COVID Information Commons (CIC) Research Lightning Talk

Transcript of a Presentation by Leila Hedayatifar (New England Complex Systems Institute), Nov 13, 2021

Title: *Modelling COVID-19 in the Context of Optimizing Quarantine Policy*

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YouTube Recording with Slides

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Transcript

Leila Hedayatifar:

Slide 1

Hello everyone, here I would like to share some of the results of our work. The goal of this project is to show that state governments should collaborate with each other, as the states are not necessarily disconnected from each other according to the mobility patterns, and we would like to create an opportunity to optimize lockdown strategies by aligning policies with the individual's mobility patterns.

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It's challenging to predict and control the outbreak due to the complexity of human interactions and movements-

Slide 3

And also population density heterogeneity and population density.

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In the U.S. we can say that most of the state governments act separately with most of the measurements and risk definitions being done by administrative patches of borders. Spatial distancing contact tracing and quarantine policies have been the most impactful policies on controlling the diffusion of the coronavirus. There's a critical need to carefully define the borders of areas with different risk levels considering the location of suspected cases, and we can say that we need to know where the people who were in touch with the infected person were, and when.

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For this purpose we use anonymized mobility data collected with Safecraft from cell phones and created networks in which locations are connected to each other based on the movement of individuals between the locations. We created weekly networks for all around the US.

Slide 6

This figure shows the degree distributions of the location showing the number of movements to and from each location, and you can see that in the city areas we have much more number of movements than compared to the suburban and rural areas.

Slide 7

Mobility patterns that we see in that figure can be characterized in three overarching concepts: short distance movements, medium distance movements, or long distance movements that happen for different reasons. A combination of these habits in a self-organized manner form the size and borders of the communities that we want to analyze.

Slide 8

We use the Louvain Method to find or detect the communities in the U.S. at multiple scales. These communities refer to the areas in which people mostly move within the communities rather than the other areas. Here, I showed the communities in the first level with the same color. But these communities are multi-scale phenomena, meaning that at a finer scale of subdivisions larger communities divided into smaller communities allow us (or policy makers) to go into the smaller scale and do the policies and apply the policies on a smaller scale. Here I show the sub communities inside the communities - they are separated from each other by black lines in this map. And we also did analysis in the larger scale: we applied the community detection into the networks of the communities and we take

clusters of communities, and I showed them here with the same color tone so you can see that we have five large clusters of communities, that they have more connections with each other than the rest of the communities. The yellow lines here represent the state boundaries, so you can see that however in some of the areas communities are aligned with these administrative borders, in many of the areas they strongly deviate from the state boundaries and-

Slide 9

Also county boundaries (that it shows here with the yellow line). This shows that why states need to collaborate with each other: because they are not really disconnected from each other.

Slide 10

By adding the number of COVID cases on top of the map of the communities, we can quantify the risk of exposure inside the communities, and this can help us to align the policies better.

Slide 11

Here I zoom into the communities in the previous figure so you can see that while a large community may have many COVID cases, when we go into the smaller communities you can see that some of the communities have higher number of cases and some of them have lower number of cases. So those communities that have less cases, they are safer to reopen earlier, and also the other thing that we can consider is that to be careful or cautious about the commute between the low risk communities to the high-risk communities. These are the things that we can consider.

Slide 12

And the other things are that by zooming into the communities we realize some interesting facts about these communities. One of them is isolated communities. We realize that there are some isolated communities that they are geographically disconnected from the original community - that they can be universities or vacation spots (like this university that is connected to the community in New York State),

Slide 13

Or vacation at spots that they are disconnected geographically from New York City community but they are some vacation spots for the people in those areas.

Slide 14

And we also have some communities within other sub communities. We realize that there are some areas that people prefer to move inside the community rather than the nearby area. The good examples for those ones are university campuses,

Slide 15

And also sub-communities in city areas -

Florence Hudson:

Looks like Leila is frozen a little bit. She was having connectivity problems, I think you said Katie?

Kathryn Naum:

Yeah I froze up for a moment myself there, Layla are you there?

Florence:

She's back now great, great.

Leila:

Yes, do you have me?

Florence:

Yes.

Leila:

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It's important to see that how lockdown strategies and quarantine policies are changing the borders of these communities and these patterns. Here, I showed this for six weeks from February to May, and you can see that at the beginning in February and March it's a very clear example. You can take a look at the Florida state: at the beginning of the pandemic it was connected to the Northeast the communal cluster in the U.S. we were showing that it was a vacationing [?] spot for the communities in that area and then in March it's getting connected to the community cluster in the rest of the U.S. And just in April and May it's getting disconnected from that for distance communities. So we try to study these patterns by more details but I didn't have time to explain them here.

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Thanks for listening. I would like to say that you can see much more about our work in endcoronavirus.org/mobility-maps and also I would like to say that we have a team of volunteers and are interested in further collaboration. You can reach a lot at EndCoronavirus.org (NECSI) or at necsi.edu.slack.com. Thank you.