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Commentary

A commentary of Digital contact tracing in MIT Technology Review 2021

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A B S T R A C T

In 2020, the COVID-19 pandemic has brought “digital contact tracing” to the forefront of public attention. In the context of COVID-19, technology has offered public health investigators a new capability for locating infected individuals, i.e., digital contact tracing. Through this technology, investigators were able to track the location of patients without relying on their memory, which alleviated disease surveillance pressure. The practical application of this technology is known as “Exposure Notification.” Developers were able to complete the creation and operation of this digital contact tracing system within a few weeks, and they made the code open-source to ensure that Apple and Android users worldwide could utilize it.

To combat the COVID-19 pandemic, Apple and Google jointly launched “Exposure Notification,” a smartphone app based on the iOS and Android operating systems, to allow tracking of COVID-10 close contacts. This technology was selected as one of the “Top 10 Breakthrough Technologies” by MIT Technology Review in 2021. By utilizing Bluetooth through a mobile phone app, this technology anonymously connects nearby devices running the same program and records high-risk contact behavior locally. Upon diagnosis of COVID-19, the app notifies the close contacts of the user, thus allowing early investigation and isolation. As opposed to traditional epidemiological investigation methods, digital contact tracing technology can increase tracking efficiency and reduce labor costs.

In fact, “Exposure Notification” is not the first digital contact tracing application developed for COVID-19. In March 2020, South Korea developed a “COVID-19 Intelligent Management System,” which mainly collects GPS positioning data of mobile phone users to determine whether there is a possibility of close contact between the smartphone user and a confirmed patient. Israel has developed the “TheShield” application, which also uses GPS positioning data. Owing to the sensitive nature of location information, this type of application poses privacy and security concerns. The “TraceTogether” application developed in Singapore uses an anonymous Bluetooth connection for tracking contacts. However, Bluetooth only records anonymous contact information and does not gather sensitive information such as the geographical location of the user. In this case, data is only stored on the user’s local device in a decentralized manner. Therefore, it has a significant advantage with regards to privacy protection. Unlike “Exposure Notification,” Singaporean authorities can access and read stored data from the “TraceTogether” app of COVID-19 patients and obtain the mobile phone number of close contacts in accordance with local regulations, thus exhibiting certain centralized characteristics.

The technical route adopted by China is slightly different from those outlined above. Since the outbreak of the pandemic, China has launched the “health code” app that allows people to report their visited places through active scanning of codes, and the national integrated government service platform is utilized for contact tracing. As another approach, the “communication big data itinerary card” provides users with fast region-level itinerary tracking by using the “mobile phone signal data” of multiple operators. Both these forms of digital tracking rely more on centralized services and are focused more on regional contact tracing than direct individual contact tracing.

As of now, many countries have employed digital contact tracing technology in the fight against COVID-19, but the usefulness of these apps is still debatable. On one hand, many of the apps are purely voluntary and the low usage rate makes it difficult for them to function effectively. This phenomenon can be explained by many factors, such as user concerns regarding program security, malfunctioning of some software, and limited smartphone penetration. On the other hand, although decentralized applications may effectively protect user privacy, they make the detection and isolation of close contacts entirely dependent on the user’s personal intention and cannot guarantee the effectiveness of epidemic prevention. For the first case, it is crucial to study appropriate promotion and guidance strategies and ensure smooth access and use of the apps. For the second case, it is necessary to explore a reasonable tradeoff scheme between privacy protection and epidemic prevention. From the standpoint of anti-epidemic results, the technical route taken by China is effective. National publicity and guidance have ensured the overall utilization rate. Additionally, the relatively centralized information gathering and storage system have enabled the medical and health departments to efficiently investigate and process close contacts. These measures are accompanied by a robust privacy protection mechanism to prevent misuse of data.

At present, the breakthrough technology of digital contact tracing, which emerged during the COVID-19 pandemic, is still in its infancy. Ultimately, the technology itself will not only contribute to the prevention
and control of epidemic diseases but may also open avenues for other applications as well. Some prospective directions worthy of further investigation and research are:

(1) Exploration of privacy protection theory for digital contact tracing. Data collection, storage, use, and destruction in digital contact tracing are targeted at human subjects. It is necessary to concentrate on privacy issues and explore related theories of privacy protection in the design phase of the technology. We must focus on aspects such as how to minimize data collection and avoid collecting non-essential data during the collection phase; which type of data should be stored locally, whether data can be uploaded or made public; which units and individuals should have authorization to access and use data; how to set the data storage period, and ensure prompt disposal of expired data.

(2) Exploration of the trade-off mechanism between privacy protection and application effects. In application scenarios such as public safety and national security, seeking privacy in an overly rigid manner may lead to difficulties in exerting the impact of the application. Transferring some private data may improve this. Hence, it is important to study the optimal trade-off mechanism between privacy protection and the application effect. Specifically, in the case of digital contact tracing, the completely decentralized scheme leads to the greatest protection of privacy. However, the response of close contacts is solely a matter of self-consciousness, and hence, it has a limited effect on epidemic prevention. Partially centralized schemes allow the state to intervene to obtain key information about infected persons and their close contacts. Hence, close contacts may receive timely and proper treatment, but there is a risk of privacy leakage. Therefore, it is worthwhile to explore high-security and high-efficiency digital contact tracing technologies and mechanisms.

(3) Exploration of applications in other fields. Digital contact tracing is an application of tracking technology with a focus on the medical and health sector. It enables the archiving of historical data and efficient retrieval of key information. Social governance and national security share similar requirements, and it is worthwhile to explore the usage of digital tracing across wider social scenarios.

Declaration of Competing Interest

The authors declare that they do not have any conflicts of interest in this work.

Reference

[1] 10 Breakthrough Technologies 2021. https://www.technologyreview.com/2021/02/24/1014369/10-breakthrough-technologies-2021, 2021 (accessed 24 March 2021).

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