

# An Efficacy of Artificial Intelligence Applications in Healthcare Systems—A Bird View



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**Abstract** Increasing statistics and the availability of computing power have led to significant expansion in the way of (AI), and artificial intelligence (AI) technology and its implementation have been flooded with media publicity. Out of five, four executives are agree that AI is a reasonable time for a corporation, but only about one in five has integrated AI into any offering or process. AI is fully integrated into the offering or process by only 1 in 20 people. There is a slit between expectations and behavior, and now, we are in the first stages of adopting artificial intelligence in the enterprise. This paper surveys the path that companies require to complete this gap and build their AI capabilities to maximize the value of this troublemaking skill. AI is considered as a promising tool to support health management and is essential change in treatment. Artificial intelligence primarily denotes the surgeons and health centers that analyzes huge datasets of possibly life-saving data through artificial intelligence systems. These systems have multiple uses in clinical laboratories, hospitals, and research institutions. It provides an overview of AI applications for improving patient flow to and within the hospitals.

**Keywords** Artificial intelligence · Machine language · Patient flow · Predictive modeling · Patient nursing · Healthcare information

## 1 Introduction

As early as 1956, John McCarthy and his colleagues Marvin Minsky, Claude Shannon, and Nathaniel Rochester invented the jargon “Artificial Intelligence.” Additionally, AI is termed as the science and technology used to create intellectual apparatuses. AI states the programs done by the computers that perform tasks such as especially intelligently, human intelligence, and self-sufficiently. The key goal of artificial intelligence is to advance machines that can demonstrate human ability.

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**Fig. 1** Representation of healthcare system

AI is seen as a capable device to support healthcare management. After a long study, we show that artificial intelligence systems have the ability to keep patients low, which can improve medical care by reducing the organizational burden of health centers. AI is not only the job done by the robots and making humans obsolete. AI in medical aims to help healthcare institutions and shareholders to manage huge amounts of information and turn it into possibly life-saving data. In spite of the benefits, artificial intelligence claims in health care remain to look major tasks. This overview focuses on the part of artificial intelligence in managing the patients and predicting patient admission to hospitals.

KP (Kaiser Permanente) started in 1945 created in Oakland, California, one of the leading American health care provides a non-profitable health plan. The main aim is to offer first-class and reasonably priced facilities to health care which helps in improving the health of our societies and the members we assist. In 2017, there were 11.8 million associates, 211 thousand staffs, \$72.7 billion in operating income, 39 medical centers, 682 clinics, and many other services. Figure 1 depicts the representation of various parametric aspects of healthcare system.

## ***1.1 Problems***

Hospitals today face many challenges that strain the capacity of existing beds and services and increase the need to improve patient movement administration. It includes the increased demand for facilities, lack of medical tools, staff, and technologies to properly manage patient flow and measure the risk of reduced patient numbers by extending hospital visits, availability. It includes a reduction in beds.

With the aging population of the United States and accelerating advances in medical skills, the demand for beds in patients is expected to increase nearly about 4–5% every year. Increment in supply is not putting pace. In short, medical centers require to control this appeal smarter.

In order to manage these problems, medical centers have traditionally used very top-down basic prediction methods. This is to identify the number of patients flowing through different channels and to see trends in time series and history.

## 2 Objectives

KP (Kaiser Permanente) aligned with provider soothing artificial intelligence to improve enduring movement models and anticipate the following to deliver visions for actual conclusion creation besides tactical arrangement.

- **Demand of Bed**—KP will predict the bed demand on an hourly basis and in actual period.
- **Safe Recruitment Levels**—medical facilities need to maintain a secure recruitment to serve patients.
- **Hospital Congestion**—once a time came when hospitals demand cannot be met by current capacity—when hospitals enter a “gridlock” situation then it took a lot of time, money as well as effort to come out of it.

## 3 Literature Review

The team began by investigating the way that inspires patient movement, by determining and answering questions. As we saw that the important issue was number of entrances from various doors of entrance—between which the Emergency Department (ED) entrances were the trickiest as everybody might arrive through the gates, a system is required to manage the crowd in an efficient manner [1]. Artificial intelligence in neuro sciences: A clinician’s perspective. Now a day, AI acts as a very important character in the field of neuro science in the different way of laser operations as well as surgery. Other factors included the arrival of time (hour/day/whether holiday) also the entrance speciality like oncology, cardiology, etc., and various other factors.

