

# Application of Data Science in Healthcare

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Data Science is one of those technologies whose applications are increasingly touching and revolutionizing every sector. The areas of applications include healthcare, IT, media and entertainment, education, banking and finance, and e-commerce. Data Science also helps change and enhance the essential services such as the healthcare industry. Thus, in this blog, we will discuss various applications of Data Science in healthcare.

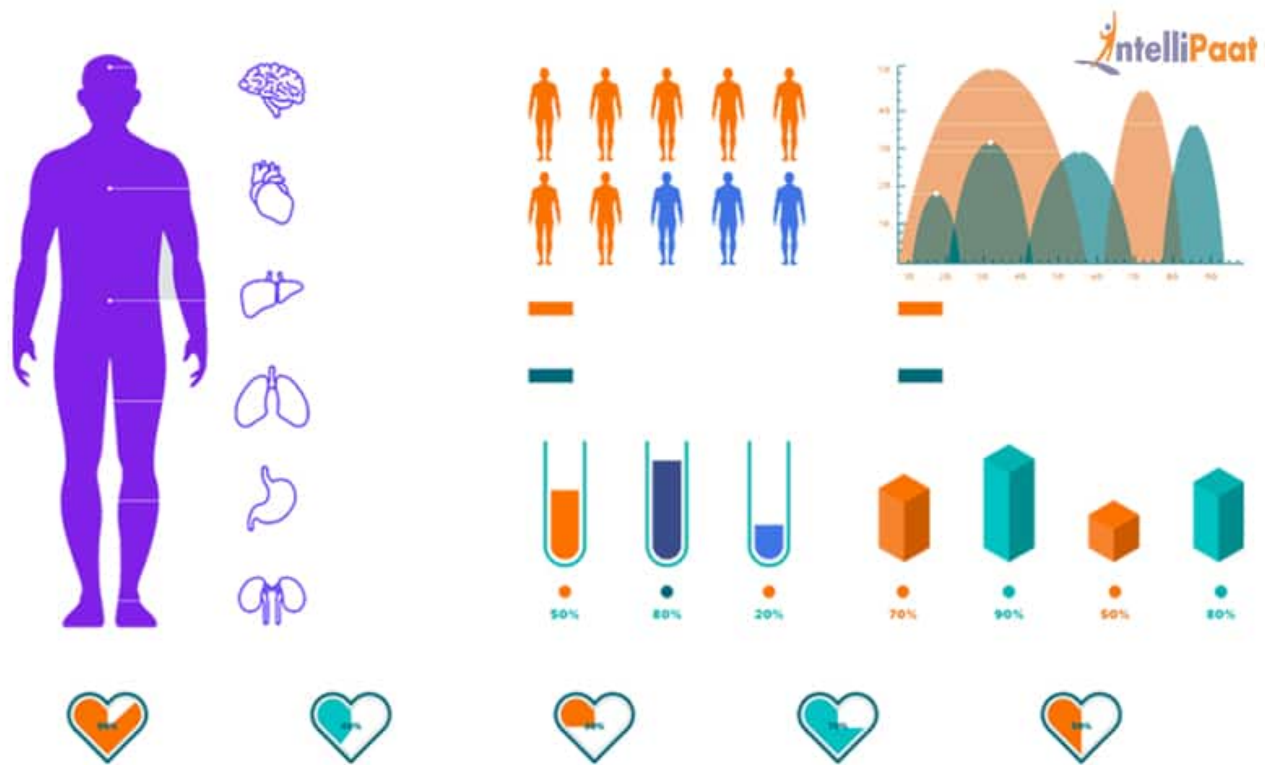
## Why do we use Data Science in Healthcare?

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According to a study, the data generated by every human body is 2 terabytes per day. This data includes activities of brain, the stress level, heart rate, the sugar level, and many more. To handle such a large amount of data, now, we have more advanced technologies and one of them is Data Science. It helps monitor patients' health using recorded data.

With the help of the application of Data Science in healthcare, it has now become possible to detect the symptoms of a disease at a very early stage. Also, with the advent of various innovative tools and technologies, doctors are able to monitor patients' conditions from remote locations.

In earlier days, doctors and hospital managements were not able to handle multiple numbers of patients at the same time. And due to the lack of proper treatment, the patients' conditions used to get worse.



However, now, the scenario has changed. With the help of Data Science and Machine Learning applications, doctors can be notified about the health conditions of the patients through wearable devices. Then, hospital management can send their junior doctors, assistants, or nurses to these patients' homes.

Hospitals can further install various equipment and devices for the diagnosis of these patients. These devices built on top of Data Science are capable of collecting data from the patients such as their heart rate, blood pressure, body temperature, etc. Doctors get this real-time data of the patients' health through updates and notification in mobile applications. They can then diagnose the conditions and assist the junior doctors or nurses to give specific treatments to the patients at home. This is how Data Science helps in caring for patients using technology.

