Data Driven Innovation through Collaboration with Enterprise Partners

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1. Background

Recently, with our aging population and innovation in work practices, many enterprises are working to improve workplace operational efficiencies. In workplace operations, there are cases when decisions are made based on big data collected in the past, and there is potential to increase efficiency through digitization. As digitization proceeds, it may also be possible to reduce the time required for beginners or foreign laborers to reach a certain level of experience, and to improve retention rates.

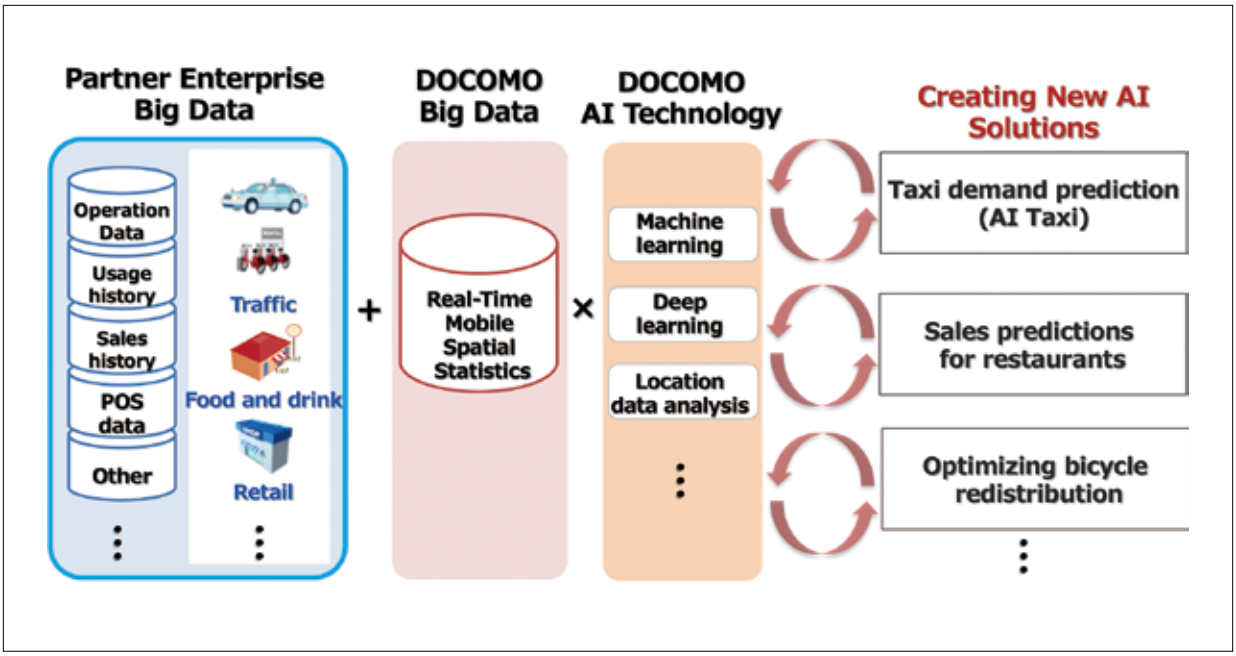
At NTT DOCOMO Inc. (DOCOMO), we are promoting initiatives in data-driven innovation through collaboration with enterprise partners, combining big data from partner enterprises with Real-Time Mobile Spatial Statistics[1] and applying the latest AI technologies as shown in Figure[2]. For example, the AI Taxi service predicts future demand for taxis, combining ridership history data from Tokyo Musen Cooperative Association with Real-Time Mobile Spatial Statistics data. This effectively digitizes know-how regarding demand for taxis from experienced drivers[3]. It enables even inexperienced drivers to know where demand is high, and to achieve a certain level of ridership results. Using AI Taxi as a showpiece, DOCOMO is now promoting solutions to issues in society through partnerships in the food and drink and transportation industries. In this article, we discuss a case of co-creation with Saizeriya Co. Ltd., in the food and drink industry[4]. We also discuss a case in the transportation industry with DOCOMO BIKESHARE, INC.[5].

