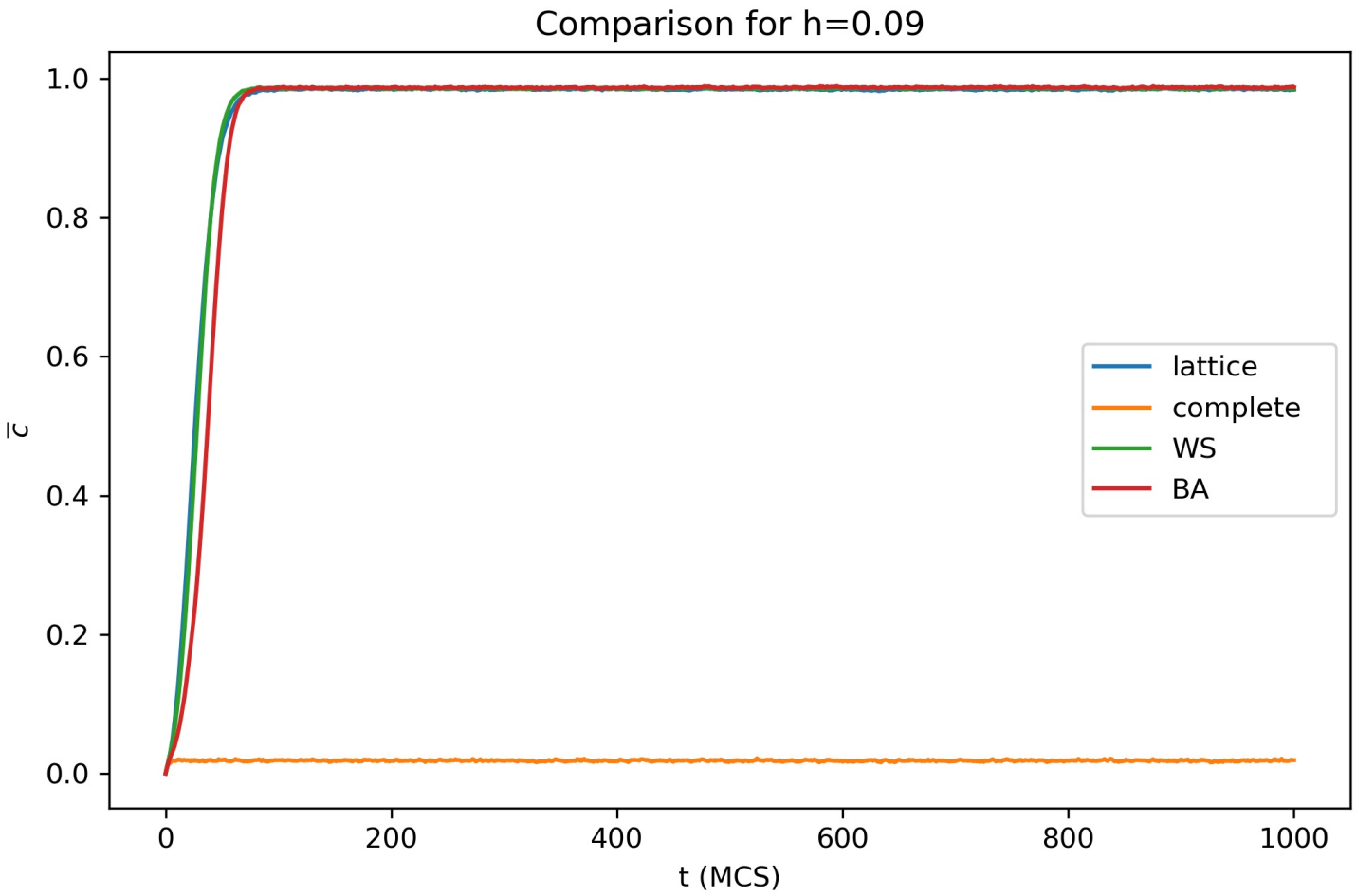


Figure 10: Our work - simulation with 1000 MC steps and 100 independent runs on graphs with 400 nodes, h=0.09.

