



# THE IMPACT OF ARTIFICIAL INTELLIGENCE IN MODERN HEALTHCARE SYSTEMS

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## Abstract

Artificial Intelligence (AI) is an area of computer science that simulates the structures and operating principles of the human brain. Machine learning (ML) belongs to the area of AI and endeavors to develop models from exposure to training data. Over the past few years, the term "deep learning" has firmly worked its way into business language when the conversation is about Artificial Intelligence (AI), Big Data and analytics. And with good reason – it is an approach to AI which is showing great promise when it comes to developing the autonomous, self-teaching systems which are revolutionizing many industries. It is generally believed that AI tools will facilitate and enhance human work and not replace the work of physicians and other healthcare staff as such. AI is ready to support healthcare personnel with a variety of tasks from administrative workflow to clinical documentation and patient outreach as well as specialized support such as in image analysis, medical device automation, and patient monitoring. While there is still much to overcome to achieve AI-dependent health care, most notably data privacy concerns and fears of mismanaged care due to machine error and lack of human oversight, there is sufficient potential that governments, tech companies, and healthcare providers are willing to invest and test out AI-powered tools and solutions. Various fields of Artificial Intelligence (AI) that enables machines to understand and communicate in natural language, like humans do. It involves using algorithms and techniques such as machine learning, deep learning and text analytics to interpret and analyse natural language content from audio recordings, documents, images or other sources.

**Keywords:** Artificial Intelligence, Natural Language Processing, Healthcare, Medical Operations, Health conditions.

## 1. Introduction

Imagine a world where doctors can work alongside with machines. [1-5]The machines in this context is Artificial Intelligence. AI plays a more significant role than expected in the field of healthcare. Not only it helps in surgeries, but it can also be applied in several other contexts like predicting the outcome of a prescription based on the patients parameters and analysing the patients data. In daily life, AI helps doctors make more accurate diagnoses by rapidly analysing medical images as well as test results. [6-15] It also forecasts possible responses to different conditions and therapies by understanding the unique medical backgrounds of each patient. Moreover, AI improves hospital operations efficiency, manages the patients' records and performs precise conduct. The routine administrative tasks thereby helping health professionals spend more time caring for their patients rather than doing paperwork. [26-20].

In addition to direct clinical applications, AI can be applied in personalized medicine to scrutinize vast amounts of genomic data in a bid to find a genetic predisposition to a specific disease. Treatment plans pertaining to the unique genes of a patient will, therefore, be created, tailored respectively. Such personalization leads to more effective treatments with fewer side effects, greatly improving patient outcomes. [21-30] Additionally, AI-driven predictive analytics enables the risk profiling of patients likely to contract chronic diseases; this can be taken care of at an earlier

stage with proactive management so as to prevent or slow the progression of diseases and hence reduce healthcare expenditure.

Advancement while, on health, through the development of telemedicine and remote monitoring, patients will be afforded consultations from their homes and continuous health monitoring made possible by AI-driven platforms.[31-40] These systems can analyse the data from wearable devices to warn the healthcare provider about any critical change in the condition of the patient to proactively intervene. Thus, improving not only convenience to the patient but also access to healthcare, particularly in remote or underserved areas.[41-45] It gets enhanced in terms of providing more qualitative care and makes the system more resistant and adaptive to the changing needs of the population by embedding AI into different facets of the healthcare ecosystem.

## 2. Literature Survey

There have been related works several studies and research papers published on the use of AI in healthcare, addressing both the benefits and the potential challenges. Some of the related works in this area include: "Artificial intelligence in healthcare: transforming the practice of medicine." By Bajwa Junaid, et al[1]. The article discusses how AI will revolutionize the field of healthcare and discusses how it will be used to predict and analyse data. Advantages talked about are improved diagnostic accuracy, personalised Treatment plans And Enhanced patient outcomes.