Once the team were trying to get this data, it exposed that nearly most of relevant factors such as acuity level of the patient, pain, and ongoing treatment were only available within free text medical notes. All notes are really dependent on the willingness and capacity of the people those who is documenting the notes; standards and nomenclature for these notes vary from facility to facility. These feature some abbreviations and nonstandard language. Juhn and Liu [2] invented the concepts of AI approaches using natural language processing to advance EHR-based clinical

research. Electronic health record (EHR) is necessary to keep the health records of a particular patient according to their diseases.

So, the challenges faced by the team were how to solve value from these notes, which is a natural language processing (NLP) problem. Tealby and Kulkarni [3] invented an approach on Spark NLP in action, which explains the improvising the patient flow forecasting using Kaiser Permanente.

Mesko et al. [4] were trying to know that the artificial intelligence will solve the human resource crisis in health care. KP approved the idea of a data factory, i.e., a stage that takes a pipeline outlook, by linking data of the producers to consumers and analysts [5]. They describe the potential for artificial intelligence in health care. Upcoming healthcare journal makes us to know the importance of artificial intelligence in life of human being by making the way of life so easy. Lin et al. [6] introduced 10 various methodologies by which the artificial intelligence will transform primary care into the secondary care with the help of AI. Analysts, engineers, data engineers, data operations, and scientist all peoples have their characters in the pipeline. Esteva et al. [7] invented a guide to deep learning in health care. A knowledge based on independent mobile robotic-assistive care given to people. Nadikattu [8] it tells that artificial intelligence in cardiac management has help the doctor to do the cardiac treatment in an easy way with doing major operations.

The platform lectures all queries related from how to productionize the model to how to get the data and addresses numerous challenges related to technical debt.

## 4 Methodology

Let's come back to the genuine NLP problem. Understanding ordinary language is difficult because languages could be subtle, ambiguous, appropriate, and media specific. See the three ER triage note examples below. Neither mentions the word "pain" or "patient," but it is the kind of language that the organization processes and these are information about how to extract symptoms. What kind and severity of pain started, where it occurred, and what the patient tried at home for solving this kind of problem need adding two healthcare exact components sourced from <https://www.johnsnowlabs.com>.

- Information: 300+ expert curated, linked, clean, enriched, and up to date datasets (including things like measures, clinical guidelines, terminology, etc.)
- Custom Procedures: Health specifies NLP annotators (e.g., doing entity recognition, word embeddings, sentiment analysis, etc.).

KP desired to privilege state of the art performance for this problem. If you need to do state of the art, you have to study up on academic literature to find out what that really is. The entire group was spending time on this initiative. Next, the team predicted that what they required to create and in what way they could create it on a large scale. Some can be reproduced well; others are not from academic

investigation. The following image displays the three working mechanisms that the squad constructed and their inspiration for academic investigation.

#### ***4.1 Analytical Demonstrating AI in Health care***

AI has multiple uses in treatment, including clinical laboratories, hospitals as well as research institutes. Healthcare management and clinical decision support, operations, healthcare predictions, patient monitoring, and healthcare interventions are key areas of application of AI.

Predictive modeling is a preventative step in health care to identify ill people at own risk of illness as well as side effects. The most familiar AI predictive models are the patient introduced into emergency department—admissions into emergency department disease or other outcomes and in-patient monitoring. An integrated patient monitoring system is used in combination with AI components for assistive decision-making.

Curtis et al. developed a combined wireless system, the Scalable Medical Alert Response Technology (SMART) system to watch over the unattended ambulatory patients. This gadget changed into included with Wi-Fi affected person video display units along with saturated oxygen, electrocardiography, geo-positioning, focused alerting, sign processing, and a Wi-Fi boundary for caregivers. Embedding AI system inside healthcare data systems can be helpful because of its potential toward improving patient's outcome, particularly in busy sections along with the emergency department. A new Web-based patient support system has been started to reduce the fee of treatment and improve the quality of life of patients. This Web-based patient support systems are planned to allow patient-centered decision-making and physician-centered health monitoring. Researchers have advanced scoring set of rules to predict cardiac arrest and severe cardiac headaches in sufferers with chest ache in emergency section.

