Cognitive Computing in the Travel and Tourism Industry

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Abstract. Cognitive computing emerged from a mixture of cognitive science and computer science. Although cognitive computing is seen as a challenge for companies, it is an opportunity that raises the bar for the services provided, allowing companies that are committed to investing in innovation, and in this particular case in the travel and tourism sector, being able to stand out from the competition by adopting new technologies that make it possible to offer revolutionary and value-added experiences. Whether optimizing processes or developing new services, this technology is the key to innovation and competitiveness in the travel and tourism sector. With the user's history and previous search data, cognitive systems, even before the user realizes it, present specific options according to their profile\preferences. In this sense, the system has the ability to automatically restrict the entire travel package. The main objective of this work is to explore the area of Cognitive computing in the context of Travel and Tourism Industry.

Keywords: Cognitive computing · Travel and Tourism Industry · Natural Language Processing · Artificial Intelligence

1 Introduction

Throughout history computers and electronic devices have had to be told what to do usually programmed by software developers before they could complete a task. But these days the scenario is different: computers will start to learn how to perform different tasks based on experiences, which is very similar to the development of cognitive abilities in humans.

However, unlike humans, these intelligent computing systems will retain and remember everything that learn. With that in mind, imagine the possibilities for every human worker to have access to a computerized assistant who will always be ready to offer

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useful information and guidance. This is the essence of the age of cognitive computing. It is very common to read or hear that the human brain is one of the most perfect and complex systems that exist. Not by chance, this is one of the bases for the development of cognitive computing.

What is cognitive computing in addition to its structure of neurons and synapses, there is another reason that places it in the focus of innovation: optimizing the performance of human beings in their activities [1].

Cognitive computing capabilities include natural language interfaces that enable users to interact with the application using common language [2] and the ability to monitor thousands of sensors embedded in the environment to understand changes in real time [3].

Less unique among cognitive applications is its ability to read unstructured data of all types, ranging from phone calls, emails, and scientific articles, to technical journals, with the aim of scanning databases to analyze and extract patterns.

Cognitive computing is available in the cloud and can be made available in almost any medium that people use. Thus, we can explore cognitive applications on smartphones, through automatic panels or digital assistants, and we can also make cognitive applications available through chips embedded in device, for example, an office machine that can talk to its user and help diagnose any problems encountered.

2 Cognitive Computing

Cognitive computing is a discipline that integrates concepts from neuroscience, cognitive psychology, information science, computational linguistic and artificial intelligence [4, 5].

Cognitive computing can be seen as the third era of computing [6]. This image has been built due to its development, which mixes the science of cognition and computer science to create technologies capable of simulating the human thought process.

The old computers needed to be commanded, which is no longer necessary nowadays, as they can use a self-learning cognitive algorithm, data mining, natural language processing and other elements, thus being able to imitate the human brain in the decision-making process.

In order to have a clearer idea of the evolution of computing, we can consider three eras: the tabulating era, the programming era, and the cognitive era [7] (Fig. 1).

Tabulating era (1900–1940s), was characterized by single-use electromechanical counter systems, and by the use of perforated cards, in which data and instructions for the machine were inserted and stored. In the case of the programming era (1950s–present), after the Second World War, due to scientific and military information needs, the evolution of digital computers was fast, becoming standard tools in companies and governments. The third era, the cognitive era (2011-) appeared as the natural evolution of programming era, to somehow overcome the limitations in the interaction with the human being, combining the human-machine forces [6–8].

AI can add a percentage point to the country's annual economic growth rate by 2035, and its results confirm this projection [9].

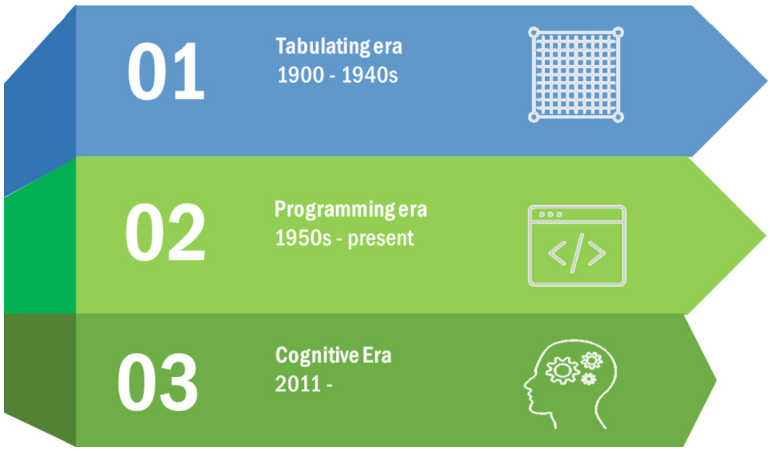

Fig. 1. Computing evolution eras.

