Exploring the implementation of artificial intelligence in the public sector and in the education

1VASILEIOS YFANTIS, 1KLIMIS NTALIANIS, 2FILOTHEOS NTALIANIS  
1Department Of Business Administration  
University of West Attica  
Address 250 Thivon & P. Ralli str, Aigaleo, Attica  
GREECE  
2Department Of Business Administration  
University of Piraeus

Abstract: - The evolution of artificial intelligence boosts its usage in the private sector, however the public administration seems to lag behind. This paper intends to identify the advantages and potential challenges for the implementation of the artificial intelligence in the public sector. The practical value of this paper lies in the fact that becomes a useful tool for decision makers that aim to adopt this technology in public organizations.  
Key-Words: - Artificial intelligence, public administration, machine learning, algorithm, technology adoption, bots, Education.


1 Introduction
The exploration of the artificial intelligence (AI) began in the decade of the 1940s [1] [2] and continued through the 2010s [3] [4] and beyond. The AI systems are operating without the participation of the human element, by detecting, learning patterns and ending in logic decision making [5]. Moreover, AI refers to the ability of specific devices to think by examining their environment, analyzing the data and acting towards the achievement of a successful goal [6]. The trend of artificial intelligence has been applied in several sectors and became a topic of discussion for the scientific community. The public sector is one of the late AI adopters, however at the moment, numerous countries decided to use AI due to its potentiality [7].

The implementation of AI in the public sector features the design, editing and use of the appropriate algorithms and technical methods that lead to the management of the public offices. Machine learning and deep learning are two AI technologies who contribute in the management of big data. The public sector benefits from the management of the big data because it helps in the identification of patterns that define the decision making in cost savings and re-use of the organization’s resources. The effectiveness of AI technology depends on the both quality and quantity of the retrieved data that the AI system uses to detect patterns [8]. The more data the AI system gathers the more effective the output of the system will be.

The importance of the AI in the public sector is defined by the fact that the public personnel is not always enough to monitor and manage all the transactions carried out in the public sphere. The use of the social media in the public administration [9] produces a large amount of data that could be useful for the public administration. The quantity of the social comments, the identification of public trends and other factors, are data that the AI technology can handle and make decisions based on this information. In other words, AI could take a central role in the governance of a country by monitoring the online behavior of the citizens.

The use of artificial intelligence in the private sector is known to almost everyone that uses the client services of various companies. For instance, there is almost always an AI call agent that answers technical questions upon calling to report a technical issue with the internet services at home. Moreover, when someone shops online, there are virtual AI agents that suggest the best commercial offers based on the detection of shopping behavior patterns. While the private companies have found the value of the AI in the transactions with the public, the research of the AI use in the public sector is still limited. The scope of this paper is to explore the use of the artificial intelligence in the
public administration by identifying the needs, upcoming trends and challenges of the sector. The methodology is an exploratory research which will present the most important concepts and analyze them from an information management perspective. The contribution of this paper lies in the fact that the public decision makers will find how to use AI as a tool to improve the decision making and adopt this technology in the government.

2 Application of AI in the public sector
The implementation of the AI in the government is present in critical departments of the government, such as the health care. In 2010, several hospitals in Great Britain used a disease surveillance system which is based on machine learning technology [10]. The adoption of the machine learning algorithms was successful, since the system managed to reduce the spreading of viruses. AI in the healthcare sector could be a very helpful tool. Whether a researcher uses supervised or unsupervised learning algorithms, the output leads to interesting results. Another critical condition sector of the government, is the national safety. The usage of AI for security reasons could lead to the prediction of crime in the urban areas. In the early 2010s, a police department in California adopted AI to find areas where criminal incidents would take place [11]. The results were impressive, since the AI’s output contributed to a reduction of property crimes, up to 27%. The probability that a criminal activity will occur, could be calculated based on the condition that another criminal activity has already taken place. The machine learning algorithm of Baye’s Theorem, calculates the probability of a hypothesis by taking into account prior knowledge [12]. In this case if we use the algorithm of Baye’s Theorem, then we could end up calculating the probability of someone to act illegally. Baye’s Theorem is defined as [13]:

\[
P(h|d) = \frac{(P(d|h) P(h))}{P(d)}
\]

- \(P(h|d)\): The probability that hypothesis \(h\) is true, based on the data \(d\).
- \((P(d|h)\): The probability of submitted data if hypothesis \(h\) is true.
- \(P(h)\): The probability that hypothesis \(h\) is true (regardless of the data).
- \((P(d)\): The probability of the data (regardless of the hypothesis).

