

Unleashing the Potential: Overcoming Hurdles and Embracing Generative AI in IT Workplaces: Advantages, Guidelines, and Policies

Pan Dhoni ¹

¹Professional

October 31, 2023

Abstract

The increasing popularity of ChatGPT and its widespread adoption across various industries have brought forth new and evolving challenges. In this research paper, our primary focus is to investigate how ChatGPT can benefit the Information Technology (IT) sector while exploring the challenges it presents.

Given the significance of this topic, numerous Chief Information Security Officers (CISOs) are currently working on understanding and implementing ChatGPT. Thus, we embarked on this research endeavor to delve deeper into this subject. Our paper, titled “Unleashing the Potential: Overcoming Hurdles and Embracing Generative AI in IT Workplaces: Advantages, Guidelines, and Policies,” aims to examine the advantages, hurdles, and potential of Generative AI (GenAI) and its applications in IT environments.

To accomplish our research goals, we employed multiple GenAI tools and conducted extensive investigations to explore their benefits and identify strategies to mitigate associated challenges. By leveraging these tools, we aimed to unlock the full potential of GenAI in the IT landscape.

Our research paper delves into various aspects, including the advantages offered by GenAI, the hurdles encountered during its implementation, and the potential it holds for transforming IT workplaces. Furthermore, we provide guidelines and policies to ensure the responsible and effective utilization of GenAI within IT organizations.

Through this research, we aim to contribute to the growing body of knowledge surrounding GenAI, enabling IT professionals to make informed decisions and harness the benefits of this emerging technology. By addressing the challenges and providing guidelines, we aim to facilitate the seamless integration of GenAI into IT workplaces, fostering innovation and efficiency in the industry.

Please see attached PDF for result.

Unleashing the Potential: Overcoming Hurdles and Embracing Generative AI in IT Workplaces: Advantages, Guidelines, and Policies

Pan Singh Dhoni ^{#1}, IEEE Reviewer Name ^{#2}

¹ *Engineering Manager, Data Platform & Data Science at Five Below, Inc*

¹ *1211 Denton Dr, 19425, USA*

¹ ps.dhoni@gmail.com

Abstract— During the pandemic (COVID-19), software companies and IT-enabled services flourished. Technology companies made considerable progress during that time. However, after the pandemic, many IT and software companies faced challenges, and there were reports of layoffs on a daily basis. This situation created panic, particularly affecting software, and IT-enabled companies.

During this period, OpenAI launched ChatGPT3 and ChatGPT4 [1], which took the world by storm. Within a very short duration of time, these models were subscribed to by millions of users worldwide. They provided some relief to the struggling industry. Generative AI (GenAI) has created a buzz around the world, with people calling it a game-changer.

This paper aims to explore the advantages, hurdles, and potential of Generative AI (GenAI), its application areas in IT, and the benefits it offers.

Finally, we will put our summary based on our research and investigation.

Keywords: Generative AI, Information Technology, Advantages, Hurdles, Potential

I. INTRODUCTION

Generative AI, although not a novel concept, has garnered considerable attention in recent months. Its impact extends to various industries such as computer and software, education, pharmaceuticals, manufacturing, engineering, media, architecture, interior design, automotive, aerospace, defence, medical, electronics, and energy.

This article delves into the applications of GenAI, particularly in language and visual models, and examines the advantages, hurdles, and prospects it presents in the field of computer and software.

The integration of data with computational power has witnessed remarkable progress in the past three decades (from

1990 to the present day). The mid-'90s and early 2000s marked the era of web development, which effectively connected peoples on a single platform. The subsequent decade saw the rapid growth of various social media platforms, leaving a profound impact on our society and culture.

In the mid-2000s, companies ventured into the development of autonomous vehicles such as cars and trucks, pushing the boundaries of technological innovation. Over the past decade, the field of AI has flourished thanks to advancements in processors and cloud providers, offering easier access to infrastructure.

Data and computation power serve as fundamental elements across all these innovations. This is why the phrase "data is the new oil" has gained popularity, as organizations increasingly deal with large volumes of data and seek valuable insights through thorough analysis.

The advancement in AI technology has opened up new possibilities for data-driven applications across diverse domains, revolutionizing the way we interact with technology.

Data and AI-driven applications have demonstrated their potential in improving efficiency, accuracy, and decision-making processes in fields such as healthcare, finance, transportation, and entertainment.

The widespread adoption of AI-driven applications has been driven by the availability of large-scale datasets, improvements in computational power, and advancements in machine learning algorithms.

Facial recognition systems have significantly evolved, enabling enhanced security measures, personalized user experiences, and efficient identity verification processes.

Weather forecasting models powered by AI algorithms have shown remarkable progress, providing more accurate

predictions, early warnings, and crucial insights for disaster preparedness and resource allocation.

Language translation applications have made significant strides in bridging communication barriers, facilitating multilingual interactions, and enabling seamless cross-cultural collaborations.

The defence sector has leveraged AI technology to enhance surveillance, threat detection, and response capabilities, resulting in improved national security and defence strategies.

The integration of AI technology into various industries has the potential to optimize operations, automate tasks, streamline decision-making processes, and unlock new avenues for innovation and growth.

The continuous advancements in AI technology, coupled with the increasing availability of data, hold promise for the development of even more sophisticated and intelligent applications in the future.

II. WHAT IS ARTIFICIAL INTELLIGENCE (AI)?

Artificial intelligence (AI) is intelligence—perceiving, synthesizing, and inferring information—demonstrated by machines, as opposed to intelligence displayed by humans or by other animals [1][2].

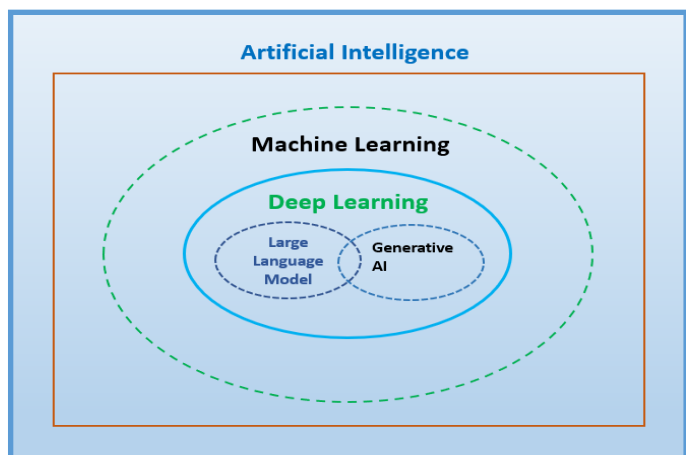


Fig. 1. The relationship between AI, Machine Learning, and deep learning

Machine learning is a subset of AI, and deep learning (Natural Language processing (NLP), Convolutional Neural Network (CNN), and Recurrent Neural Network (RNN)) is a subset of

machine learning (See Fig 1). Deep and machine learning have two important types: supervised learning (labelled data) and unsupervised learning.

III. ARTIFICIAL INTELLIGENCE (AI) BRIEF HISTORY

70 years ago, the first seeds of AI were planted when Alan Turing, in his 1950 paper titled "Computer Machinery and Intelligence," posed the fundamental question, "Can machines think? [3]"

The term "artificial intelligence" was coined by John McCarthy in 1956 during the Dartmouth Summer research project [4].

In 1958, John McCarthy developed the programming language LISP, which became instrumental in AI research and remains influential in the field to this day [5].

In the 1960s, Joseph Weizenbaum created ELIZA, a computer program designed to simulate conversation and demonstrate the potential of natural language processing.

In 1965, Ivakhnenko and Lapa published the groundbreaking paper "Group Method of Data Handling - A Rival Method of Stochastic Approximation," which presented the first functional neural network [3].

The 1970s witnessed advancements in knowledge representation with the development of expert systems. The MYCIN system, developed by Edward Shortliffe [6], showcased the ability of computers to diagnose diseases based on expert-level knowledge.

In the 1980s, the field of AI experienced a shift towards knowledge-based systems and symbolic reasoning. The development of rule-based expert systems like XCON and R1 showcased the potential of AI in various domains.

In the 1990s, AI research saw a resurgence with the introduction of machine learning techniques. The field witnessed breakthroughs in areas such as neural networks, reinforcement learning, and genetic algorithms.

In recent years, advancements in deep learning, fuelled by the availability of big data and improvements in computational power, have revolutionized AI applications. Deep learning models, such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs), have achieved remarkable success in image recognition, natural language processing, and other complex tasks.

Today, AI is integrated into our daily lives, powering virtual assistants, autonomous vehicles, recommendation systems, and much more. Ongoing research and development continue to push the boundaries of AI, aiming to create systems that can reason, understand, and learn like humans.

