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The Place and Importance of Artificial Intelligence in the Gastronomy Sector

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Abstract

The demand for artificial intelligence in the world is increasing day by day in the gastronomy sector. In this study, the importance of artificial intelligence in the gastronomy sector is emphasized and the studies on this subject are mentioned. Since the studies in the literature are limited, studies on all sub-branches related to artificial intelligence-based gastronomy and tourism are mentioned. The number of studies related to gastronomy and artificial intelligence in the literature is limited. Therefore, in this study, artificial intelligence applications used in the gastronomy sector are detailed under the subheadings of cuisine, promotion, health, and forecasting. Accordingly, approximately 40 articles were analyzed considering these sub-headings. In light of the information obtained from these studies, artificial intelligence systems to be developed in the gastronomy sector will provide great gains. Moreover, it is estimated that meeting consumer expectations and using innovative technologies in the gastronomy sector will increase the popularity of gastronomy science.

1. INTRODUCTION

With the development of technology, access to information has become easier and a new era has begun. Limited information has been eliminated and a transition to the world of information has been made; creativity and innovation have come to the fore. The development of technology has taken the sectors one step further and caused rapid and radical changes. In this age in which the use of technology has become a necessity, it is observed that businesses that cannot update themselves and adapt to technology will find it very difficult to hold on to the sector and will not be able to continue their lives.

In the gastronomy sector, businesses need to offer goods and services by the desires and wishes of the consumer. The changing needs of the consumer require businesses to offer different and creative methods in a competitive environment [1-2]. The field of artificial intelligence, which provides creative and different methods, directly affects the gastronomy sector.

Nowadays, since artificial intelligence is used in many fields, many applications have been made in this field. Artificial intelligence is used in agriculture, marketing, science, advertising, health, and many other sectors. In this study, artificial intelligence, which is related to many sectors, is included in the studies related to the field of gastronomy. In the study, a literature review was conducted on the subject. These article studies were evaluated, and their characteristics were examined by considering the artificial intelligence applications related to the field of gastronomy. As a result, this article is intended to be a comprehensive study that includes the importance and applications in the field of artificial intelligence-based gastronomy and to be a pioneer for similar studies.

In the article's following sections, the definition and history of gastronomy and artificial intelligence are given in Section 2, and Section 3, respectively. Section 4 is detailed the importance of artificial intelligence in the gastronomy sector. Artificial intelligence applications used in the gastronomy sector are presented

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under subheadings in Section 5. Finally, the results from the previous studies and the future studies that are being planned are discussed in Section 6.

2. GASTRONOMY

The word gastronomy originated in Greek. The word gastronomy is derived from the combination of the words gaster (stomach) and nomos (law). The difficulty of defining a concept in social sciences is also encountered when defining gastronomy. In the simplest sense, gastronomy is defined as the law or craft of stomach regulation [3-4]. Gastronomy also means stomach science.

Conceptually, the use of gastronomy can be traced back to the 4th century BC in the historical process. The book written by Joserh Berchoux in French in 1801, translated into Turkish as "Gastronomy ya da Sofradaki Tarla İnsanı", is the first book with the word gastronomy in its title [4].

When we examine the definitions of gastronomy, the famous gastronomy Brillant Savarin stated that "Gastronomy is the systematic study of everything related to human nutrition" [5-6]. When we examine another definition, Çavuşoğlu (2011) explains gastronomy as an art of eating and drinking that examines the relationship between the cultures of societies and their food [7]. The most basic definition of gastronomy is to meet the eating and drinking needs of people to continue their vital activities [1]. Eating and drinking, which is our physiological need, and is at the bottom of Maslow's hierarchy of needs, is not only meeting the needs of people today but also taking pleasure from food, where we consume food, and many factors [6, 8].

Considering food as a work of art and presenting it beautifully is an aspect that reveals creativity. For this reason, gastronomy provides aesthetic experiences in the preparation and presentation stages of food. Looking at gastronomy from the perspective of art, Baysal and Küçükaslan (2009) defined the concept of gastronomy as culinary art [6, 9].

