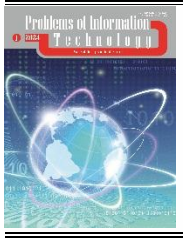

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# The use of generative artificial intelligence for customer services

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**ABSTRACT**

This study explores the use of artificial intelligence (AI) in e-government applications, focusing on the various phases of e-government expansion and advancement. The frameworks include providing information, enabling interaction, and facilitating transactions. The main source of improvement is the integration of AI into government services, enabling computer systems to learn, reason, and make human-like decisions. The use of generator AI is expected to result in more intelligent, precise, and efficient approaches, but it is essential for organizations to formulate plans that align with advancements and consequences of intelligent technology. The goal is to achieve development goals that enable the government to adopt smart generators in its applications.

## 1. Introduction

AI is employed by developers to enhance the efficiency of manual activities, facilitate client communication, detect trends, and resolve problems more effectively (Ryman-Tubb et al., 2018). To commence the utilization of artificial intelligence, it is vital for developers to possess foundational knowledge in mathematics and exhibit a sense of ease while working with algorithms.

When embarking on realization of AI for the purpose of app development, commencing with modest objectives becomes advantageous (Alqudah, 2021a; Alqudah & Muradkhanli, 2021b). Through the construction of a relatively uncomplicated undertaking, such as tic-tac-toe, for instance, one might acquire fundamental knowledge pertaining to artificial intelligence. Engaging in experiential learning is an effective approach for enhancing proficiency in several domains, including artificial intelligence. After accomplishing a series of tiny tasks, the potential for AI's impact becomes boundless. The primary tenet of AI is to emulate and surpass human cognition and engagement with the surrounding environment. The concept in question is rapidly emerging as the fundamental basis for driving innovation. AI technology, via the use of various machine learning techniques, enhances the operational efficiency and productivity of organizations by automating jobs and processes that were previously reliant on human intervention. This is achieved by using data patterns to create accurate predictions (Wirtz et al., 2019). AI possesses the capability to comprehend facts on a scale that surpasses human capacity. The capability has the potential to yield substantial advantages for the

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enterprise.

Generative AI refers to a category of AI systems that has the capability to generate novel material and unique concepts across several domains, encompassing conversational exchanges, narratives, visual imagery, audiovisual presentations, and musical compositions. AI technologies aim to replicate human intellect in unconventional computational endeavors, including but not limited to image recognition, natural language processing (NLP), and translation. Generative AI signifies the subsequent advancement in the field of AI. It is possible to facilitate the training of the model to acquire proficiency in several domains, including but not limited to human language, computer languages, art, chemistry, biology, and other intricate subjects. The approach involves the use of existing training data to address novel issue instances (Limna et al., 2022). Organizations have the capacity to employ generative AI for a multitude of objectives, encompassing the utilization of chatbots, media generation, product development, and design. To study the impact of the generator on many areas of life, this working paper also seeks to clarify the prevailing programs and tools that facilitate the widespread use of the generator in the context of digital transformation, which ultimately serves e-government. The research methodology used in this study is as follows: The current study used a descriptive and analytical methodology to examine and evaluate various government initiatives related to AI and generators. What are the many fields in which the generator is applied? How is it used in the context of developing e-government applications? Is it a factor in the decision-making process? Given the current state of global interconnectedness, it has become necessary to recognize the importance of generators and their ability to accelerate However, despite its importance and ability to facilitate beneficial transformations within societies, many societies still show a heavy reliance on AI, mostly due to the infrequent use of the generator in smart applications, which has been constantly troubled. Given the circumstances, subsequent investigations can successfully address the research problem. To address these queries, the study was divided into three distinct parts. The paper discusses three main aspects: the theoretical framework, including artificial and generative intelligence; the idea and objectives of smart e-government; and applications of AI and generator, along with their consequential impact on information (Alryalat et al., 2020).

## 2. Significance of generative AI in e-government

The proliferation of generative AI applications, such as ChatGPT, has garnered significant interest and sparked imaginative speculation. This technology has the potential to revolutionize various customer and application experiences, facilitate the development of unprecedented apps, and enhance customers' productivity to unprecedented heights.

The implementation of generative AI has the potential to result in a substantial 7 percent rise in the world gross domestic product (GDP), equivalent to an approximate value of $7 trillion. Additionally, there is an expectation that this technology will result in a 1.5 percentage point boost in productivity growth over a span of 10 years. In the subsequent section, we shall elucidate further advantages associated with generative AI.

