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Artificial Intelligence in Government

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ABSTRACT

Artificial intelligence (AI) is an emerging technology where machines are programmed to learn, reason, and perform in ways that simulate human intelligence. It has become a game-changing tool in the rapidly evolving technological landscape. It has the potential to reshape the fundamental workings of governments worldwide. The use of AI in government refers to the implementation of AI in governmental affairs and the rules and regulations those officials make to legislate how private companies and individuals use it.

The adoption of AI by government agencies is now widespread, covering a broad range of functions from surveillance monitoring to screening, scoring, transcription, and more. AI holds immense potential for improving government services. This paper takes an in-depth look into the many ways artificial intelligence has made and continues to make an impact in government.

KEYWORDS: *artificial intelligence, machine learning, AI, generative AI, government, public service.*

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INTRODUCTION

Technology companies are partnering and exploring opportunities to work with the public sector on deploying AI tools. Democracies around the world face a fundamental challenge: declining trust in government, driven in part by the perception that public institutions are neither responsive nor transparent. It seems inevitable that technological advances, including the deployment of artificial intelligence (AI), will be part of any proposed solution. These technological investments could theoretically help to improve perceptions of government too. In the realm of public services, AI offers new opportunities for efficiency and innovation.

Agencies and Congress are discovering ways to leverage advanced technologies to improve their internal processes and assist in ministerial decision-making. The federal government has significantly expanded its use of AI in recent years. It is implementing AI applications in many sectors, from public health and national security to finance and regulatory compliance. The Office of Management and Budget encourages the use of AI in government to streamline operations, reduce costs, and improve overall efficiency. It suggests that agencies need to make sure that their AI systems are used ethically, with a major focus on fairness, accountability, and transparency [1].

WHAT IS ARTIFICIAL INTELLIGENCE?

The term "artificial intelligence" (AI) is an umbrella term John McCarthy, a computer scientist, coined in 1955 and defined as "the science and engineering of intelligent machines." It refers to the ability of a computer system to perform human tasks (such as thinking and learning) that usually can only be accomplished using human intelligence [2]. Typically, AI systems demonstrate at least some of the following human behaviors: planning, learning, reasoning, problem solving, knowledge representation, perception, speech recognition, decision-making, language translation, motion, manipulation, intelligence, and creativity.

The 10 U.S. Code § 2358 define artificial intelligence as [3]:

1. "Any artificial system that performs tasks under varying and unpredictable circumstances without significant human oversight, or that can learn

from experience and improve performance when exposed to data sets.

2. An artificial system developed in computer software, physical hardware, or other context that solves tasks requiring human-like perception, cognition, planning, learning, communication, or physical action.
3. An artificial system designed to think or act like a human, including cognitive architectures and neural networks.
4. A set of techniques, including machine learning, that is designed to approximate a cognitive task.
5. An artificial system designed to act rationally, including an intelligent software agent or embodied robot that achieves goals using perception, planning, reasoning, learning, communicating, decision making, and acting."

AI provides tools creating intelligent machines which can behave like humans, think like humans, and make decisions like humans. The main goals of artificial intelligence are [4]:

1. Replicate human intelligence
2. Solve knowledge-intensive tasks
3. Make an intelligent connection of perception and action
4. Build a machine which can perform tasks that requires human intelligence
5. Create some system which can exhibit intelligent behavior, learn new things by itself, demonstrate, explain, and can advise to its user.

AI is not a single technology but a range of computational models and algorithms. The concept of AI is an umbrella term that encompasses many different technologies. AI is not a single technology but a collection of techniques that enables computer systems to perform tasks that would otherwise require human intelligence. The major disciplines in AI include [5]:

- Expert systems
- Fuzzy logic
- Neural networks
- Machine learning (ML)
- Deep learning
- Natural Language Processors (NLP)
- Robots

These computer-based tools or technologies have been used to achieve AI's goals. Each AI tool has its own advantages. Using a combination of these models, rather than a single model, is recommended. Figure 1 shows a typical expert system, while Figure 2 illustrates the AI tools. These tools are gaining momentum across every industry. Analytics can be considered a core AI capability.

