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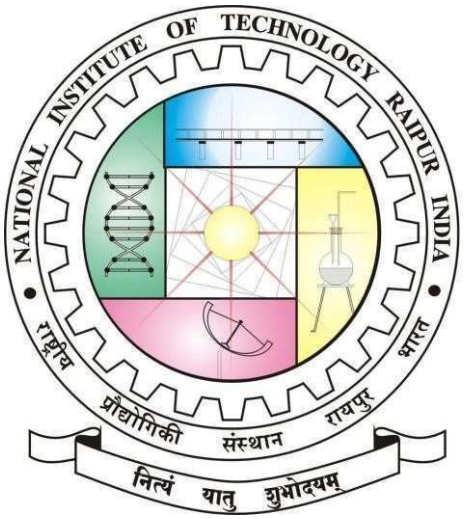

PROJECT REPORT ON

Data Science And Digital Technology in Healthcare

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DATA SCIENCE AND DIGITAL TECHNOLOGY IN HEALTHCARE

1 Abstract

Digital technologies and data science have laid down the promise to revolutionize healthcare by transforming the way health and disease are analyzed and managed in the future. Digital health applications in healthcare include telemedicine, electronic health records, wearable, implantable, injectable and ingestible digital medical devices, health mobile apps as well as the application of artificial intelligence and machine learning algorithms to medical and public health prognosis and decision-making. As is often the case with technological advancement, progress in digital health raises compelling ethical, legal, and social implications (ELSI). This article aims to succinctly map relevant ELSI of the digital health field. The issues of patient autonomy; assessment, value attribution, and validation of health innovation; equity and trustworthiness in healthcare; professional roles and skills and data protection and security are highlighted against the backdrop of the risks of dehumanization of care, the limitations of machine learning-based decisionmaking and, ultimately, the future contours of human interaction in medicine and public health.

2 Introduction

Data Science is rapidly growing to occupy all the industries of the world today. In this topic, we will understand how data science is transforming the healthcare sector. We will understand various underlying concepts of data science, used in medicine and biotechnology. Medicine and healthcare are two of the most important part of our human lives. Traditionally, medicine solely relied on the discretion advised by the doctors. For example, a doctor would have to suggest suitable treatments based on a patient's

symptoms.However, this wasn't always correct and was prone to human errors. However, with the advancements in computers and in particular, Data Science, it is now possible to obtain accurate diagnostic measures. There are several fields in healthcare such as medical imaging, drug discovery, genetics, predictive diagnosis and several others that make use of data science. We will go through each field one by one, with examples.

3 Why do we use data science in healthcare

According to a study, the data generated by every human body is 2 terabytes per day. This data includes activities of the brain, stress level, heart rate, 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 patient's conditions from remote locations.

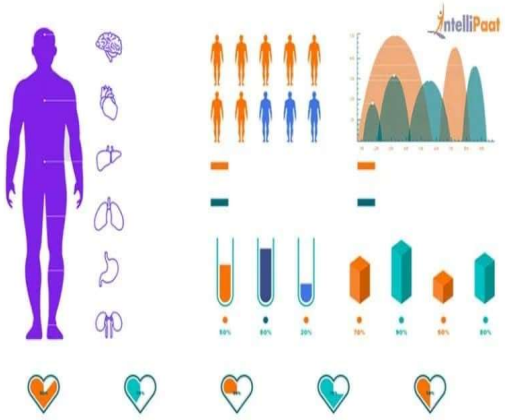

Figure 1:

In earlier days, doctors and hospital management 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

3.1 Data science In Medical Imaging

The primary and foremost use of data science in the health industry is through medical imaging. There are various imaging techniques like X-Ray, MRI and CT Scan. All these techniques visualize the inner parts of the human body. Traditionally, doctors would manually inspect these images and find irregularities within them. However, it was often difficult to find microscopic deformities and as a result, doctors could not suggest a proper diagnosis. With the advent of deep learning technologies in data science, it is now possible to find such microscopic deformities in the scanned images. Through image segmentation, it is possible to search for defects present

Figure 2:

There are several other methods that are applied to enhance the images and improve the accuracy of the outcome. Big Data platforms like Hadoop apply MapReduce to find parameters that can be used in various tasks. For data science enthusiasts beginning with image analysis, there are several open datasets of brain imaging that you can utilize for gaining a practical experience.

3.1.1 BrainWeb

3.1.2 IXI Datset

3.1.3 Fast MRI

3.2 Data Science For Genomics

Genomics is the study of sequencing and analysis of genomes. A genome consists of the DNA and all the genes of the organisms. Ever since the compilation of the Human Genome Project, the research has been advancing rapidly and has inculcated itself in the realms of big data and data science.

Before the availability of powerful computation, the organizations spent a lot of time and money on analyzing the sequence of genes. This was an expensive and tedious process.

However, with the advanced data science tools, it is now possible to analyze and derive insights from the human gene in a much shorter period of time and in a much lower cost.