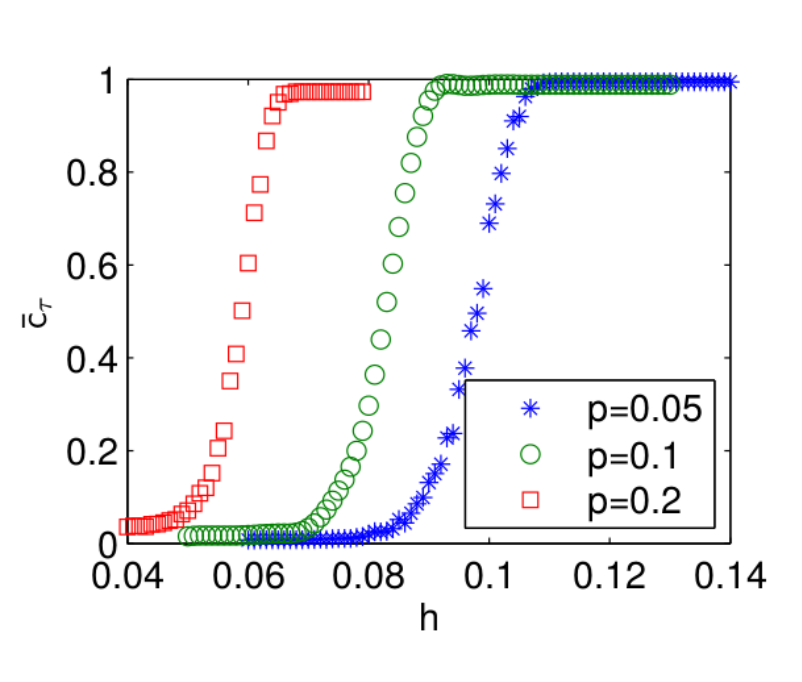
Market penetration level

Valley of death

Valley of death is a metaphor of way from the laboratory to the market when in reality many innovators fail. Contrary to aggregate models, such as Bass model, this kind of phenomena can be explained by agent-based models.

We can observe that phenomenon near the threshold values of p and h.

2D Lattice results



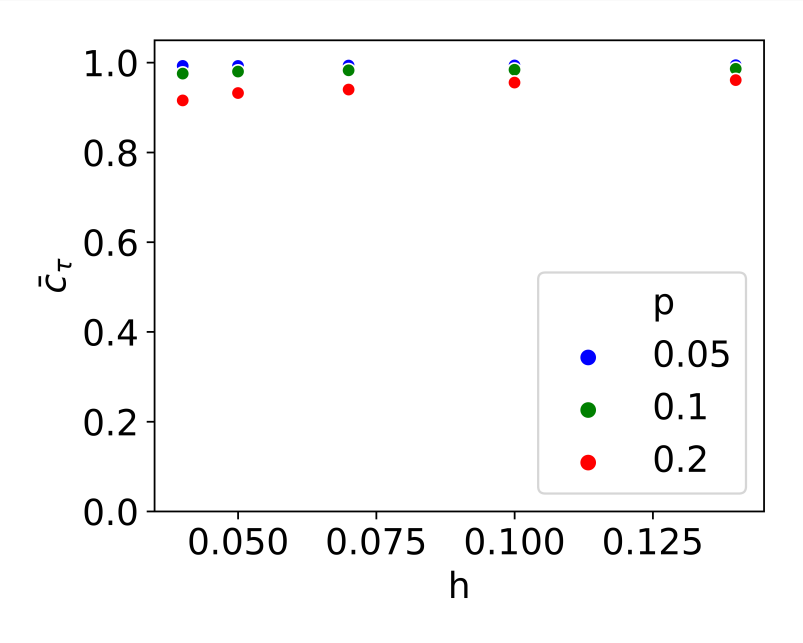
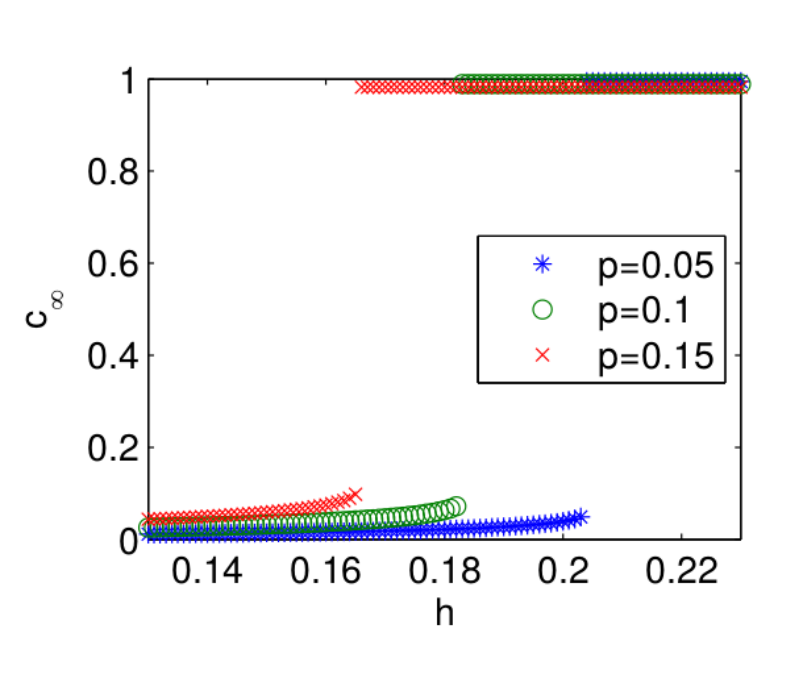