The history of AI is marked by a series of milestones, breakthroughs, and paradigm shifts, laying the foundation for the ever-evolving field that continues to shape our world.

IV. NEURAL NETWORK

In our day-to-day lives, inspiration can come from various sources, including other humans, nature, animals, and birds, leading to greater innovation. The quest for innovation has led to the development of intelligent machines, which has given rise to the concept of Artificial Neural Networks (ANNs).

The exponential growth in computing power over the past few decades, particularly since the 1990s, has facilitated the training of large-scale neural networks within a feasible timeframe. This remarkable progress can be attributed not only to the advancements dictated by Moore's Law but also to the contributions of the industry, which has manufactured and distributed millions of powerful GPU cards, further enhancing computational capabilities.

Before going into the ANNs, let's discuss biological neurons.

Biological Neurons: According to the Oxford dictionary, a neuron is defined as a specialized cell responsible for transmitting nerve impulses within a nervous system.

Wikipedia describes a neuron as an electrically excitable cell within a neural network that generates and propagates electric signals known as action potentials.

Below reference is taken from the [7] chapter "Neural network and deep learning".

A biological neuron (see Fig 2) consists of a cell body that houses the nucleus and most of the cell's complex components. It also has branching extensions called dendrites and a long extension known as the axon. The axon can be several times longer than the cell body or even tens of thousands of times longer. Towards the end of the axon, it splits into multiple branches called telodendria, which terminate in tiny structures called synaptic terminals or synapses. These synapses are connected to the dendrites or directly to the cell body of other neurons. Biological neurons receive short electrical signals known as impulses from other neurons through these synapses. When a neuron receives a sufficient number of signals from other neurons within a few milliseconds, it generates its own signals.

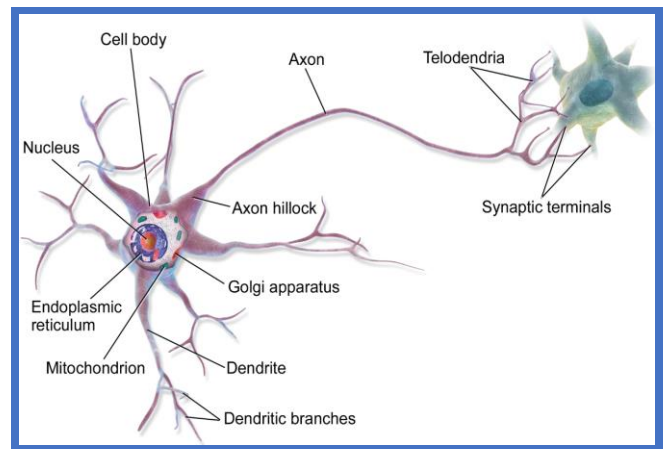


Fig. 2. Biological Neurons

Without diverting the topic, let's discuss briefly on ANNs.

In a neural network, there are multiple layers that work together to process and analyse data. The first layer is the input layer, where the data is initially fed into the network. From the input layer, the data is passed through a complex hidden layer. The hidden layer consists of nodes or neurons that apply mathematical operations such as adding weights and biases to the input data. These weights and biases help the network adjust the importance of different features in the data. Additionally, a threshold is applied to determine whether a neuron should activate or not based on the weighted sum of inputs.

During the process known as forward propagation, the data is passed through each layer of the neural network, with calculations performed at each neuron to generate output values. These output values are then passed to the next layer as inputs, and the process continues until the data reaches the output layer.

As the data passes through the hidden layers, the neural network learns by adjusting the weights and biases through a process called backpropagation. Backpropagation involves comparing the network's predictions with the expected outputs, calculating the errors, and then propagating these errors backward through the network. The network updates the weights and biases based on the magnitude of the errors, aiming to minimize them and improve the overall performance of the network.

The training process involves iterative steps of forward propagation and backpropagation, with the network making predictions, comparing them to the expected outputs, and adjusting the internal parameters (weights and biases) accordingly. This iterative process helps the network learn to recognize patterns and make accurate predictions based on the provided training data.

Sample mathematical formula, it can have complex based on the problem:

Neuron Activation:

Input to a neuron: $z = w_1x_1 + w_2x_2 + \dots + w_nx_n + b$

Output of a neuron (after applying activation function): $a = f(z)$

Forward Propagation:

Weighted sum of inputs for a neuron in layer j : $z^j = \sum (w_{ji} * a^{(j-1)}) + b_j$

Activation of a neuron in layer j : $a^j = f(z^j)$

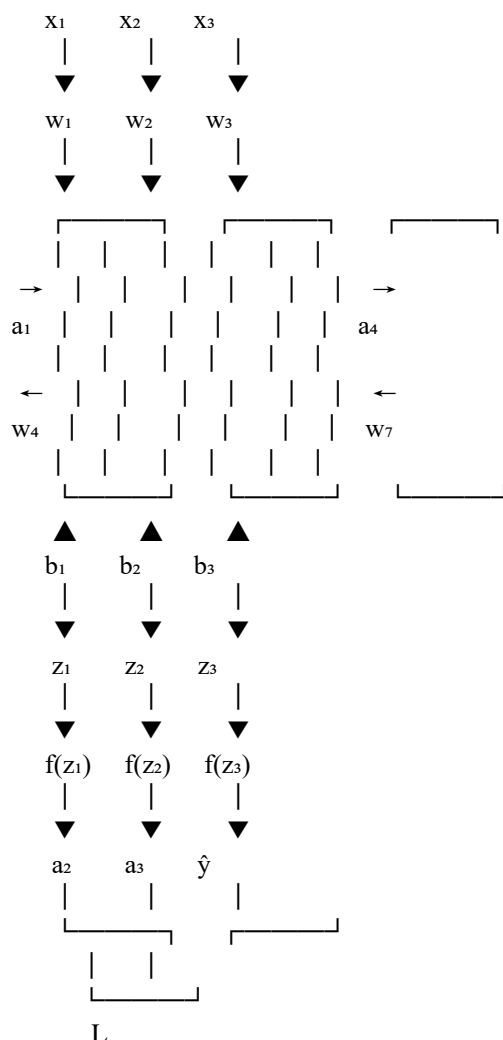
Loss or Cost Function (used for measuring the network's performance):

Mean Squared Error (MSE): $L = (1/n) * \sum (y - \hat{y})^2$, where y is the actual output and \hat{y} is the predicted output

Backpropagation (Gradient Descent):

Update rule for weights: $w_j = w_j - \eta * (\partial L / \partial w_j)$, where η is the learning rate

Update rule for biases: $b_j = b_j - \eta * (\partial L / \partial b_j)$



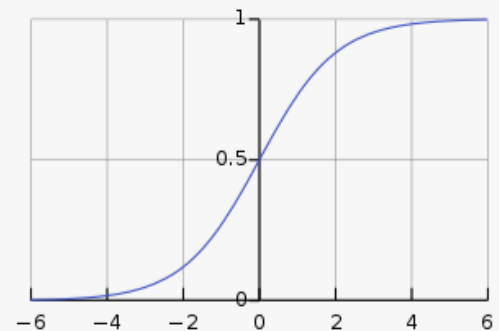
Activation functions are mathematical functions applied to the output of each neuron in a neural network. They introduce non-linearity to the network, allowing it to learn and model complex relationships between inputs and outputs. Activation functions determine whether a neuron should be activated (fire) or not based on the weighted sum of its inputs.

Here are some commonly used activation functions in neural networks, will cover Sigmoid, Rectified and Hyperbolic Tangent (will skip some of the activation functions):

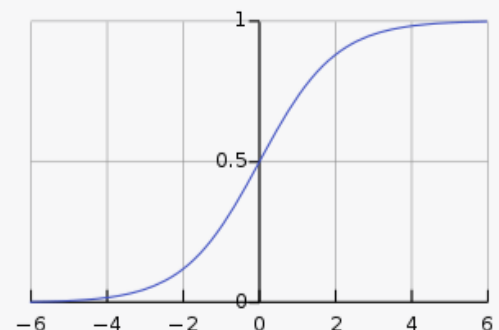
1. Sigmoid Function (Logistic Activation):

1. Sigmoid Activation Function:

- Activation function:



- Derivative:



2. Rectified Linear Unit (ReLU) Activation Function:

- Activation function:

Fig. 3. Sigmoid Activation Functions

The sigmoid function (see Fig 3) is defined as:

$$\sigma(z) = \frac{1}{1 + e^{-z}}$$

It squashes the input value to a range between 0 and 1, which is useful in binary classification problems or when you want to produce a probability-like output.

