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Make Technology Work

NLP to Unlock the Potential of Data in improving outcomes of the Healthcare Industry

A Whitepaper

An Introduction to AI in Healthcare

Recent trends reveal the impact of artificial intelligence (AI) in every aspect of our lives. Perhaps, AI's most prominent role is its contribution to healthcare with various tools and intelligent systems to aid in disease prevention and bring automation to critical yet monotonous and time-consuming tasks. Furthermore, as the world witnesses a switch toward digitization, innovative healthcare with greater AI integration is becoming a priority amidst the goal of a sustainable future. Modern healthcare setups have broader data sources with many diagnostic devices, patient monitoring systems, and IT resources generating various patient-related data that can transform healthcare service delivery and enhance diagnosis and treatments.

In a healthcare setting, several data sources generate enormous amounts of unstructured data. Extracting and analyzing this healthcare data is challenging and requires advanced systems and models to help derive all the vital information to improve health outcomes.

But several healthcare facilities lack the resources to leverage such critical information to enhance healthcare services.
In this context, AI has the potential to bring in automation, reduce manual intervention and reduce efforts with real-time insights from data.

Many researchers investigating AI in healthcare emphasize its impact on various stakeholders in the healthcare industry, such as patients, clinical practitioners, the pharmaceutical industry, and insurance providers.

On careful observation, it is evident that AI has immense capabilities to contribute to a wide variety of healthcare applications, from clinical-decision support systems and virtual assistants, aiding in automated diagnosis from images to enhancing insights for drug discovery.

AI has also opened the playing field as its implementation is helpful for insurance players focusing on healthcare. These stakeholders benefit from AI in terms of faster insurance claim payments, better transparency between customers and insurers, and improved customer experience.

Likewise, when we consider other stakeholders like the pharmaceutical industry, AI integration in this industry has led to better study designs, reduced protocol development duration, and greater accuracy in identifying drug reactions.

At the heart of digital evolution, AI technology in the healthcare landscape is poised to make a significant difference in the future.

This whitepaper discusses various aspects of AI in the healthcare industry and how sub-branches of AI like machine learning, deep learning, and natural language processing (NLP) are steadily rising towards considerable advances.

Apart from that, we delve into some of the exciting and promising AI tools that forward-thinking stakeholders should leverage to evolve and improve the quality of services in the healthcare industry.

Natural Language Processing (NLP), can unlock the potential of unstructured data or data in the form of freeform texts of medical experts by deriving meaningful insights to achieve better, faster, and more accurate clinical decisions. Though NLP is still evolving, it has shown tremendous capabilities to help organizations across industries to be able to do more with their data.

NLP Boost for The Healthcare Industry: A Game Changer

Healthcare has become an analytics-driven industry in recent years as they have identified the capabilities of advanced automated systems and technologies for better healthcare delivery. At the same time, new diagnostic devices generate a tremendous amount of critical data, but it is complex due to various factors related to their sources and storage locations. Growing research has unlocked NLP systems' potential to extract helpful information from diagnostic devices and EHR records and even incorporate speech recognition capabilities to achieve a cost-effective approach to delivering healthcare services.

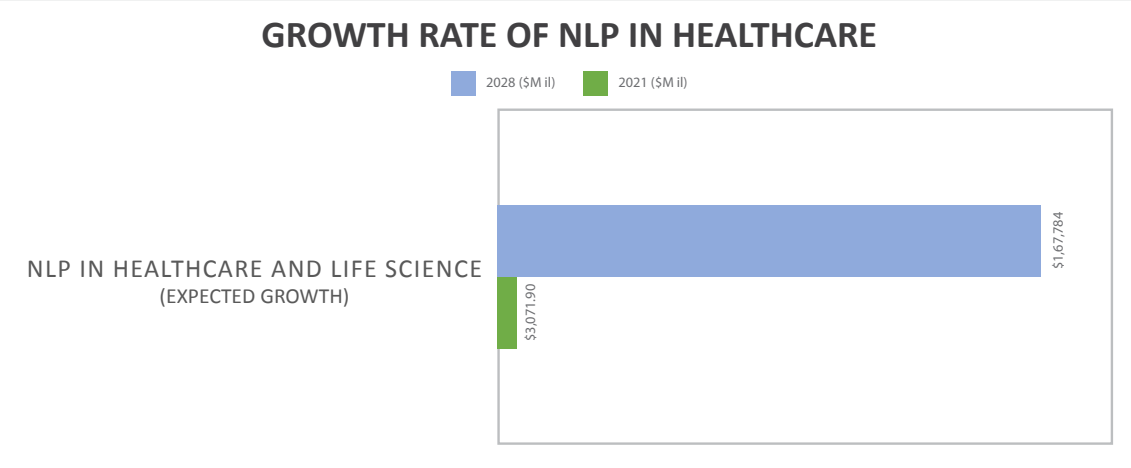


Figure.1: Expected Growth of NLP in Healthcare. Source

According to Coherent Market Insights, the global NLP in the healthcare and life sciences market is valued at $3071.9 Million in 2021, with expected growth of $1.68 Billion by 2028, exhibiting a CAGR of 27.4%. While healthcare has made significant progress in the past decade, patient safety remains a critical area that must be addressed.