Figure 11: Left - publication; right - ours.

Comparison - Fig. 9 (left) Simulations

Complete graph results



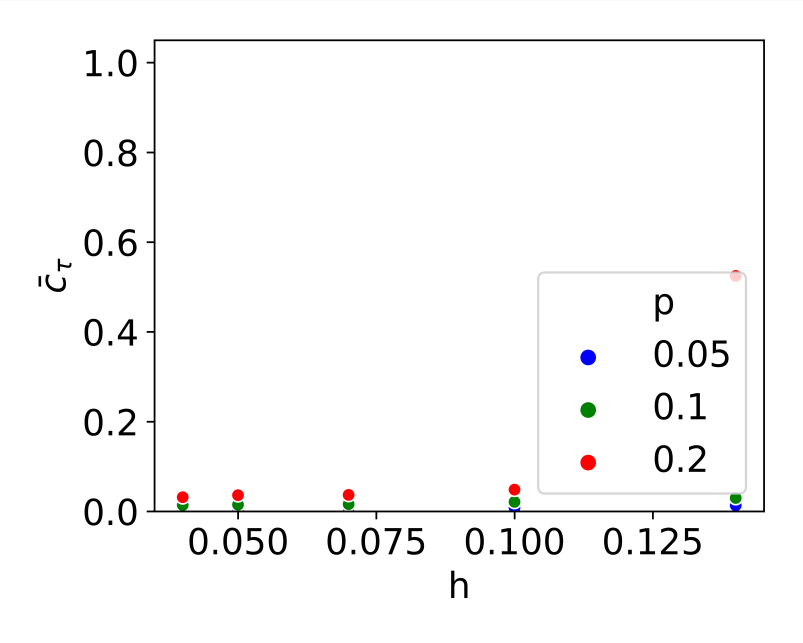


Figure 12: Left - publication; right - ours.

