

One-stop Solution for Increasing Customer Satisfaction

Data Analysis and Machine Learning for Application in Various Fields



WATARU SAKAI*1

YUDAI KATO*2

KATSUAKI MORITA*3

KAZUKI OZAKI*1

TETSUHIRO HASHIMOTO*4

SHIGEO HOSAKA*2

In Tokyu Community Corporation's customer center, it has become quite necessary to create measures and new services to further improve customer satisfaction due to the increasing number of inquiries from customers. To address this issue, Mitsubishi Heavy Industries, Ltd. (MHI) developed a new system that predicts the number of future inquiries, utilizing machine learning, and classifies/visualizes text information of inquiries made in the past by customers. This is one form of the application of the prediction technique and text mining technology that have been applied to our products in the past. MHI will continue to support a variety of customer value creation activities utilizing data and our wide range of product/service knowledge to contribute to the creation of a more prosperous society.

1. Introduction

Since May 2016, Tokyu Community Corporation, a leading company in general property management, has run a customer center that responds promptly to inquiries from customers, aggregates and analyzes customer requests and consultation details (that are subsequently turned into new services) for the purpose of boosting customer satisfaction. The customer center responds to all consultations from approximately 600,000 residents nationwide. The consultations vary widely from interior repair and renovation, the buying/selling and leasing of properties, appropriate attitude to the neighborhood, etc. While the attentive and appropriate care provided by dedicated operators has led to improved service quality, the following issues have become obvious in terms of a further increase in customer satisfaction.

- (1) It is necessary to suppress the decline in customer satisfaction by being capable of handling a sudden increase of inquiries at the end of the month or after public holidays.
- (2) It is necessary to analyze trends of various inquiries from customers, to optimize the contents of the FAQ (Frequently Asked Questions) on the company's website, and to grasp customer needs, which would lead to the launch of entirely new services.

In response to these issues, MHI has developed a new system where the comprehensive energy solution service ENERGY CLOUD™, which utilizes our original machine learning that we have been applying to what we offer for large energy consumers including manufacturing businesses, is applied to service industries and management areas such as call centers. This report introduces the process of development of our new system, covering everything from the implementation details to outcomes in terms of problem solving.

2. Approach to problem solving

Firstly, we ascertained the actual conditions of the worksite and data trends accumulated at the customer center, and then narrowed down the target for analysis. In terms of understanding the

*1 EPI Department, ICT Solution Headquarters

*2 Power & Energy Solution Business Planning Department, Power & Energy Solution Business Division, Power Systems

*3 Chief Staff Manager, EPI Department, ICT Solution Headquarters

*4 ICT Solution Department, ICT Solution Division, MHPS Control Systems Co., Ltd.

data trends, the following four types of data were used.

- (1) Number of actual inquiries made
- (2) Operator performance/schedules
- (3) Public holidays
- (4) Text information of the inquiries

According to the above data, we ascertained the chronological changes in the number of inquiries and contents based on Exploratory Data Analysis (EDA) (**Figure 1** and **Figure 2**). Figure 1 illustrates text information of inquiries classified by category and visualized chronological changes in the number of inquiries, whereas Figure 2 demonstrates text information of 10,000 inquiries classified by contents utilizing text mining technology.

