



# The Art of Augmenting Patient Experience: A Journey through LLMs

A Whitepaper



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## Highlights

- **Transformative Potential:** LLMs like ChatGPT are revolutionizing healthcare by offering intelligent decision support, telemedicine, patient monitoring, and health education.
- **Data Security:** Adhering to HIPAA regulations is crucial when integrating LLMs into healthcare systems to ensure patient data security and compliance.
- **Real-World Impact:** Explore real use cases showcasing LLMs' benefits, from automating tasks and improving diagnoses to enhancing communication and mental health support.
- **AI Doctor Evolution:** The rise of AI doctors is changing patient care, providing personalized medical assistance, improving diagnostics, and expanding access to healthcare services.
- **Future Recognition:** Expect organizations like WHO, HIMSS, and JCAHO to acknowledge and incentivize LLM adoption for better patient care, engagement, and communication.



## Executive Summary

The Art of Augmenting Patient Experience: A Journey through LLMs white paper explores how ChatGPT, an AI-powered conversational agent, is changing the landscape of healthcare. Through Intelligent Decision Support, Telemedicine, Patient Monitoring, and Health Education, ChatGPT enhances care by offering data-driven insights, remote consultations, proactive monitoring, and patient empowerment.

ChatGPT seamlessly integrates with Electronic Health Records while ensuring data security through HIPAA regulations. Real-world use cases demonstrate its impact on patient care and operational efficiency.

By embracing ChatGPT and Language Model Models (LLMs), healthcare providers can deliver patient-centric care, improve satisfaction, and enter a transformative era of healthcare.

Indium Software is prepared to support providers in adopting ChatGPT and LLMs technologies, providing tailored solutions for a patient-focused, technologically advanced healthcare environment.

## All About the LLMs

The rapid advances in artificial intelligence (AI) have led to the development of large language models (LLMs), such GPT-4 and Bard. In the healthcare sector, LLMs can be used for a variety of tasks, such as facilitating clinical paperwork, securing insurance pre-authorization, summarising research publications, and serving as a chatbot to address patient enquiries about their specific data and problems.

LLMs, however, have the potential to revolutionise medicine because they are trained differently than previously controlled AI-based medical technologies, especially in the vital area of patient care.



This necessitates utilising LLMs with the utmost prudence. Recent research has emphasised the necessity of regulatory control of extensive language models in healthcare. Although LLMs have the potential to revolutionise healthcare, their usage necessitates careful deliberation and regulatory control. Over the past three years, there has been a dramatic increase in the

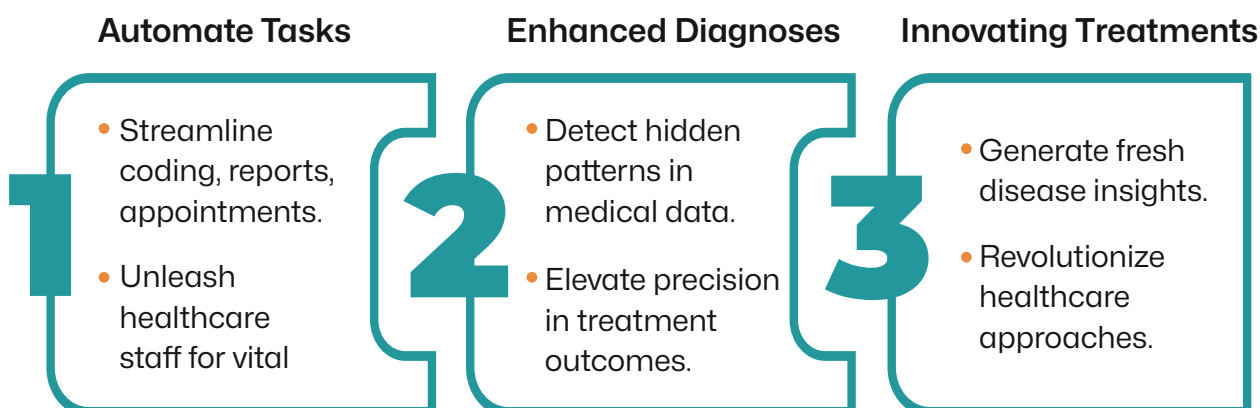
## The Promise of LLMs in Healthcare

As virtual assistants, ChatGPT and other generative AI tools can help healthcare professionals organise their schedules, set priorities for their activities, and keep informed about upcoming events and initiatives. Beyond providing care for patients, they are also responsible for a variety of administrative duties, research commitments, teaching responsibilities, and leadership roles.