GENERATIVE AI

Artificial Intelligence (AI) is increasingly a part of our world and it is rapidly changing our lives. Generative AI (GenAI) is a subset of artificial intelligence that uses generative models to produce text, images, videos, or other forms of data. Generative AI (GenAI) is a term for any type of AI system capable of using generative models to create new forms of humanlike creative content, like text, images, music, audio, video and more. GenAI models include various algorithms able to learn the various patterns and structures of input training data before generating novel outputs with similar characteristics. It is essentially a narrow type and application of the broader artificial intelligence umbrella of technologies. It describes algorithms (such as ChatGPT) that can be used to create new content, including audio, code, images, text, simulations, and videos. It is specifically designed and trained to generate new content. The versatility and potential of GenAI to transform various aspects of business operations make it an attractive investment for companies across industries. GenAI uses neural networks, machine learning, deep learning models, complex algorithms, and large and varied training datasets to produce original content based on user input and how to reason in ways akin to a human brain. The technology is built on AI tools shown in Figure 3 [6]. It uses neural networks to identify the patterns and structures within existing data to generate new and original content.

Generative AI can be thought of as a machine-learning model that is trained to create new data, rather than making a prediction about a specific dataset. Since its inception, the field of machine learning used both discriminative models and generative models, to model and predict data. A generative AI system is constructed by applying unsupervised machine learning or self-supervised machine learning to a data set. The most common way to train a generative AI model is to use supervised learning. Generative AI can also be trained on the motions of a robotic system to generate new trajectories for motion planning or navigation. Generative AI models are used to power chatbot products such as ChatGPT [7].

Generative AI is transforming nearly all aspects of the pharmaceutical industry, revamping the way companies operate and potentially unlocking billions of dollars in value. The pharmaceutical-operations value chain encompasses sourcing, manufacturing,

quality, and the supply chain—and gen AI is expected to improve them all

AI IN GOVERNMENT

The rapid adoption of artificial intelligence tools is not specific to the private sector. Federal, state, and local governments have started to adopt AI tools in their daily operations and to deliver government benefits and services. From fraud and error detection to the prediction of service disruptions, the variety of data held by government agencies means that they are well positioned to use artificial intelligence. If AI is effectively applied across government departments, it can have a positive impact on the healthcare, energy, economic, and agriculture sectors. State and federal lawmakers are expanding the use of artificial intelligence across agencies to improve efficiency, decision-making, and the delivery of government services, with a strong focus on governance, ethical practices and interagency collaboration [1]. Figure 4 shows a representation of AI in government [8].

Artificial Intelligence (AI) could have a significant impact on individuals, businesses, and governments. It is expected to transform all sectors of society, including the very character of war. Governments worldwide are increasingly leveraging AI to enhance service delivery, streamline processes, and make informed decisions. For government, artificial intelligence promises to streamline operations, facilitate decision-making and improve customer services in ways that were not possible before. AI allows the government to harness the power that is already available in various datasets to make more informed and more accurate decisions on behalf of citizens. AI does that by giving agency subject-matter experts the ability to quickly solve complex problems without relying on manpower in the form of dedicated data science teams [9]. AI can be used to assist the public to interact with the government and access citizen services. AI adoption acts as a lever for transformational change in the way government services are conceived, designed, delivered, and consumed. Figure 5 depicts various types of AI for government services [10].

APPLICATIONS OF AI IN GOVERNMENT

Government agencies have started investing in AI technologies to solve various public sector problems. They use AI to design better policies, make better decisions, enhance relationships with citizens, and improve the quality of services. Here are several ways governments are using AI to improve public services [10-12]:

