Probabilistic Risk Awareness (PRA) framework to generate Early-Warning Signals of COVID-19

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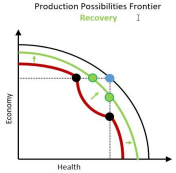
MOTIVATION: *How could we expand the economy-health frontier during the pandemic?*



- Economic and health outcomes have fallen short of their efficient levels
- Monetary policies or vaccine development aim to revive these outcomes back
- **Tracing can play a role in opening up the economy while detecting and preventing outbreaks at the same time**

EXISTING TRACING METHODS

- Manual Tracing - requires **human experts, potential suspects** to trace are **biased towards known contacts**, makes an **expert use of clues** like age and medical conditions to **recommend quarantine or not**.
- Binary Digital Tracing (BDT) - requires **an app**, **potential suspects** are **digitally registered interactions with other app-users**, **uses reported test results** to **notify** past contacts **to quarantine or not.**
- PRA Tracing - requires **an app**, **potential suspects** are **digitally registered interactions with other app-users**, **uses individual clues, symptoms, test results and interactions** to **evaluate risk level of users** and **recommend varying degrees of social distancing.**

What is wrong with digital tracing?

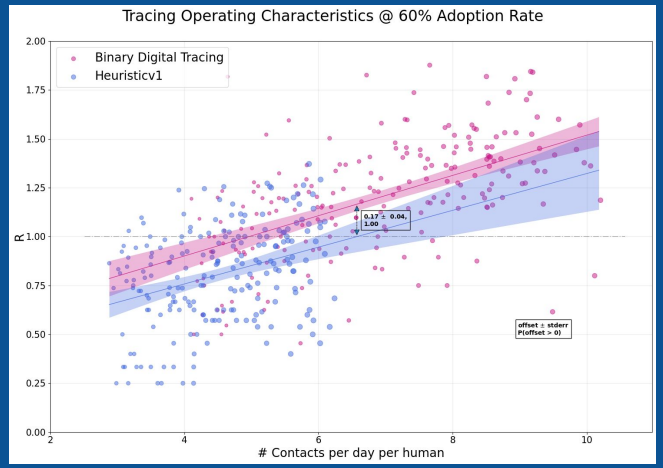
BDT notifies contacts of positive test results, but ...

- Tests are administered **only after symptoms**
- Test have **high false negative** rates
- Test results have a **1-2 days delay**
- Tests are highly **"uncomfortable"** to act as a deterrent

> PRA doesn't rely solely on test results, and it also encompasses BDT.

A Contact Tracing framework to **generate early-warning signals of COVID-19** and **restore pre-pandemic economic** and **health outcomes**.

White Paper



Simulation results (based on 3K population) suggests that (i) for the same outcome of R, PRA allows for 1 extra contact (per day per human) (ii) Similarly, for the same mobility restrictions PRA achieves a lower R, about 0.17 lower than the existing tracing method (BDT)

Authors

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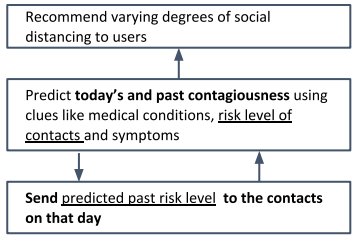
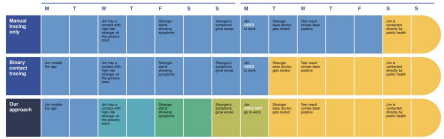
Privacy preserving PRA Framework



Note: only an integer is exchanged between two users resulting in an exchange of only N bits anytime. Lower values of N are preferred. Simulation uses N=4, resulting in a maximum risk level of 4. Sensitivity on N is WIP

Example scenario of better early warning signals



How to predict contagiousness?

1. **Rule-based PRA (Heuristic v1)** directly sets today's and past risk level of users based on symptoms and risk level of contacts.
2. (WIP) **Machine Learning based PRA** predicts contagiousness using all the clues i.e. medical conditions, risk level of contacts, and symptoms.

Heuristic PRA