The concept of gastronomy has a multidisciplinary structure, and the concept of gastronomy has a relationship with many branches of science. The concept of gastronomy also contributes to the fields it cooperates with and expands its range. The foundation of artificial intelligence, which is one of the remarkable applications of today's age, was laid in 1950. Artificial intelligence studies, which are popular application areas, are related to the gastronomy sector as well as many other fields [6]. Today, the use of artificial intelligence in the food and beverage sector has provided convenience for the sector and has also changed traditional methods. When artificial intelligence is associated with gastronomy, it can provide less human error, less waste, fast service, customer satisfaction, and many benefits [10].

3. ARTIFICIAL INTELLIGENCE

Historically, the concept of artificial intelligence was first used by John McCarthy in 1956 at a conference held in Dortmund [11,12]. Artificial intelligence has many application areas and is among the topics researched by different disciplines. Therefore, the concept of artificial intelligence can be defined in many different ways. Artificial intelligence refers to the operation and development of cognitive functions such as reasoning, visual perception, voice recognition, problem-solving, learning, and decision-making, which are human-specific features with the help of computer models, and the operation and development of intelligent machines and software controlled by computers [4,13-14]. Artificial intelligence is a branch of engineering that paves the way for computer-controlled machines, robots, or software that thinks with intelligence [4, 15-16]. Artificial intelligence flows into the human brain and examines how a human learns, how they make decisions and how they solve a problem. It then builds on this knowledge by developing intelligent software and systems based on the results [4, 17].

Although the 1950s are taken as the basis in the literature as the period when artificial intelligence emerged, it is observed that machines similar to artificial intelligence applications were made in previous periods. In the 13th century, Abul Iz Al-Jazari made machines such as encrypted keys, automatic ablution, and water closets in the Artuqid palace [10,18]. When we look at the first studies on artificial intelligence in Turkey, Turkey's first five-axis robot was produced by Hakan Altunay at Istanbul Technical University in 1990. Likewise, the industrial robot produced at the first technology center in Turkey in 1994 is also the first in this field [10, 19].

Aydın (2017) classified artificial intelligence in terms of its purposes and examined it as scientific purpose, educational purpose, and engineering purposes [20]. The scientific purpose of artificial intelligence aims to understand learning, find practical solutions, and create strategies through computer models by examining intelligence. When we look at the educational purpose, it aims to keep the information in the human mind with various simulation software such as learning, understanding, and gaining the ability to solve problems. When we look at the purpose of engineering, it includes the production of programs and robots that can think and decide like humans to make people's lives easier [4]. When we look at these purposes of artificial intelligence, it is seen that production is mostly made for engineering purposes in the gastronomy sector. As gastronomy is intertwined with the fields of kitchen, cooking, service, food, and restaurant in the use of artificial intelligence, it is observed that studies are carried out in these fields.

4. THE IMPORTANCE OF ARTIFICIAL INTELLIGENCE IN THE GASTRONOMY SECTOR

A new era has begun with the prominence of technology in the developing world order. During this period, revolutionary changes and transformations have been experienced in all sectors. These technological developments in the world increase the demand for artificial intelligence. This demand has led to radical changes in the field of gastronomy, and artificial intelligence products have taken their place in many businesses. Technological applications such as robots, smart menus, and advice robots used in the field of gastronomy in artificial intelligence applications have provided many benefits to the sector. The most prominent of these benefits is the elimination of human-induced errors and faster work, saving time and cost and contributing to increased work efficiency.

Artificial intelligence-modeled robots are used to perform difficult, dangerous, and repetitive tasks for humans. Robots affect the staffing of enterprises and reduce costs. However, it is observed that artificial intelligence, which is costly when considered in the short term, is preferred by large and well-established companies in the sector [10].