## **5 Key Factors**

The team began by investigating the way that inspires patient movement, by determining and answering questions.

An important factor was that it is difficult to predict number of arrivals from various ports of entry. Among them, the arrival of the emergency room (ED) was the most difficult because anyone could go through the door. Other factors include various factors such as arrival time (time/day/holiday) and hospitalization target (oncology, heart disease, etc.).

Therefore, there were more challenges for the team members to unleash the worth of these notes. This is a natural language processing (NLP) issue.

## **6 Benefits of AI in Health care**

Nearly, the potential benefits of AI in healthcare systems are explained in the below sections.

### ***6.1 Providing a User-Centered Experience***

AI uses large datasets and machine learning to enable healthcare organizations to gain faster and more accurate insights, increasing satisfaction for both in-house and service providers.

### ***6.2 Improvement of Operational Efficiency***

AI technology helps healthcare organizations maximize data, assets, and resources, increase efficiency, and improve clinical and operational workflows, processes, and financial performance by examining data patterns.

### ***6.3 Various Healthcare Data Connections***

Health data are often used in a variety of formats. Using AI and machine learning technology, businesses can connect heterogeneous data to create a more unified image of the people behind the data. The benefits of AI in healthcare systems are modeled diagrammatically in Figs. 2 and 3, respectively.

## **7 AI Applications in Health care**

Artificial intelligence has proved that the medical industry is useful for identifying connections between deploy surgical robots, genetic codes, and even maximize hospital proficiency.

### ***7.1 Supporting Clinical Decisions***

It is very exciting for medical professionals to consider all important information when diagnosing a patient. As per result, this leads to a search for several complex



Fig. 2 Benefits of AI in healthcare systems



Fig. 3 Patient self-service benefits with AI assistance

amorphous notes stored in health records. Any single error in tracking any relevant fact can endanger the patient’s life.

With natural language processing (NLP) support, physicians can easily find out all the relevant data from patient reports. AI can store and process large amounts of data. This provides all the data, facilitates individualized testing and recommendations for each patient, and helps improve clinical decision support. This skill can be trusted by doctors for aid in sensing risk issues over unstructured notes.

## 7.2 *Improving Primary Care and Triage with Chatbots*

People tend to make appointments with their GPs with minor threats and medical concerns. This is often curable with false alarms and self-medication. Artificial intelligence enables the easy movement and computerization of primary care and allows physicians to worry about extra important as well as worse cases. Patients can save money on avoidable doctor visits and took an advantage of medical chatbots. Medical chatbots are the services powered by AI with intelligent systems which answer all health-related questions and concerns instantly, while showing you how to manage potential risk issues.

These chatbots are available 24/7 days and can treat number of patients at the similar period of time.

## 7.3 *Robotic Operation*

Artificial intelligence and compound machines have transformed operation in terms of depth and speed while making slight cuts. Machines do not feel uneasy, eliminating the problem of tiredness during important time-consuming procedures.

AI machines can use the information from earlier surgery to develop the new operational approaches. Careful use of the machine reduces the possibility of vibration and accidental movement during operation. An application of robotic operation in surgery is represented in Fig. 4.

Some samples of robots designed for surgery include vicarious operation, which combines practical certainty with artificial intelligence-enabled robots to enable surgeons to execute slightly invasive surgery and heart, a small mobile robot developed by Carnegie Mellon University's Faculty of Robotics. There is a lander and the heart. AI is intelligently useful for robotic surgery.



Fig. 4 Representation of robotic surgery



## **7.4 *Virtual Nursing Assistants***

The AI system allows virtual care assistants to perform tasks ranging from interacting patients to guide them toward the better as well as most actual care unit. Available 24/7 day, these virtual nurses can answer questions, watch the patients, as well as give immediate results.