- *Smart Cities:* Concepts of a "smart city" are visualized with a city data platform that shows insights into urban infrastructure and public safety. AI is used in smart city concepts such as safe city, smart water, smart transport, smart waste, smart parking, smart homes, and smart traffic.
- *Automation:* One of the primary applications of AI in government is the automation of administrative tasks. All public sector departments deal with a lot of paperwork. Manual data entry or verification consumes a lot of time and resources, making it difficult to prove quick services to the public. In this technology-intensive world, individuals, businesses, and governments use AI to automate their workflows and minimize redundant tasks. There are many areas of central and local government that would benefit from citizens being able to access help without human intervention as the first port of call.
- *Fraud Detection:* Fraud detection and prevention are areas where AI can significantly benefit government operations. Governments today can benefit from the application of anomaly detection to benefits claims and tax rebates. By leveraging machine learning techniques, AI systems can continuously learn and adapt to new fraud schemes, improving their effectiveness. These AI-powered fraud detection systems can help government agencies proactively identify and prevent fraudulent activities.
- *Service Delivery:* Many public services are becoming digital, creating electronic footprints of the business processes in operation. AI can significantly enhance the delivery of government services to citizens. Chatbots, powered by natural language processing (NLP), provide 24/7 assistance, answering queries and resolving issues promptly. Combined with user feedback, process mining creates a fuller picture of the issues faced by users and indicates how to make the service more efficient.
- *Prediction:* The use of predictive modelling is becoming increasingly important in the fight against epidemic diseases. During the COVID-19 pandemic, machine learning has been used in different ways to inform our understanding of the disease.
- *Resource Allocation:* Resource allocation is paramount in delivering effective public services, whether it is the management of intensive-care beds or the maintenance of the road and rail network. The ability to predict need before it occurs allows managers to make better decisions; giving them this capability will become increasingly important in the public sector.

- *Transportation:* World Health Organization (WHO) estimates that 1.3 million people die in road crashes yearly. By effectively applying AI in transportation, governments can significantly reduce road safety issues. AI and machine learning algorithms provide data-driven analyses that aid officials in controlling traffic flow, preventing accidents and congestion, monitoring logistics, and improving road safety. AI-based systems can help transportation services providers optimize route planning and delivery schedules.
- *Healthcare:* Governments can leverage AI to provide effective health services to citizens. AI in healthcare has achieved several breakthroughs in medical science, from early disease detection and prevention to clinical decision support. AI allows real-time tracking of patients' health. This includes monitoring weight, height, blood glucose, stress levels, heart rate, etc. The precision of the AI models is highly dependent on the quality and quantity of the medical images dataset. The Department of Health and Human Services has deployed AI tools to enhance medical research and track disease outbreaks. The Food and Drug Administration has been using AI to review drug applications. The National Institutes of Health (NIH) has been using AI technology to predict disease progression and identify scientific literature. The Department of Veterans Affairs uses AI to help analyze medical records and data to predict risk-related incidents of suicide.
- *Agriculture:* Agriculture is an area that requires various resources, labor, money, and time for the best results. Today, agriculture is becoming digital, and AI is emerging in this field. AI in agriculture can be very helpful for farmers and is being applied to agriculture robotics, solid and crop monitoring, and predictive analysis.
- *Education:* AI can automate grading so that the tutor can have more time to teach. AI chatbots can communicate with students as teaching assistants. AI can work as a personal virtual tutor for students, which will be accessible easily at any time and any place.
- *Virtual Assistants:* Chatbots and virtual assistants are visualized through friendly avatars or conversational interfaces. For example, in 2015, the US Citizenship and Immigration Services (USCIS) announced the launch of a chatbot named Emma. USCIS uses Emma to help people with website navigation. By late 2016, the Department of Homeland Security (DHS) reported that Emma was already helping to answer nearly a half-million questions per month, allowing DHS to handle many more inquiries than it had previously. State agencies have seen a steady increase in chatbot use since the COVID-19 pandemic.
- *National Security:* Security and governance are key attributes of any modernization effort. AI holds great promise for the public sector, and governments are in a unique position in relation to AI. The Department of Homeland Security is using AI to help advance its homeland security mission while still protecting privacy and individual rights for the public. For example, the US Customs and Border Protection helps keep fentanyl and other drugs out of the country by using AI to identify a suspicious pattern in a car's border crossing history. The Department of Defense has been using machine learning for many years to help with predictive maintenance and military logistics. In high-impact areas like airport security, streamlining access could make once cumbersome processes more efficient and help ensure that the gains from AI are more equally distributed. Figure 6 shows security services at Newark airport [13].
- *Law enforcement:* AI can help to ensure public safety when they use their services. Powerful ML platforms can help federal agencies concerned with law enforcement to better track threats in and outside of the country and solve crimes. Using pattern recognition, AI can analyze surveillance cameras, such as at airports, to identify suspects.