By managing schedules, creating reminders, and gaining access to data on events, conferences, and campaigns, ChatGPT can offer individualised support. With this support, the healthcare professionals may enhance time management, streamline workflow, and encourage active participation.

Additionally, ChatGPT assists in navigating the complexity of healthcare organisations by providing advice on workforce management, staffing strategies, and operational efficiencies. With the aid of this technology, and they may concentrate on providing high-quality care while efficiently handling their administrative duties.

Large Language Models (LLMs) have the potential to revolutionize healthcare



## Benefits of LLMs in Healthcare

How healthcare systems can benefit from using LLMs:

- **Clinical Decision Support:** LLMs can analyze vast amounts of medical literature, clinical trials, and patient data to provide evidence-based treatment recommendations to healthcare professionals.
- **Medical Image Analysis:** Radiologists can be benefited by LLMs as they can assist them in interpreting medical images, like X-rays and MRIs, improving diagnostic accuracy and reducing the time taken for diagnosis.
- **Natural Language Processing in Electronic Health Records (EHRs):** LLMs can extract valuable information from unstructured EHRs, making it easier for healthcare providers to access patient histories and crucial medical data.
- **Personalized Treatment Plans:** when you have vast datasets, including patients' medical history, genetic information, and lifestyle factors, to generate personalized treatment plans that are tailored to individual patients' needs.
- **Clinical Trial Matching:** LLMs can help match eligible patients with appropriate clinical trials, speeding up the recruitment process for medical research and ensuring that patients have access to cutting-edge treatments.



- **Real-time Monitoring and Alerts:** Continuously monitor patients' vital signs, lab results, and other health metrics, issuing real-time alerts to healthcare providers when anomalies or concerning patterns are detected.
- **Patient Outcome Prediction:** By analyzing historical patient data, LLMs can predict potential patient outcomes, aiding healthcare professionals in proactively addressing potential complications and improving patient care.
- **Language Translation and Multilingual Support:** Facilitate communication between healthcare providers and patients who speak different languages, breaking down language barriers and ensuring better patient understanding.
- **Mental Health Support:** LLMs can be used as virtual counsellors or mental health support systems, providing resources, coping strategies, and guidance for patients struggling with mental health issues.
- **Healthcare Compliance and Regulatory Assistance:** LLMs can assist healthcare organizations in staying compliant with complex regulations and guidelines by providing real-time insights and updates related to legal and regulatory changes.
- **Fraud Detection and Prevention:** LLMs can analyze healthcare claims data to identify patterns indicative of fraudulent activities, helping insurance companies and healthcare systems mitigate financial losses.
- **Bioethics and Medical Ethics Guidance:** LLMs can offer support to healthcare professionals in addressing ethical dilemmas and complex decision-making situations, ensuring patient care aligns with moral and ethical principles.
- **Chronic Disease Management:** Managing chronic conditions by providing patients with reminders for medication adherence, lifestyle recommendations, and monitoring progress over time.
- **Medical Coding and Billing Optimization:** Streamlining medical coding and billing processes, reducing errors and administrative burdens for healthcare providers and insurance companies will be an easy task.



## Limitations of Traditional Approach

Traditional healthcare approaches have long served as the foundation of medical practice, relying on established methods and experience. However, the ever-evolving landscape of medicine calls for the integration of new technologies to enhance patient care and support healthcare providers and language model assistants (LLMs) in their roles.

For instance, the utilization of artificial intelligence (AI) in medical diagnostics allows for more accurate and rapid assessments, assisting healthcare professionals in making informed decisions. One such example is the use of AI algorithms to analyze medical images and detect abnormalities with greater precision. Implementing these cutting-edge technologies in healthcare can lead to improved patient outcomes and increased efficiency.

To learn more about AI applications in healthcare, visit: [AI in Healthcare: How It's Changing the Industry](#).

