Policy Making
Based on Real-Scale Social Simulations

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Abstract*—In this paper, we discuss decision-making processes for our communities using social simulation tools using some machine learning or artificial intelligence techniques. We take an example of considering preventive measures based on simulation results during COVID-19 pandemic. To avoid explosive infection in Japan, several preventive measures were considered. Among them, short-time business for restaurants, tourism support policies and vaccination schedules are included. I am involved in Covid-19 AI & Simulation Project Team (AISP) of Cabinet Secretariat, Japanese government. My contribution is to provide synthetic population data for real-scale social simulations for specific areas. In those simulations, we do not aim to predict a precise number of infected or severe patients by COVID-19 but to show several simulation results under various scenarios with different simulation parameters. After their simulation results are compared with each other, common outcomes are extracted from their results, and finally they are provided to the government. In that decision making process, their simulation results under several scenarios are shown to government officers, and final decision makings are left for politicians to decide. Since experts who are not elected are not able to take political responsibilities for their decision making, the AISP team shows several scenarios using their simulation models to support government officers and politicians to make their decisions.

Keywords—social simulations, decision making, responsibility

I. Introduction

Some people expect computers or machines to make their decisions instead of themselves. If the computers and machines give only benefits by their automatic decision making, such replacement should be welcome without doubt. It is different when their replacement will result in gains for some people and losses for the other people. Such decision-making with unbalanced benefits should be decided by those who are entrusted. Social simulations using some techniques of artificial intelligence should be carefully treated since their results affect a lot of people in a community positively and negatively.

It is not the case of introducing some technologies to modify some tools or means. For example, automobiles are replaced with horses as transportation means although they bring traffic accidents and environmental destruction. For some people, benefits brought by automobiles are greater than their losses. Automobiles are utilized by those who accept both of their benefits and losses as individuals. On the other hand, social simulation tools that bring some schemes or systems for a community give advantages for some people and disadvantages for the other people. For example, if the government taxes the riches more heavily than the other ones, the definition of the rich becomes an issue. Those who earn more than or less than some income will be taxed heavily or lightly, respectively. Results of tax simulation will make those who get advantages or disadvantages. Such political decision making should be exercised by those who are entrusted. Politicians who are elected by elections are entrusted by electorates in some democratized countries.

During COVID-19 pandemic, the Cabinet Secretariat of Japanese Government established an AI & Simulation Project (AISP) team for COVID-19. The project team consists of several scientists who have different simulation models such as SIR (Susceptible-Infected-Recovered) model, agent-based model, network model and so on. As a member of that team, I provided synthetic population data of Japan to some teams to conduct real-scale social simulations. TABLE I shows models of social simulations employed in the team. To conduct real-scale social simulation in a specific community, I provided a synthetic population [1,2] in Fig. 1 to Yukio Ohsawa [3, 4] and Setsuya Kurahashi [5]. Using the attributes of synthetic population in Fig. 1, Ohsawa connects networks between agents, and Kurahashi decides places of worker agents in their simulations. Simulation results of the researchers in TABLE I are shown at the website that is managed by the Cabinet Secretariat [6].

Ohsawa et al. extended their model in [3] using the synthetic population in Tokyo and Yokohama [4]. They

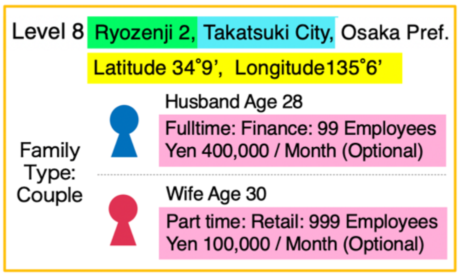

Fig. 1. Attributes of synthetic population.