2. Rectified Linear Unit (ReLU):

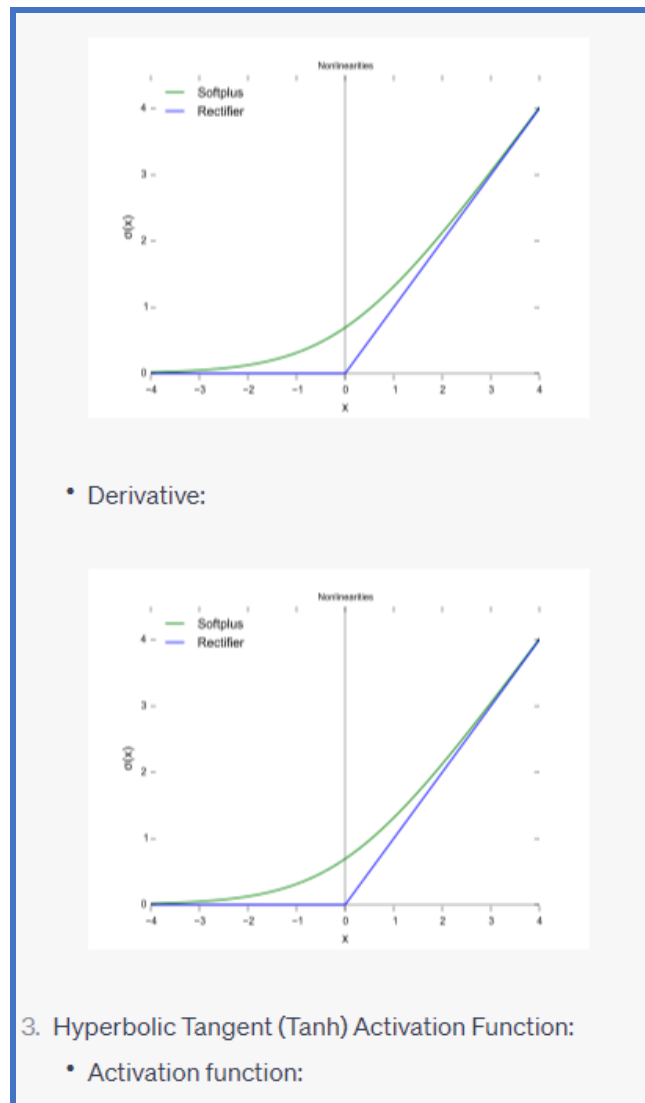


Fig. 4. Rectified Linear Unit (ReLU)

The ReLU function (see Fig 4) is defined as:

$$\text{ReLU}(z) = \max(0, z)$$

3. Hyperbolic Tangent (tanh) Function:

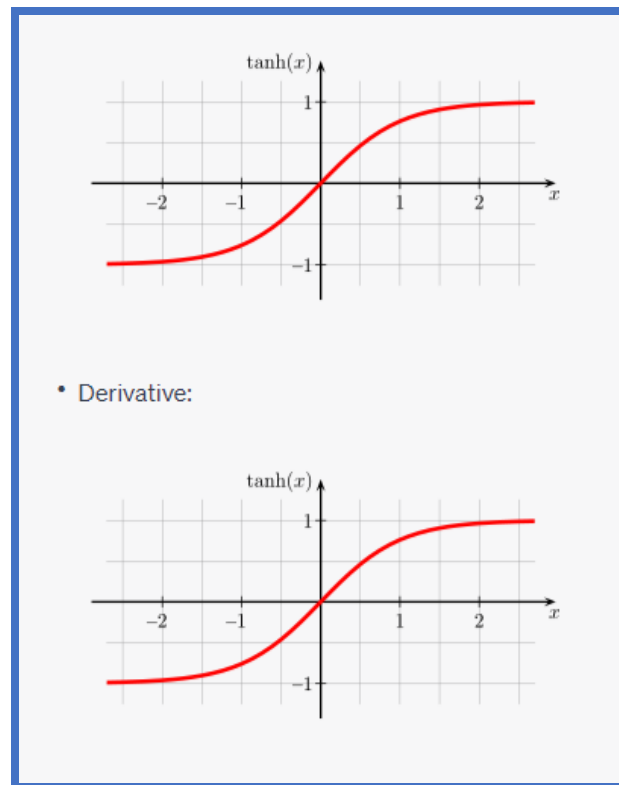


Fig. 5. Hyperbolic tangent

The hyperbolic tangent (see Fig 5) function is defined as:

$$\tanh(z) = \frac{e^z - e^{-z}}{e^z + e^{-z}}$$

It squashes the input value to a range between -1 and 1. It is often used in hidden layers of neural networks.

It returns the input value if it is positive, otherwise, it returns zero. ReLU has become one of the most popular activation functions due to its simplicity and ability to alleviate the vanishing gradient problem.

These are just a few examples of activation functions used in neural networks. Choosing the right activation function depends on the problem you are trying to solve, the characteristics of your data, and the specific requirements of your network.

Overall, a neural network consists of an input layer, one or more hidden layers, and an output layer. Through the process of forward propagation and backpropagation, the network learns to adjust its internal parameters to make accurate predictions or classifications based on the provided input data.

V. GENERATIVE AI

Generative AI [9] has the capability to learn from existing artifacts and generate new, realistic creations that capture the characteristics of the training data without merely duplicating it. This technology can produce diverse forms of original content, including images, videos, music, speech, text, software code, and product designs.

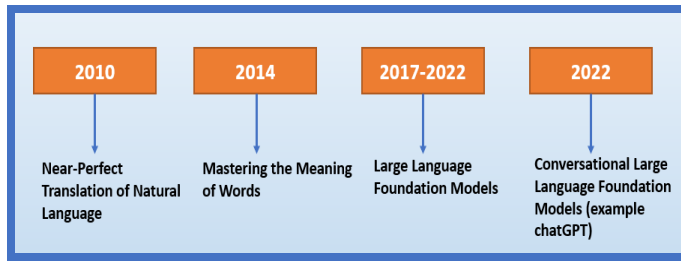


Fig. 6. Generative AI Timeline [2]

See GenAI Timeline (Fig 6).

As GenAI has been widely used, it is more likely that significant ongoing data on the internet will be generated using chatbots.

Generative models in AI, such as Variational Autoencoders (VAEs) and Generative Adversarial Networks (GANs), utilize neural networks to generate new data samples. The core mathematical formulas for these models are as follows:

Variational Autoencoder (VAE):

The VAE consists of an encoder network that maps the input data to a latent space and a decoder network that generates output data from points in the latent space. The objective is to learn the parameters of the encoder and decoder networks to maximize the evidence lower bound (ELBO), which is equivalent to minimizing the reconstruction loss and the Kullback-Leibler (KL) divergence.

Reconstruction Loss:

$$L_{\text{recon}} = -\sum (x \log(x_{\text{hat}}) + (1 - x) \log(1 - x_{\text{hat}}))$$

KL Divergence:

$$L_{\text{KL}} = 0.5 * \sum (1 + \log(\text{var}) - \text{mean}^2 - \text{var})$$

Overall Loss:

$$L_{\text{total}} = L_{\text{recon}} + L_{\text{KL}}$$

Generative Adversarial Network (GAN):

The GAN consists of a generator network that generates synthetic samples and a discriminator network that tries to distinguish between real and synthetic samples. The objective is to find a Nash equilibrium between the generator and discriminator, which is achieved through an adversarial training process.

Generator Loss:

$$L_{\text{G}} = -\log(D(G(z)))$$

Discriminator Loss:

$$L_{\text{D}} = -\log(D(x)) - \log(1 - D(G(z)))$$

Overall Loss:

$$L_{\text{total}} = L_{\text{G}} + L_{\text{D}}$$

In both VAEs and GANs, the parameters of the neural networks (weights and biases) are optimized using gradient-based optimization algorithms such as stochastic gradient descent (SGD) or its variants, by computing the gradients of the loss function with respect to the network parameters and updating them iteratively.

VI. METHODOLOGY

A. Method 1-

A. Method 1 - Constructing a Chatbot with Node.js and OpenAI:

Exploring the Benefits, Challenges, and Potential To gain a comprehensive understanding of the advantages, obstacles, and potential applications of artificial intelligence (AI), a chatbot was developed using Node.js and OpenAI. The purpose of building this chatbot was to harness the power of data and explore its capabilities. The OpenAI API [10] was utilized to leverage the democratized data, enabling seamless integration into the chatbot system. A user-friendly interface was created and deployed on a Node.js backend server.