## An Introduction to ChatGPT in Healthcare

Whatever the case, Better or Worse, ChatGPT is ready to play. For professionals in a variety of industries, ChatGPT is invaluable since it is trained on massive volumes of text data and produces responses that are coherent and contextually appropriate. But the truth, though, is what drives healthcare's concentration on these cutting-edge methods. The reason for this is that





The definition of "personal" is being expanded as a result of the use of artificial intelligence (AI), which involves using robots to carry out tasks that would typically require human intelligence. Healthcare professionals now have more access to the technology because of recent advancements in generative AI, a class of AI that can generate natural language, visual, and audio data.

Healthcare providers have the chance to use AI to supplement the current healthcare delivery system and, in certain situations, possibly replace current human processes as AI becomes more and more established in the sector. This makes it urgently necessary to develop regulatory frameworks throughout the sector to oversee and regulate the usage of AI. In a recent Yale CEO Summit study, 48% of CEOs stated that the healthcare sector would be the one to experience AI's largest impact.

**The information below makes clear how generative AI is positioned to transform healthcare:**

- According to a **McKinsey** analysis, AI can automate 50–75% of manual processes, increasing productivity and cutting costs while also improving patient care.
- The global healthcare market for AI is expected to reach \$48.77 billion in 2027, according to a **market research report**.
- Additionally, **Forrester** forecasts a 25% reduction in wait times in retail healthcare after AI adoption.





# ChatGPT: The Rise of the AI Doctor

The integration of artificial intelligence (AI) in the field of healthcare has given rise to a new phenomenon—the AI doctor. These intelligent virtual physicians are transforming the landscape of patient care, offering personalized medical assistance, and expanding access to healthcare services. Let's explore the fascinating rise of the AI doctor and its potential impact on the healthcare industry.

## Intelligent Decision Support:

AI doctors serve as reliable sources of medical knowledge, assisting healthcare professionals in making accurate diagnoses and treatment plans. By analyzing a patient's medical records, lab results, and imaging data, AI doctors can identify patterns and propose potential diagnoses or recommend evidence-based treatment options. This collaboration between human doctors and AI doctors enhances diagnostic accuracy and helps improve patient outcomes.

## Telemedicine and Triage:

AI doctors are playing a vital role in telemedicine by providing initial assessments and triage recommendations. Patients can interact with an AI doctor via online platforms or mobile applications, describing their symptoms and medical history. Using sophisticated algorithms and vast medical databases, AI doctors can rapidly analyze the information and offer preliminary diagnoses or advise patients on appropriate next steps. This empowers individuals to make informed decisions about seeking further medical attention.



## Patient Monitoring and Management:

AI doctors excel in continuous patient monitoring and disease management. By integrating with wearable devices and IoT technologies, AI doctors can collect real-time data on patients' vital signs, activity levels, and medication adherence. This information enables timely interventions, personalized recommendations, and early detection of potential health complications. For instance, an AI doctor can identify irregularities in heart rate patterns and promptly alert patients and healthcare providers, facilitating proactive interventions.

## Health Education and Empowerment:

AI doctors are excellent educators, providing patients with valuable information about their health conditions, treatment options, and preventive measures. Through interactive conversations, AI doctors address patients' queries, debunk myths, and promote health literacy. Patients gain a deeper understanding of their health, enabling them to actively participate in their own care and make informed lifestyle choices.

# The Indispensable Need for ChatGPT in Healthcare

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*"The potential of large language models in healthcare is immense, but we need to be careful about how we use them. We need to ensure that they are used safely and ethically."*

*- Dr. Jane Smith, Chief Medical Officer, Acme Healthcare*

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Medical practitioners need precise communication because they must make important judgements quickly. The administrative demands of the healthcare industry, however, can be difficult to handle using conventional techniques like emails and phone calls. This opinion piece examines ChatGPT's potential uses for busy clinical experts, emphasising how technology can enhance collaboration and knowledge sharing and how it offers insightful information.

For example, Surgeons, particularly those from elite areas, encounter a variety of difficulties when it comes to patient care, research, education, and career advancement. Overwhelming these obligations might leave little time for efficient communication and collaboration, which are equally crucial within the community and play crucial roles in local practise settings. To guarantee coordinated and secure patient care, surgeons must effectively interact with their coworkers, the nursing staff, and other healthcare experts.