3.3 Drug Discovery With Data Science

Drug Discovery is a highly complicated discipline. Pharmaceutical industries are heavily relying on data science to solve their problems and create better drugs for the people. Drug Discovery is a time-consuming process that also involves heavy financial expenditure and heavy testing.

Data Science and Machine Learning algorithms are revolutionizing this process and providing extensive insights into optimizing and increasing the success rate of predictions. Drug Discovery is a highly complicated discipline. Pharmaceutical industries are heavily relying on data science to solve their problems and create better drugs for the people. Drug Discovery is a timeconsuming process that also involves heavy financial expenditure and heavy testing.

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Figure 3:

3.4 Monitering Patient Health

Data Science plays a vital role in IoT (Internet of Things). These IoT devices, that are present as wearable devices that track heartbeat, temperature and other medical parameters of the users. The data that is collected is analyzed with the help of data science.

Figure 4:

With the help of analytical tools, doctors are able to keep track of patient's circadian cycle, their blood pressure as well as their calorie intake.

Other than wearable monitoring sensors, doctor can monitor a patient's health through home devices. For patients that are chronically ill, there are several systems that track patient's movements, monitor their physical parameters and analyze the patterns that are present in the data.

3.5 Tracking and Preventing Diseases

Data Science plays a pivotal role in monitoring patient's health and notifying necessary steps to be taken in order to prevent potential diseases from taking place. Data Scientists are using powerful predictive analytical tools to detect chronic diseases at an early level.

In many extreme cases, there are instances where due to negligibility, diseases are not caught at an early stage.

This proves to be highly detrimental to not only the patient's health but also the economic costs. As the disease grows, the cost of curing it also increases. Therefore, data science plays a huge role in optimizing the economic spending on healthcare.

4 Benefits of data science in Healthcare

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

4.1 To ease the Workflow of the healthccare system

4.2 To reduce the risk of treatment failure

4.3 To provide Proper Treatment

4.4 To reduce the waiting time of patient

5 The Role Of Data Science Reshaped by COVID-19

In year 2020 will go down in history as one drastically shaped by a virus that, as of late October, had infected more than 40 million people worldwide. Apt

assessments have compared what's happening now to the devastations of the 1918 flu pandemic. But what's different today is how technology has allowed us to see, almost in real time, where the virus is spreading, how it's mutating, and what effect it's having on economies across the world. This detailed view

Figure 5: .

of COVID-19 is made possible thanks, in part, to a new generation of huge datasets—hundreds of genomes, millions of tweets—along with advances in computing power and the analytical methods to study them. Of course, massive datasets play different roles depending on the field using them. To provide some context, Penn Today spoke to experts across the University about how they and others are employing data to identify patterns and find solutions to the many challenges raised by the ongoing pandemic. Image

5.1 How Artificial Intelligence, Data Science And Technology Is Used To Fight The Pandemic

Since the first report of coronavirus (COVID-19) in Wuhan, China, it has spread to at least 100 other countries. As China initiated its response to the virus, it leaned on its strong technology sector and specifically artificial intelligence (AI), data science, and technology to track and fight the pandemic while tech leaders, including Alibaba, Baidu, Huawei and more accelerated their company's healthcare initiatives. As a result, tech startups are integrally involved with clinicians, academics, and government entities around the

world to activate technology as the virus continues to spread to many other countries. Here are 10 ways artificial intelligence, data science, and technology are being used to manage and fight COVID-19.

5.2 AI To Identify, Track and forecast outbreaks

The better we can track the virus, the better we can fight it. By analyzing news reports, social media platforms, and government documents, AI can learn to detect an outbreak. Tracking infectious disease risks by using AI is exactly the service Canadian startup BlueDot provides. In fact, the BlueDot's AI warned of the threat several days before the Centers for Disease Control and Prevention or the World Health Organization issued their public warnings.

5.3 AI to help Diagonse The virus

Artificial intelligence company Infervision launched a coronavirus AI solution that helps front-line healthcare workers detect and monitor the disease efficiently. Imaging departments in healthcare facilities are being taxed with the increased workload created by the virus. This solution improves CT diagnosis speed. Chinese e-commerce giant Alibaba also built an AI-powered diagnosis system they claim is 96

5.4 Process Healthcare Claims

It's not only the clinical operations of healthcare systems that are being taxed but also the business and administrative divisions as they deal with the surge of patients. A blockchain platform offered by Ant Financial helps speed up claims processing and reduces the amount of face-to-face interaction between patients and hospital staff.

5.5 Drones Deliver Medical Supplies

One of the safest and fastest ways to get medical supplies where they need to go during a disease outbreak is with drone delivery. Terra Drone is using its unmanned aerial vehicles to transport medical samples and quarantine material with minimal risk between Xinchang County's disease control centre and the People's Hospital. Drones also are used to patrol public spaces, track non-compliance to quarantine mandates, and for thermal imaging.

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