For instance, it is assumed that 100% of citizens associated with illegal activity are in a specific financial status. When another citizen is in the same status, it does not mean that this person has a 100% chance of becoming a criminal. By taking into account the incidence rate (1/100000 and 1/10000 non-criminals people with the same financial status worldwide) we submit data to the algorithm and retrieve results about the probability of people with certain income to become criminals. The results will help the police to monitor the annual income of people in an area and predict the potential criminal record profile of those persons. Consequently, the police could plan the appropriate number of personnel that is required to guard in the neighborhoods.

Another interesting example of AI application in the public sector, was implemented in the country of Australia. The Australian authorities in charge of the tax services, created an AI bot that answers citizens questions for the taxes [14]. The result was an increase of first contact resolution rate to 80% [15]. The chatbot systems consist of three elements [16]: A knowledge base, a chat engine interface and an interpreter program that communicates with the interface. The citizen enters a question (data input) which is being analysed by the system and looks for a potential answer in the knowledge base. Then the system displays an answer with the help of the natural language processing (NLP) and artificial intelligence. The value of the AI chatbot systems lies in the fact that the AI learns patterns from the human behaviour and business information for a specified business database. The citizens benefit from both those elements because the client service is information driven without the unexpected factors of the human intervention. While this system is virtually located, it could be physically installed in a real office. The suggested system would consist of a chatbot system inside an empty public office which is connected to an internet of things (IoT) system. The citizen will enter questions and several sensors around will measure his/her blood pressure/temperature, etc. In case the sensor spots that the heart rate or blood pressure is high then it probably means that the citizen is feeling angry due to issues with chatbot system. The sensors will transfer this type of information to an administrator.
device, who will call a real public servant to come inside the office and answer the questions.

Of course there are other examples of AI application in the public sector as well. However, by taking into account the advantages of the technology, it is important to find out about the challenges of the technology’s implementation as well.

3 Challenges of AI in the public sector
The adoption of AI technology in the public sector is the first issue that the decision makers have to deal with. There are case studies who prove the value of AI in the public sector. Nevertheless, what are the factors that influence the successful implementation of the AI in the public sector? There are several scholars that argue about how challenging the implementation of AI [17] is and how weak or unsuccessful the implementation could be [18].

Security is a factor which absolutely affects the likelihood of implementing the AI technology. It is common knowledge that the AI system learns from a behavior and makes decisions based on this knowledge. What would happen if the system adopts a negative behavior [19] [20]? This is a serious issue that could transform AI from a prediction tool to a destruction tool. Consequently, there should be a security mechanism behind the AI implementation which defines the positive or negative behavior. Maybe an ambient intelligent methodology or an IoT one which detects the human condition with the sensors. In this case, sensor signals that detect a risky human condition could boost a mechanism that interrupts the implementation of the AI process.

Privacy of the citizen’s data is a factor that the information technology personnel of the government should also take care. The non-authorized access to the AI system could allow the loss or modification of critical data. Especially, the issue of privacy is also discussed in the use of AI surveillance systems that act as a monitoring system for very sensitive data [21].

Data quantity and quality are two additional factors that could influence the implementation of AI in the public administration. The more data the system retrieves the more patterns identifies for analysis. In sectors such as healthcare, the quantity of data is low [22] which makes the AI less effective. On data quality level, the integration of data is a critical issue because there should be a connection between types of data in the database such as demographical with clinical data [23].

Expertise is the next factor that will adopt the implementation of AI in the public sector. The value of the AI system depends on the people who will design and modify its features. The lack of data scientists with the appropriate skills, could reduce the development rate of AI in the public sector. The human resources department of the government should offer a competitive advantage to hire the specialists.

At last but not least, the ethical issue of machines replacing the human beings [24] boosts reactions from the employees and not only. Is a smart machine more important than a skilled worker? How many public servants are going to lose their jobs? The fact that AI systems have no emotion and consciousness [25] compared with the humans, poses the question if an emotionless entity could make decision about an entity with emotions.

These are numerous challenges that are points of discussion for the public decision makers that want to adopt the AI in the government. Moreover, there are other challenges related to the managerial side of the implementation such as economic and organizational changes. Since this research work is in process, more details will be published in a next paper which will categorize and analyze each different challenge. The same concepts can also be applied in Education (Primary Schools, Secondary Schools, Universities, etc...)

4 Conclusion
The paper discusses the use of artificial intelligence in the public sector by taking into account its current applications and challenges of technology’s implementation. According to our research, the most significant challenges are: Technology adoption, security, privacy, data quantity/quality, expertise and ethical issues. The prospective use of AI in the public sector will minimize the cost of the public expenses by identifying behavior trends of the citizens and re-using available data assets. The next step is to test the significance of the AI technology from the citizen’s perspective because they could possibly influence the government’s decision to use AI. Techniques such as gamification could be used to motivate both citizens and public servants to gain trust in the AI system. Trust is the key for the productive operation of a government which invests in a long term collaboration with the citizens.

AI can be also applied in Education (Schools, Colleges, Universities etc...)

References:


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