Comparison - Fig. 10 (right) Theoretical results

Watts-Strogatz results

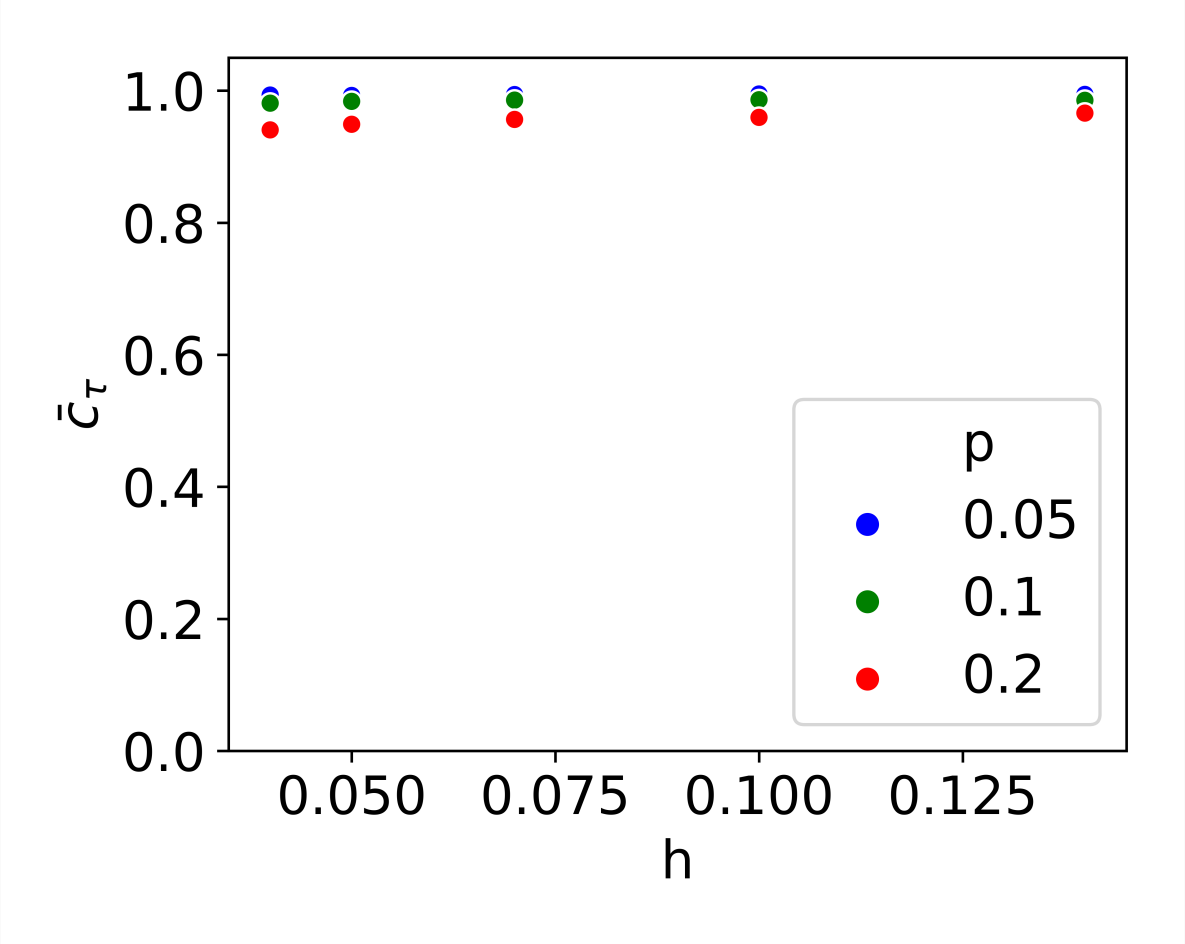


Figure 13: Our work - simulation.