Key Technologies: API, Node.js, macOS, Explorer

What is OpenAI: According to OpenAI's Wikipedia page, OpenAI is an American AI research laboratory consisting of both a non-profit entity, OpenAI Incorporated, and a for-profit subsidiary corporation called OpenAI Limited Partnership. OpenAI's primary goal is to conduct AI research with the intention of promoting and developing friendly AI. The organization was established in 2015 by Ilya Sutskever, Greg Brockman, Trevor Blackwell, Vicki Cheung, Andrej Karpathy, Durk Kingma, Jessica Livingston, John Schulman, Pamela Vagata, and Wojciech Zaremba, with Sam Altman and Elon Musk serving as initial board members. OpenAI's official website states that their mission is to ensure that artificial general intelligence benefits all of humanity.

API: APIs serve as mechanisms that facilitate communication between two software components by utilizing predefined definitions and protocols.

Node.js: Node.js is an event-driven JavaScript runtime that operates asynchronously, making it ideal for building scalable network applications. It can handle multiple connections concurrently, executing the corresponding callback for each connection. When there is no pending work, Node.js enters a sleep state [11][12].

Operating System: The macOS platform was utilized for developing and deploying the chatbot application.

Explorer (Visual Studio Code 2): The explorer tool was employed as a development environment for coding purposes.

- B. **Method 2- Building Chatbot using Dolly:** To enhance the scope and rigour of our research, we incorporated the utilization of an additional Language and Learning Model (LLM) known as "Dolly." Dolly, a cutting-edge LLM, possesses remarkable capabilities that align with the objectives of our study, allowing us to explore the integration of GenAI in the workplace of Information Technology with greater depth.

For instance, when examining the potential advantages of GenAI in IT workplaces, Dolly's vast linguistic abilities enabled us to generate detailed examples and scenarios. It provided us with a comprehensive understanding of how GenAI can streamline repetitive tasks, optimize resource allocation, and foster innovative solutions. By leveraging Dolly's proficiency in language generation, we were able to showcase specific instances where GenAI can enhance efficiency and productivity in IT environments. Thanks to Databricks.

Furthermore, when analyzing the hurdles associated with integrating GenAI in the workplace, Dolly's vast knowledge base helped us identify and elaborate on potential challenges. By utilizing Dolly's expertise, we could provide concrete examples of potential ethical dilemmas, data privacy concerns, and workforce adaptability issues that organizations may face during the implementation of GenAI technologies.

The inclusion of Dolly as an additional LLM model bolstered the comprehensiveness and accuracy of our research. Its advanced capabilities not only facilitated a deeper exploration of the advantages of GenAI but also allowed us to highlight the specific hurdles and challenges that need to be addressed. Through the use of Dolly, our research paper presents a comprehensive analysis of the

potential, guidelines, and policies surrounding the integration of GenAI in the IT workplace.

Key-Technology: Databricks, Dolly 2.0 library

Dolly: Dolly LLM model trained on the Databricks machine learning platform.[13][14][15]

PySpark: As per spark.apache.org [<https://spark.apache.org/docs/latest/api/python/>], PySpark is the Python API for Apache Spark. It enables you to perform real-time, large-scale data processing in a distributed environment using Python. It also provides a PySpark shell for interactively analysing your data.

Databricks: Databricks is an American enterprise software company founded by the creators of Apache Spark. As per Databricks website [16] "Unify all your data, analytics and AI on one platform".

Build Your own chatbot using Dolly: See details at [17]

- C. **Internet research:** In our quest to gather comprehensive and up-to-date information for our research paper on GenAI, we recognized the immense value that the internet holds as a vast source of data. To ensure a robust foundation for our study, we embarked on an extensive review of relevant articles, news reports, academic papers, and training materials available online. By harnessing the power of the internet, we aimed to gain a comprehensive understanding of the subject matter and identify the latest trends and advancements in GenAI.

To augment the quality and depth of our internet research, we actively engaged with an online forum dedicated to AI and machine learning. This forum provided us with a platform to connect with experts and enthusiasts in the field, enabling us to exchange ideas, seek clarifications, and gain valuable insights. The discussions and feedback we received from the forum members played a crucial role in refining our understanding of GenAI and deepening our analysis.

Recognizing the impact of social media as a dynamic platform for knowledge sharing, we dedicated significant time to explore relevant channels and communities. By actively participating in AI-focused groups and following influential individuals in the field, we were able to tap into real-time discussions and updates. Additionally, we curated a selection of informative and relevant videos from reputable sources, which further enriched our understanding of GenAI and its practical applications.

Throughout our internet research journey, we employed targeted search strategies to ensure the retrieval of pertinent information. We utilized a combination of keywords, such as "generative AI," "generative AI

advantages," "Generative AI advantages in Information Technology," "Generative AI challenges," ""GenAI" and "generative AI benefits," to refine our search queries. This approach enabled us to access a wide range of resources, including scholarly articles, technical papers, industry reports, and case studies, all of which contributed to the breadth and depth of our research findings.

It is important to note that in adherence to scholarly practices, we have diligently acknowledged and cited the notable references we encountered during our internet research. The references section of this paper includes proper attribution to ensure academic integrity and to acknowledge the contributions of the authors and researchers whose work has informed our study.

By leveraging the vast resources available on the internet and employing targeted search strategies, we have endeavoured to gather a comprehensive and diverse range of perspectives on GenAI. This approach has allowed us to explore the advantages, challenges, and potential benefits of GenAI in the context of Information Technology, contributing to a well-rounded and informed research paper.

D. *Attended Databricks Virtual sessions:* Artificial Intelligence (AI) has emerged as a transformative technology with significant implications for various domains. Recognizing its potential impact, we had the privilege of attending the Databricks virtual summit on AI, which took place on June 28, 2023. This invaluable opportunity allowed us to delve deeper into the latest advancements and trends in AI, gaining valuable insights that directly influenced our research in the field of Information Technology (IT).

The Databricks virtual summit provided a platform for leading experts, researchers, and industry professionals to share their knowledge and experiences in the realm of AI. The event featured a diverse range of sessions, including keynote speeches, panel discussions, and technical workshops, all aimed at exploring the cutting-edge developments and applications of AI.

Attending this summit proved instrumental in enhancing our understanding of AI and its potential impact on the IT landscape. The sessions covered a wide array of topics, such as machine learning algorithms, deep learning frameworks, natural language processing techniques, and ethical considerations in AI deployment. Engaging with industry pioneers and academic experts expanded our perspectives and enabled us to grasp the latest methodologies and advancements in the field.

Furthermore, the summit provided us with an opportunity to interact with fellow researchers and professionals from various sectors. These networking interactions facilitated

valuable discussions and knowledge sharing, enriching our understanding of the challenges and opportunities associated with implementing AI solutions in IT environments. It also allowed us to establish valuable connections, fostering potential collaborations in the future.

The insights gained from the Databricks virtual summit on AI have been instrumental in shaping our research trajectory. The knowledge acquired has provided us with a deeper understanding of the state-of-the-art AI techniques and methodologies, allowing us to explore the potential of GenAI through the utilization of neural networks.

In this research paper, we aim to investigate the transformative power of GenAI, facilitated by neural networks, and its implications in the field of IT. Through a rigorous methodology, we analyse the effectiveness of generative models in creating new content that closely resembles human-generated data. By presenting our findings, we hope to contribute to the existing body of knowledge in AI research and provide valuable insights for practitioners and researchers in the IT domain.

By leveraging the knowledge gained from the Databricks virtual summit on AI, this research endeavours to push the boundaries of AI applications in IT, opening new avenues for innovation and advancement. Through our exploration of GenAI and neural networks, we seek to uncover novel approaches that can revolutionize various aspects of information technology, ultimately contributing to the growth and development of the field.

- E. In order to gain a deeper understanding of generative artificial intelligence (AI), a pivotal aspect of contemporary technology, an invaluable step was taken by arranging a meeting with esteemed subject matter experts (SMEs). These experts hailed from renowned companies, widely acknowledged for their unparalleled proficiency in the domains of technology and data analytics. Particularly, the consultation aimed to delve into the intricacies of GenAI, uncovering its inner workings, potential applications, and the challenges associated with its implementation. The insights gleaned from this meeting proved to be instrumental in enhancing the research Endeavor and shedding light on the cutting-edge advancements in this rapidly evolving field.
- F. In addition to our extensive internet research, our research process also involved engaging in insightful conversations with numerous IT professionals over the course of several months. These discussions provided us with a unique opportunity to gain firsthand perspectives and insights into the practical implications and challenges associated with GenAI.

Through fruitful conversations with a diverse range of IT professionals, including engineers, developers, data

scientists, and IT managers, we delved deep into the intricacies of GenAI and its relevance to the field of Information Technology. These interactions allowed us to explore various aspects of GenAI, such as its potential applications, limitations, and ethical considerations.