To improve patient safety and enable accurate treatment delivery, NLP tools help automate extracting essential information from a large volume of clinical data. These NLP tools are helpful in text extraction, identifying relevant patient and disease-related information from several handwritten clinical documents.

NLP is effective for healthcare practitioners in daily tasks as it can be used to perform text classification and summarization to create appropriate groups of similar text genres according to the patient information about treatments, surgeries, and post-treatment follow-up records.

In addition, these NLP systems can help predict the prognosis of the disease by determining the risk scores of a particular patient for better-informed decisions in a clinical setting.

As we aim for better and more intelligent healthcare solutions, NLP tools can help reduce manual effort to extract meaningful information from the sheer volume of daily healthcare data.

But, using NLP is not restricted to deriving information as it can contribute immensely to reducing the rate of misdiagnosis and improving patient safety and the overall delivery of clinical services effectively.

What are healthcare organizations doing?

The most critical aspect of healthcare services is improving the quality of primary healthcare services. A recent paper discusses that primary care is the most promising area where AI can excel on an ambitious scale.

The research highlights that AI can free up the cognitive space of physicians with automation and help shift their focus from transactional and daily tasks to solely focusing on personalized patient care[1].

Becoming digital in a healthcare setup does not mean setting up a computer network but integrating technologies like AI to help achieve better primary care facilities, timely access to information, and lower operations costs to deliver more affordable healthcare services.

Radiology & Imaging Studies

Machine learning and deep learning algorithms are continuously evolving to address radiology and medical imaging problems.

The aim is that these advanced algorithms can be trained to process multiple scans and provide accurate disease information to allow specialists to treat critical cases faster.

For example, not only the diagnosis but AI algorithms are proposed to help process mammography results faster to help in accurate screening for breast cancer and assist radiologists in diagnosing and classifying various diseases with greater accuracy and efficiency.

According to the American Cancer Society, mammogram screening yields a high percentage of false-positive rates leading to several healthy women being informed about breast cancer possibilities[2]. But using AI has significantly improved mammogram interpretation with 99% accuracy and at a 30 times faster rate than a physician[3].

Bots as Virtual Nursing Assistants

Although AI cannot replace the expertise of a human nurse, NLP-based chatbots have immense capabilities to process human inputs. These virtual assistants can reduce the workload of physicians and administration by employing these bots to help improve the communication flow between patients and healthcare providers. Patients can gain information on specific health conditions and plan their travel if the symptoms seem severe. In addition, the increasing use of smartphones and websites for booking appointments and even conducting online consultations provide tremendous opportunities for NLP integration.

What does Indium do for Healthcare providers

One of our clients developed a special olfactory sensor that can record the different elements present in the air. Indium provided an AI/ML solution to read the streamed data from the olfactory sensor and classify the sensory patterns to determine the presence of abnormalities in the air.

The model can determine if there is gunpowder/nitroglycerine in the air and trigger alerts to the monitoring team to avert any issues that compromise public security measures.

The model is being expanded to enable the detection of potential cancer-related growth based on the sensory data gathered from dogs trained to detect abnormal growth of cancerous cells. Indium is supporting the client by providing the technology solution for their primary research in the field.

Pharmaceuticals

Drug discovery is an expensive process where only a few potential medications successfully reach the market. Given that drug development requires better success rates, pharmaceutical industries are rapidly integrating AI to speed up drug discovery. AI technologies help derive critical information about the disease's biological aspects and identify patterns. This results in minimizing manual interventions and building hypotheses faster than several experimental phases to determine medication outcomes.

Clinical Research

Clinical trials are most successful when there is a proper balance of cost factors, timelines, and operational efficiency. Although healthcare data helps speed up the process, these studies require significant considerations for the regulations, payers, and patient data.

Therefore, leveraging machine learning techniques and NLP tools result in reduced study cycle time and higher efficiency during the entire development lifecycle.