TABLE I. Simulation Models of AI & Simulation Team

Researcher	Model
Yukio Ohsawa	Multi Layer-Multi-Agent Model
Setsuya Kurahashi	Multi-Agent Model
Tatsuo Unemi	Multi-Agent Model
Satoshi Kurihara	Multi-Agent Model
Asako Chiba	Multi-Agent Model
Taisuke Nakata	SIRD (D: Death) Model
Akimasa Hirata	LSTM: Long Short Term Memory
Mitsubishi Research Institute	SEQIR Model (Q: Quarantine) Model

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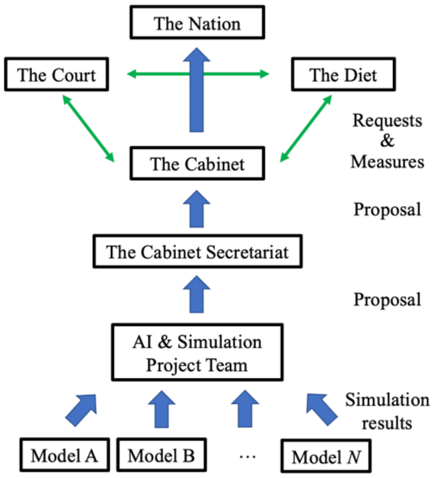

Fig. 2. The flow of proposals from AI & Simulation Project team.

introduce the probability to connect networks according to the distance among residents in this area. Since each household in the synthetic population data has the location information (i.e., the latitude and the longitude of the household member), they can calculate the distance among household members. Considering the distance-dependent probability in their network model, they found that infection explosion may happen when the number of people who meet intentionally and unintetionally is larger than twice the number of people who meet intentionally even in the lower probability with the meet of people in long distance. This simulation result was reported to the Cabinet Secretariat on December 11, 2020. The Japanese government decided to stop the travel campaign called "GoToTravel" that financially supports travelers in Japan to visit Japanese sightseeing places on December 13, 2020.

Nagai and Kurahashi [5] showed their simulation results by the number of the infected, the serious patients and the dead under respective preventive measures in a community. They compare 16 preventive measures with two basic scenarios such as a case of no tourists accepted in a target cityor the other case of accepting tourists as usual. The peak number of the infected patients during the simulation term is indicated by the average value over 100 trials. On the other hand, the number of serious patients is shown by four statistical values such as average, the 1st quartile, median and the 3rd quartile over 100 trials. Explanations on scenarios are given to a tourist section of the municipality but decision making are left to its decision makers such as officers or politicians.

II. Decision Making and Enforcement by The Government

To avoid explosive infection in Japan, several preventive measures were considered. Among them, short-time business for restaurants, tourism support policies and vaccination schedules are included. Some measures are requested by the government of Japan or local governments. For example, Immunization act of Japanese law states that "The mayor of the municipality or the prefectural governor is to recommend a routine vaccination ... or a temporary vaccination to the recipient of a vaccination" in Article 8 and "The recipient of a vaccination ... must endeavor to undergo a routine vaccination ... or a temporary vaccination." These law shows that mayor or governor just recommend vaccinations and recipients just endeavor to undergo them. There are no penalties for those who do not follow these articles. Therefore, what the cabinet secretariat could do was to support ministers to propose several measures that nations voluntarily follow.

Fig. 2 shows the flow of proposals from AI & Simulation Project team (AISP) to the Cabinet. In the AISP, several simulation results are provided to the project meeting. The chair of AISP summarizes a proposal based on several simulation results from different models. The officers of the cabinet secretariat examine the proposal and show it to the related ministry. After the decision by the cabinet, several requests and measures are provided through related government agencies. Using this scheme, simulation results from AISP are provided and considered by the cabinet to make their decisions.

III. Conclusion

In this paper, the decision-making process using social simulation tools was described. During Covid-19 pandemic, Japanese government adopted a democratic method to reflect simulation results on requests and measures based on the simulation results. Since political decision making gives a positive and negative effects to some and others, the decision making should be done by those who are entrusted. However, this process seems to be a time-consuming method. Japanese government should consider how they can introduce automatic decision-making process using simulation tools. Remaining issues are how to keep balance between agreements by elected people and scientific implications given by specialists in each specialty. Smooth communications are important among them.

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