Furthermore, improvements in the field of surgery are powered by the community's sharing of knowledge, best practises, and research results. However, the difficulties of time limits, geographic distances, and diverse schedules may impede collaborative efforts and obstruct the efficient flow of information.

## Conversational AI & EHRs





Electronic health records (EHRs) and conventional messaging systems are commonly used in healthcare settings, including in the context of conversational AI. However, these technologies often have limitations when it comes to effective communication. For instance, email does not support real-time collaboration, and sharing extensive information over the phone is constrained. These challenges are not unique to surgeons but affect healthcare professionals in general.

The manual input required for EHRs adds to the administrative burden faced by physicians who are already overwhelmed with personal, clinical, and academic obligations. The widespread adoption of EHRs and associated insurance tasks has further increased the administrative strain on healthcare providers.

Consequently, finding efficient communication solutions becomes crucial as time spent on lengthy documentation and challenging invoicing procedures detracts from patient care and professional development. To address these challenges, innovative solutions are needed to enhance communication, reduce administrative duties, and promote collaboration among busy physicians.

## The Why & How of ChatGPT in Healthcare

ChatGPT can provide real-time support by providing succinct and contextually relevant prompts thanks to its extensive training data and language understanding skills. The outcomes of patient care are improved greatly by this functionality and decision-making.

Recognising that ChatGPT's replies are based on patterns and associations revealed from its training data is crucial. Despite our best attempts to give correct responses, there may be occasions when the data we provide is not totally accurate or current.



**Prompt:**

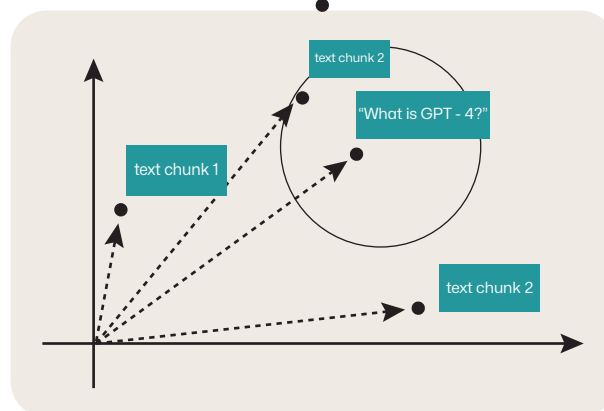
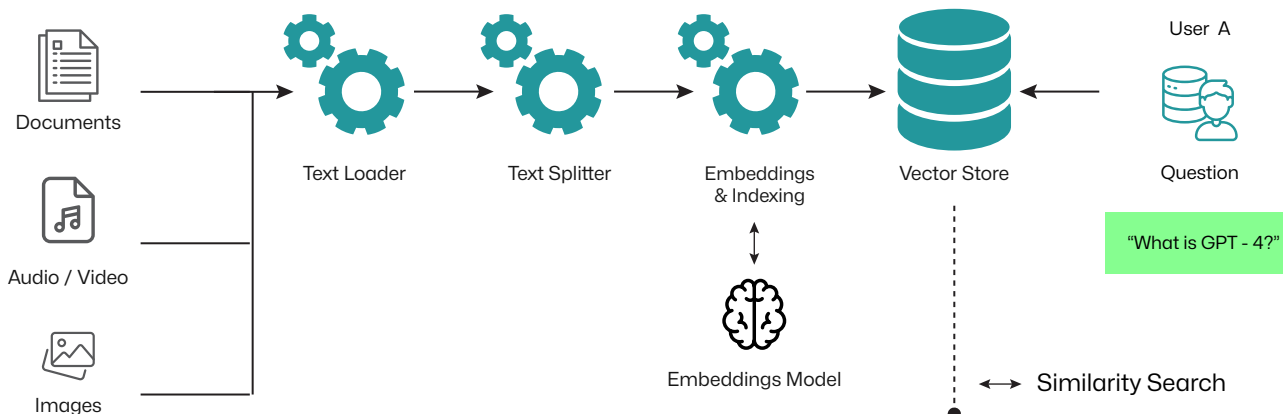
"You are a friendly chatbot. Answer the following question using only the information from the context."

**Questions:**

"What is GPT - 4?"