Sean Ekins[4] who wrote in his paper discusses how it is easy to handle and analyse large amounts of data using machine learning, whereas A. Lavecchia[6] in his article discusses how some applications of deep learning are useful in drug discovery. The ups of the article include increased predictive accuracy and processing complex data, whereas the downs include sometimes this model can be biased.

Bernard Marr[7] talks about various techniques of AI including ML and DL in his article. Positives include increased speed in diagnosis and accuracy, meanwhile the other side include rigorous validation for an AI algorithm to be reliable and safe.

Both Miller DD[9] and Singhal S[8] have used Artificial intelligence to reference the contribution it had and has been doing for the healthcare industry. Miller DD in the year of 2018 used the technique named Artificial Intelligence(AI) in the paper. This describes how the article manifests how AI can be integrated into the practice of medicine: Is AI the solution to improving health outcomes? The advantages of using this technique is that the potential of AI lies in delivering more accurate diagnoses treatment tailored for each patient, and smoothening healthcare operations.

Combi C[10] in the year 2016 used the technique Telemedicine in their paper "Telemedicine for Developing Countries: A Survey and Some Design Issues". The present paper deals with the application of telemedicine in developing countries. According to the series, telemedicine has been reflected as a potential application that can surmount geographical and infrastructural barriers. Telemedicine refers to the delivery of healthcare at a distance through the use of telecommunications technology. It acts in providing consultations, remote diagnoses, and monitoring through videoconferencing software and other open lines of communication.

The advantages of this is dreaded benefits it offers are access to healthcare within remote, inaccessible, or underserved areas, reduces the need for home visits and other physical visits, along with their related travel costs; and more rapid diagnosis and institution of treatment. And the limitations of this technique is Reduced quality of care as compared to face-to-face consultation.

## 3. Proposed Methodology

Before using the dataset the data must be pre-processed. We must look out any missing values or duplicate data or any kind of data that doesn't belong to the dataset. Many AI methods like KNN, Random Forests, SVM are used in here. These methods help to improve accuracy, retrieve faster results, predict dangers beforehand, analyse patients health with ease and predict outcomes of the procedures.

### 3.1 Algorithm

An algorithm is proposed on how to deal with training, testing, and splitting of the data from the dataset. The below two algorithm helps with the calculating the accuracy using **RANDOM FOREST** and **KNN**.

### 3.1.1 Random Forest

1: load the synthetic dataset, if there are any missing values in the set then handle them

Else move to step 2

2: Split the data into 15% for validation, 15% for testing and remaining for training

3: choose AI models like Random forest for analysis

model = RandomForestClassifier()

4: Train the model on the training dataset.

model.fit(x\_train, y\_train)

5: Now evaluate the model using validation dataset and calculate the final metrics.

value\_predictions = model.predict(x\_val)

6: Load the Synthetic dataset into the model and compare the model's results with that of the original dataset.

original\_predictions = model.predict(x\_original)

7: Perform statistical tests to identify the difference between both results

statistic\_test\_result = perform\_statistical\_test(validation\_metrics, comparison\_metrics)

If the result of the statistical test is large then train the model again

Else go to step 8

8: Write a final report containing a detailed information about the metrics and provide insights based on the results.

9: stop

### 3.1.2 K-Nearest Neighbours

1: Load synthetic data set and handle missing values if any, Otherwise, go to step 2.

2: Allocate the data into training, testing and validation at a ratio of 70:15:15 respectively.

3: Create KNN model object and introduce parameters to it.

knn\_model = KNeighborsClassifier(neighbors=5)

4: Train the model and fit the dataset in the model.

knn\_model.fit(x\_train, y\_train)

5: Now validate the model with Validation Dataset and predict the result by generated by Model.

val\_predictions = knn\_model.predict(x\_val)

6: calculate predictions on original dataset

original\_predictions = knn\_model.predict(x\_original)

7: Comparing these two sets

```
statistic_test_result = perform_statistical_test(validation_metrics, comparison_metrics)
```

If the result of the statistical test is large then train the model again

Else go to step 8

8: Write a final report containing a detailed information about the metrics and provide insights based on the results.