## Benefits of Data Science in Healthcare

Data Science helps in advancing healthcare facilities and processes. It helps boost productivity in diagnosis and treatment and enhance the workflow of healthcare systems. The ultimate goals of the healthcare system are as follows:

- To ease the workflow of the healthcare system
- To reduce the risk of treatment failure
- To provide proper treatment on time
- To avoid unnecessary emergency due to the non-availability of doctors
- To reduce the waiting time of patients

## The Role of a Data Scientist in Healthcare

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The role of a Data Scientist is to implement all techniques of Data Science for integrating it in healthcare software. The Data Scientist extracts useful insights from the data to make predictive models. Overall, the responsibilities of a Data Scientist in healthcare are as follows:

- Collecting data from patients
- Analyzing the needs of hospitals
- Structuring and sorting the data for use
- Performing Data Analytics using various tools
- Implementing algorithms on the data to extract insights
- Building predictive models with the development team

Now, let's discuss the major applications of Data Science in healthcare.

### Medical Image Analysis

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Medicine and healthcare together form a promising field for utilizing technological advancements. The healthcare sector is acquiring new heights due to the advancements in Data Science. It is helping in various aspects, and one of them is the analysis of medical images. It is one of the most interesting areas of study in image recognition technology.

Data Science helps in the recognition of scanned images to figure out the defects in a human body for helping doctors make an effective treatment strategy. These medical image tests include X-ray, sonography, MRI (Magnetic Resonance Imaging), CT scan, and many more. Proper analysis of the images of these tests helps gain valuable insights for the doctors to provide the patients with better treatment.



These are the general imaging techniques. But, the involvement of Data Science has made these imaging techniques further revolutionize the healthcare industry. There are various methods in Data Science that find the differences between the states of image and resolution and check the orthogonality. Data Scientists are working on creating more advanced techniques to improve the quality of the image analysis so that the patient's data from an image is extracted efficiently.

There is a recent study published by Google AI on diagnosing skin diseases using Deep Learning. The Deep Learning model is created in such a way that it can diagnose 26 diseases related to skin with an accuracy of 97 percent. The diagnosis is performed using deep neural networks, Machine Learning, and Data Science. Now, let us look at the three common algorithms used in medical image analysis:

**Anomaly detection algorithm:** This algorithm helps in identifying conditions such as bone fracture and displacements.

**Image processing algorithm:** The image processing algorithm helps in analyzing images and enhancing and denoising them.

**Descriptive image recognition algorithm:** It visualizes and extracts data from images, interprets it, and makes use of it to form a bigger picture (for example, merging the images of the brain scan and designating them accordingly)

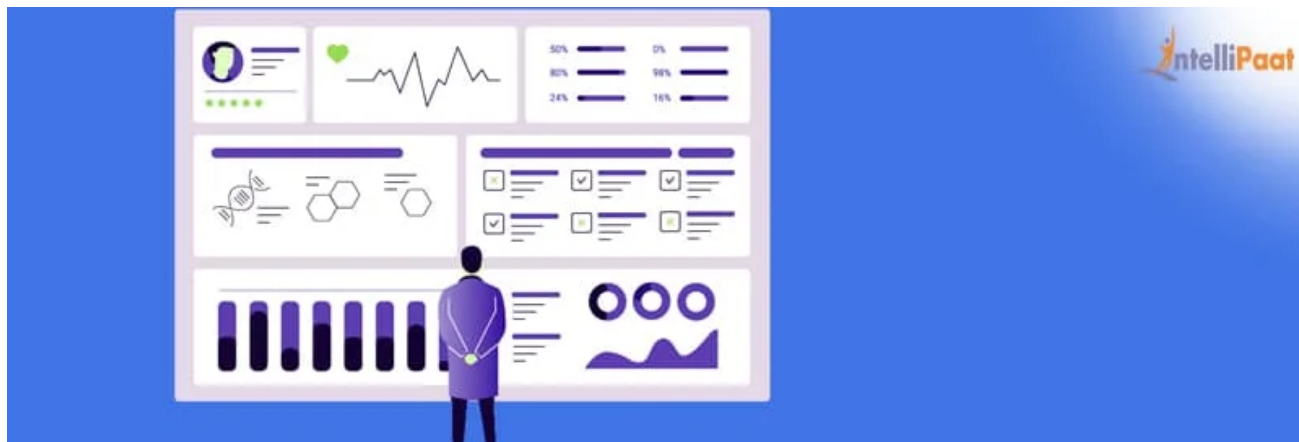
These algorithms are successfully implemented by using supervised and unsupervised algorithms.

## Predictive Analytics in Healthcare

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In today's world, information is one of the important factors in healthcare analytics. Due to the lack of proper information about a patient, the condition can get worse. Thus, information or data about the patient must be collected efficiently. This data can be anything from the patient's blood pressure, body temperature to sugar level. After collecting the patient's data, it is analyzed to search for patterns and correlations in it. This process tries to identify the symptoms of a disease, the stages of the disease, the extent of damage, and many more.