**Context:**

relevant text chunks





# ChatGPT & Patient Care – The Smarter Triage

Future uses for ChatGPT in the field of surgery include telemedicine, interdisciplinary collaboration, and surgical education. Knowing about these possibilities will help you better understand how ChatGPT is changing the way that surgeons do their jobs.

ChatGPT and comparable Large Language Models (LLMs) can help with retrieving research data, clinical practise recommendations, and case studies by properly configuring an internal network. Using ChatGPT, surgeons and other healthcare professionals can easily obtain the most recent developments in surgical research and evidence-based recommendations that are relevant to their sector.

By giving relevant words or the right prompt, ChatGPT assists in navigating the massive amount of information present in different resources, saving time and effort when looking for important clinical knowledge. Surgeons can ask for advice on difficult cases, specific surgical procedures, or suggested courses of therapy.

It is significant to remember that ChatGPT's training data determines the dependability and quality of the information it provides. The ability of ChatGPT to retrieve information from reliable and private sources can be improved by including vetted sources into the training data and implementing ChatGPT inside the patient context.

This development would necessitate careful evaluation and precautions because it has the potential to revolutionise information retrieval and decision assistance within that community.



## Essentials

**Patient-Doctor Encounter:** Patients and doctors sometimes have trouble getting enough time for consultations, which leads to hurried appointments and insufficient information sharing. Doctors can spend more time with patients by automating administrative activities with the aid of generative AI and LLMs. For instance, AI-driven chatbots can collect basic patient data like as symptom descriptions and medical history, allowing doctors to prioritise and concentrate on the most important elements during consultations.

**Health Plan Services:** Patients frequently struggle to comprehend and use their health plan's services, including navigating complex insurance terminology, processing claims, and understanding coverage specifics. Generic AI and LLMs can respond to frequently asked questions, offer individualised, simple-to-understand explanations, and help with questions about plans. By giving correct and timely information and lowering uncertainty and frustration, these technologies can improve the customer experience by utilising natural language processing.

**Buyer and Payee Services:** The management of billing queries, payment processing, and dispute resolution are among the customer service challenges faced by buyers and payees. Automation of repetitive chores, real-time payment updates, and the provision of individualised support through virtual assistants are all ways that generative AI and LLMs might speed up these procedures. In order to provide rapid and reliable customer support, these technologies can also produce automated solutions to frequently requested inquiries.

**Organizational Struggles in the New Age:** Businesses today face a variety of difficulties, including the need to adapt to quickly changing technologies, satisfy shifting customer expectations, and deal with cybersecurity issues. By encouraging innovation, boosting customer relations, and strengthening data security, generative AI and LLMs can assist organisations in overcoming these challenges. They may help organisations succeed in the digital age by assisting in the creation of personalised marketing strategies, analysing client feedback, and putting in place strong security measures.





## Adhering to HIPAA Regulations

When using Large Language Models in the healthcare sector, strict adherence to the rules outlined by HIPAA (Health Insurance Portability and Accountability Act) is essential. It is crucial to make sure that these models are implemented on a safe and legal IT infrastructure, such as private clouds within the organization's walls, virtual private clouds, or HIPAA-compliant cloud storage.

In order to successfully reduce the danger of any potential breaches, it is also required to carefully programme systems to automatically de-identify personal health information in the input and re-identify it in the output. In order to maintain compliance, organisations must also take care to make sure that these models follow data-sharing agreements and secure patient consent.

Addressing the crucial issues of Personally Identifiable Information (PII) and Protected Health Information (PHI) becomes essential as generative AI and language models advance. These systems prioritise data privacy and security using a human-written methodology. In order to ensure the proper management and protection of PII and PHI, solid frameworks are being built.

To avoid unauthorised disclosure, strict data anonymization procedures, tough access controls, and advanced encryption techniques are used. Additionally, ongoing initiatives are being made to increase openness and secure user permission, allowing people to maintain control over their





# Jumping in with a Focus on Business

Even when new technologies have clear advantages, spreading them throughout an organisation can be difficult, particularly if the innovation is disruptive to the way things are done now. Companies will develop the early successes, change agents, and opinion leaders required to enhance acceptability and propagate the innovation further, launching the transformation and reskilling agenda, by experimenting with generative AI capabilities.