AI has been developed to perform tasks of low decision-making and bureaucratic complexity, leaving human capital to focus its efforts on more relevant and strategic activities for the business.

In this mix of new technologies, there's still the machine learning (ML) category, which consists of improving the processing of data collected from different sources, allowing patterns and mathematical models to be transformed into forecasts, scenarios and trends.

The aim of cognitive computing applications, is the data interpretation, just like the human brain. Cognitive innovations go beyond the volume of data to be interconnected, considering structured and unstructured data for their analysis, such as text, audio and voice [1].

3 Advantages of Cognitive Computing

Systems that combine cognitive intelligence and AI allow the processing and analysis of data from different sources and formats, then where executed nothing is neglected (data, knowledge), allowing decision making to be more assertive and fast.

A professional in the accounting field, for example, can take months to understand the laws and rules of a particular country, quoted to host a new branch of the company. With cognitive computing, he could indicate that, after an analysis and comparison of all variables, the business would be unfeasible.

According to the IDC (International Data Corporation) study with predictions for the IT industry in 2020, it is projected that: by 2025, at least 90% of new enterprise applications will have Artificial Intelligence (AI) built in and that; and by 2024, more than 50% of user interaction interfaces will use AI-enabled computer vision, speech, natural language processing (NLP) and AR/VR [10].

Cognitive computing must be used to provide more resources to business leaders facing a time of great business impact [11]. And to succeed or even survive, they must reinvent their organizations with digital technologies.

Some advantages of implementing cognitive computing in the business, in addition to facilitating the management of the enterprise, is provide more efficiency for solving problems.

It is safe to say, therefore, in these examples of cognitive technology, that computers become experts in a certain topic, and their contributions can be unlimited for their users.

As in AI, the use of cognitive computing is already a reality and is used in companies in different segments, there are ten several factors where it can bring positive results with cognitive computing (Table 1).

Table 1. Cognitive computation factors with a positive impact on results [12–17].

Factors	Description
Processes Automation	Cognitive computing is an excellent ally for the automation of processes, since, through algorithms, it can help in the self-learning of these machines so that they perform activities in a more intelligent, agile way and with the reduction or elimination of repetitive tasks that before they were executed by people
Task complexity reduction	Cognitive technology is capable of simplifying processes that were previously performed manually. Through agile software, companies will be able to process large amounts of data to make the best possible decisions, which makes it possible to direct employees to other more strategic tasks for the business
Project management	When identifying patterns in the data, calculating scenarios is one of the most basic functions that cognitive computing can offer, as well as in project planning and tracking. There is also an improvement in the analysis of information and survey of trends that can offer advantages to the business, or allow them to be corrected within a safe limit for the success of the goals
Client management	Companies that offer different relationship channels have access to data in different. With cognitive computing and artificial intelligence, all the information generated from customer contacts can be used to customize the service and consumption experience. The history of individual contacts, evaluated with other customer data, ensures that the company can map behavior and consumption trends. From there, the company can create more efficient commercial strategies in attracting new leads and maintaining the relationship with its buyers

(*continued*)

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Factors	Description
Increase in sales	Invest in this technology, where machines can be trained to approach consumers across multiple communication channels. Through the algorithms, a reading and evaluation of customer histories, their credit score and even predictions is performed. With this, it is possible to use the correct and more natural language to recommend products and offers, helping the company in its sales
Access by all media	Cognitive computing can be applied on any platform, as the execution of algorithms allows it to be accessible in any environment, while the results generated can be analyzed in an unlimited way
Reading unstructured data	A cognitive system is able to analyze both information called structured data, which are complete and clearly identified, and data that are apparently disconnected to generate conclusions, known as unstructured data, as they will not always be available or clear. Its reading becomes more complex for human readers, but not for machines. Thus, all types of information become input for the cognitive system to determine patterns and make connections, quickly and safely, adding positive results to your business
External sensor monitoring	With the growing use of Internet of Things applications, it has become necessary to implement smart sensors to track the data generated by these devices. The union of cognitive technology with IoT in external sensors makes it possible to capture more detailed information on the operation of equipment, monitor the data generated from operations and also seek solutions to improve their efficiency
Proactive security detection	Cognitive computing is widely used to control the security of company devices. You can monitor device performance data through cognitive analytics and check crash reports. Therefore, it is possible to identify the possible causes of malfunctions and suggest the best corrective actions to solve possible problems quickly and effectively

4 Cognitive Computing in Travel and Tourism Industry

The evolution of technology has led to new trends in the industry, and some of these trends have significantly affected the travel and tourism industry, and compared to other sectors, is at the forefront of digital transformation.

