Machine Learning in the Catering Industry

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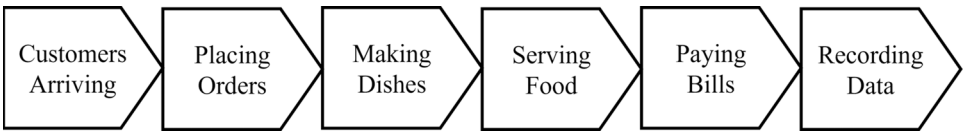
INTRODUCTION

Restaurants provide diverse choices, delicious dishes, and enjoyable environments compared to home cooking. Enjoying foods from restaurants has become a lifestyle, and the catering industry has developed rapidly. In the past, people played the most indispensable roles in the catering industry because of its service nature. Giving customers a satisfying experience is essential in services. However, machine learning, which simulates the human behavior of acquiring knowledge to allow machines to think and act like humans, is now providing a new way to fill these service roles (Jordan & Mitchell, 2015; Wang et al., 2017).

Robots empowered by machine learning can take orders, make recommendations, process foods, collect payments, and even deliver takeaways (Jang & Lee, 2020). Figure 1 shows how machine learning can play a role in various tasks in the catering industry. Customers arriving at a restaurant can place orders with a robot server. After receiving the order, robot cooks can make dishes catering to customers' requests, and when the food is ready, the robot server takes it to the customers' table. When the customers finish, the robot server can process the bill with cash, credit card, or mobile payment. After the customers leave, the customer information and transaction data are recorded to a database and analyzed for recommendations that meet customers' personal preferences the next time.

Figure 1. Machine learning can play a role in various tasks in the catering industry



This chapter discusses machine learning in the catering industry in detail. In the next section, the authors describe the background and review relevant research. Then, the authors discuss the opportunities and challenges that machine learning brings to the catering industry, as well as solutions and recommendations to the issues. Finally, the authors conclude the chapter.

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BACKGROUND

The literature on machine learning has surged in recent years. Jordan and Mitchell (2015) introduce machine learning and its applications. They discuss what machine learning is, which areas it relates to, and the value of machine learning in various industries, including healthcare, education, manufacturing, service, finance, and marketing.

Notably, the application of machine learning to the catering industry is widely documented in the literature. In China, prestigious hotpot restaurants like Haidilao use robots with machine learning to replace human staff (Zheng, 2021); in Korea, LG Electronics design robots that can be utilized to carry and deliver foods to customers (Cho, 2020); and in Thailand, five types of restaurant service robots (Order One, Order Two, Serve One, Serve Two, and Slim) work in MK Company's restaurants (Eksiri & Kimura, 2015). With the advances of machine learning, an increasing number of catering companies use this technology to better anticipate the demand from customers (Hess et al., 2021). For example, Yu and Fu (2020) deploy machine learning models to predict the demand for Japanese food based on questionnaires about dietary habits and personal information. Machine learning is also adopted to predict the degree of processing for food (Menichetti et al., 2021) and wine quality (Dahal et al., 2020).

A vast literature presents the advances of machine learning in the catering industry. For example, Jang and Lee (2020) examine attributes of service robots and their impact on restaurant customers. They find that customers' perceived value from interacting with a robot has a significant relationship with likeability (a positive first impression of a robot), intelligence (a robot can complete a task intelligently), and safety (users feel safe when interacting with a robot). Jang and Lee (2020) also affirm the direction of effects between perceived benefits (perceived value) and satisfaction (revisit intention) and give suggestions on how to make restaurants sustainable. Alabdulrahman and Viktor (2021) note that customers with unique tastes are often ignored, suggesting restaurants may lose these customers by not catering to their tastes and following the new trends. They propose a new system using one-class decision tree algorithms to outperform the traditional filtering-based recommendation system in both accuracy and model construction time.

Food delivery is an area of the catering industry to which machine learning already contributes considerably. Liu et al. (2020) find that the actual route that a delivery person take is often different from the route that the system recommends, and the information on roads may be either outdated or incomplete. They invent a novel algorithm that records the preferred routes of delivery people and then recommends their preferred routes in the future. The algorithm also improves the accuracy of navigation and the efficiency of food delivery. Lou et al. (2020) recognize that order allocation in the food delivery industry is complex due to uneven demand and large-scale optimization of human resources. They build a model that considers the deteriorating effect and learning effect, and the model can be utilized in decision-making in order allocation and labor scheduling in food delivery. Moreover, Bertsimas et al. (2021) investigate the prediction of the demand in an area by comparing classical methods and machine learning. They find that machine learning prediction is more accurate than classical methods when with a limited demand history.

OPPORTUNITIES AND CHALLENGES

The adoption of machine learning brings benefits to restaurants. First of all, it saves costs. Restaurants nowadays face the pressure of rising labor costs. The adoption of machine learning allows restaurants