A revolutionary revolution has begun, though it is still in its early phases, thanks to generative AI, especially Large Language Models (LLMs). Undoubtedly, the healthcare industry will make use of AI language model skills to improve patient care and advance societal wellbeing. It is crucial to keep up with the changing AI landscape and smoothly incorporate it into many sectors of healthcare in order to assure ongoing success.

Here are few use cases of application using the conversational system demonstrating how Large Language Models (LLMs) can support healthcare professionals in making accurate and evidence-based decisions.

## Use Cases

### Use Case 1

Many conversational systems lack the ability to generate coherent and contextually relevant responses, resulting in frustrating and ineffective interactions. This limitation hampers their usefulness in various domains, such as customer support, virtual assistants, and chatbots.



Furthermore, existing models often struggle with understanding complex prompts and fail to provide accurate and informative responses.

There is a need for an advanced language model that can effectively handle conversational tasks, including natural language understanding, context retention, and generating coherent and contextually relevant responses in time and extract summarization as needed.

## The Backstory

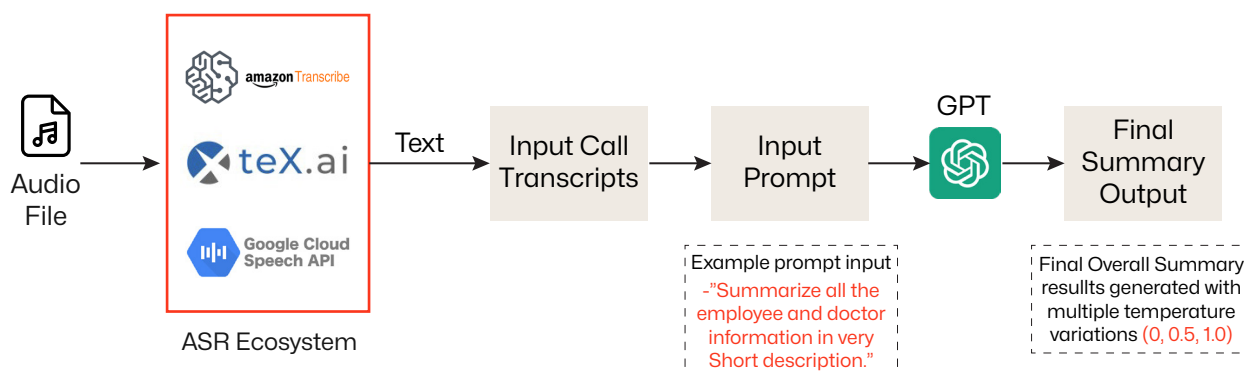
- Reduce the **Average Call Handling Time (AHT)** from 10 – 12 minutes per call to 6 – 8 minutes.
- Improve the **quality of call summarization notes** fed into the CRM

## Solution Summary

- Generated summaries of call transcript documents using text summarization API from OpenAPI GPT.
- Developed MVP using OpenAI GPT3.5 Davinci model to ingest the transcripts.
- Fine-tuned the model for best results for the business users prompts.
- Research on cost model for summarization – Considering audio length, token length and generation quality etc.

## Process Flow

Indium's Large Language Model, based on the GPT architecture, is equipped with domain knowledge injection, fine tuning, and pretraining capabilities. With its extensive training data like audio and text files, the model can accurately understand and interpret complex prompts across various domains.



By leveraging its conversational system, the model excels in generating coherent and contextually relevant responses, ensuring effective and engaging interactions with Healthcare Providers. Furthermore, its summarization ability condenses lengthy text into informative summaries, enhancing conversational system efficiency. Its transformation and text expansion capabilities further amplify its utility by generating creative and contextually appropriate responses to Healthcare Providers.

The model also supports prompt engineering by providing templates, serialization, and partial prompts. This enables users, including healthcare providers and patients, to customize and control the model's output. Indium's Large Language Model enhances conversational systems with improved understanding, response generation, and customization. This leads to more satisfying user experiences for both healthcare providers and

## Key Outcomes

- Quality of the summarization with **key facts/outcomes is improved** due to automated process.
- AHT is still being observed. Initial results show the overall time is **reduced close to 9 – 10 minutes**.



## Use Case 2

Current natural language processing models often struggle with inferring accurate information from incomplete or ambiguous text as the size of the data will be so huge in dimension, hindering their ability to provide comprehensive and reliable insights.