5. ARTIFICIAL INTELLIGENCE APPLICATIONS USED IN THE GASTRONOMY SECTOR

The demand for artificial intelligence in the world is increasing day by day. Today, there is almost no area where artificial intelligence is not used. Therefore, artificial intelligence technologies affect many fields [6,21]. As in many fields, it has started to be used successfully in the gastronomy sector. Looking at the contributions of artificial intelligence applications to the gastronomy sector; it is understood that it provides advantages such as classification in foods, minimizing the cost of high-cost and labor-intensive processes, reassuring prediction, ensuring the safety of food and beverage, and standardizing the product [6].

Artificial intelligence in gastronomy has applications in classification and prediction. In the classification part, artificial neural networks, machine learning, and deep learning methods are generally used. Using these methods, studies such as quality control classification, product recognition, and food safety detection are carried out [22]. For example, the process of setting aside damaged rice grains and broken ones during production in rice production factories. In terms of business, it prevents loss of time and prevents possible wrong or missing products from being released to the market. Fuzzy logic, regression analysis methods, and optimization methods are used in prediction studies. With these methods, predictive studies such as the cooking time of foods, product yield estimation, and determination of sales times of foods are carried out [6,23]. For example, fuzzy logic is used to determine the cooking time of foods, the classification of pears according to the degree of hardness, and the classification of eggplant according to quality criteria.

The use of artificial intelligence applications in gastronomy is categorized under the headings of cuisine, promotion, health, and prediction. These areas are detailed in sub-headings.

5.1. Kitchen

The concepts of gastronomy and cuisine are often confused and sometimes used interchangeably. Gastronomy is in a general sense and covers the whole process of food from seed to soil in an abstract sense. Cuisine, on the other hand, covers the preparation, cooking, and presentation of food and deals with more concrete issues [24,25].

The relationship between gastronomy, which is related to many disciplines due to its multidisciplinary characteristic, and cuisine is only one of them [24]. While the kitchen is more concerned with the preparation of products, how they are cooked and their presentation, gastronomy deals with issues such as the methods of cooking, what to use, how long it should be, and how long it should take, and explains which combinations should be revealed and is a guiding science [24,26].

Gastronomy has not been a discipline, but a multidisciplinary science. The reason is that it has influenced and been influenced by so many fields that it does not fit into any boundaries. History, chemistry, psychology, sociology, sociology, economy, health, artificial intelligence, robotics, technology, and many other fields are fed and affected [24].

There are many artificial intelligence-based studies in the field of cuisine. A few of these studies are summarized below:

- Şahin and Ağaoğlu (2020) aimed to make predictions about the cooking condition of meat with the system they designed [6]. As a result of the study, the cooking rate of the meat was determined by analyzing the values entered by the user of the program into the system with the rule base inference method. A fuzzy logic model was used. It was determined that the program was 92% successful and can be used safely in the food and beverage sector. It was determined that the most important factor affecting the cooking rate of meat is temperature. Therefore, since the temperature and time intervals can be predicted with the help of the system, the losses experienced will be minimized and customer satisfaction will be ensured.
- Çerkez and Kızıldemir (2020) conducted a study in a restaurant where artificial intelligence and robotics technology was applied [10]. The qualitative research method was used in the study, and it was aimed to reveal the impact of technology use on consumers and what kind of expectations are in which age frequencies. Consumers' behavior was observed, and it was found that robots attracted the attention of all age groups. The smart table application, on the other hand, attracted more interest from children than young people. At the same time, smart tables are not used functionally during meals. Another observed result was that traditional methods were preferred when ordering food. According to the results of the research, these applications, which are new in our country, should be followed and adapted to other applications in the world. In this way, not only technology will not lag, but also changing consumer expectations will be met. In addition, it will contribute to the development of the sector.
- Sugiura et al. (2010) designed a cooking system that works in an open space [27]. In this system, various ingredients are poured into the pot on the induction cooker and a meal is cooked with the heat setting adjusted according to the user's instructions. To realize the cooking function, both robot and human features are specified in the common working part of the system. Small mobile robots are utilized in the system to save money and increase flexibility and safety. These small robots have tasks such as transporting uncooked food, and spices and stirring the pot. The cooking process is started by selecting the recipe from the recipe book. The functioning of the designed system: First, the system user prepares the ingredients according to the instructions, puts them on the plate, and places the relevant visual on the plate. Mobile robots memorize the product on the plate with the help of signs. The user puts water in the pot, places it on the stove, and presses the start button, the ingredients are placed in the pot respectively. The heat is preset and the system alerts when cooking is complete. When the system was tested, it was observed that the food was cooked successfully.