Engaging with a wide array of IT folks proved invaluable in understanding the real-world implications of GenAI. The conversations provided firsthand accounts of the successes, challenges, and lessons learned from implementing GenAI models in practical IT scenarios. By actively listening to their experiences and insights, we gained a deeper understanding of the practical considerations involved in deploying and managing GenAI systems.

These conversations also enabled us to identify emerging trends and areas of innovation within the realm of GenAI. By tapping into the collective knowledge and experiences of IT professionals, we were able to gather valuable anecdotal evidence, which complemented our research findings and enriched our understanding of the subject.

We are immensely grateful to all the IT professionals who generously shared their time, expertise, and experiences with us. Their contributions have played a crucial role in shaping the direction and scope of our research, ensuring its relevance and practical applicability in the context of Information Technology.

It is important to note that while these conversations have provided valuable insights, they are qualitative in nature and should be considered as complementary to the broader research framework. The information gathered from these discussions has been carefully integrated into our analysis, enhancing the richness and depth of our research findings.

Through our engagement with IT professionals and their invaluable input, we aim to bridge the gap between theoretical knowledge and practical implementation, presenting a comprehensive perspective on the potential impact and challenges of GenAI in the realm of Information Technology.

VII. RESULTS

A. Benefits of Generative AI Applications

- 1) **Benefits in Text Translation and Productivity:** Text-based NLP models have a significant impact on written communication and translation. They can translate text into easily understandable language for native speakers. These models can be integrated with

various communication mediums, enhancing user content and productivity.

- 2) **Democratize organization data:**

Big or small organizations will try to democratize their own data and scan large datasets for LLM models so that users within the organization can derive value from it. In the past, organizations with a presence in Europe, Asia, Africa, or America were not fully utilizing their own data (although some organizations had made progress in this regard). With the recent surge in popularity of ChatGPT [19][20] and other LLMs like Dolly, many people are now going to begin training, fine-tuning, and deploying their own custom models to address domain-specific challenges.

- 3) **Data + AI companies will get funding and Growth:**

Most probably, Data + AI driven companies will see growth on their business [21], e.g. Microsoft, Google. [21_1]

(See Fig 7 for Databricks GenAI use)

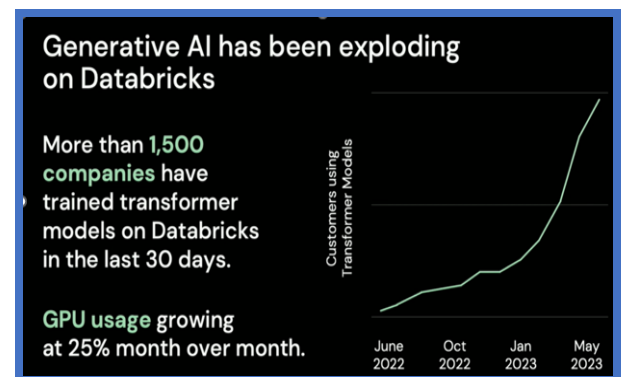


Fig. 7. Dolly & Generative AI use in Databricks

- 4) **Easy to generate SQL queries:** A text-based model can assist in generating SQL queries, providing significant support to our business partners, business partner liaisons, and even business analysts who may not be proficient in SQL writing. By correctly inputting the desired text, the MML-based model will generate the appropriate SQL query. These queries can then be executed using the organization's designated SQL editor.
- 5) **Chatbot for Dialog & Prompt engineering [22] for Developers;** As this service has become increasingly prevalent across industries, more companies are expected to invest in this area and leverage AI capabilities for further enhancements. The chatbot feature enables event-based communication with respective vendors and stakeholders, facilitating seamless interactions. chatbot can be leveraged for education and training purpose.

We have tested this capability; it is easy and building this capability. Effort can be reduced significantly.

- 6) **For Developers, code migration will be easy:** AI tools support a broader range of languages, which helps facilitate code migration from one language to another. For example, it allows for converting Java or C++ code into Python, or vice versa.
- 7) **Managing Meetings will be easy:** As AI tools can be seamlessly integrated with communication platforms, they can efficiently track the availability of attendees and schedule meetings accordingly.
- 8) **Improving Code Quality with AI Tools:** Code quality is set to witness significant improvements with the integration of AI tools. These tools empower developers to efficiently search for the right code, validate prewritten code, and conduct thorough testing. By accessing optimized versions of such code, developers can enhance the overall quality of their codebase.
- 9) **Software Coding for the Developer Community:** As of today, the developer community already benefits from a wide range of AI assistance for code development, including co-pilot assistance and more. However, the introduction of LLM-based models is expected to further streamline their efforts and reduce development time. LLM based models can assist on code generation, explanation, and debugging.

Screenshot (see Fig 8) from one of the LLM based models:

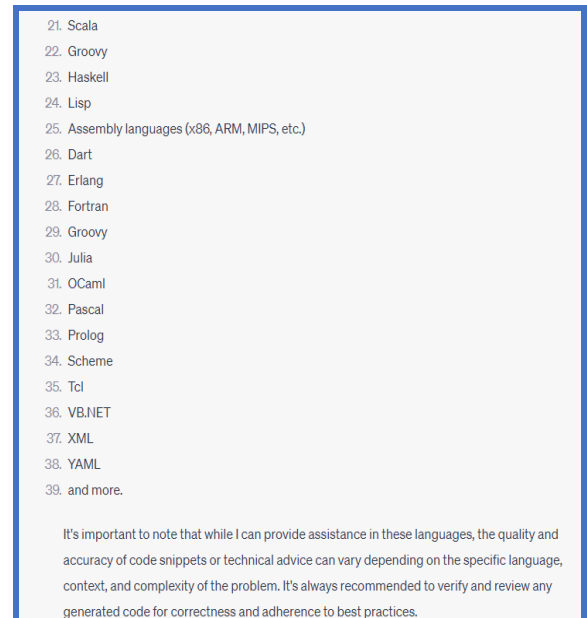
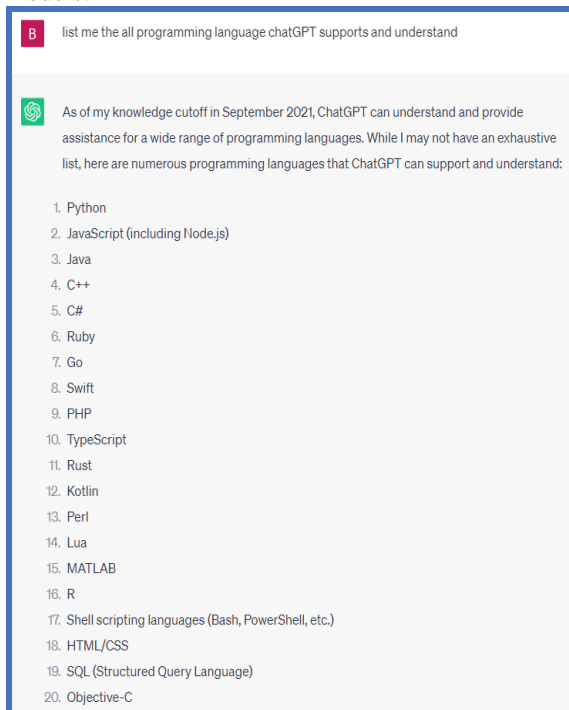


Fig. 8. chatGPT conversation

- 10) **Generating Images with AI:** With the aid of GenAI algorithms and data, image generation becomes a breeze. Creating and customizing images becomes a seamless process. AI image generators, such as Midjourney and DALL·E 2, produce remarkable visuals in various styles, including aged photographs, watercolors, pencil drawings, and Pointillism. The resulting products boast both impressive quality and speed, revolutionizing the creation process and boosting human productivity. Example, GenAI can be used to enhance medical images.
 - 11) **Computer programmer & Data Scientist:** A truly skilled programmer will be more productive, while an ordinary programmer can simply write good codes.
 - 12) **Security Audit will be easy:** Using LLM security audit can enhance security measures.
 - 13) **Mock interview:** Can be used for mock interviews.
 - 14) **Apps creation with Generative AI tools:** We can build Serverless API, email responder, we applications, Job application creator, power apps, list is endless.
 - 15) **Time Management:** GenAI has the potential to greatly assist in time management by automating repetitive and time-consuming tasks, providing intelligent insights, and optimizing resource allocation.
- Few points are given below:
1. GenAI can automate data entry, report generation, scheduling, and basic customer support queries. By offloading these tasks to GenAI systems, employees can focus on more strategic and value-added

activities, resulting in increased productivity and time savings.