Additionally, the process of prompt engineering and avoiding prompt injection errors can be complex and time-consuming. There is a need for a powerful language model that excels in inferring and expanding text, while also providing efficient prompt engineering features to ensure reliable and accurate results.

## The Backstory

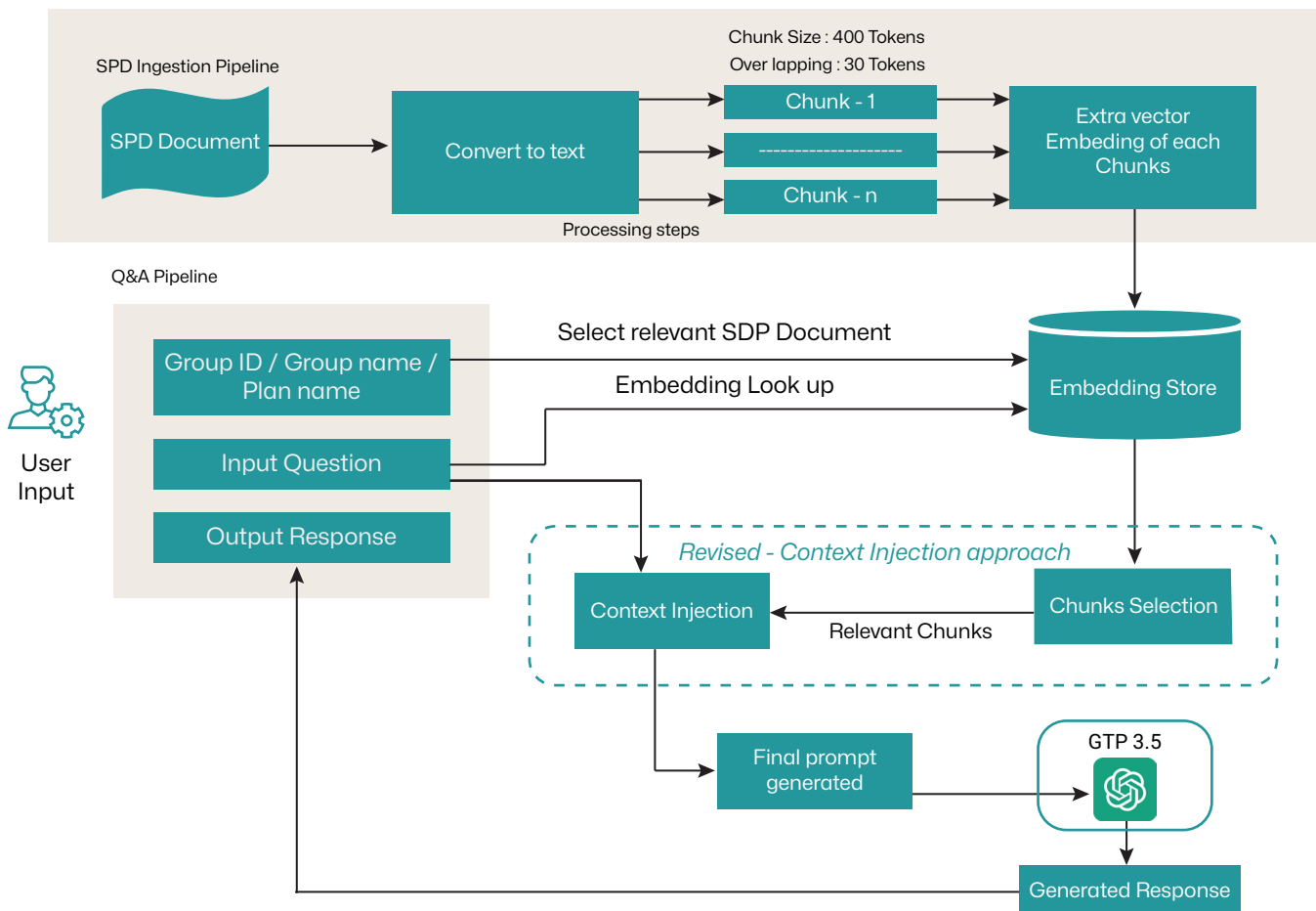
- **CSRs** are manually searching the benefit details from 1000+ documents every time they get the call.
- Call handing time is so high, leads to member dissatisfaction.
- Reduce the Average Call Handling Time (AHT) from 10 – 15 minutes per call to 6 – 8 minutes.