In the gastronomy sector, artificial intelligence products are used in robot chefs. Robotics is the common field of study of engineering branches that deal with the construction, design, and use of robots to do the work done by humans [4,28]. In the literature, it is considered a sub-branch of artificial intelligence. There are many studies where robotics and gastronomy meet. A few of the robots working in kitchens are detailed below:

- Looking at the examples of robots used in kitchens; Moley company is the company that produces the world's first fully automatic and intelligent cooking robot "Robotic Chef", as seen in Figure 1 [29]. It was produced for the first time in 2015. The design of this product consists of robotic arms, an oven, a cooker, and a touchscreen unit. Other items are stovetops, food processors, dishwashers,

basic appliances, and kitchen utensils. The cooking techniques of Chef Tim Anderson, who won the title of BBC Master Chef, were recorded in the system and defined to the robot, and thanks to its advanced arm, it can cook more than a hundred dishes. The robotic kitchen can be operated with a smartphone or touch screen. In 2015, it won the best of the best award at the Asian Consumer Electronics Fair [6,10,29].

Figure 1. *Robot assisting called Robotic Chef [29]*

- "Bot Chef", which is designed as another example of a robot assisting the chef with artificial intelligence support, was produced by Samsung, as seen in Figure 2 [30]. Among the functions of the Bot Chef, it is observed that it can perform mixing, pouring, cleaning and chopping operations. The design of the robotic arm is inspired by the human arm and has six levels of freedom with its diameter, accessibility, and safety. The robotic arm can be operated through simple and intuitive voice commands. The platform of basic artificial intelligence and machine learning skills enables users to easily perform the assigned task using voice control, physical manipulation, and application-based controls. Thus, they can create new skills. New skills can be downloaded, customized, and shared online. The Bot chef can understand the location of the objects and direct them by telling the robot with a voice command [4,30].

Figure 2. *Robot assisting called Bot Chef [30]*

- Among the other robots produced, "Foxbot" cuts noodles and cleans itself; "AUSCA" is one of the robots used in the kitchen with an artificial intelligence product that can pour oil into the pan, break eggs and finally make and serve the omelet [31,32].

These studies and robots produced in the field of the kitchen in the gastronomy sector are very beneficial to the sector in the field of artificial intelligence. It has reduced costs and parallel stress by providing savings in the kitchen area. It has minimized human errors by increasing efficiency and saving time by being faster and more planned in the kitchen. In addition to these benefits, when we look at the risks, developing and implementing artificial intelligence is costly. It is necessary to upgrade the applications used to keep up with the ever-evolving technology and this requires payment. In addition, the use of artificial intelligence applications instead of humans can create unemployment problems [10,31].

In the future, it is expected that intelligence will become widespread in the culinary field and many more innovations will be seen. Instead of the content of recipes, technological processes will be patented. Artificial intelligence will have the ability to analyze and synthesize information about food, beverages, ingredients, and flavors, exceeding human capacity. It is predicted that artificial intelligence will create

food varieties and recipes other than human recipes. Artificial intelligence chefs could become very popular in the future and create entirely new categories of cuisine and beverages. If medical and health information is provided, it is thought that it will be able to benefit at the highest level in terms of health [33].

5.2. Promotion

Gastronomy supports and feeds the field of tourism. Likewise, gastronomy also benefits from tourism through gastronomy tourism, which is one of the alternative tourism types. Thus, there is a mutual interaction. Gastronomy tourism has a very important place in the economy of many countries. Gastronomy also increases local consumption and has a positive economic impact on the people. To ensure the continuity and sustainability of tourism, support from gastronomy are required. Along with the tourism products of the regions, food and beverage products, tourist products, local dishes, herbs, and spices produced in the region should be promoted. These elements that will contribute to the development and branding of regions can be promoted with artificial intelligence applications [34]. Branding will be realized and promoted by ensuring that the region is mentioned with food and beverages specific to the region. The number of studies conducted with artificial intelligence in this field is limited and should be expanded.