2. Collaboration with Saizeriya

An important aspect of operating food and drink establishments is predicting demand: when and how many customers will arrive. For example, employee shift schedules, amounts of ingredients, and when to start preparing food can vary greatly based on the level of demand. Predicting higher demand than actually occurs can result in increased staffing costs and food waste. Predicting lower demand than actually occurs can result in longer wait-times for customers, shortages of ingredients, and lost opportunities for customers and orders. As such, predicting customer arrivals is extremely important for operation of such establishments. However, it can fluctuate due to combinations of many factors, such as the weather, characteristics of the location, and nearby events, so it is very difficult to predict demand accurately, even for an experienced person.

In collaboration with Saizeriya, NTT DOCOMO created a supervised machine-learning model that predicts hourly restaurant

Figure: Data Driven Innovation through Collaboration with Enterprise Partners



sales, using training data including past sales data from Saizeriya restaurants, Real-Time Mobile Spatial Statistics and weather characteristics in the areas around each restaurant, and actual sales data as ground truth. We also developed a model emphasizing the real-time features, to increase the accuracy of demand predictions during high-demand periods[6]. This enabled demand to be predicted more accurately during high-demand periods than was possible with Saizeriya's previous model. In preparation for trials in actual restaurants, we built a tool that can be used in Saizeriya restaurants to visualize demand predictions. The visualization tool provides visualizations of prediction results created two weeks earlier, the previous day, and the previous hour. We intend the prediction values from the previous two weeks and previous day to be used by staff for managing shifts. On the other hand, predictions for the previous hour use recent, nearby Real-Time Mobile Spatial Statistics and weather data, so we can expect them to more accurately predict sudden fluctuations in demand, and to be used to grasp unexpected sudden busy times and to help prepare ingredients and other aspects. We conducted a trial at Saizeriya restaurants using this visualization tool from November 2018 to March 2019.

3. Collaboration with DOCOMO BIKESHARE, INC.

Recently, bicycle sharing has been expanding around the world, to relieve crowded traffic congestion, and reduce the burden on the environment. In Japan, DOCOMO BIKESHARE, INC. is also taking the lead, expanding bicycle sharing in various regions. Use of this service has increased sharply between FY2011 and FY2018, from approximately 40,000 uses to 8.1 million uses. With bicycle sharing, users can borrow bicycles at cycle ports in key locations, and return them to any cycle port when they are done. To enable users to borrow and return the bicycles when they want to, it is necessary to understand when and where there will be demand to borrow or return them before hand, and to redistribute them from ports with strong demand for returns, to ports with strong demand for borrowing. If this redistribution is done based on incorrect borrowing estimates, cycle ports where demand is high will run out of bicycles, and opportunities for users to use them will be lost. Cycle ports where demand for returns is high will also overflow with returned bicycles, degrading the surroundings and obstructing traffic. At the end of September 2019, DOCOMO BIKESHARE, INC. had approximately 760 cycle ports and 7,700 bicycles in Tokyo, and optimizing redistribution of bicycles had become an urgent issue.

As such, in collaboration with DOCOMO BIKESHARE, INC., NTT DOCOMO created a supervised machine learning model that predicts demand for borrowing and returning bicycles, using training data that includes past borrowing and returning data from DOCOMO BIKESHARE, INC., real-time population statistics and weather characteristics in the areas around each cycle port, and actual cycle-port borrowing and returning data each hour on the day as ground truth. We built a visualization tool that uses the demand prediction model to generate a redistribution plan, and presents it on a tablet terminal. Since November 26, 2018, we have conducted trials using this tool to perform redistribution work in several wards of Tokyo and in the Sapporo area.

4. Conclusion

This article has introduced collaborations with partner enterprises, creating new value using NTT DOCOMO's Real-Time Mobile Spatial Statistics and the latest AI technologies. Real-Time Mobile Spatial Statistics provides an understanding of the movement of people in real time, and we have shown its potential in improving operational efficiencies in actual establishments in the restaurant industry and in the transportation industry. In the future, we will verify the results of the trials, and also promote partnerships in other industries such as retail and logistics.

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