2. GenAI models can analyze vast amounts of data and provide actionable insights in real-time. This capability allows individuals to make informed decisions quickly.

3. GenAI-powered tools can facilitate efficient communication and collaboration among team members. For instance, chatbots and virtual assistants can help streamline internal communication by answering routine queries, scheduling meetings, and providing relevant information. By reducing the time spent on administrative tasks, employees can focus on collaborative work, fostering better teamwork and improved time management.

4. GenAI can analyze individual work patterns, preferences, and priorities to provide personalized time management assistance. It can suggest optimal schedules, task prioritization, and reminders based on an individual's workload and deadlines. This personalized guidance can assist employees in effectively managing their time, ensuring tasks are completed on time and reducing the chances of procrastination.

16) **Benefits for Editing:** An NLP-based tool will be utilized for spelling check, grammar check, and style recommendation in editing.

17) **Behaviour prediction & Creative writing:** NLP based tools will be utilized for finance applications, election forecasting, marketing, movie scripts, poetry, song lyrics, bot-powered financial and sports news stories.

18) **Fact Checking, generate ideas:** GenAI can be used for fact checking way that may use google and Wikipedia. It can also be useful for idea generation.

B. Challenges Faced by Generative AI Applications

1) **Intellectual Property Concerns:** Given the focus on information technology, it becomes crucial to address the issue of safeguarding company intellectual property. Engineers should refrain from sharing code with AI companies. Additionally, when utilizing cloud tools, organizations must ensure that their cloud providers do not share sensitive information with third parties. Close collaboration with various stakeholders, including tracking IPs within the organization, may be necessary.

2) **Cost and Management of GPU-Enabled Infrastructure:** IT managers will face the challenge of cost control, as LLM models predominantly rely on expensive GPU [24] infrastructure. Scaling such infrastructure and effectively managing costs will require strategic planning and implementation.

3) **Carbon Emissions:** More and more companies are investing in GenAI, which means we need to use more GPU-powered machines. These machines can

process large datasets with significant processing power. The impact of this will be on the environment, as the machines will generate more CO₂.

4) **Cybersecurity Risks:** The utilization of LLM-based chatbots may inadvertently aid attackers in writing phishing emails and polymorphic malware, thereby posing cybersecurity risks. Implementing robust security measures becomes imperative in this context.

5) **Potential Job Disruption:** While certain IT roles may experience minor disruptions (positions will evolve as such Low-level positions, back-office jobs e.g. data entry and basic programming and content generation), this does not necessarily imply a reduction in the workforce. Rather, the evolving landscape will create new opportunities and necessitate reskilling and upskilling efforts.

6) **Unclear Copyright Laws for Image Generation:** The laws pertaining to copyright [8] and AI-generated images are still evolving and differ across countries and jurisdictions. As a general recommendation, users are advised to label AI-generated images to avoid confusion or misattribution.

7) **Disturbing images can circulate & manipulated:** Disturbing images can circulate; it can cause problem for safety investigators that will undermine efforts to find victims and combat real-world abuse. Pedophile forum can misuse images using AI capability.

8) **Accuracy:** GenAI systems sometimes produce inaccurate and fabricated answers, so we have to verify them before using them. Specifically, we have to be careful in life-threatening areas.

9) **Integration with other Tools:** As GenAI is evolving, currently existing tools has integration issues, we have to keep eye on app integration capabilities.

C. Opportunities

1) **In-House LLM Models with Limited Data:** Large and mid-sized organizations can capitalize on the opportunities presented by LLM-based models by investing in their developers and training. These models can facilitate knowledge transition, training, and workforce productivity, offering significant benefits. Build your own LLM model.

2) **Career Opportunities in Prompt Engineering and LLM-Based Technologies:** Prompt Engineering [22] will emerge as a promising career path, with organizations recognizing the potential for innovation in this area. Investing in prompt engineering expertise can unlock new avenues for growth.

3) **Training for High-Quality Data Provision to LLMs:** To optimize AI algorithms, providing high-quality input is paramount. Improved questions lead to better answers, while incomplete or incorrect input may result in inaccurate outcomes. Training initiatives

- focused on providing high-quality data can harness the full potential of AI tools for improved results.
- 4) **Revisiting New Hire Training Models:** Offshore companies often hire a large number of resources from campuses and invest in extensive training programs. In light of evolving technologies, these companies should reassess their training processes and evaluate the necessity and adequacy of their investments for freshers.
 - 5) **Evolution of New IT Roles:** As technology advances, new IT roles will emerge, requiring organizations to allocate resources and effort to adapt and embrace these changes. E.g., ethicists and bias auditor's positions will be re-created.
 - 6) **Growth:** While a machine can handle certain tasks, a person can focus on more valuable work, leading to wage growth and job growth (as per World Economic Forum
<https://www.imf.org/en/Publications/fandd/issues/2020/12/WEF-future-of-jobs-report-2020-zahidi#:~:text=The%20robot%20revolution%20will%20create%2097%20million%20new%20jobs.&text=The%20emerging%20professions%20reflect%20the,cloud%20computing%2C%20and%20product%20development.>).
 - 7) **Improving Data quality:** We will have pre trained model for data quality checks, however there is a scope to refine and make good quality data.
 - 8) **Train End users:** There is opportunity to train business partners, and end users.
 - 9) **Open Dialog with workers:** Leaders have to engage workers, understand their point of views and also train them on GenAI.
 - 10) **Managing Generative AI at workplace:** Impose tight controls on data access.
Engage in careful external vendor contract reviews.
Develop disciplinary innovation teams that include legal and human resource staff.
Implement disclosure and informed consent when necessary.
 - 11) **More opportunities at CISO organization:** In the future, Chief Security organizations are expected to encounter a greater number of opportunities and responsibilities pertaining to data security and the establishment of workplace guidelines. Consequently, they will be required to operate across multiple dimensions to enhance auditing and logging capabilities for tracking user behaviour with regard to sensitive data.
 - 12) **Build more mature audit and logging mechanism for Customer Data platform:** To ensure effective monitoring of employee activity related to sensitive data, it is crucial to track individuals who access this data and the purpose of their access, while also implementing measures to prevent the upload of sensitive data to the GenAI tools. In the event that sensitive data is inadvertently released to the GenAI tools, this logging mechanism will aid in identifying the responsible party.
 - 13) **Training:** Provide training sessions for managers and employees regarding the potential risks associated with GenAI tools, as well as educate them on the organization's internal policy guidelines regarding the utilization of such tools.
 - 14) **Start labelling and cataloguing your data:** Organization has opportunities to properly tag or label data so, in case of breach, we can easily identify Enterprise data. Catalog will help to train about organization data.
 - 15) **Start maintaining Inventory:** Companies, going to use GenAI for their respective work or app development. Please start tracking those kinds of tools or apps at inhouse inventory.
 - 16) **Build mature Enterprise Data platform:** Bring all the required data in one location using ingestion patterns. Do cleaning and labelling of data so, it can be leveraged for building in house LLM models.
 - 17) **Build Application using ChatGPT:** You can leverage Microsoft Azure and use respective integrated tools with ChatGPT from Web, chatbot, training app, HR app, ... so on (list is long).
 - 18) **Generative AI Tool can be used for better Customer Data Platform:** It can be used for generated leads by engaging with potential customers and provide them relevant information about products and services. It will translate into sales increase.
GenAI can be used for personalized customer experience by providing customers with tailored content and recommendations based on their interest and preferences.
GenAI can be used for automating customer service, Analyse customer data and marketing campaigns.