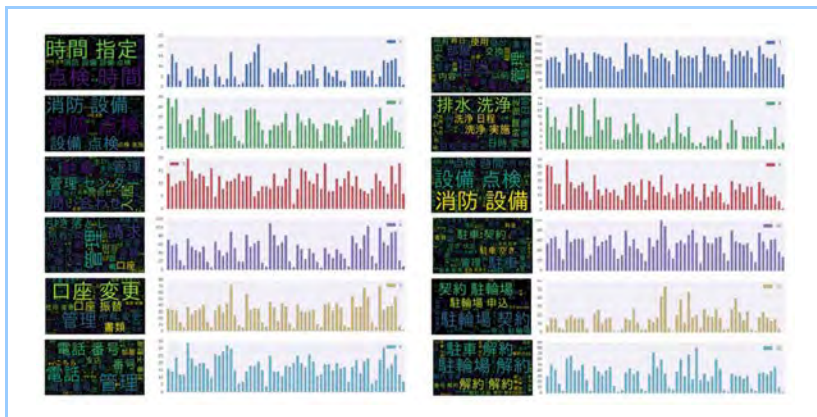


Figure 1 Number of inquiries by category

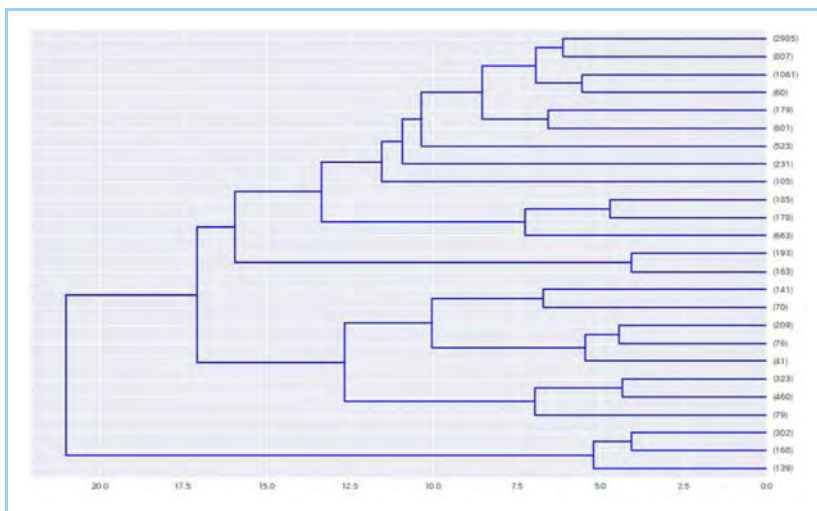


Figure 2 Results of classification of text information from inquiries made

The EDA results verified the on-site tacit knowledge and empirical rules in a quantitative manner, including categories in which the number of inquiries increases around specific dates, those in which periodic fluctuations occur and those which vary depending on events such as weather conditions. Based on these premises, MHI, in tandem with Tokyu Community, co-created solutions to the problems, as well as required functions.

As a result of the co-creation, we formed a hypothesis that the problems can be solved by utilizing the following two functions (**Figure 3**).

- (1) Predicting the number of future inquiries and utilizing this information to determine operator work schedules, leading to the optimal allocation of human resources
- (2) Categorizing inquiry details through text mining to ascertain customer needs and optimize FAQ contents

Based on this hypothesis, the new system was implemented.

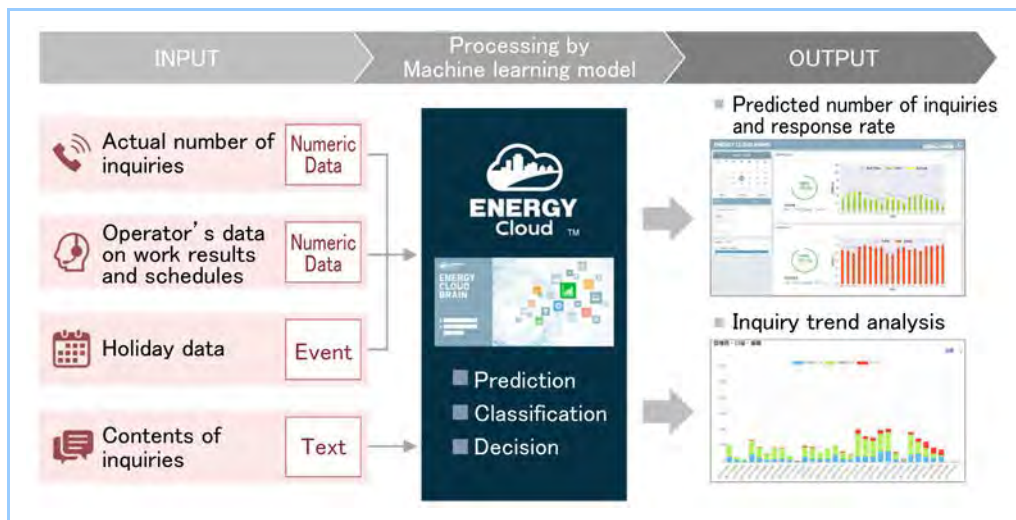


Figure 3 Results of solution co-creation

3. Results

3.1 Predicting the number of inquiries and optimally allocating human resources

To solve the problem described in Paragraph 1 (1), we developed a system which predicted the number of future inquiries and the response rate. The number of past inquiries is entered into the system as learning data, and a machine learning model which has learned the data allows us to predict the number of future inquiries.