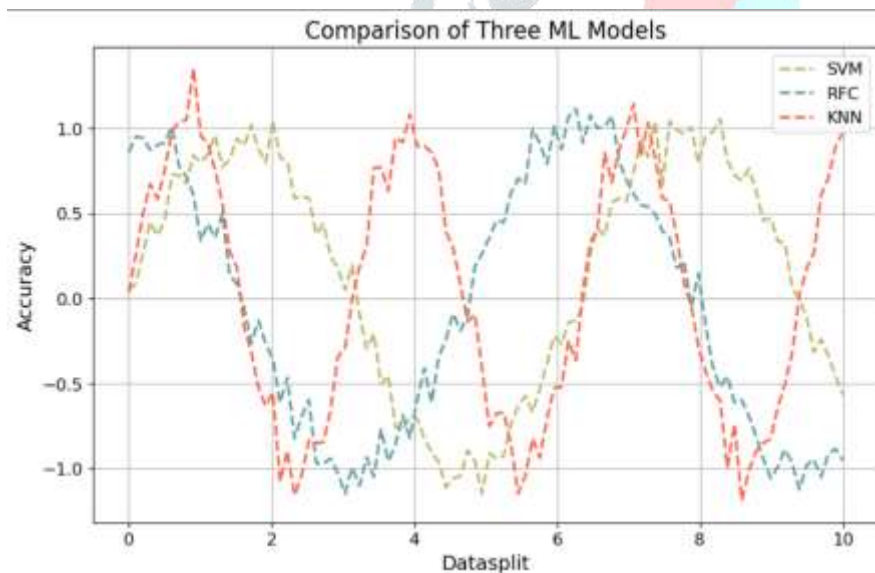
9: stop

According to the algorithm synthetic dataset is loaded and then checks it for missing values and treats them. Secondly, it creates a split in data: 15% for validation and testing each and finally the rest 70% for training. Subsequently, this random forest model is run on a training dataset.

#### 4. Results and Discussions

Here's a pictogram to understand the difference between the actual and model-generated results:

The role of AI in healthcare has changed patient care by increasing outcomes and enhancing efficiency. As observed the AI model has resulted in pretty accurate results. Artificial Intelligence technologies are seen in a variety of health applications nowadays.. These technologies were developed to minimize the burden on healthcare professionals. Healthcare professionals can benefit a lot from these technologies. When integrated with accuracy these technologies would be more accurate.



The above graph represents the comparison of three machine learning models namely Support Vector Regression(SVM), Random Forest Classifier(RFC), and K-Nearest Neighbours(KNN). Datasplit on X-axis refers to how data is split and accuracy on Y-axis refers to how each machine learning model shows its accuracy for different parameters of data. As seen above KNN shows the highest accuracy for the taken dataset. So, KNN can be chosen for calculating the accuracy.

#### 5. Conclusion

Many sectors now a days integrate AI in their fields. The healthcare industry is no exception. AI technologies such as ML and NLP have revolutionized various aspects of healthcare. From diagnostics to personalized treatment plans, AI is playing a keen role. Patients datasets can be analysed quickly and precisely. This means better decisions and care for patients. In simple words, AI is contributing a lot to the health society with it's work. Literature survey reveals that several AI applications for health services and a stream of research that has yet to fully be covered.

The research, therefore, adopts a quantitative approach to the analysis of bibliometric variables and a qualitative approach to the study of recurring keywords, which has allowed us to demonstrate strands of literature that are not purely positive. There are currently some limitations that will affect future.

AI technology is being used around the world in healthcare and research for many different purposes ranging from the detection of diseases and management of chronic conditions to the delivery of healthcare services and drug discovery. Although not enough development has been made for AI in the field of healthcare, but it can be said that AI will significantly make greater help.

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