BENEFITS

Artificial intelligence is revolutionizing government by automating tasks, enhancing service delivery, and enabling data-driven decision-making. Governments at all levels are striving to balance the risks and opportunities of AI adoption. They are discussing real world impacts, building governance structures and privacy standards to support responsible use and ensure the reliability, safety and security of AI applications. AI has the potential to foster greater public engagement. Other benefits of AI in government include the following [12,14]:

- *Efficiency:* A major reason for using AI in government processes is that it can free up millions of labor hours. The public sector deals with large amounts of data, so increasing efficiency is key. AI and automation can help increase processing speed, minimize costs, and provide services to the public faster. By replacing government officials, AI chatbots can effectively automate interactions, allowing workers to focus on more complex tasks.

- *Accountability:* Public-use technologies demand a higher level of accountability and compliance with regulations than technologies developed by the private sector. Government agencies must also be concerned with the accountability of AI as these initiatives directly impact public and national safety.
- *Transparency:* Government operations can, at times, be perceived as opaque and subject to subjective human decision-making. By employing AI that operates on clear rules and utilizes transparent data, decisions can become more data-driven and comprehensible. Artificial intelligence systems can, if properly used, help make government more effective and responsive, improving the lives of citizens.
- *Cyber Attack Prevention:* Government agencies sit on top of critical public and defense data. This makes them a target for cyber-attacks. Any intrusion in government databases affects national security and damages the public's trust. As cyber attacks become more and more sophisticated, legacy systems fail to prevent malicious activities. AI in government workflows allows agencies to prevent or minimize cyber attacks.
- *Decision-Making*: AI enables governments to make data-driven decisions by analyzing vast amounts of information. This data-driven approach allows for more informed and efficient decision-making, as it eliminates guesswork and relies on objective information. Predictive analytics tools can identify patterns and trends, helping policymakers anticipate future needs and allocate resources accordingly. AI also facilitates risk assessment, fraud detection, and compliance monitoring, ensuring transparency and accountability.

CHALLENGES

The deployment of AI in government is not without challenges. There is a dire need to spread awareness and develop AI expertise among government workers. Government agencies need to adopt and enforce ethical AI guidelines in different phases of the AI lifecycle to ensure transparency, contestability, and accountability. Unfortunately, most public-sector AI initiatives are underfunded and understaffed to execute ethical AI policies effectively. The top three barriers to AI expansion in government are unclear governance frameworks, lack of technology infrastructure. and the failure of AI applications to align with current agency needs. These cause some major challenges and risks in adopting AI in government. Other challenges include the following [12,15]:

- *Ethical Concerns*: AI models have always been subject to ethical issues, and their public sector implementations are no different. Ethical issues in AI mainly arise due to data biases and privacy. Governments are in a unique position of power, with access to a wide range of sensitive data. The use of AI in public services will need to operate within a robust ethical framework, supported by strong security and clear understanding of its place in decision hierarchies.
- *Bias:* Unfortunately, many of the AI systems on which state and local government rely do produce errors and biases. AI bias has long been a challenge for experts. AI models can display bias based on different characteristics, raising questions about the fairness and integrity of the government. For instance, a facial recognition security and surveillance system used by a government agency could mischaracterize a citizen, leading to false legal action against them. To address concerns about possible bias, discrimination, and disparate impact, some states in the US have mandated that state agencies run impact assessments to ensure that the AI systems in use are ethical, trustworthy, and beneficial.
- *Privacy:* Collecting large amounts of citizen data may be met with protests from citizens concerned with safeguarding their identities. Most government agencies outsource the development of AI systems, which leads to sharing citizen data with third-party companies. Also, it is challenging to get the consent of each individual. Data biases impact how the model treats certain sects and communities, and the use of public data puts its privacy at risk.
- *Artificial General Intelligence*: Most AI experts believe humanity will be able to create artificial general intelligence (AGI). This theory is that AI will eventually reach the level of human cognition, effectively being able to do anything humans can do and, often, without human operators. There is the fear that the AI becomes too powerful or quickly evolves into superintelligence where machines start making decisions that benefit themselves and not humanity.
- *Lack of AI Expertise:* High-quality AI resources are rare. Government workers often lack the data science and AI skills necessary to handle the massive scale of citizen data and build state-of-the-art AI models that benefit the public.
- *Lack of Motivation:* Typically, government workers are accustomed to their existing

workflows. Their existing organizational culture does not encourage an R&D-based environment which is critical for AI adoption.