According to Statista [18], an increase in the global online travel sector was estimated in 2021 compared to the year 2020. The global online travel market is expected to be valued at around USD 433 billion in 2021, rising from around USD 396 billion in 2020, and by 2026 it is forecast to total approximately USD 691 billion (Fig. 2).

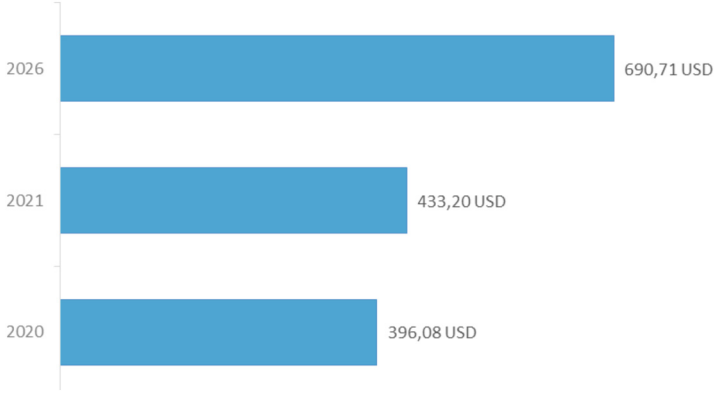

Fig. 2. Online travel market size worldwide in 2020 and 2021, with a forecast for 2026 in billion U.S. dollars [18].

Travel and tourism industry has always been supported by collaborative processes, since in each travel package there are different suppliers for each of the elements of the travel package. This collaboration allows us to offer customers the best possible options.

Cognitive computing in travel and tourism industry has a fundamental characteristic, which is the ability to understand and respond to human behavior in the event of unforeseen events or emergencies.

Customers often have to look for the package that meets their needs in different channels. It is in this sense that cognitive computing, supported by the customer's previous travel information regarding their preferences (duration, price), can book similar tickets and accommodation.

It will be possible to choose different travel options in case there is any unforeseen in terms of accommodation, and can also automatically modify itineraries making alternative reservations automatically, allowing the tourist to have a viable option without causing any inconvenience in their trip, facilitating automatic contact with their services supplier, so we have support in the solution reached, guaranteeing that the trip will not be affected by any unforeseen.

Cognitive computing can accompany the entire travel process from reservations (flights, accommodation, and transport), personalized recommendations during the trip, to travel assistance.

Cognitive computing can make transport and accommodation reservations autonomously, looking for the best offers, and selecting the most advantageous option for the user according to his profile, without his intervention being necessary.

It should be noted that one of the most important benefits of cognitive computing in travel and tourism is the ability to understand and respond to human behavior [19]. In this sense, in the event of an unforeseen occurrence, you can choose other travel options, and book alternative accommodation automatically, thus minimizing the inconvenience caused to the traveler.

5 Conclusions

Cognitive computing is based on self-learning systems that use techniques to intelligently perform specific human tasks.

Cognitive computing began to enhance business decisions and the performance of human thought processes and traditional analytics. Thus, it represents an approach to deploying software and solutions that encompass the use of artificial intelligence to mimic human thinking.

The growth of such innovations has been exponential as applications of the technology become more sophisticated, and the use of such technologies is taking root in places and industries with new applications being discovered almost daily.

Cognitive computing borrows its brain power from machine learning algorithms and artificial intelligence. After all, using these technologies, they continually learn from data received as input during the normal course of operations.

Pattern recognition systems, natural language processing, data mining increase the efficiency of these systems. With intelligence, which is continually built up, they are able to predict patterns and arrive at proactive decisions. That is, anticipating problems and deriving possible solutions. Over time, they become fully autonomous and can handle operations without human interference. In this way, the long-awaited future of complete automation becomes real.

To conclude, cognitive technology is going to enrich the interaction of tourists with the company or with the tourist destination where they are, as never before, in such a way that the visitor lives a much more pleasant experience. Cognitive systems will function as advisors with the capacity to dialogue with tourists, help them enjoy the tourist environment based on their preferences and even respond to their concerns. Cognitive computing ensures that travelers can make their trips and put aside worries about unforeseen events.

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