D. Guidelines and policies for Workplace

Prior to formulating guidelines and policies, it is imperative to acknowledge the significance of data security. Given that a substantial portion of a company's data is housed within on-premises and cloud provider data centers, it becomes the responsibility of the organization itself to ensure the implementation of robust security measures. These measures should encompass a wide range of strategies, including encryption, role-based access controls, IP whitelisting, firewall rules, logging, and the auditing of user activities. It is crucial to recognize that these security practices retain their utmost relevance even in the context of GenAI. As organizations embrace GenAI, they will inevitably shoulder additional responsibilities in monitoring and overseeing users' interactions with sensitive data. While each organization may adopt a unique stance, such as initial-stage banks or healthcare establishments initially prohibiting the use of GenAI tools, it is foreseeable that with the refinement of their policies, they

will eventually permit the utilization of GenAI to benefit their employees. Vcr4fed3x

- 1) **Set-up Generative AI Review board:** Company should set-up a GenAI review board, generated code will be carefully review by the board before implementing.
- 2) **Privacy and Data Security:** Clearly outline how user data will be handled and stored. Implement robust security measures to protect sensitive information. Obtain necessary consent from employees for data collection and usage.
- 3) **User Training and Awareness:** Provide comprehensive training to employees on how to use the AI tool effectively and responsibly. Educate them about the limitations and potential biases of the AI system. Encourage employees to exercise critical thinking and not solely rely on AI-generated outputs.
- 4) **Disable chat history & Training (This for chatGPT):**
 - Click your account in the bottom left corner.
 - Click Settings
 - Click on the Show menu next to Data Controls
 - Toggle off the Chat History & TrainingMore details can be found [26]
- 5) **Don't submit source code at external generative AI tool:** Give clear guidelines to developer for source code, don't put company source code to external GenAI tools.
- 6) **As we have already covered in opportunity section, company must do honest conversation with there Employee on GenAI. Particularly engage Data Science and AI teams on conversations.**
- 7) **Build custom front-end on top of ChatGPT:** Companies must build a custom front-end that replaces the ChatGPT interface to leverage the chat LLM API (OpenAI) directly. It will reduce data leakage.
- 8) **Prohibited Generative AI tool for Checking confidential Data:** to check for mistakes in confidential company or client documents, or sensitive company code [27].
- 9) **Identify or purchase license for AI tracking tool (for generative apps uses within organization):** Definitely, Employees must use AI tool for productivity, but we must track for their uses. Companies must track misuse of the Tool. It includes IP tracking.
Companies can use like Extended detection and response (XDR) solutions, that will watch for abnormal behaviours in the enterprise IT environment, Other types of monitoring tools such as security information and event management (SIEM), application firewalls, and data loss prevention solutions can also be used to manage users' web browsing and software use, and to monitor information leaving the company IT environment. This will minimizing risks and potential data loss.
- 10) **Don't put any kind of PII or PCI data into the generative AI tool:** Ask employees, not to put any kind of PII or PCI data into the external AI tool. Company

has o clearly define PII and PCI data and prohibit employee to place such data into the GenAI tools.

- 11) **Legal must avoid generative AI tools for their work (specially for vendor information etc.):** It can release, company sophisticated information.
- 12) **Ethical Guidelines:** Establish clear guidelines on the acceptable and ethical use of the AI tool. Prohibit the use of AI tools for illegal or unethical purposes. Encourage employees to report any concerns or issues related to the AI tool's usage.
- 13) **Transparency:** Clearly communicate to employees when they are interacting with an AI system. Disclose that their conversations may be monitored for quality assurance or training purposes. E.g.: Use for email writing, but don't put PII or PCI information on it, you may be use for grammar or spelling check.
Developer can use for enhancing code quality, but don't put code for review, or no company code at AI tool.
- 14) **Regular Monitoring and Evaluation:** Continuously monitor the AI system's performance and accuracy. Regularly evaluate the impact of the AI tool on employee productivity and well-being. Make necessary adjustments or updates based on user feedback and evolving needs.
- 15) **Support Mechanisms:** Provide channels for employees to seek assistance or clarification regarding the AI tool's usage. Offer ongoing support and address any questions or concerns promptly.
- 16) **Hire dedicated resources for workplace policy implementation.**
- 17) **Compliance with Legal and Regulatory Requirements:** Ensure compliance with relevant laws and regulations pertaining to data privacy, AI usage, and workplace policies.
- 18) **Continuous Improvement:** Stay updated with advancements in AI technology and incorporate best practices. Regularly review and update the guidelines and policies as needed.
- 19) **Is the data will be shared with partners e.g., chatGPT:** Ask this question to Microsoft and respective vendors.
- 20) **Zero tolerance and define Consequences.** As with any company policy, you should inform your employees that they could face repercussions should they violate any of its tenets. Let them know they could face disciplinary action including immediate termination, and possibly legal action. The policy should also direct employees to report potential violations they learn about to their supervisor or to HR. We must put hefty penalties on vendors, in case they or their resources releases to the external GenAI applications.
- 21) **Prohibit Employment-Based Decisions:** Don't use GenAI tool for hiring, retention, promotions, transfers, performance monitoring, discipline, demotion, and terminations. [https://www.fisherphillips.com/news-insights/10-things-employers-must-include-workplace-ai-policy.html].

- 22) ***Inform Supervisor for using GenAI Tools:*** Resources has to inform their supervisor for what purpose, they have used GenAI tool, so they will aware of use.

invaluable insights. We are also grateful to the researchers and professionals who shared their knowledge and expertise, enriching our understanding of AI and its applications. Their contributions have been invaluable in shaping our research and enhancing its potential impact in the realm of information technology.

VIII. CONCLUSION

As GenAI was not a new concept, but after researching on this topic for Information technology, we found that it is just not a buzz word, it is going to transform and bring Information Technology on next level. It has potential to transform Information technology and will bring new opportunities. During the study, we found it also poses some threat on intellectual property and will create positive disruption on the Information Technology field. During the research we found that, Information technology companies has to come up with Guidelines and policy. Few companies have already started this journey, more will follow in the future. Next few years GenAI will be more mature and will have significant impact on the Information technology. Most of the IT CEOs have been acknowledging the value of data and assessing its impact on the information and software industry. Our conclusion is that it will disrupt the software and IT industry. The capability of GenAI will significantly improve productivity, leading to the elimination of certain job roles, such as communication-related positions like Scrum Masters, coordinators, trainees, or junior roles. However, a few new roles will be added.

Most importantly, remember that AI is a tool – perhaps the most useful and powerful one that will emerge during our lifetimes. By mastering it and learning to use it effectively, we can enjoy careers that are more productive, interesting, and rewarding.

Artificial intelligence (AI) isn't going to replace people – but people who use AI are going to replace people who don't.

I would like to thank my wife Beena Dhoni who gave me the support, time, and freedom to pursue my passions.

Finally, thank you to the maker of ChatGPT for correcting grammar and sentences.

ACKNOWLEDGMENT

We would like to thank the following people for their immense help throughout our journey in writing this research paper. Without them, this research paper would not be possible.

First foremost is IEEE reviewer (Name will come here), second from my Research and Development Team in India Nishant Malik (from Infosys), he has done research on Databricks Dolly with me.

My Friend Anshul Jain (from EPAM System), whom I discuss on various subjects including Data Science and AI.

Also, we would like to express our sincere gratitude to the organizers of the Databricks virtual summit on AI for providing us with the opportunity to attend the event and gain