- *Job Displacement:* Automation of tasks by AI can lead to job displacement, requiring governments to address labor market implications.

CONCLUSION

In a time of skepticism towards government around the world, AI is an opportunity to redefine what public services can deliver. AI provides an opportunity to redefine what public services can deliver. With advanced technologies, government agencies can cut labor costs, speed up processes, save man-hours and provide smooth and quicker services to the public. Federal offices must start building an AI culture and raise employee awareness. However, government use of AI is a controversial topic, given the power it has and how it might be misused to benefit some and penalize others.

The United States is in a race to achieve global dominance in artificial intelligence. Strategic competitors, such as China and Russia, are making significant investments in AI for national security purposes. The US government has invested funds and research into the emerging field of AI. Governments at all levels are using AI and automated decision-making systems to expand or replace law enforcement functions, assist in public benefit decisions, determine housing eligibility, and more. As the federal government continues to incorporate AI into various functions, there is a growing emphasis on safeguarding transparency, accountability, and fairness in AI deployment.

The website https://www.ai.gov provides additional information on how federal agencies are using AI to better serve the public, including a full inventory of AI use cases. Just as the federal government is using AI, state governments are using AI for government operations and to provide service to constituents. Governors in various states have issued executive orders to study AI use in running government operations and providing government services and benefits. Many states have focused specifically on generative AI applications in their AI government guidance. Federal and state leaders have jumped into action to understand current uses of AI and to measure its impacts [1]. More information on artificial intelligence in government is available from the books in [16-23] and the following related journals:

- The AI Journal
- AI Magazine
- Journal of Intelligence

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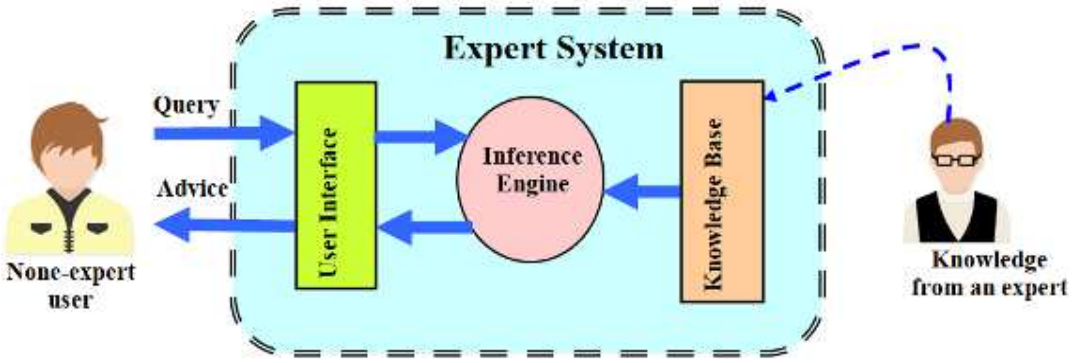

Figure 1 A typical expert system.

