Epidemic Mitigation through Mobile Micro-measures

Mohamed Kafsi  Ehsan Kazemi  Lucas Maystre  Lyudmila Yartseva
Matthias Grossglauser  Patrick Thiran

School of Computer and Communication Sciences
Overview

The **context** is epidemic outbreaks.

The **problem** is that traditional mitigation measures are insufficient.

→ idea: **take advantage of mobile technology**

1. personal measurements
2. individualized recommendations
Motivation

Can **small** adjustments to local interactions **significantly** slow an epidemic?
Key properties

**Personalized** individuals are differentiated

**Adaptive** measures generated in real-time

**State-independent** don’t know if infective
Models
Models

The **mobility model** depends only on time and home location.

The **epidemic model** is a discrete, stochastic SIR process for each metapopulation.

**Interaction** between metapopulations happens through mobility.
Outcome: simulation of human-mediated epidemics at the individual level
Results
Strategies

Uncover **mobility communities** & restrict cross-community trips

Segment **social communities**, rewire accidental contacts.

Send people **home**.
## Results

<table>
<thead>
<tr>
<th>intuition</th>
<th>cost</th>
<th>benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>weakening weak geographical links</td>
<td>12% of trips</td>
<td>delay peak by 15%</td>
</tr>
<tr>
<td>segmenting social communities</td>
<td>90% of accidental contacts</td>
<td>delay peak by 20%</td>
</tr>
<tr>
<td>home is a safe place</td>
<td>15% of trips</td>
<td>reduce spread by 20%</td>
</tr>
</tbody>
</table>
Conclusions

Taking advantage of mobile phones opens up new possibilities for epidemic mitigation.

Our concrete micro-measures provide a baseline for future work.
From quarantines...
...to micro-measures.