As a result of verification, it is clear that the number of inquiries can be predicted with an accuracy of about 70% at the time of the completion of the system. However, the number of inquiries tends to change over the long term, and to maintain and improve accuracy, it is necessary to upgrade the machine learning model on a regular basis. Therefore, in this system, the embedded machine learning model learns the number of past inquiries according to the nature thereof, which leads to maintaining and improving the prediction accuracy.

The prediction results of the number of inquiries provided by this system are used for operator allocation. Traditionally, personnel distribution was determined based on the tacit knowledge and empirical rules at the worksite. However, this system facilitates it based on quantitative standards, which also allows us to suppress the decline in customer satisfaction due to a decrease in the response rate (Figure 4 1).

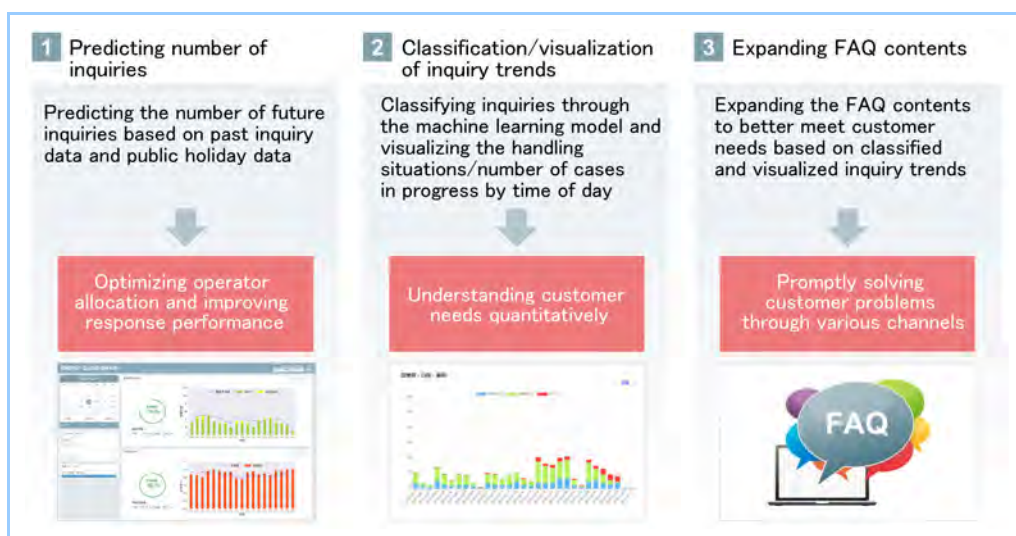


Figure 4 Results and outcomes

3.2 Understanding customer needs through text mining

To solve the problem introduced in Paragraph 1 (2), we developed a system that classified and visualized the inquiry details by category. The text information of the inquiries is entered into

the system utilizing text mining, which is subsequently classified into multiple categories according to the nature of the text information. The classified text is visualized by time of day in terms of the handling situation and number of cases in progress, which leads to the understanding of inquiry trends in individual time periods.

Based on the classification results of the text information obtained from the inquiries made, the system allows us to understand customer needs in a quantitative manner (Figure 4 [2]). By reflecting such needs in the FAQ contents for customers on the company's website, we can encourage customers to tackle problems, which are the causes of their inquiries, and solve them on their own, leading to a reduced number of inquiries (Figure 4 [3]).

4. Conclusion

This report has introduced a series of efforts in the development of a system which predicts the number of inquiries and helps us understand the inquiry trends by utilizing ENERGY CLOUD™ for the purpose of streamlining the operation of a customer center.

Tokyu Community Corporation won the 2017 CRM Best Practice Award (CRM Association Japan), which is awarded to business entities engaged in activities contributing to customer satisfaction and business management, and MHI plays a role in these activities. ⁽¹⁾

Finally, although this technology is based on what has been applied to large energy consumers including manufacturing businesses, it has become clear that it is applicable to service industries and management areas as in this case. In the future, we will utilize the MHI Group's extensive product/service knowledge to support diverse customer value creation activities using data and contribute to the formation of a society with further prosperity.

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References

- (1) CRM Association Japan 2017 CRM Best Practice White paper (2018) p.128~137