### *2.1. Facilitate the advancement of scientific inquiry*

Generative AI algorithms have the capability to investigate and scrutinize intricate data using novel methodologies. Hence, researchers have the capacity to uncover novel trends and patterns that may not be readily discernible under different circumstances. The algorithms have the capability to condense information, discern several approaches to problem-solving, generate creative ideas, and provide comprehensive documentation based on research notes. Generative AI significantly amplifies the scope of research and innovation. Generative AI systems are found in use within the pharmaceutical business for the purpose of generating and optimizing protein sequences, hence speeding up drug development (Alqudah & Muradkhanli, 2021a).

### *2.2. Optimize the customer experience*

Generative AI has the capability to engage in human discourse in a natural manner, so serving as a valuable tool for customer care. Moreover, it possesses the ability to personalize client processes, enhancing the overall customer experience. One may utilize AI chatbots, speech bots, and virtual assistants as means to enhance client interactions by delivering prompt and correct responses, hence facilitating effective problem resolution right from the initial point of contact. One potential strategy for enhancing consumer engagement is the implementation of thoughtfully curated promotions

and personalized communication techniques.

### *2.3. Enhancing organizational workflows and operational efficiency*

By employing generative AI, organizations could enhance their business operations by incorporating machine learning (ML) and AI technologies across several functional areas (Alqudah & Muradkhanli, 2021a; Alqudah et al., 2021; Alqudah, 2021b). This method may be implemented across several functional areas, encompassing engineering, marketing, customer support, finance, and sales. For instance, the application of generative AI can yield enhancements in several domains. The process of collecting information from many sources and condensing it for the specific objective of cognitive research endeavors. This analysis aims to assess several scenarios for cost reduction and improvement in key areas, including marketing, advertising, finance, and logistics. To generate labelled data for supervised learning and other ML procedures, it is necessary to fabricate synthetic data.

### *2.4. Enhancing employee productivity*

Generative AI models can grow employee workflows and serve as effective assistants for everyone in your organization. It can do everything from research to creativity in a human-like way. Generative AI can boost productivity for different types of workers:

- Support creative tasks by creating multiple prototypes based on given inputs and constraints. It can also improve existing designs based on human feedback and specified constraints.
- Create new code suggestions within application development tasks.
- Support management by creating reports, summaries, and forecasts.
- Create new sales scripts, email content, and blogs for marketing teams.
- You can save time, reduce costs, and improve efficiency throughout your organization.

## 3. Influence of generative AI on e-government

While it is true that generative AI has the potential to influence several businesses in the long run, certain industries are positioned to swiftly reap the advantages of this technology.

### *3.1. The field of financial services*

- Financial services firms have the potential to leverage the capabilities of generative AI to enhance customer service and achieve cost reduction.
- Financial organizations have the capability to employ chatbots to provide product suggestions and address consumer queries, hence enhancing the quality of customer care provided.
- Lending institutions have the capacity to speed up loan approvals, hence facilitating access to financial resources for markets experiencing a shortage of funds, particularly in developing nations.
- Financial institutions can promptly identify fraudulent endeavors pertaining to insurance claims, credit card transactions, and loan applications.
- Investment businesses have the potential to leverage the capabilities of generative AI to deliver tailored financial guidance to their clientele at a reduced expense.

### *3.2. The field of healthcare*

The field of healthcare and life sciences encompasses a broad range of disciplines and industries that focus on the study, improvement, and provision of healthcare services, as well as the exploration and understanding of biological processes and phenomena.

Accelerating drug discovery and development stands up as a very potential use Generative AI to computational models to generate novel protein sequences with targeted characteristics, hence facilitating the development of antibodies, enzymes, vaccines, and gene treatments (Mohan et al., 2023).

Healthcare and life sciences enterprises have the potential to employ generative models for the purpose of designing synthetic gene sequences, which may be utilized in the fields of synthetic biology and metabolic engineering. As an illustration, researchers have the capacity to generate novel biosynthetic routes or enhance gene expression with the intention of facilitating biomanufacturing objectives.

Generative AI has the potential to be utilized for the generation of synthetic patient and healthcare data (Alqudah, 2021c). This application proves to be advantageous in the context of training AI models,

conducting simulated clinical trials, or investigating uncommon diseases in situations where extensive real-world datasets are not readily available.

### *3.3. The automotive and manufacturing industries*

Generative AI holds significant potential for use within the automotive industry, including a wide range of functions including engineering, in-vehicle experiences, and customer support. For instance, one potential avenue for improvement is in enhancing the design of mechanical components with the aim of minimizing drag in vehicle configurations. Another possibility involves modifying the design of personal assistants to better suit the user's needs.