Ergün and Öztürk (2018) created a hierarchical ontology model including recipes, food categories, and ingredient types (Figure 3) [22]. For the first time, a semantic data analysis of Turkish dishes was performed for Turkish Cuisine and a database consisting of 50 varieties and 800 images was created. The features, recipes and pictures of the dishes were collected and associated. Using the deep learning model, the dishes can be searched faster with automatic recognition.

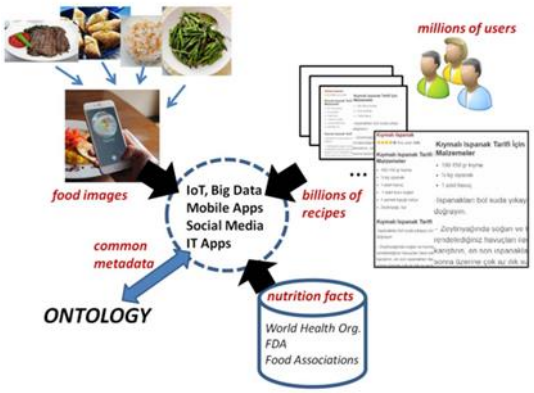

Figure 3. *A hierarchical ontology model [22]*

Chen et al. (2017) created a large-scale image dataset for Chinese food recognition (Figure 4) [35]. This dataset contains more than 180,000 labeled food images with 208 categories. Later, using this dataset, they developed a deep model called ChineseFoodNet based on Convolutional Neural Networks. In the experimental results, an accuracy score of 81.43% was obtained.

Figure 4. *Data Set images [35]*

Razali et al. (2021) developed a local food recognition model to promote gastronomy tourism [36]. In their proposed model, they used pre-trained deep architectures based on the transfer learning approach. VIREO-Food172 and Sabah Food datasets were used to evaluate the food recognition model and experimental results showed accuracies of 94.01% and 86.57%, respectively. Similarly, Jiang et al. (2020) developed a multiscale deep neural network for food recognition [37]. High-level semantic features, mid-level features, and deep visual features were obtained from food images. Then, a hybrid model is presented by combining these features. In the experimental studies, pre-created datasets containing 3 large food images were used (Figure 5). As a result, an average accuracy of 95% was achieved using the proposed model. Similar to these previous studies, Khan et al. [38], Chen et al. [39], Min et al. [40], Kumar Dey et al. [41], and Shifat et al. [42] used a deep learning approach based on convolutional neural networks for local food recognition and ingredient detection.

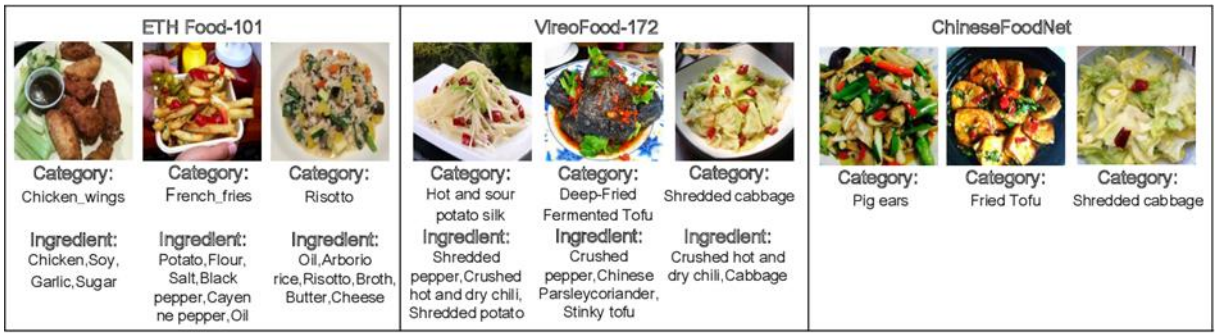

Figure 5. *Images of the data set used [37]*

In addition to the above studies, there are already mobile/web applications in the field of gastronomy related to food recognition in the world. Some of these applications are as follows:

- The Calorie Mama app [43] is a culturally diverse app that provides food identification and information on the nutritional content of the identified dishes.
- Yummly application [44] identifies food ingredients. It then lists the dishes that can be made with these identified ingredients.
- Logmeal application [45] performs food detection, recognition, and content detection from images. In this application, 880 food types from different regions have been identified.