Barabasi-Albert results

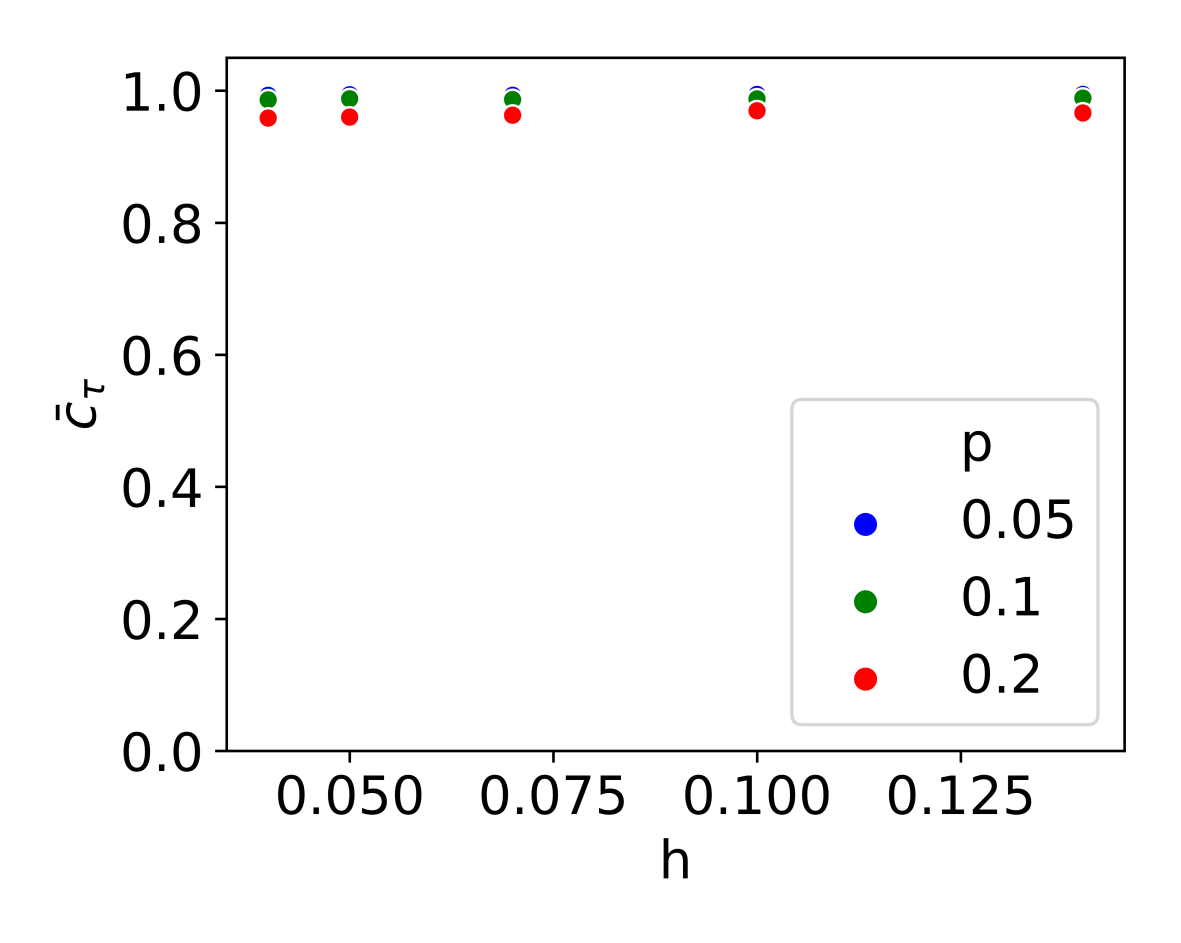


Figure 14: Our work - simulation.

Comparison of models

Try to find universal h

	p		
Graph	0.05	0.1	0.2
2D Lattice grid			
Complete graph			
Watts-Strogatz			
Barabasi-Albert			

Conclusions

Conclusions

- Because of independence system never reaches an absorbing unanimous steady state.
- Independence allows to investigate the system in which initially there are no adopters.
- Differences between the article and our simulations may arise from the use of much smaller graphs.

Contributions

Presentation:

- Patryk Wielopolski

Plots and analysis:

- Maria Kowalczyk
- Anna Szymanek

Simulations:

- Patryk Wielopolski

References i

P. Przybyła, K. Sznajd-Weron, and R. Weron.
Diffusion of innovation within an agent-based model: Spinsons, independence and advertising.
Advances in Complex Systems, 17, 04 2014.

Thank you for your attention!