Then, the predictive analytics model built on top of Data Science makes predictions on the condition of the patient. Also, it helps in making strategies for the appropriate treatment that should be given to the patient. Therefore, predictive analytics is a very useful technique and it plays a major role in the healthcare industry.



**The major benefits of predictive analytics in healthcare are given below:**

- It helps in the management of chronic diseases.
- It efficiently monitors and analyzes the demand for pharmaceutical logistics.
- It predicts a patient's condition and suggests preventive measures.
- It provides faster documentation of hospital data.
- It helps in efficiently utilizing doctors and other resources for the benefit of the maximum number of patients.
- It predicts the future medical crises of a patient.

Thus, the application of Data Science in healthcare in the form of predictive analytics is proving itself to be of great use.

## Drug Research

As the world's population is growing, there are many issues in a human body emerging every now and then. This may be due to the lack of proper food, anxiety disorder, pollution, physical illnesses, etc. It has now become a challenge for medical research institutes to find medicines or vaccines for the diseases in a short time. Since, to find a formula for a medicine, the researchers have to understand the characteristics of the causative agent, it may require millions of test cases to do this. Then, after finding a formula, the researchers have to perform further tests on the formula.



To go through the data of the millions of test cases mentioned above, in earlier days, it required 10–12 years. But, now, with the help of various applications of Data Science in healthcare, it has become a much easier task. The data from millions of test cases can be processed within months or may be in weeks. It helps in evaluating the efficiency of the drug through data analysis. Hence, the successfully tested vaccine or medicine can be launched in less than a year. This is all possible with the help of Data Science and Machine Learning. Both have revolutionized the research and development sectors of medicinal drug industry. Next, we will see the application of Data Science in genomics.

## Data Science in Genomics

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Genomics is one of the interesting areas of study in medical science. It is the study for the sequencing and examination of genomes that consist of genes and DNAs of the living beings. The research on the genes of organisms facilitates high-level treatments. The aim of studying genomics is to find the characteristics and irregularities in DNAs. Also, it helps find the correlation between a disease, symptoms, and the health condition of the person affected. Further, the study of genomics includes the analysis of drug response for a particular type of DNA.



Earlier, before the emergence of powerful data analysis techniques, the study of genomics was a redundant and time-consuming task. This is due to the presence of millions of pairs of DNA cells in the human body. But, now, the applications of Data Science in healthcare and genomics has made this task easier. With the help of various Data Science and Big Data tools, we can analyze human genes with less effort and time. These tools facilitate researchers to find specific genetic issues and the drug that responds best for a specific type of gene.

**The tools used in the research of genomics are:**

- **MapReduce:** MapReduce helps in processing huge amounts of genetic data. With the help of MapReduce, the genetic sequences can be processed in lesser time.
- **SQL:** SQL helps in the retrieval of the genomic data from various databases and also help in the computation of this data.



- **Galaxy:** It is a GUI-based application used for biomedical researches. To perform research on genomes, we can do specific operations using Galaxy.
- **Bioconductor:** Bioconductors are used for the analysis of the genetic data.

Having knowledge of how DNA cells respond to a particular drug for a patient, doctors can perform the treatment efficiently. The useful insights into the genetic structure help them make effective strategies to cure a disease for a particular patient.

## Virtual Assistance

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The applications that are built using virtual assistance are a great example of the utilization of Data Science. Data Scientists have built comprehensive platforms that give personalized experience to patients. The medical applications that use Data Science assist a patient in identifying the disease by analyzing the symptoms. The patient just needs to enter his/her symptoms and the application will predict the disease and condition of the patient. It will suggest precautions, medication, and the treatment required as per the condition of the patient.



Further, the application analyzes the data of the patient and creates a checklist of the treatment processes that need to follow. Then, it regularly notifies the patient for taking medicines. This helps in avoiding the situation of negligence that might make the condition worse.

Virtual assistance has also proved to be useful for patients who suffer from Alzheimer's, anxiety, depression, and other psychological disorders. The treatment of these patients become productive as the application regularly notifies them of taking required measures. These measures include proper medication, exercise, and food intake. One of the examples of virtual assistance is Woebot developed by Stanford University. It is a chatbot that helps patients with psychological disorders in improving their mental health with the proper treatment.

By looking at all these applications of Data Science in healthcare, we can say that Data Science is one of the wonderful creations by humans.

## Future of Data Science in Healthcare

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Basically, there are four factors leading to rapid improvement in the healthcare industry:

- Technological advancements
- Digitalization
- Need for reducing treatment costs and duration
- Need for handling large population

Data Science has already started addressing all these to bring the desired effect. As Data Science is already doing wonders for society, there is no doubt that its application in the future will prove itself to be more invaluable. It will take the healthcare industry to further heights. Doctors will get ample assistance and patients will get a more personalized experience and perfect treatments.

To conclude, the applications of Data Science in healthcare has the potential to enhance the entire healthcare system.