Clinical developments are often critical and require high manual processing of structured and unstructured data during clinical trials.Therefore, many pharma companies are looking for NLP tools to deal with such challenges.

In addition, these clinical trials involve physician notes, pathology reports, diagnostic and surgical reports, and historical patient data acquired from electronic medical records (EMR).

In such scenarios, NLP tools help discover and match data with chemical reactions, dosage information, and patient information to identify potential clinical trial participants.

At the same time, NLP allows the construction of the textual representations of biochemical entities, maps various interactions between diseases, bio-macro molecules, and chemical compounds, and predicts the molecular properties more efficiently[4].

What do we do for our customers

Indium has helped a leading Clinical Trial Organization to redact PII / PHI data from medical trials reports with almost 100% accuracy.

Health Insurance and Payers

The insurance industry is continuously evolving, and events like the Covid-19 pandemic have created additional pressure on professionals. A recent report on sustainable growth and living by Accenture suggests that 64% of the time, customers shift brands to seek relevant products, services, or better experiences. This approach is far more prevalent in the insurance industry, which requires insurance payers to be more agile to accommodate customers' changing needs due to various circumstances. To do that, insurance payers require a customer-centric mindset to identify different behaviors and new approaches to help meet diverse needs[5].

Consequently, insurance payers look to integrate AI technologies like NLP to equip themselves to achieve better predictive analytics and gain insights into changing consumer needs, behaviors, and patterns.

To understand insurance payers' perceptions about the benefits of integrating AI technologies, Morgan Stanley, one of the largest US banks, suggests that the early adopters of automation have been the finance and insurance service sectors as the opportunities are higher.

The reports further state that these mature industries have immense data volumes resulting from significant customer interactions and legacy systems. In such cases, automation using AI technologies can facilitate claims processing and a host of time-consuming processes.

"Gartner report forecasts that the global market of technology comprising robotic process automation, AI and virtual assistants will enable hyperautomation with an expected growth of $596.6 billion in 2022"[6].

But we will focus on the primary question of how automation will impact the insurance industry. One of the most recent surveys by WorkFusion reveals that automation technologies such as

AI have tremendous potential and have several expected outcomes such as creating new jobs, better integration between systems, customer onboarding with the help of chatbots, and allowing personalized services.

In addition, WorkFusion suggests that some of the critical areas that will benefit from intelligent systems and automation include claims processing, policy management, regulatory compliance, and underwriting[7].

At the same time, similar forecasts by Morgan Stanley on automation suggest insurance industries can benefit in terms of policy administration, claims management, price comparison, redemption processing, fraud detection, underwriting, debt recovery, funds transfer, deceased notifications, and several more.

Similarly, the report highlights how these automation technologies can be incorporated into healthcare for patient registration, claims administration, customer complaints handling, fraud prevention, administration and reporting, and revenue cycle management[8].

Health insurance payers generally consider health records for reviewing multiple business processes. But this includes manual investigation of a vast amount of unstructured medical data that are labor-intensive and require a significant investment of resources on staff and time, resulting in an overall higher cost of operations.

Similarly, most insurance companies can benefit from augmented intelligence by gaining deeper insights to streamline business processes. Thus, NLP techniques have become increasingly popular among insurance payers.

Figure.2: Benefits of Automation in the Insurance Industry. Source

By implementing NLP, unstructured data from texts, PDFs, customer support transcripts, EHR, and medical records are evaluated and analyzed faster to extract insights about customers within a fraction of the cost and time. In particular, NLP benefits encompass a wide range of operational tasks in the insurance industry, such as:

1. Virtual assistance to create a personalized experience for insurance customers.
2. NLP technology explores faster in terms of speech and text than humans, mitigating human errors and improving claims management significantly.
3. NLP is an effective tool for underwriters to extract information, identify the risk level, and analyze various policies and documents to reach a fundamental conclusion. For healthcare insurance, NLP tools help extract essential information about patients' names, dates, locations, and diagnostic results quicker without parsing multiple documents.

What do we do for our Insurance / Payers customers?

We have helped multiple customers improve their claims processing by extraction of drugs details from benefits records and matching them with submitted claims, extraction of billing data from scanned records, etc. helping them reduce manual intervention by upto 60% with 95% accuracy.