Today, several artificial intelligence-powered virtual nursing assistant requests allow for additional regular connections among patients and nurses, and it reduces the unnecessary hospital visits of doctor. Care Angel, world's first computer-generated care associate, can also give health checks via vocal sound and artificial intelligence.

## **7.5 *Support for Exact Diagnosis***

The ability of AI is to exceed doctors, helping them predict, detect, and diagnose illnesses extra exactly and quickly. Similarly, AI algorithms have proven not only accurate in professional-level diagnostics, also cost-effective in detecting diabetic retinopathy.

For example, Path AI is emerging machine learning technology to help pathologists to make more perfect diagnoses. The current goals of companies are to include reducing cancer diagnosis errors and emerging personalized therapies.

Buoy Health is based on AI which is used to check symptom and treatment that uses algorithms to diagnose and treat illness. It is convenient here. Chatbots listen to a patient's health concerns and symptoms and guide the patient to appropriate treatment based on the diagnosis. It helps them get in touch with the relevant departments.

## **7.6 *Minimizing the Burden of Using EHR***

Electronic health record (EHR) has played a vital character in the digitalization path of the medical industry, but the changes have led to endless documentation, cognitive overload, and user experience. Many problems have occurred related to tension. Electronic health record (EHR) inventors were using AI to generate more instinctive boundaries and systematize some of the routine processes that take up most of the operator's time.

Speech dictation and recognition can help in improving the clinical documentation process, but natural language processing (NLP) tools can't be very advanced. AI can also help handle regular inbox requests. It also helps you prioritize tasks that require your doctor's attention and make it easy for the users to work with their to-do list.

## 8 Conclusion

Ultimately, the team wanted to demonstrate improvements beyond the baseline in forecasting hospitalization demand for emergency room (ED). This was an important prediction point for hospitals, as ED is a placeholder, but, for example, planning surgery and transfers from other hospitals as shown in Fig. 5.

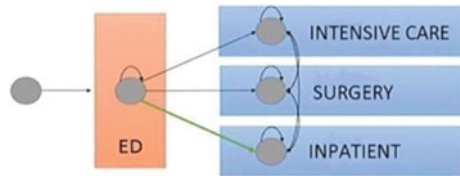
The baseline is predicting human manual—what a huge majority of hospitals do, i.e., they talk people, and have number of meetings per day. The team saw that it was quite easy to beat this by using designed data. The structured data are represented in Fig. 6.

But, while using designed data improves the performance versus human manual prediction, the more important uplift came from adding features from the unstructured clinical notes.

Figure 7 shows the features extracted from natural language text.

This paper deals with reflecting various applications of healthcare systems using artificial intelligence techniques, which gives a detailed information to the society in various aspects. But, this article won't explain about the algorithms of AI techniques, implications, and implementations of algorithms are not the part of this paper. It is planned to resolve this drawback in the future studies.

**Fig. 5** Request predicting of admission from the emergency department



### Features from Structured Data

- How many patients will be admitted today?
- Data Source: EHR data

Reason for visit	Current wait time
Age	Number of orders
Gender	Admit in past 30 days
Vital signs	Type of insurance

**Fig. 6** Designed data

**Fig. 7** Features extracted from unstructured data

### Features from Natural Language Text

- A majority of the rich relevant content lies in unstructured notes that are contributed by doctors and nurses from patient interactions.
- Data Source: Emergency Department Triage notes and other ED notes

Type of Pain	Symptoms
Intensity of Pain	Onset of symptoms
Body part of region	Attempted home remedy

## 9 Future Scope

The AI has the better future in medical outcomes achieved by the advance treatment and more perfect diagnosis, as well as more known and engaged patients authorized with easy access to healthcare support and more effective administrative processes using robotic credentials and coding algorithm.

In future advances, decision support systems in assistance with clinical lab reports, helping primary and emergency aid for patients, incorporating the robotic assistance in healthcare systems, monitoring the diagnosis with the help of virtual nursing assistance, and minimizing the manual documentation of the patient records can be improvised to the next level of implementation, that in turn results in fully automated framework without intervention of the clerical staff. These automated operations are more accurate, appropriate, and efficient than the conventional way of maintaining records.

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