

FOCAL POINT ON COVID-19 MODELLING IN JAPAN

PRODUCED IN PARTNERSHIP WITH THE COVID-19 AI & SIMULATION PROJECT

HOW MODELLING WITH AI HELPED BEAT COVID-19

Japan assembled its **TOP TALENT** in modelling and artificial intelligence to respond to the pandemic. Their knowledge is being used to plan for future pandemics.

It was just before the **COVID-19 pandemic began** that Hiroaki Kitano, CEO of Sony AI Inc., found himself in a bunker. In his last trip before the world went into lockdown, Kitano visited the Churchill War Rooms in London. It's a day that he was to think of often in the months that followed, while working on very different strategies than those described in the historical attraction he had visited.

In early April 2020, after Japan had been through the first wave of the pandemic, Kitano and his colleague Atsushi Shinjo, from Keio University in Tokyo, were contacted by the government's cabinet secretariat. "They wanted a group of people who could respond to the decision-making process of the government, to provide some independent scientific advice and technology-based means to mitigate the risk of infection for them to look into," says Kitano.

Kitano and Shinjo devised the COVID & AI Simulation project — an initiative gathering teams of experts who could construct computational models to provide the government and the public with an evidence base around which a rapid response to the evolving pandemic could be designed.

"Providing evidence is critical in situations where policy-makers must make decisions on unprecedented situations," adds Shinjo. And it's a skillset that can now be employed when future disease threats emerge.

"In a sense, this is the first pandemic that has occurred since large scale computing and AI capabilities have been available," as well as since researchers

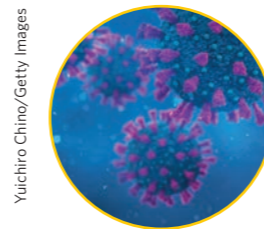


Swarms of people cross the road at one of Tokyo's busiest crossings.

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1

More than **33 MILLION** confirmed cases of COVID-19 in Japan have been reported to the WHO since the beginning of the pandemic.



Yuichiro Chino/Getty Images

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Almost **75,000 DEATHS** have been attributed to COVID-19 in Japan



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have developed the experience of using big data in biomedicine for things such as genome sequencing, says Kitano. The researchers quickly realized that employing the standard methods of modeling infectious diseases, such as the SEIR (susceptible-exposed-infectious-recovered) model — which provides information about viral activity and rates of increases under a homogeneous interaction assumption— would not be enough to predict disease spread.

Understanding the effect of lockdowns and other restrictions on behaviour, wasn't enough on its own — the government also needed to understand the impact on industries and the economy as well. "For every week of lockdown during the first state of emergency in April-May 2020, the cost to the economy would have been about 1 trillion yen (approximately US\$7.2 billion), so it was a balancing act," says Kitano.

SCIENTISTS ASSEMBLE

To capture the situation's nuances, Kitano and Shinjo engaged a team with experts from multiple fields, including agent-based modeling, complex network theory, machine learning, various statistical analysis, economics, and behavioral and social models.

This approach was particularly effective for simulating the spread and containment of infection and deciding when to begin or end a state of emergency. "The diversity of experience has been critically important," says Kitano. "Multiple teams independently assessed each issue for policy implications," he says. "This ensured the government was provided with views from various approaches."

What made this work different from the standard academic route was the order and faster than usual speed at which results were released to the public. Each research team shared their latest results and submitted them to the government at weekly meetings, after which they were also made available to the public on the internet. This was prior to publication in academic journals, the usual route that scientists use to make their findings available to the public, explains Shinjo.

"As this was a global emergency,

our mission was to provide policy recommendations to save people's lives, rather than to publish papers," Kitano says.

Instead of making simple predictions, the project teams analysed multiple scenarios based on different policies, trying to find out what the possible outcomes would be. For example, one simulation using the FUGAKU supercomputer, based at the Kobe campus of RIKEN, Japan's largest research institution, visualized droplet and aerosol spread in various situations. It had a significant impact on policy and aided in the formulation of guidelines to mitigate risk at various service establishments, such as restaurants, concert halls, taxis, public transport and karaoke bars, says Kitano.

The formulation of the vaccination strategy was another highlight, says Kitano. "Upon recognizing that mRNA vaccine can reduce the severity of symptoms and the risk of infection, we calculated an optimal strategy that simultaneously reduced mortality and new cases." The teams' strategy was implemented through two routes: mass vaccination centers in Tokyo and Osaka run by Japan's national self-defence force and a workplace vaccination programme using Moderna's spikevax COVID-19 vaccine.

LOOKING AHEAD

"This was a very successful strategy signified by extremely low cases during the fall of 2021," says Kitano. "This continued until the emergence of the Omicron strains."

"This kind of collaboration between policy-makers and the simulation team has not been done before, but will become increasingly important in the future," adds Shinjo. The project team is wrapping up now that there is no longer an active emergency. Both Kitano and Shinjo are keen for the lessons learned during this project to become a part of future crisis management systems.

"We should have some sort of structure in place during an emergency to start a project like this right away, we can't act as though it's business as usual," says Kitano. "We need to have a talent pool, and we need to have someone who can actually pass the experience to the next generation." ■

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More than **400 MILLION** vaccine doses have been administered in Japan since the beginning of the pandemic.



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"Providing evidence is critical in situations where policy-makers must make decisions on unprecedented situations."