REFERENCES

- [1] Koul, Anirudh, et al. "Chapter 1: Exploring the Landscape of Artificial Intelligence, What Is AI?" Practical Deep Learning for Cloud, Mobile, and Edge: Real-World AI & Computer-Vision Projects Using Python, Keras & Tensorflow, O'Reilly Media, Sebastopol, CA, 2019, pp. 3–4.
- [2] 02:42, 22 June 2023
https://en.wikipedia.org/w/index.php?title=Artificial_intelligence&oldid=1161337952
- [3] Koul, Anirudh, et al. "Chapter 1: Exploring the Landscape of Artificial Intelligence, What Is AI?" Practical Deep Learning for Cloud, Mobile, and Edge: Real-World AI & Computer-Vision Projects Using Python, Keras & Tensorflow, O'Reilly Media, Sebastopol, CA, 2019, pp. 6–7.
- [4] June 5, 2023
https://en.wikipedia.org/w/index.php?title=Dartmouth_workshop&oldid=1158728511
- [5] Jan 22, 2023
https://en.wikipedia.org/w/index.php?title=Logic_Theorist&oldid=1135115007
- [6] Shortliffe, Edward. "Rule-Based Expert Systems:The MYCIN Experiments of the Stanford Heuristic Programming Project." Rule-Based Expert Systems: MYCIN, www.shortliffe.net/Buchanan-Shortliffe-1984/MYCIN%20Book.htm. Accessed 4 July 2023.
- [7] Géron, Aurélien. "Neural Networks and Deep Learning." O'Reilly Online Learning, learning.oreilly.com/library/view/neural-networks-and/9781492037354/ch01.html#idm139624972225600. Accessed 4 July 2023.
- [9] "What Is Generative Ai?" *NVIDIA*, www.nvidia.com/en-us/glossary/data-science/generative-ai/. Accessed 26 June 2023.
- [9] Bell, Elysse. "Generative AI: How It Works, History, and Pros and Cons." Investopedia, 7 June 2023, www.investopedia.com/generative-ai-7497939#:~:text=Generative%20AI%20can%20benefit%20just,future%20AI%20models%20can%20train.
- [10] "OpenAI Platform." *OpenAI Platform*, platform.openai.com/overview. Accessed 26 June 2023.
- [11] About Node.Js, nodejs.org/en/about. Accessed 13 June 2023.
- [12] Pasquali, Sandro, and Kevin Faaborg. Mastering Node.Js: Build Robust and Scalable Real-Time Server-Side Web Applications Efficiently. Packt Pub., 2017.
- [13] Mike Conover, Matt Hayes, Ankit Mathur, Xiangrui Meng, Jianwei Xie, Jun Wan, Ali Ghodsi, Patrick Wendell and Matei Zaharia. "Hello Dolly: Democratizing the Magic of Chatgpt with Open Models." Databricks, 12 Apr. 2023, www.databricks.com/blog/2023/03/24/hello-dolly-democratizing-magic-chatgpt-open-models.html.
- [14] <https://www.databricks.com/blog/2023/04/12/dolly-first-open-commercially-viable-instruction-tuned-llm>
- [15] <https://github.com/databricks/dolly>
- [16] [20] "Data Lakehouse Architecture and AI Company." Databricks, www.databricks.com/. Accessed 4 July 2023.
- [17] <https://www.databricks.com/resources/demos/tutorials/data-science-and-ai/build-your-chat-bot-with-dolly>
- [18] Refer Databricks AI
- [19] [6] 03:57, 24 June 2023
<https://en.wikipedia.org/w/index.php?title=ChatGPT&oldid=1161652382>
- [20] 05:11, 30 June 2023
<https://en.wikipedia.org/w/index.php?title=OpenAI&oldid=1162610604>
- [21] Mark Roepke, Sam Raymond, Chengyin Eng, Joseph Bradley, Brooke Wenig and Trang Le. "Now Available: New Generative AI Learning Offerings." 06 June 2023 <https://www.databricks.com/blog/now-available-new-generative-ai-learning-offerings>.
- [22] 01:16, 24 June 2023
https://en.wikipedia.org/w/index.php?title=Prompt_engineering&oldid=1161638045
- [24] 10:05, 23 June 2023
https://en.wikipedia.org/w/index.php?title=List_of_Nvidia_graphics_processing_units&oldid=1161533173
- [26] J., Joshua. "Data Controls FAQ." OpenAI Help Center, 2023, help.openai.com/en/articles/7730893-data-controls-faq.
- [27] *The Benefits and Limitations of Generative AI: Harvard Experts Answer Your Questions*, 19 Apr. 2023, <https://www.harvardonline.harvard.edu/blog/benefits-limitations-generative-ai>. Accessed 26 June 2023.
- [28] Gesser, Avi, et al. "Does Your Company Need a ChatGPT Policy? Probably." Compliance and Enforcement, 10 Feb. 2023, wp.nyu.edu/compliance_enforcement/2023/02/10/does-your-company-need-a-chatgpt-policy-probably/.
- [21_1] <https://www.joinsuperhuman.ai/p/3-key-ai-market-trends-know>
- [Other References] S. M. Metev Generative AI: What Is It, Tools, Models, Applications and Use Cases." Gartner, 2023, www.gartner.com/en/topics/generative-ai#:~:text=Generative%20AI%20can%20learn%20from,software%20code%20and%20product%20designs
- [Other References] Howard, Jeremy. "GPT 4 and the Uncharted Territories of Language." 20 Mar. 2023, <https://www.fast.ai/posts/2023-03-20-wittgenstein.html>. Accessed 26 June 2023.
- [Other References] Mikaela Cohen. "It's Only a Matter of Time before A.I. Chatbots Are Teaching in Primary Schools." *CNBC*, 25 June 2023, www.cnbc.com/2023/06/25/only-a-matter-of-time-before-ai-chatbots-are-teaching-kids-in-school.html.

APPENDIX

index.html

```
<!DOCTYPE html>
<html lang="en">

<head>
  <meta charset="UTF-8">
  <meta http-equiv="X-UA-Compatible"
content="IE=edge">
  <meta name="viewport" content="width=device-width,
initial-scale=1.0">
  <title>Chatbot for research project</title>
  <link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.3.0/dist/css/bo
otstrap.min.css" rel="stylesheet"
integrity="sha384-
9ndCyUaIbzAi2FUVXJi0CjmCapSmO7SnpJef0486qhLnuZ2
cdeRhO02iuK6FUUVM" crossorigin="anonymous">
</head>

<body>
  <div class="container mt-5 w-50">
    <h1 class="text-center">Chatbot for Testing</h1>
    <div class="card">
      <div class="card-header">
        Chat History
      </div>
      <ul id="chat-history" class="list-group list-group-
flush">
        </ul>
      </div>

    <div class="input-group">
      <span class="input-group-text">
        <svg xmlns="http://www.w3.org/2000/svg"
width="16" height="16" viewBox="0 0 16 16"><g
fill="currentColor">
          <path d="M11 6a3 3 0 1 1-6 0a3 3 0 1 1 6
0z"/><path fill-rule="evenodd" d="M0 8a8 8 0 1 1 16 0A8 8 0
0 1 0 8zm8-7a7 7 0 0 0-5.468 11.37C3.242 11.226 4.805 10 8
10s4.757 1.225 5.468 2.37A7 7 0 0 0 8 1z"/></g>
        </svg>&nbsp;User (You)
      </span>
      <textarea id="user-input" class="form-control" aria-
label="With textarea"></textarea>
    </div>

    <div class="text-center">
      <button id="submit" type="button" class="btn btn-
primary mt-2">Submit Prompt</button>
      <div id="spinner" class="spinner-grow text-primary
visually-hidden mt-2" role="status">
        </div>
      </div>
    </div>

    <script
src="https://cdn.jsdelivr.net/npm/bootstrap@5.3.0/dist/js/boot
strap.bundle.min.js"
integrity="sha384-
geWF76RCwLtnZ8qwWowPQNguL3RmwHVBC9FhGdlKrx
diJJigb/j/68SIy3Te4Bkz" crossorigin="anonymous"></script>
    <script src="js/script.js"></script>
  </body>
</html>
```

applicationFile.js

```
const openai = require('openai');
require('dotenv').config();
const express = require('express');
const path = require('path');
const app = express();
const port = 8080 || process.env.PORT;

app.use(express.json());
app.use(express.static('public'));
app.use(express.urlencoded({ extended: true }));

//OpenAI Keys
const configuration = new openai.Configuration({
  organization: process.env.OPENAI_ORG,
  apiKey: process.env.OPENAI_API_KEY,
});

const openaiApi = new openai.OpenAIApi(configuration);
app.get('/', (req, res) => {
  res.sendFile(path.join(__dirname, 'index.html'));
});

app.post('/chat', async (req, res) => {
  const messages = req.body.messages;
  const model = req.body.model;
  const tempVar = req.body.temp;
  const completion = await
openaiApi.createChatCompletion({
  model: model,
  messages: messages,
  temperature: tempVar,
});
  res.status(200).json({ result: completion.data.choices });
});

app.listen(port, () => {
  console.log(`App listening on port ${port}`);
});
```

scriptFile.js

```
const submit = document.getElementById("submit");
const responseData =
document.getElementById("response");
const userInput = document.getElementById("user-input");
const chatHistoryLoad = document.getElementById("chat-
history");
const loading = document.getElementById("spinner");

let promptResponses = [];
```

```
//API call
const generateResponse = async () => {
  //Get the user input
  loading.classList.remove("visually-hidden");
  submit.classList.add("visually-hidden");
  const input = userInput.value;
  const response = await fetch('/chat', {
    method: 'POST',
    body: JSON.stringify({
      model: "gpt-3.5-turbo",
      messages: [{"role": "user", "content": input}],
      temp: 0.6
    }),
    headers: {
      'Content-Type': 'application/json'
    }
  });

  const responseData = await response.json();
  const message = responseData.result[0].message.content;
  console.log(message);
  promptResponses.push({question: input, response:
message});
  //Clear fields
  userInput.value = "";

  const historyElement = document.createElement('div');
  historyElement.innerHTML = `- 

```

.env File

Do not share your OpenAI API key with anyone! It should remain a secret.

```
OPENAI_API_KEY=sk-
saFN1XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXZlh
OPENAI_ORG=org-
eXXXXXXXXXXXXXXXXXXXXXXXXXXHj
```

Output File

localhost:8080/index.html

ides... SQL Interview Qu... Cisco Webex Mee... 5th grade spelling...

Chatbot for Testing

Chat History

Prompt: list top programming languages

Response: 1. Python 2. JavaScript 3. Java 4. C++ 5. C# 6. PHP 7. Ruby 8. Swift 9. Go 10. TypeScript

Prompt: give me top brands for washer and Dryer

Response: 1. Samsung 2. LG 3. Whirlpool 4. Maytag 5. GE 6. Bosch 7. Electrolux 8. Kenmore 9. Amana 10. Speed Queen

User (You)

Submit PromptButton