Automotive enterprises are employing generative AI to enhance customer service through the expeditious provision of replies to frequently encountered consumer inquiries. Generative AI may be employed to enhance manufacturing processes and mitigate expenses by facilitating the development of designs that integrate novel materials, chips, and components.

The use of generative AI extends to the generation of synthetic data for the purpose of testing various applications. This feature is particularly valuable for data that is infrequently incorporated into test data sets, such as instances of flaws or crashes occurring in severe use situations.

### *3.4. The field of media and entertainment*

Generative AI models have the capability to generate many forms of content, including animation, screenplays, and full-length films, with much reduced costs and time requirements compared to conventional production methods.

There exist alternative applications of generative AI inside several industrial sectors.

Artists can augment and enrich their albums by including AI-generated tracks, therefore engendering whole novel experiences.

Media organizations have the potential to enhance audience experiences and augment income generation through the utilization of generative AI. This may be achieved by offering tailored content and personalized advertisements to individual users.

Gaming firms have the capability to employ generative AI techniques to develop novel games and facilitate the creation of avatars by players.

### *3.5. Telecommunications industries*

The initial applications of generative AI in the telecommunications industry mostly revolve around the reimagining of the user experience. The customer experience is influenced by the collective interactions of subscribers at many touchpoints over the entirety of their customer journey (Alqudah et al., 2023; Khan et al., 2020; Alqudah & Muradkhanli, 2021c).

Telecommunications organizations have the potential to enhance customer service by implementing generative AI technology, namely through the utilization of human-like live chat operators. Furthermore, network performance may be enhanced by the analysis of network data, which subsequently enables the identification and recommendation of appropriate solutions. The use of personalized one-on-one sales assistants has the potential to revolutionize client relationships.

### *3.6. The energy industry*

It refers to the Generative AI exhibits suitability for jobs within the energy industry that need intricate analysis of raw data, detection of patterns, forecasting, and optimization. Energy organizations have the potential to enhance customer service by conducting an analysis of company data to ascertain use trends. Based on the provided data, it is possible to formulate specific product offerings, implement energy efficiency programs, or establish demand response efforts.

Generative AI has the potential to effectively facilitate grid management, enhance operational safety at sites, and optimize energy output by means of inventory simulation.

## 4. Functioning Mechanism of Generative AI

Like other types of AI, generative AI operates by leveraging ML models. However, generative AI specifically relies on extensive pre-training of large-scale models utilizing vast quantities of data.

The topic of interest is the many types of incorporation forms.

Foundation models (FM) refer to machine learning models that have been trained on a diverse range of generalized, unlabeled data. The system exhibits the ability to execute a diverse range of general tasks (Grover et al., 2018).

FM represents the culmination of technological advancements witnessed over the course of several decades. Typically, a foundation model leverages acquired patterns and correlations to forecast the subsequent element within a certain sequence.

During the process of picture generation, the

model does an analysis of the image and subsequently generates a refined rendition that exhibits enhanced sharpness and improved accuracy. Similarly, in the realm of textual data, the model utilizes its predictive capabilities to anticipate the subsequent word within a given text sequence, drawing off the preceding words and their contextual information. Subsequently, the subsequent word is selected utilizing probability distribution methodologies. Language models of significant size and complexity Large Language Models belong to the category of FMs. An illustration of this may be seen in the case of OpenAI's Generative Pre-Trained Transformer (GPT) models, which can be characterized as expansive language models. Language models of significant scale primarily prioritize tasks that are centered around language, including but not limited to summarization, text generation, categorization, open conversation, and information extraction.

The distinguishing characteristic of big language models is in their capacity to effectively execute a multitude of tasks. This capability is attributed to the numerous factors it possesses, which enable it to acquire proficiency in complex topics.

A language model of considerable scale, such as GPT-3, possesses the capacity to encompass an extensive number of parameters, reaching into the billions. This enables the model to produce material with remarkable proficiency, even when provided with only a limited amount of input. Large language models are exposed to a vast amount of Internet-scale data including many forms and patterns. Consequently, they acquire the ability to apply their knowledge across a diverse range of settings.

## 5. Generative AI Models Work

Traditional ML models were discriminative or focused on classifying data points.to determine the relationship between known and unknown factors. For example, models look at images (the known data such as pixel arrangement, font, color, and shape) and map them to words (the unknown factor). Mathematically, models worked by specifying equations that could numerically map unknown and known factors such as the variables x and y.