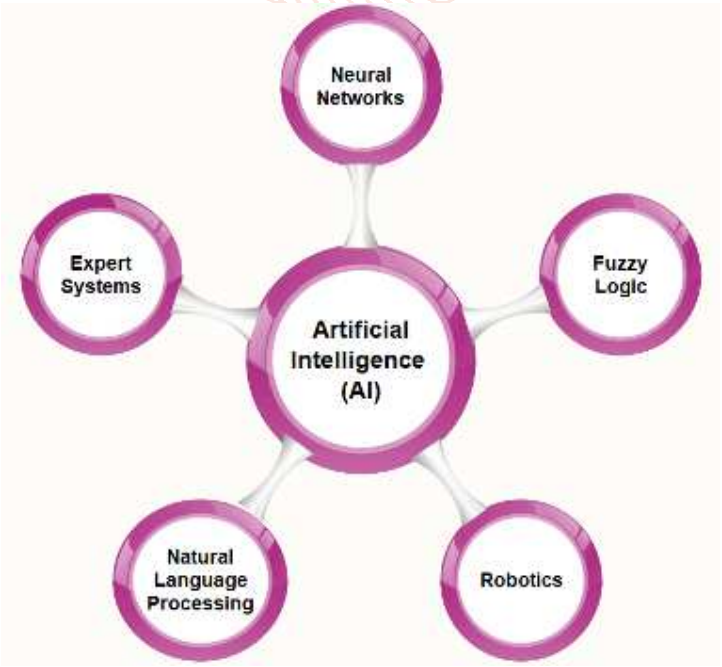

Figure 2 AI tools.

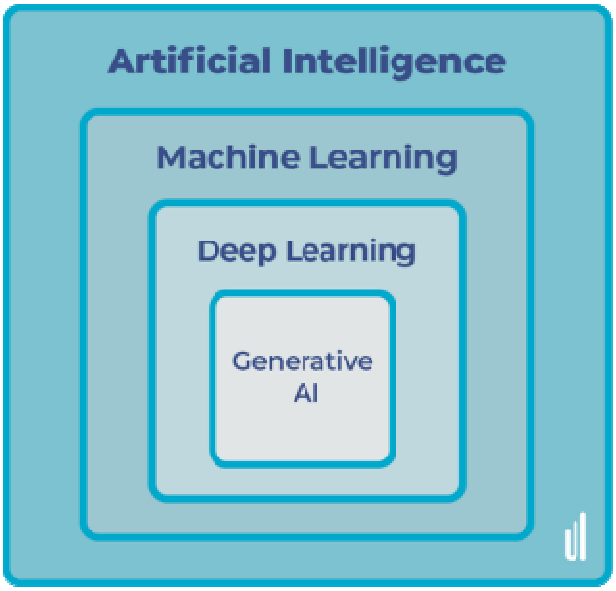

Figure 3 GenAI built on AI tools listed above [6].

Figure 4 A representation of AI in government [8].

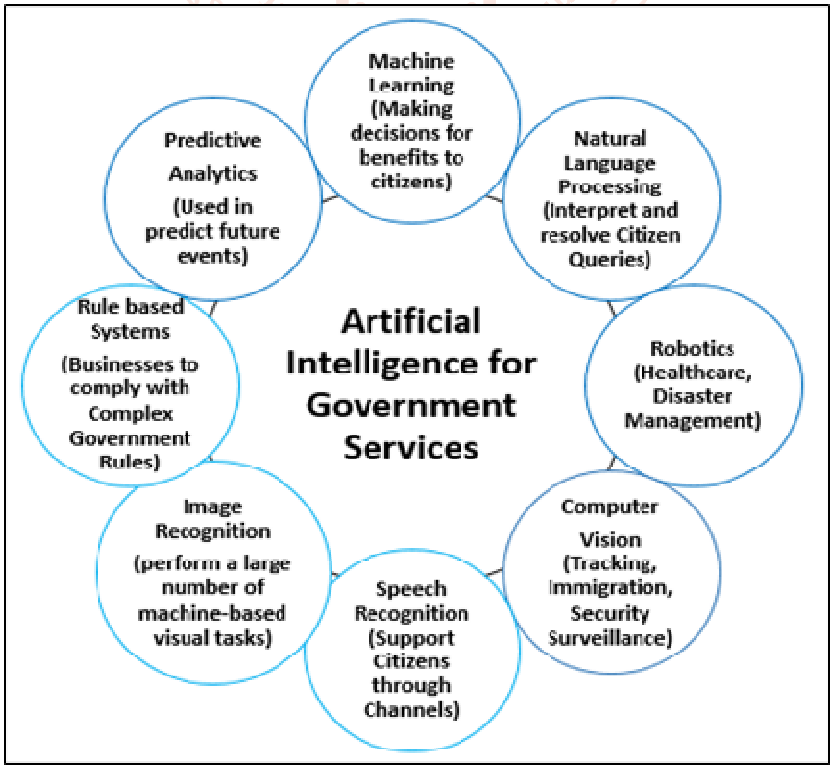

Figure 5 Various types of AI for government services [10].

Figure 6 Security services at Newark airport [13].