5.3. Health

In food and beverage factories, enterprises, and kitchens, food hygiene and the personal hygiene of employees are very important. Companies like KanKan aim to contribute by using artificial intelligence to ensure and monitor this hygiene. With the help of cameras, KanKan monitors employees both in the kitchen and in the restaurant and observes their equipment for food safety and has also developed facial recognition and object recognition software that checks whether rules such as hand hygiene rules are applied. It has developed software that warns when these rules are violated [10].

Recommendation engines that enable consumers to make healthier food preferences and choices are one of the artificial intelligence applications. This method is aimed to determine people's preferences in line with the flavors they have tasted before. Founded in 2016 in Los Angeles, "Halla" was established to develop artificial intelligence that will enable consumers to make the right choices. It has emerged intending to help consumers by ranking restaurants by taking into account consumers' previous preferences and palate flavors. Another recommendation engine, "TellSpec", reflects the data about the content of the food, total calorie value, glycemic index and fat content of the food, etc. to the mobile phone application as a result of directing the device towards a food [10,46].

There are many artificial intelligence-based studies in food calorie estimation. These studies are summarized below:

- Poladzadeh et al. (2014) proposed a mobile cloud-based food calorie measurement system [47]. This system is a smart mechanism that allows consumers to track their food intake and monitor

their calorie counts. In experimental studies, images of 40 different foods and fruits were used to train the system. As a result, approximately 99% accuracy was achieved.

- Tanno et al. (2018) proposed an approach based on ESA and augmented reality for real-size estimation and food calorie estimation (Figure 4) [48]. Using augmented reality, the actual size of the dining area was measured by taking real-world coordinates as a three-dimensional representation. As a result, the accuracy of real-time calorie estimation is improved by using current technologies.

Figure 4. *AR DeepCalorieCamV2 proposed by Tanno et al. (2018) [48]*

- Ege and Yanai (2018) developed a CNN-based system that includes simultaneous food recognition and calorie calculation in images containing multiple foods [49]. The YOLOv2 model is used as a CNN-based object detector for this system. As a result, they achieved high speed and a small network size for food recognition and calorie estimation.
- Ege and Yanai (2018) proposed two approaches based on image-based estimation of the real size of foods for accurate food calorie estimation: DepthCalorieCam, and RiceCalorieCam [50]. DepthCalorieCam from these approaches, based on a food calorie estimation system with iPhone stereo cameras. On the other hand, RiceCalorieCam includes food size estimation by reference to rice objects. As a result, 90% or more success in estimating food calories was achieved in both approaches.
- Naritomi and Yanai (2020) presented a system based on image processing with AR / MR glasses for food calorie estimation [51]. They used deep learning-based Mask RCNN for food recognition, while AR / MR glasses were used for measuring the actual food size. In experimental works, authors achieved very successful results for food calorie estimation.
- Kumar et al. (2021) developed a hybrid system based on image processing methods for the recognition of food type and calorie estimation [52]. Authors and regions of interest are selected from food images, and the features such as color, shape, and texture are extracted. Then, at the classification stage, these features are fed as the input to the multilayer perceptron (MLP). The experiment results demonstrated that the proposed system produced a high performance for the recognition of food type and calorie estimation.

