



HOW DOES ARTIFICIAL INTELLIGENCE AFFECT THE TOURISM INDUSTRY?

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Annotation

Technological innovations support increased efficiency in every industrial sector. Artificial intelligence (AI) is among the most important innovative solutions. Intelligence is measurable and clearly defined. The science of AI has already achieved many significant results and is used in several fields in different industries. The meaning of AI is not clearly defined; however, the term is most often associated with practical advantages and development. Beyond many positive practical possibilities, AI has brought several new ideas into our everyday lives like 'sharing economy', 'Internet of Things' or 'Internet of People'. Tourism industry is no exception of the many sectors affected by AI: different smart systems and chatbots are used in travel agencies and air transport companies. Predictions about the near future foresee the development of personalised solutions, which will lead to further re-arrangement in the technological revolution that has been going on for decades in the tourism industry. The process of continuous progress seems to be unstoppable, and that leads to the big question: how can we adapt to the new world brought to humanity by AI?

KEY WORDS: artificial intelligence; internet of people; internet of things; sharing economy; tourism.

Introduction

Understanding intelligence has always been an important question for humanity. In the ancient days, Aristotle was among the first ones to explore the realm of human intelligence by contemplating on our judgement about right and wrong. Intelligence can be characterised in many different ways. The term can refer to a way of thinking or can be defined as a synonym of acumen. In common sense, the term intelligence refers to the level of exploiting one's skills and knowledge (Horváth 1991). Intelligence is independent from culture, and has many different types. When talking about intelligence, we can talk about emotional, logical, cognitive, musical any many other types of intelligence. The possibility of creating artificial cognition - the initial idea of AI - was conceived during the process of differentiating the many types of intelligence.

The term 'artificial intelligence' was first introduced by American computer scientist John McCarthy in 1965. The idea of extending the definition of intelligence as a theoretical concept emerged during the simplification of logical problem solving in computer science. (McCarthy 1968). Initially, AI was meant to be an aid for theoretical thinking, mainly used for solving complex and difficult mathematical problems (Minsky 1961). The Turing machine – designed by Alan Turing for the examination of the relationship between programmed predictability and human intuition – also had a great impact on the evolution and development of computer technology. By using a series of simple questions, the Turing machine could solve problems in a way that could easily be seen as if the machine was 'thinking' (Turing 1950). The system of the popular Turing tests - that are still frequently used even today - was developed on the

basis of the Turing machine with the synthesis of mathematic problem solving thinking, actions and logical and physical processes.

The demonstrating of AI was quite problematic at the beginning. It was professor Douglas Carl Engelbart whose university experiences helped to clarify the concept widely among scientists. As an acknowledged inventor, Prof Engelbart contributed to the development of computer science with many milestones. His inventions like the mouse or the hypertext not only helped the work of theoretical researchers but also gave way to the processes that have eventually resulted in the everyday use of computers. The evolution of computer science was going on parallel with the development of intelligence research, which resulted in the defining the main characteristics of intelligence: intentionality, flexibility and productive laziness (Sloman 1978). Further research had proven that intelligence produces explicit knowledge from implicit information through deduction process. The term 'agent' – which refers to the personal attributes of intelligence - has become the core expression of contemporary AI research. AI systems today consist of new problem solving systems like multi-agent systems (MAS) and distributed agent systems (DAI) (Futó 1999). AI research has become an independent scientific field and is applied in several industries. AI is widely used in various industrial sectors because it can enhance quality and efficiency, thus improving the speed of different processes¹. Regarding future predictions, the development is foreseen to continue beyond our recent knowledge; therefore it will be critical how we can adapt to the new world created by AI.

