From InfluSim to the Explorator
Consumer Story and Demo

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Background

- Mathematics and Biology
- Modeling and Simulation
- Quantitative Epidemiology
- Deterministic and Stochastic Models
- Individual and Network Based
- Pandemic Preparedness Planning
Metabolizer

- Gillespie algorithm for stochastic biochemistry Simulations
- Graphical Model Editor
- Mimicking JBuilder IDE
Model-View-Controller

SEIR-Model

Parameter Control

Graph View

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Infection Dynamics

- Individual-based
- Network-based
- Stochastic
- Interventions?
EpiDyNet

- AWT/Swing
- Stochastic
- Network-Based
- Individual-Based
- Re-use of Metabolizer code
- Smallpox, Influenza
- SARS, Polio, Rumors
Modeling of antiviral efficacy and antiviral treatment strategies
Symptoms

- dead
- obvious
- detectable
- none

States: susceptible, infected, contagious, immune

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Interventions

- dead
- obvious
- detectable
- none

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- none
- traced
- observed
- detected
- secluded
- isolated
Contact Networks

Network Interface

Local

Random

Scalefree

Social
Periodic outbreaks due to behaviour change of susceptibles
InterSim

- Based on EpiDyNet
- Focus on interventions: surveillance, contact tracing, observation, detection, seclusion, isolation, quarantine, vaccination, behavior change, prophylaxis
- Software Award 2004
Modeling of group quarantine
What if...  

Experts have been forecasting a flu pandemic for decades.

But it is still hard to say when such a spectre will become reality.

in case of emergency...

People whose job it is to protect others have to be well-prepared for the real thing at all times.

So far, it has not been possible to adequately predict how infectious diseases will spread.

People in positions of responsibility need reliable information to timely make the right decisions.

The interdisciplinary team of ExploSYS helps by providing innovative simulation tools.

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InfluSim 1.0

- AWT/Swing
- 520 DGLs
- www.influsim.info
- Sourceforge
- CPL
Influenzadynamik

- **S**: susceptible
- **E**: infected
- **A**: asymptomatic
- **M**: moderately sick
- **V**: very sick
- **X**: extremely sick
- **W_u**: untreated
- **W_t**: treated
- **H_t**: treated hospit.
- **H_u**: untreated hospit.
- **D**: dead
- **I**: recovered and immune
- **R**: reconvalescent
- Tabletop exercise at the South Korean Center of Disease Control (October 2006)
InfluSim 2.0 beta

- SWT/JFace/RCP
- Forms
- Intro
- Online Help
- Update System

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Contact matrix

In this section, it is defined how frequently people of the different age classes come into contact. A contact between a contagious and a susceptible individual makes the transmission of the pathogen possible, but it is not necessarily sufficient for a transmission.

<table>
<thead>
<tr>
<th>Contact matrix</th>
<th>age 0-5</th>
<th>6-12</th>
<th>13-19</th>
<th>20-39</th>
<th>40-59</th>
<th>60+</th>
</tr>
</thead>
<tbody>
<tr>
<td>From age 0-5 to</td>
<td>168.14</td>
<td>274.51</td>
<td>224.26</td>
<td>193.35</td>
<td>156.02</td>
<td>114.67</td>
</tr>
<tr>
<td>From age 6-12 to</td>
<td>215.14</td>
<td>317.97</td>
<td>264.31</td>
<td>227.45</td>
<td>191.03</td>
<td>149.78</td>
</tr>
<tr>
<td>From age 13-19 to</td>
<td>176.14</td>
<td>255.97</td>
<td>216.31</td>
<td>187.45</td>
<td>151.03</td>
<td>119.78</td>
</tr>
<tr>
<td>From age 20-39 to</td>
<td>157.14</td>
<td>235.97</td>
<td>196.31</td>
<td>167.45</td>
<td>131.03</td>
<td>99.78</td>
</tr>
<tr>
<td>From age 40-59 to</td>
<td>138.14</td>
<td>215.97</td>
<td>176.31</td>
<td>147.45</td>
<td>111.03</td>
<td>79.78</td>
</tr>
<tr>
<td>From age 60+ to</td>
<td>119.14</td>
<td>195.97</td>
<td>156.31</td>
<td>127.45</td>
<td>91.03</td>
<td>59.78</td>
</tr>
</tbody>
</table>

Contact intensification by child health

Contacts of children

Child-child contacts at school

The Contact matrix is based on the definition of the age classes. It determines how likely people of different age classes infect each other.

The pre-set Contact matrix can temporarily be modified by general reduction of contacts, by closing of day care centers and schools and by cancelling of mass gathering events.

The Contact matrix can also temporarily be modified by partial isolation of cases.

Literature

Für bis zu 10 Schieberegeln wurden Intervalle bestimmt, aus denen zufällige Werte gezogen wurden.

**Umgang mit Unsicherheit**

<table>
<thead>
<tr>
<th>50 simulations</th>
<th>peak of outpatients per day</th>
<th>peak of hospitalizations</th>
<th>total number of deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>no intervention</td>
<td><img src="image1" alt="Histogram" /></td>
<td><img src="image2" alt="Histogram" /></td>
<td><img src="image3" alt="Histogram" /></td>
</tr>
<tr>
<td>antiviral treatment only</td>
<td><img src="image4" alt="Histogram" /></td>
<td><img src="image5" alt="Histogram" /></td>
<td><img src="image6" alt="Histogram" /></td>
</tr>
<tr>
<td>contact reduction only</td>
<td><img src="image7" alt="Histogram" /></td>
<td><img src="image8" alt="Histogram" /></td>
<td><img src="image9" alt="Histogram" /></td>
</tr>
<tr>
<td>combined interventions</td>
<td><img src="image10" alt="Histogram" /></td>
<td><img src="image11" alt="Histogram" /></td>
<td><img src="image12" alt="Histogram" /></td>
</tr>
</tbody>
</table>

Bevölkerung: 100 000 EW

Resultate von 50 000 Simulationen

dk: niedr. $R_0$
hell: hoh. $R_0$
The Explorator Project

Graphical Model Editor

Deterministic Simulator

Stochastic Simulator
Eclipse

- helps to make a product
- open source benefits
- warm response of the community
- inspires to adopt new technology
Mathematical modelling…

Bringing together biology, medicine, statistics and information technology,

ExploSYS succeeded in developing a simulator capable of realistically describing how infections spread.

as tools for diagnosis and decision making…

The »ExploSYS Simulator« provides realistic best-case and worst-case scenarios, helping to ensure the best possible response in case of an emergency.

so that people can be well prepared.

The ExploSYS experts assist decision makers on a high scientific level, acting »what if« scenarios to the end.

Reliable planning, lower costs and higher margins of safety.

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