Complex networks and agent-based models of HIV epidemic

Zarrabi, N.

Link to publication

Citation for published version (APA):
# Contents

1 Introduction .................................................................................. 1
  1.1 Background and Motivation ..................................................... 1
    1.1.1 HIV Epidemic .............................................................. 3
    1.1.2 HIV Dynamics .............................................................. 4
  1.2 Modeling HIV Dynamics ......................................................... 5
    1.2.1 Phylogenetic Analysis .................................................... 6
    1.2.2 Agent-based Models ...................................................... 7
    1.2.3 Complex Network Models .............................................. 7
  1.3 Thesis Overview ...................................................................... 9

2 Modeling HIV-1 Intracellular Replication ..................................... 11
  2.1 Introduction ........................................................................... 12
  2.2 Modeling HIV-1 intracellular replication ................................ 13
    2.2.1 Cell infection ............................................................. 14
    2.2.2 Cell states and transitions .......................................... 16
  2.3 Model Implementation: Two different approaches .................. 17
    2.3.1 Stochastic Rate-Based Approach ................................ 17
    2.3.2 Stochastic diffusion-based Approach .......................... 22
  2.4 Simulation Results ............................................................... 26
  2.5 Conclusions .......................................................................... 29
Combining Epidemiological and Genetic Networks Signifies the Importance of Early Treatment in HIV-1 Transmission

3

3.1 Introduction

3.2 Results

3.2.1 Characteristics of the study population

3.2.2 Filter-reduction method and network construction

3.2.3 Analyzing characteristics of the contact network

3.2.4 Constructing the hypothetical transmission networks

3.2.5 Transmission network and phylogenetic clusters

3.2.6 Factors associated with super-spreaders

3.2.7 Comparison with random networks

3.3 Discussion

3.4 Materials and Methods

3.4.1 The Data

3.4.2 Phylogenetic analysis

3.4.3 Filtering process in the filter-reduction method

3.4.4 Network visualization

3.A Appendix Chapter 3

3.A.1 Tables

3.A.2 Figures

Combining Social and Genetic Networks to Study HIV transmission in Mixed Risk Groups

4

4.1 Introduction

4.2 Combining Social and Genetic Networks

4.2.1 Filter-Reduction Method

4.2.2 Overlaying Networks

4.3 Transmission Between Risk Groups

4.4 Conclusions and Future Directions

Complex Agent Networks: An Emerging approach for Modeling Complex Systems

5

5.1 Introduction

5.2 Formal definition of CANs

5.2.1 The agent node model

5.2.2 Networks of agent interactions
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.3 Applying CANs to modeling infectious diseases</td>
<td>101</td>
</tr>
<tr>
<td>5.3.1 Modeling host agent nodes</td>
<td>102</td>
</tr>
<tr>
<td>5.3.2 Measurements of the spreading of infectious diseases</td>
<td>104</td>
</tr>
<tr>
<td>5.4 Other Examples of CANs</td>
<td>108</td>
</tr>
<tr>
<td>5.4.1 Ecological examples</td>
<td>108</td>
</tr>
<tr>
<td>5.4.2 Economical and social examples</td>
<td>109</td>
</tr>
<tr>
<td>5.5 Research Issues</td>
<td>110</td>
</tr>
<tr>
<td>6 Summary and Conclusions</td>
<td>113</td>
</tr>
<tr>
<td>Samenvatting</td>
<td>117</td>
</tr>
<tr>
<td>Acknowledgments</td>
<td>141</td>
</tr>
<tr>
<td>Bibliography</td>
<td>143</td>
</tr>
</tbody>
</table>