¹ Accenture LLP – <https://www.accenture.com>

Research method

My research focused on the relationship between artificial intelligence and the tourism industry. During the examination of relevant literature, I have noticed that both the scientific field and application possibilities of AI are changing. While the early literature on AI dominantly focuses on the mathematical aspects of AI, the definitions and terms of the field have been extended in the newer researches lately. The distance and reaction time between the industry and customers have significantly shortened. In order to gain an in-depth understanding of ICT used in tourism, I have conducted interviews with tourism experts and AI researchers. I have also used the economic data of an innovative tourism business for my research. My results offer a new approach towards real-life results, which can induce further specialised research, targeted tourism development and ICT-related investments in the field.

Internet of Things

The results of AI-based development can be seen in every industrial sector, especially in the manufacturing and ICT sectors. There are various options of further evolution, both in theoretical development and industrial application.

Based on our current knowledge, AI is closely connected to the following - and several more - fields (Russel et al 2010):

- logical games
- theorem proving
- automated programming
- symbolic algebraic computation
- vision
- robotics
- voice recognition
- natural multi-language processing
- constraint satisfaction
- plan, adoption, use, and value creation
- expert systems
- artificial neural nets
- data mining and knowledge management
- mobility
- information-to-knowledge transformations
- user decision modelling and usage analysis
- location-based services and context-aware systems
- travel information search and retrieval
- social networking, social media and social inspiration
- innovation and service design

Computers are not able to handle information on real life objects, their relations and connections in their original format; the data need to be coded into a processable format. The programming language used for coding defines the speed and effectiveness of processing and the possible operations that can be performed with the data. Knowledge representation requires a suitable amount of operation time and storage in order to be able to perform searches, comparisons, chains and affiliations, etc. (Winston 1992), and the use of AI can largely contribute to these fields. With the spreading of the internet and the expansion of virtual networks, large spatial relations can be included in a single system unit. The data available online and the systemised followability of objects deeply impact human life and thinking (Ashton 2009). The acquired data can help to recognise system errors, lessen production loss, track products and generally improve the quality of life.

According to the general strategy of product development, almost every object and device will be accessible through the internet, which will result in the realisation of IoT. Every device that is capable of bidirectional communication belongs to the system of IoT. Unlike today, the devices of the future will communicate in a bidirectional way. These smart devices and state-of-the-art products will be able to communicate with a central hub or with each other multidirectionally. These devices transfer the data and information created during their operation towards other technical devices, and are able to share them with various ICT solutions through networks, databases and cloud systems. As of today, safe robust data handling, personalised differentiation, personalisation and sufficient decision making are the key challenges related to AI. As a result of constant data collection and systematic data handling, all information should be collected in one system eventually.

The most sensitive issues of data collection and handling are safety and anonymity. From the user's point of view, the most important questions are: where are my preferences collected, who can access them and for what purposes? The European legislation on the topic was issued on 24th May 2016, but will only enter into force on 25th May 2018 (EC 2016). In the meantime, EU member states are obliged to adapt the regulation frameworks to their national legislative background and find the safety measures that will guarantee the safety of users. The regulation aims to solve the problems of data handling. Moreover, it will result in a digital reform that enables European citizens to become full members of the digital world economy. According to the plans, the service providers will be obliged to have certificates that provide information on all their partners and affiliates with regards to all their activities. This of course will not stop marketing and market-research companies from data mining, but the transparency will enable users to keep track of how their data are handled.

The special characteristics of the tourism industry and the development of ICT

Tourism is a primarily business-to-consumer (B2C) centred industry, with a target group of individual consumers. Tourism is based on mobility (Zsarnoczky 2017a). The supply and demand sides of the industry usually meet through internet networks, which requires a great deal of co-operation and trust. In the past, several providers competed for the consumers and the basic definition of travel also had a different meaning. Not so long ago, the typical decision making process included a visit to the nearest travel agency and choosing from the options offered by the company. Another typical solution was to choose from mail-ordered catalogues. If the consumer couldn't find the right option, they would go to another travel agency and compare the different options. Today, this process is dramatically shorter: with the use of smart devices, the whole process of ordering, paying and travelling can be completed within minutes.