Safeguarding Digital Patient Data

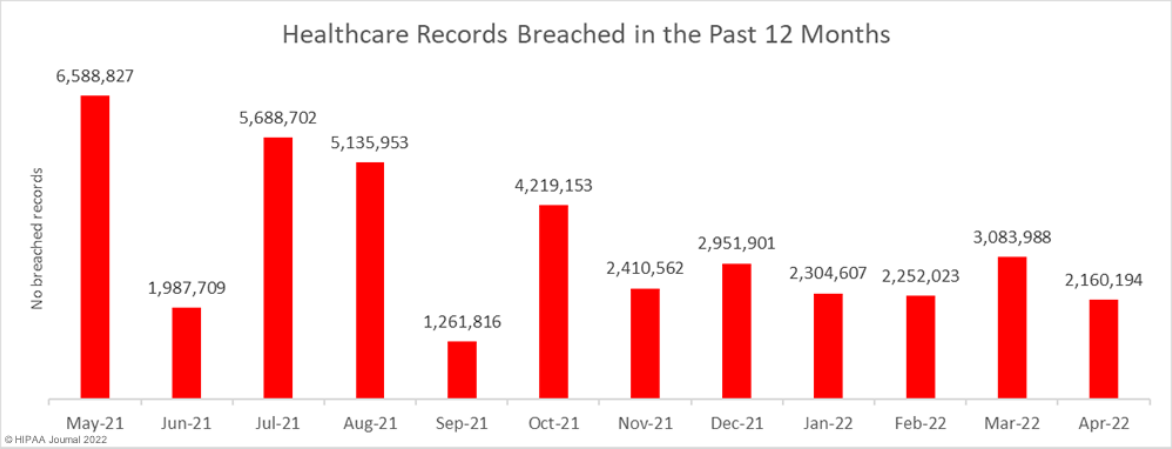
Most digital integrations in the healthcare industry have led to data digitization. But these advances have not gone unnoticed by regulatory authorities across countries. Now, there are stringent regulations in safeguarding the privacy of patients' healthcare records due to apparent reasons for sensitive information falling into the wrong hands.

In this regard, healthcare compliance and Protected Health Information (PHI) necessitate the protection of patient data from data breaches. PHI, defined by Health Insurance Portability and Accountability Act (HIPPA), specifies that any record that allows associating a person based on their identity to their healthcare records is a valuable asset and must be safeguarded to prevent cyber attackers use or selling on the dark web for money.

This medical information is disclosed without consent. According to HIPPA and Health Information Technology for Economic and Clinical Health Act (HITECH), protecting PHI is a serious concern because these regulatory authorities have laid out general guidelines and steps to implement protection policies for protecting healthcare information[9].

Recent trends reported in HIPPA journal suggest one of the most significant healthcare data breaches was reported in April 2022. Millions have been impacted by these breaches, and several healthcare providers suffered malfunctions and disrupted systems allowing hackers to access a significant amount of healthcare.

While safeguarding healthcare records entails cybersecurity solutions, NLP technologies have tremendous potential to scan and identify if the healthcare information is stored per the PHI guidelines to present data integrity with appropriate masking and encryption.



What have we done?

Indium has helped multiple customers including organizations such as a leading global provider of third-party medical data for research, a leading clinical trial organization to redact PII/PHI data from medical documentation with ~95% accuracy.

Closing Thoughts

The healthcare industry is witnessing a paradigm shift towards intelligent solutions to help tackle various problems in the healthcare space. Embracing powerful tools with boosted capabilities due to machine learning and NLP techniques helps in different ways in the industry. AI is beneficial for multiple stakeholders in the healthcare industry. Whether as a tactical approach or to facilitate better customer services, clinical services, and management and clinical development, a strategic view to integrate AI helps healthcare organizations carry out various operations effectively. Leveraging AI, machine learning, and NLP equip healthcare organizations to gain critical insights into patient and risk management and improve primary care services. Similarly, by using AI, pharmaceuticals can accelerate drug discovery at lower costs and risks, making it vital in clinical development.

This begs the question: Are AI, ML, and NLP the future of healthcare?

To answer this, AI still has its challenges, but by following the standards and protocols, a multidisciplinary environment with more accountability can help tackle them. But the proven promise and the immense potential of AI in accelerating various aspects of the healthcare industry make it an effective catalyst for change and digitization of healthcare services and their delivery.

How can we Help?

At Indium, we offer solutions that allow organizations to innovate confidently because we value your business. The only way to organize and manage better is to innovate and stay ahead of the curve. Therefore, we provide uniquely engineered solutions to make them applicable to organizations.

What do we offer?

Our digital accelerator teX.ai, offers a robust NLP-based solution for your data-centric challenges and helps you gain better and faster actionable insights to transform your operational workflow.

If you are a stakeholder in the healthcare industry, teX.ai can help accelerate your business by leveraging organization specific content. teX.ai & help you gain insights from your data to transform healthcare service delivery.

Get in touch with us to learn more about teX.ai and how it can benefit your business.

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