

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

RESEARCH PROJECT

BACHELOR'S THESIS PROJECT

Simulation and Source Detection of Infectious Processes on Networks

Author:

Ahmed Abdelmalek

Supervisor:

Paula Murmann

May 7, 2024



*School of Computer and Communication Sciences
École Polytechnique Fédérale de Lausanne
Route Cantonale
CH-1015 Lausanne, Switzerland*

*Information and Network Dynamics Lab
EPFL IC IINFCOM INDY 1 & 2
Station 14
CH-1015 Lausanne, Switzerland*

"At least I tried"

— Ann Brashares

Dedicated to the curious side of me that drives me crazy.

And to my idolized grandfather, who showered me with his fountain of knowledge.

Acknowledgements

I am grateful to Paula Murmann for her guidance throughout the entire semester. Her expertise has significantly shaped this project.

I am also thankful to my parents, who have provided emotional support throughout my bachelor studies. Their encouragement has been my foundation, and I owe them my heartfelt recognition.

Lastly, a hat tip to all the professors of the IC faculty who transmitted their knowledge and their passion for this domain.

Ahmed Abdelmalek

ABSTRACT

This thesis explores the simulation of infectious processes on networks, focusing on the identification of infection sources within graph-based models. Utilizing a combination of probabilistic models and network theory, this study examines the dynamics of infectious spread in both synthetic and real-world networks. By implementing algorithms like the Reverse Infection Algorithm, significant insights were gained into the source detection efficacy across various network topologies. Results indicate that certain network structures enhance the traceability of the infection origin, offering potential strategies for effective disease monitoring and control. This research contributes to our understanding of epidemiological frameworks and proposes new avenues for enhancing disease surveillance systems.

Contents

1	Introduction	1
1.1	Need	1
2	Literature Survey	2
2.1	Paper1	2
2.1.1	Summary	2
2.1.2	Advantages	2
2.1.3	Disadvantages	2
3	Proposed Work	3
3.1	Problem Statement	3
3.2	Module1	3
3.2.1	SubSection1	3
4	Research Methodology	4
4.1	Module1	4
4.1.1	Subsection	4
5	Project Design	5
6	Implementation	6
6.1	Module1	6
6.1.1	Submodule1	6
7	Scheduling	7
7.1	Proposed Modules	7
7.2	Scheduling	7
8	Conclusion and Future Scope	8
8.1	Future Scope	8
8.2	Conclusion	8
	Bibliography	8

List of Figures

Chapter 1

Introduction

1.1 Need

XXXXXXX

Chapter 2

Literature Survey

2.1 Paper1

2.1.1 Summary

XXXXXXX

2.1.2 Advantages

XXXXXXX

2.1.3 Disadvantages

XXXXXXX

Chapter 3

Proposed Work

3.1 Problem Statement

XXXXXXX

3.2 Module1

XXXXXXX

3.2.1 SubSection1

XXXXXXX

Chapter 4

Research Methodology

4.1 Module1

4.1.1 Subsection

XXXXXXX

SubSub

XXXXXXXXXXXXXXXXXXXXXXXXXXXX

Chapter 5

Project Design

XXXXXXX

Chapter 6

Implementation

6.1 Module1

6.1.1 Submodule1

Code Snippet

```
1 def hello_world():  
2     print("Hello , world!")
```

Listing 6.1: Example of inline Python code

Chapter 7

Scheduling

7.1 Proposed Modules

XXXXXXX

7.2 Scheduling

XXXXXXX

Chapter 8

Conclusion and Future Scope

8.1 Future Scope

8.2 Conclusion

Bibliography

[1] *The Title of the Paper*; Author Name, Journal Name, year.

[2] Official LaTeX Site

<https://www.latex-project.org/>