As a result of the development of ICT systems, the tourism industry has changed dramatically and its processes have accelerated (Zsarnoczky 2016). Formerly, successful tourism businesses were based on personal relations. The online booking systems of airlines not only resulted in better capacity utilisation, but also in the comparability of prices. The rise of low cost airlines has further forced industrial innovation and increased efficiency. New travel sites like Expedia, Orbitz or Kayak have made the decision making process much easier for the consumer; however, the companies that couldn't keep up with the rapid evolution of the industry were forced out of the market. Travel packages – including car rental and airplane tickets – and untraditional travel offers (e.g.: Lonely Planet) are the opposite of the former business idea of the tourism industry. As online travel offers have become popular very rapidly, the innovative approach - which integrates consumers into the development process - became a fundamental value in the tourism industry. With the appearance of Google, a fierce competition begun among different blogs, tourism offers sites and price comparing online systems. The bidirectional communication, where the consumer is an integral part of the business model (which provides long term information on the preferences of the user), has begun with the introduction of cookies.

The new economic models, based on community service purchases like the Sharing Economy (Sundararajan 2016), are forcing tourism industry stakeholders towards further innovations. Accommodation reservation sites like Booking.com operate deeply embedded in social media; they are able to map their consumers and provide them with tailor made and up-to-date offers. Despite all objections, community-based services like Uber and Airbnb will continue to prosper, simply because consumers use them, thus supporting the reform of new and innovative economic systems. Tourism businesses also must take into account the newest results of robotisation, the success of experimental self-driving

cars and innovative transport solutions, VR-glasses and other ICT developments like tourism-related smartphone applications that appear by the thousand every day. The popularity of Facebook Messenger chatbots (which are connected with other deep text analysing systems of Facebook) is growing rapidly among the customer service centres of state-of-the art airline companies (Alaska Airlines, Lufthansa Group, KLM, Aero Mexico) and travel agencies (Neckermann, TSI). The development of technology cannot be stopped or slowed down; however, businesses can prepare for and adapt to them with organisational flexibility and openness. The new generation of consumers will have different demands. The members of the Internet of People (IoP) community offer their free time to achieve common goals, where community-based new frameworks are set up for a non-specifiable target group (Miranda et al 2015). Similar incentives will make it very difficult for companies that are not ready to serve the needs of consumers in a flexible way, and insist on only selling their own products on the market in a traditional way.

New ways of influencing Traveller's decision

Today, AI plays a huge role in creating personalised offers for users (Russel et al 2010). These tailor-made solutions make travelling more cost effective; ensure that the reservations are made with regards to personal preferences; offer the favourite foods and drinks and preferred programmes for the user; in short, they enable the organisation of the perfect trip, based on the traveller's demands.

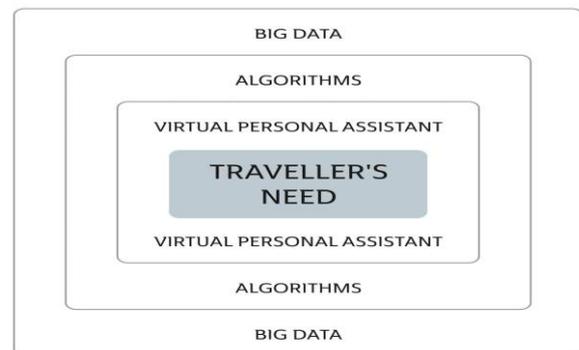


Fig. 1. VPN in the travel decision making

The new decision making system (including Virtual Personal Assistant – VPN) is also beneficial for the service providers, because they can align their operation to the existing capacities (Fig. 1). AI knows personal preferences and individual demands much better than travel agencies. Travel agents might know more about the market as a whole, but no matter how long they'd been working together, they cannot know all the preferences and motivations of the traveller. In addition, AI takes into account positive ideologies like sustainability and climate change awareness (Zsarnoczky 2017b), which at the same time represents a challenge and a huge opportunity for increased efficiency in the tourism industry. In today's fierce

competition within the industry, AI offers a huge advantage; however, not every stakeholder in the tourism industry is ready for its exploitation. While conglomerates and industrial giants are idly watching the evolution of the future, it is the creativity mindset of small innovative businesses that make the economy move forward (Musk 2015). In the future, the uniform offers of today's supply side of the market will be undertaken by personalised services, provided with the help of AI.