## Solution Summary

- Extraction of **Benefit grid data from Summary Plan Documents (SPD)** using GPT model.
- Built pipeline to read documents and used **overlapping chunking approach** to handle large document.
- Fine-tune base GPT model by training limitation.
- **Adopted Context Injection approach** to traverse the document to fetch the required details.



## Process Flow



Indium's Large Language Model, based on the GPT architecture, is adept at addressing challenges involving text inference and expansion. Leveraging its fine-tuning and pretraining capabilities, the model effectively deduces missing information, resolves ambiguities, and offers contextually fitting expansions.

For Customer Service Representatives, this meant quicker access to accurate information during calls. Its advanced prompt engineering, encompassing prompt templates, serialization, and partial prompts, simplifies generating desired outputs while minimizing prompt injection errors. As a result, Customer Service Representatives experienced streamlined workflows, and the AHT saw a significant reduction to 6 - 8 minutes, leading to enhanced member satisfaction.



By utilizing Indium's Large Language Model, healthcare providers, doctors, and patients can seamlessly incorporate additional details and context into their healthcare-related text. This process enhances the accuracy and comprehensiveness of the generated responses, addressing the challenges of incomplete or ambiguous medical information.

Moreover, the model's proficiency in avoiding prompt injection guarantees that the desired medical information remains intact without compromising the input's integrity. This feature ensures that the insights provided are dependable and trustworthy, benefiting healthcare professionals and patients alike.

Indium's Large Language Model empowers healthcare providers, doctors, and patients to overcome the complexities of inferring and expanding healthcare-related text. At the same time, it simplifies prompt engineering, leading to more reliable and accurate results in healthcare communication.

## Key Outcomes

- The POC is working as eligibility BOT now.
- Responding to 90% of the questions posed by the end users with accuracy rate of 99%
- AHT is still being observed.
- A few exclusion criteria aren't answered correctly, being worked upon.



## Conclusion

In conclusion, the importance of Language Model Models (LLMs) in healthcare cannot be overstated. As demonstrated in our white paper, "The Art of Augmenting Patient Experience: A Journey through LLM," LLMs, like ChatGPT, hold the key to a transformative healthcare landscape. The need for LLMs arises from the ever-evolving challenges faced by the healthcare industry. With the rising demand for patient-centric care, efficient decision-making, and seamless communication, healthcare providers seek innovative solutions. LLMs offer a powerful means to address these demands.

By integrating LLMs into healthcare, providers can tap into their potential for intelligent decision support, remote consultations, proactive patient monitoring, and empowering health education. These capabilities empower healthcare professionals to deliver personalized care and enhance patient experiences significantly.

Moreover, the seamless integration of LLMs with Electronic Health Records ensures optimized care processes and streamlined communication, leading to more efficient healthcare delivery. By adhering to data security regulations like HIPAA, healthcare organizations can confidently embrace LLMs while safeguarding patient information.

Here are some instances of how health care providers can benefit from employing LLMs in healthcare:

- **WHO** could offer grants or funding opportunities for healthcare systems that implement LLMs to enhance patient care, diagnosis accuracy, or improve communication with patients from diverse linguistic backgrounds.
- **HIMSS** might recognize healthcare systems that leverage LLMs to enhance patient engagement, develop personalized treatment plans, or implement advanced telemedicine solutions.
- It came to news that **JCAHO** could include LLM adoption as one of the criteria for accreditation, incentivizing healthcare systems to integrate language models into their patient care processes.





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## About Indium

Indium is an AI-driven digital engineering company that helps enterprises build, scale, and innovate with cutting-edge technology. We specialize in custom solutions, ensuring every engagement is tailored to business needs with a relentless customer-first approach. Our expertise spans Generative AI, Product Engineering, Intelligent Automation, Data & AI, Quality Engineering, and Gaming, delivering high-impact solutions that drive real business impact.

With 5,000+ associates globally, we partner with Fortune 500, Global 2000, and leading technology firms across Financial Services, Healthcare, Manufacturing, Retail, and Technology—driving impact in North America, India, the UK, Singapore, Australia, and Japan to keep businesses ahead in an AI-first world.

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