In the literature, there are limited studies based on image processing and machine learning methods similar to the above studies for food calorie estimation [53-55]. Contrary to all these studies, there are two studies based on food calorie estimation using different tools. These:

- Turmchokkasam and Chamnongthai (2018) presented a system based on thermal imaging for ingredient-based food calorie prediction [56]. The proposed model is based on the classification of food ingredients with the fuzzy logic method by using heat and intensities obtained from thermal images. Later, the classified ingredients are calculated for total calories based on area ratio and nutrition knowledge. As a result, they achieved acceptable results for food calorie estimation.
- Hu et al. (2022) proposed a mobile system called NIRSCAM based on Near-Infrared Sensing (NIR) using signal processing for food calorie estimation [57]. Experimental results demonstrated that they were more successful than previous studies based on image-based methods.

All studies on food calorie estimation were calculated using deep learning, machine learning, and image processing techniques. As a result, this is due to the camera distance measurement, the variable plate size, and the fact that the food is not on the plate in an orderly manner, making calorie calculation in real-time a difficult problem.

5.4. Prediction

In recent years, culinary culture and food and beverage diversity play an important role in the choice of country or city to be traveled to. Therefore, Turkish cuisine, which has a rich variety and delicious dishes, has a successful potential in terms of gastronomy tourism. Turkish cuisine is preferred by tourists in the tourism sector due to its characteristics. Food and beverage services, which are among the most revenue-generating departments in the tourism and accommodation sector, contribute to the strengthening and development of tourism [34,58].

Tourism demand prediction programs can be made using artificial intelligence applications. These prediction data provide foresight for both the public and private sectors and make important contributions to planning. It contributes to the distribution of resources and investments in the right areas, especially in pricing, promotion, and food and beverage sector planning. Accordingly, some of the studies on tourism demand forecasting in the literature are as follows:

- Çuhadar (2013) developed an artificial intelligence-based model for tourism demand prediction in Turkey [23]. This study, it is aimed to reach the highest prediction performance of Turkey's foreign tourism demand by using artificial neural network architecture. In experimental works, In the training phase of the proposed system, the monthly number of foreign tourists coming to Turkey between January 1987 and December 2012 was used. In the testing phase, a monthly foreign tourism demand forecast in 2013 was made for Turkey. As a result, they have achieved quite successful results for foreign tourism demand forecasting.
- Pai et al. (2014) proposed a novel hybrid system for forecasting tourism demand [59]. This system is based on a combination of fuzzy c-means and least-squares support vector regression. In addition, a Genetic algorithm was used for classifier parameter selection. In experimental works, they used data on tourist arrivals to Taiwan and Hong Kong. As a result, the proposed forecasting model was observed to be more successful than other methods.
- Law et al. (2019) presented a deep-learning method for forecast tourist demand [60]. The monthly Macau tourist arrival volumes were used to test the proposed approach. They achieved superior performance compared to other methods.

Similar to the above studies, Li et al. (2017) [61] and Chen et al. (2007) [62] proposed a novel approach to accurately forecast Chinese tourism demand. In these studies, it has been observed that successful results have been obtained for tourism demand.

6. CONCLUSION

Gastronomy is a multidisciplinary science. Many branches of science will contribute to the development of gastronomy science. With the development of technology, one of the most important of these disciplines has been artificial intelligence. New applications have started to be developed in the field of gastronomy using artificial intelligence technology. In the literature, the number of studies in which the field of artificial intelligence and the gastronomy sector meet is limited. In this study, studies on artificial intelligence-based gastronomy were investigated. These studies were evaluated under the subheadings of cuisine, promotion, health, and forecasting related to gastronomy, and approximately 20 international articles were analyzed. These articles are about problems such as robot chefs, food recognition, gastronomy tourism forecasting, safety issues, and calorie calculation. In conclusion, it is aimed that this study, which is prepared as a literature review, will be a pioneer for other studies planned to be carried out using artificial intelligence technologies in the field of gastronomy.

As a result of the information obtained from these studies, meeting consumer expectations in the field of gastronomy and using innovative technologies will provide great gains in the gastronomy sector. In the future, thanks to the artificial intelligence-based gastronomy industry, it is thought that the latest

technological systems will be developed for solving tedious, time-consuming, and low-performance problems.

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