Instead of today's uniformed services, the tourism industry should focus on individual preferences in the future (Ricci et al 2002). For instance, today, most service providers cannot imagine that during 'happy hours', they would serve something their guest prefers instead of what they have on offer. However, services like that are exactly what the tourists of the future are looking for, and providing them is a huge advance in the competition. The use of AI is not likely to dramatically change the relationships between the actors and stakeholders of tourism. The fundamental activities in the industry are likely to remain the same: travellers will make decisions on the details of their trip and they will arrive to the chosen destination using their preferred means of travel (Fesenmaier et al 2000). It is clear even today that tourists and local citizens have quite different expectations of the offer of travel portals – influenced by marketing objectives – and what these sites recommend as 'must see' attractions (Zsarnoczky 2017c). In the future, these 'must see' offers can also be personalised and travel options will be brought to consumers in 3D (with devices like Google Glass), so that they can choose between offers especially made for them.

Formerly, besides the offline influences (Fig. 2.) the online solutions that tried to influence the consumers' decisions were following the patterns of user habits in order to enhance their willingness to purchase. The websites with precisely placed information represented a one-way communication, which enabled consumers to choose from the given options. New generation commercial technologies follow and analyse the reactions of consumers via web cameras. There are stores that use real time, camera-based solutions to follow the flow of customers within the stores and analyse their decision making process instead of using the usual shelf placement techniques. This way, retail businesses are able to use not only 'external' marketing strategies, but they can adapt to their consumers' habits based on information gained within their own system. The softwares used in these retail units recognise the gender of the customer, and collect data on what products they are interested in and how they react to the information they read on the packages of products.

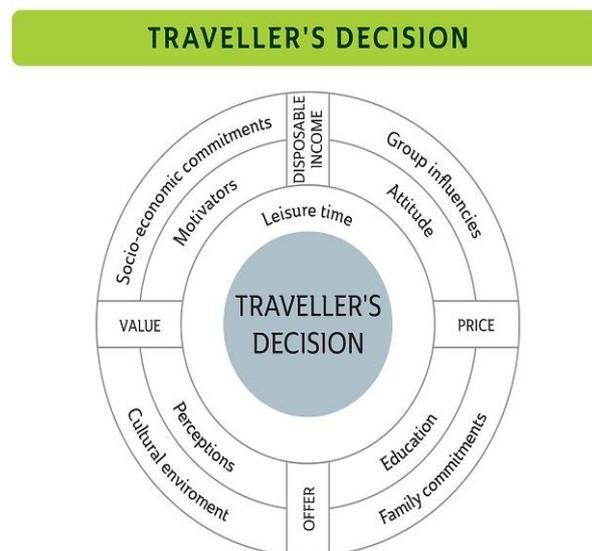


Fig. 2. Influences of offline travel making decision

Results

In the technological revolution of the tourism industry, AI-controlled chatbots play an important role. The first chatbot - called ELIZA - was developed in 1964 (Weizenbaum 1976). Chatbots, developed for automatized communication, have evolved enormously since the introduction of the first model; their most popular versions are counselling and personal assistant applications. Their main fields of use are retail, customer services, decision making support, state-of-the-art payment systems and online community building.

This case study examines the use of chatbots within the frameworks of an innovative tourism enterprise. The Matra Resort tourism project in Hungary² operates guesthouses and uses a Facebook Messenger type chatbot since 2017. They also tried to use drag&drop chat software in the past but without any positive response from the customers.