The generative models perform another additional step. Instead of predicting a classification or label based on some given feature, it attempts to predict features based on some given classification or label. Mathematically, generative models calculate the probability of x and y occurring together. You learn the distribution of different data features and the relationships between them (Wang et al., 2017).

For example, generative models analyze images of animals to record variables such as different ear shapes, eye shapes, tail features, and skin patterns. You learn the features and relationships between them to understand what different animals generally look like. It can then recreate images of new animals that were not in the training set.

### *5.1. Diffusion models*

Diffusion models create new data by repeatedly making controlled, random changes to an initial data sample. They start with the original data and add subtle changes (called distortion), gradually making it less like the original. This distortion is carefully controlled to ensure that the generated data remains consistent and realistic (Sezgin et al., 2022). After distortion is added over many iterations, the diffusion model reverses the process, with the distortion gradually removed through an inverse distortion process to produce a new data sample that resembles the original sample.as you see in Fig.1.

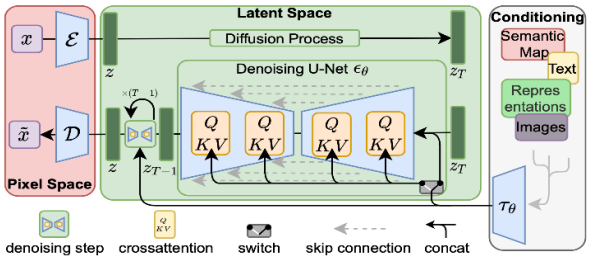


**Fig. 1.** Diffusion models

### *5.2. Generative adversarial network*

The Generative Adversarial Network (GAN) is another generative AI model based on the concept of the diffusion model. GANs work by training two neural networks competitively. The first network, known as a generator, creates fake data samples by adding random distortion. The second network, called a discriminator, attempts to distinguish between real data and fake data produced by the generator.

During training, the generator continually improves its ability to generate realistic data, while the discriminator becomes better at distinguishing between real and fake data. This competitive process continues until the generator produces data so convincing that the discriminator cannot distinguish it from the real data.

GANs are widely used in photorealistic image generation, pattern transfer, and data augmentation tasks.

### *5.3. Variable autoencoders*

Variational autoencoders (VAE) recognize the existence of a compressed representation of data called latent space. This latent space is a mathematical representation of data. You can think of it as a unique code that represents data based on all its attributes. For example, when studying faces, the latent space contains numbers representing the shape of the eyes, the shape of the nose, the cheekbones, and the ears.

VAE uses two neural networks: the encoder and the decoder. The encoder's neural network maps the input data to a mean and a variable for each dimension of the latent space. It creates a random sample from a Gaussian distribution (normal distribution). This sample appears as a point in the latent space, and represents a compressed, simplified version of the input data.

The decoder's neural network takes this sample point from the latent space and reconstructs it back into data that resembles the original input data. Mathematical functions are used to measure how well the reconstructed data matches the original data. Fig. 2 explains variable autoencoders.

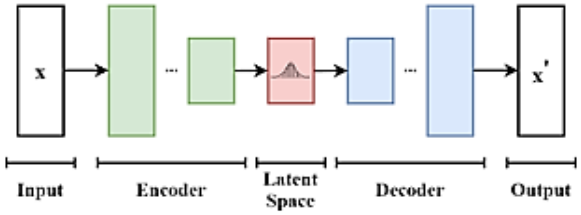


**Fig. 2.** Variable autoencoders

### *5.4. Transformer-based models*

The transformer-based generative AI model is based on the concepts of encoder and decoder in the context of VAE. Transformer-based models add more layers to the encoder to improve performance on text-based tasks, such as comprehension, translation, and creative writing (Repecka et al., 2021). Transformer-based models use a self-attention mechanism. It evaluates the importance of different parts of the input sequence when processing each element in the sequence. Another major advantage is that these AI models implement contextual embeddings. The encoding of a sequence element depends not only on the element itself, but also on its context within the sequence.

## 6. Results adopting Generative AI

If your organization wants to implement generative AI solutions, consider the following best practices to enhance your efforts.

### *6.1. Starting with internal applications*

The optimal approach to using generative AI initially involves creating internal applications that prioritize enhancing operational processes and increasing staff efficiency. The provision of a controlled setting for testing outcomes, along with the opportunity to develop skills and comprehension of the technology, is advantageous. Models can be subjected to thorough testing and can also be customized based on internal sources of information. This way, your customers will have a much better experience when you eventually use the templates for external applications.