The following data were used for our research:

- chatbot usage timeframe: 20/02/2017 – 20/08/2017
- website visitors during the selected period: 841 downloads
- number of chatbot questions: 301

The operators of the Matra Resort have uploaded 145 questions with their respective answer options into the chatbot system. The questions and answers contained information on the guesthouses, travel and transportation options and available programmes in the following distribution:

- 69 chatbot questions about the guest houses
- 32 chatbot questions about travel and transportation
- 44 chatbot questions about available programmes.

² Matra Resort – <http://matraresort.com>

For our research, we have chosen the 10 most frequent chatbot questions:

Table 1. The 10 most frequently asked questions at the Matra Resort's chatbot

1.	where is the guesthouse located	53 times
2.	how can I get there	50 times
3.	what are the available programmes	32 times
4.	what can I do there	30 times
5.	what is the name of the street	29 times
6.	what is name of the guesthouse	25 times
7.	how many people can go	12 times
8.	are there any neighbours	11 times
9.	what time should we arrive	10 times
10.	where can we eat	9times

The list of 10 most frequently asked questions adds up to a total number of 261, representing 86.7% of all questions asked. Among the 10 above listed questions, the first two: 'where is the guest house located' and 'how can I get there', have an outstanding ratio of 34.2%. The analysis of the rest of the questions (not listed among the 10 most frequently asked ones) shows that 19 questions were not referring to the profile of the guest house. Another 16 questions were rude and offensive and revealed no relevant information on how the questioner was related to local tourism. The remaining 6 questions were asked by aromatised robots.

The results reveal the following:

- the questioners were searching for practical information on Matra Resort via chatbots; out of the 145 questions presumed by Matra Resort – a.k.a. the service provider -, less than 10% accounted for more than 90% of the actual questions asked via the chatbots;
- the questions asked via chatbots were inquiring about information that can also be found on the website. This means that the number of website visits is not directly connected to the use of chatbots.

The analysis of the results assumes that the users mainly use their smartphones for communication with the Matra Resort chatbots. The answers to the question 'where is the guesthouse' are the name of the settlement (Parádsasvár) and the street address (Béke u. 1.). When typed into Google or other search engines, these location data will result in displaying visual information and further data about the place. The second question ('how can I get there') is answered with a multiple option description on accessibility, including information about different roads and motorways, the duration of travel and notable sights along the way. This chatbot answer is useful for route planning programmes. Based on the information, the

travel programme can be extended with further tourism programmes and other options.

To justify our hypothesis, we have also analysed the time logs of the first two questions. We have found that out of the 103 questions, 86 were asked between 8 a.m. and 12:30 p.m., and 11 between 7:30 p.m. and 10:30 p.m. The remaining 6 questions were asked at different times. This pattern suggests that the use of chatbots is directly linked to the planning process of the travel preparation, and that chatbots are a convenient form of acquiring information.

Conclusions

Artificial intelligence is a new form of intelligence, which is able to synthesise several different ideas simultaneously. Today's technological revolution requires effectiveness, sustainability and productivity at the same time. The use of artificial intelligence – which can be utilised in numerous different fields - is expanding in every industrial sector. For the users of the online world, it is natural to share data or send back information for big companies, and because of that, enterprisers are able to analyse big data and create a profile for each of their customers.

The efficiency of interactive communication is of key importance for innovative companies in order to increase their sales. The ICT revolution has brought forth dramatic changes in the tourism industry as well. AI-operated chatbots and other smart solutions used by different service providers enable the development of personalised offers. Although AI-related solutions are still not widespread within the tourism sector, they are predicted to be used more often in the future in order to increase the quality of the products and services. The big question about today's technological boom is whether the process will continue in the long run. The further expansion of artificial intelligence has a positive impact on the future of the tourism industry sector.

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RECEIVED: 1 June 2017

ACCEPTED: 10 October 2017

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