### *6.2. Enhancing transparency*

It is important to ensure that information regarding the various applications and outcomes of generative AI is unambiguous, hence enabling users to discern their interactions with AI systems as opposed to human counterparts. For instance, AI has the capability to identify itself as such, while search results that are derived from AI algorithms might be prominently shown and emphasized. In this manner, individuals can depend on their own discernment while engaging with the material. Additionally, individuals may exhibit a higher level of proactivity in addressing any mistakes or concealed biases that might arise from the inherent limits of the training data used in the underlying models.

### *6.3. Implement safety measures*

Implementing guardrails is essential to prevent unauthorized and unintentional access to sensitive data inside generative AI systems. It is advisable to engage security teams from the outset to ensure comprehensive consideration of all factors from the inception stage. As an illustration, it may be necessary to anonymize data and eliminate personally identifying information prior to doing any model training on internal data.

### *6.4. Testing on a large scale*

The implementation of both automatic and manual testing procedures is essential to verify outcomes and assess various scenarios that the generative AI system could encounter. Create diverse cohorts of beta testers who engage in varied approaches to app testing and meticulously

record the outcomes. The model's performance will be enhanced iteratively through rigorous testing, so affording users' greater autonomy in shaping the outcomes and anticipating the reactions. Fig. 3 explains generative AI system model testing.

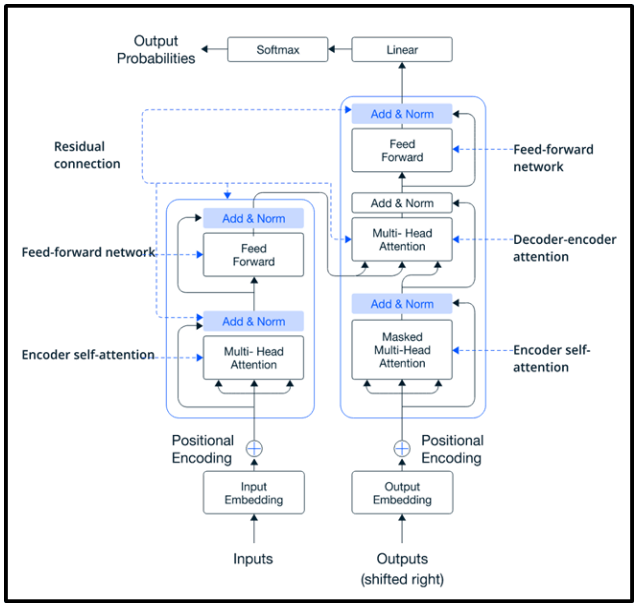


**Fig. 3.** Generative AI system model testing

## 7. Conclusion and future work

Generative AI enables the utilization of ML techniques to enhance the efficiency of corporate operations and extend its applicability to a wider range of scenarios. Generative AI may be implemented in several domains of business, encompassing engineering and design, marketing, customer service, finance, and sales. Code generation is a very promising use of Generative AI.

In addition to code generation, there exist several applications in which Generative AI may be employed to significantly enhance customer experience, staff productivity, company efficiency, and creative endeavors. Generative AI may be leveraged to enhance customer experience through many functionalities such as chatbots, virtual assistants, intelligent contact centers, customization, and content moderation. One potential strategy for enhancing staff productivity involves the use of AI-enabled conversational search, content generation, and text summarization, among other techniques. Business processes may be enhanced through the utilization of intelligent document processing, maintenance assistants, quality control measures, visual inspection techniques, and the generation of synthetic training data. Generative AI may be effectively employed to facilitate the creation of diverse forms of artistic output, encompassing art, music, writing, animation, video, and photographs. The incorporation of generative AI into the government sector has substantial potential for boosting administrative efficiency, improving citizen services, and promoting transparency. Generative AI models like ChatGPT may overcome the constraints of classic chatbots, such as their inadequate natural language comprehension and restricted adaptability. Governments around are acknowledging the promise of generative AI and have begun investigating its applications in many domains, such as optimizing administrative chores and enhancing access to government services. Nevertheless, the use of generative AI in the government sector necessitates the inclusion of measures to tackle privacy issues and possible biases. It is essential for governments to implement strong safeguards to safeguard sensitive information and guarantee fairness in the decision-making process of AI. Although generative AI has significant advantages, it should be seen as a tool to enhance government processes rather than replace human judgement. Through strategic navigation of obstacles and effective use of generative AI, governments may establish a path towards a digital age administration that is more inclusive, transparent, and focused on the needs of its citizens.

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