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Artificial Intelligence in Predictive Forecasting for Healthcare

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***Abstract*: Artificial Intelligence (AI) is one of the technologies that has shown to be incredibly useful and efficient in allowing automated computerized systems to become increasingly personalized in order to fulfil human desires. Artificial intelligence (AI) is a key technology that is being used to make robots intelligent and capable of emulating human actions and behaviors. One of the methods is predictive forecasting. It produces forecasts using both current and historical data. Future events and variable behavior can be predicted using predictive analytics models. Predictive forecasting is valuable in a variety of industries, including healthcare, where it may be used to predict epidemics, pharmaceutical product manufacture, and marketing. We discussed how to use machine learning in predicting. Machine learning is a branch of computer science in which algorithms learn from data. AI is capable of producing forecasts that are 100 percent correct or have a 0% error rate.**

***Keywords*: Artificial intelligence, predictive analysis, pharmaceutical marketing and demand forecasting.**

1. Introduction

AI can simulate the human brain in order to deliver data by recognising the target audience based on previous behavioural insights. When clients search and browse particular websites to get the essential information, AI can create a profile of a human that covers the skills of picture, recognition, and speech using machine learning and semantic search [1]. Predictive analytics are used to predict the future by using past and present data through AI [2]. Forecasting is the practise of creating future predictions based on historical and current data, and most typically via trend analysis. Health care is the diagnosis, treatment, and prevention of illnesses utilising contemporary technologies in order to maintain or enhance one's health. The convergence of information science, computer science, and health care is known as health information systems. Countless lives have been saved as a result of the continuous advancement of technology in the health and medical fields, and the general quality of life continues to improve with time.

2. Predictive Analysis

Predictive analytics is an analytic process that uses models, methods, and computers to forecast future events. Predictive analytics entails a series of processes that allow a data analyst to forecast the future using current and previous data. After forecasting the analyzed data, it should be monitored properly. The process of predictive analysis are mentioned below in figure: 1.

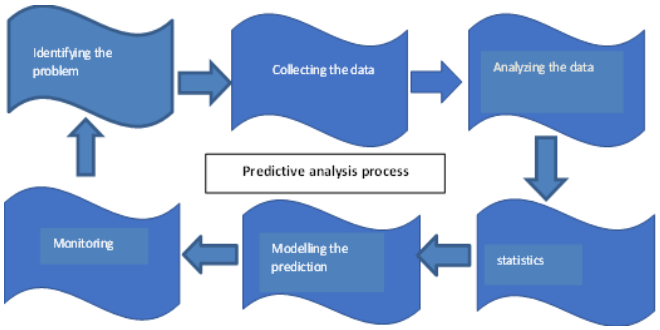

Fig. 1. Predictive analysis process

3. Predictive Analysis- Healthcare

Predictive analytics is a subset of advanced analytics that involves making predictions about unknown future occurrences. Health care is the practise of doing preventative or essential medical operations in order to preserve and restore one's health through illness treatment and prevention. In health care, predictive analytics uses technology and statistical approaches to sift through massive amounts of data and analyse it to anticipate specific patient outcomes[3].

In health care research, data mining and machine learning

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combined with soft computing approaches are playing a critical role in illness detection and prediction. Predictive analysis plays a critical role in healthcare, as seen in Figure 2. According to prediction study, noncommunicable illnesses will kill and disable more people in every world area in the next ten years than infectious diseases. As a result, noncommunicable illnesses such as cancer, diabetes, and heart disease will impose growing strain on global health and social care systems.

4. Time Series Analysis Based on Prediction Cases in Hospital

Time series analysis is a statistical technique that use data collected at regular intervals over a long period of time. It uses both traditional data mining and forecasting techniques [4]. It estimates the future of a variable at future time intervals based on the evaluation of values at past time intervals. For example: The time series analysis is used to estimate the number of instances of infectious diseases and, as a result, the number of over-the-counter and prescribed medications for the given ailment in figure:3. The precise projection will give useful information for campaign strategy planning.

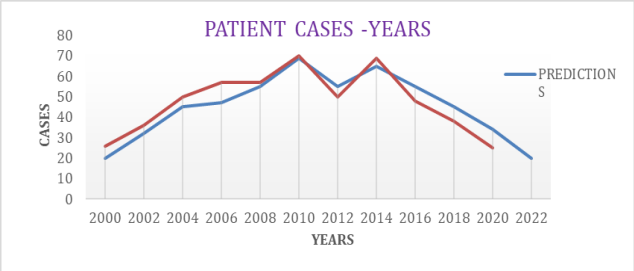

Fig. 3. Time series analysis

5. Reducing Readmission in Hospital by Predictive Analysis

Patients dislike being readmitted to the hospital, and healthcare systems find it costly. Returning to hospitals needlessly soon after discharge is becoming more often seen as a gauge of the quality of care received during a hospital stay. Under the Patient Protection and Affordable Care Act, the Centres for Medicare and Medicaid Services (CMS) began reducing payment money for hospitals with high 30-day readmission rates for heart failure, myocardial infarction, and pneumonia patients (PPACA, generally known as Obamacare). In recent years, several techniques for predicting hospital readmission have been described, but the bulk of them either lack predictive accuracy or rely on patient variables that are not routinely acquired during clinical care [5]. Readmission to the hospital has become a key indicator of healthcare quality and cost. Medicare expects to pay out almost $17 billion to the 20% of patients who are readmitted within 30 days of their release. Although numerous treatments, such as transition care management and discharge reengineering, have been implemented in recent years, their success and long-term viability are dependent on their capacity to identify and target patients who are at high risk of rehospitalization.

6. Predictive Analysis in Pharmaceutical Marketing By AI

Artificial intelligence (AI) is projected to have a significant impact on marketing tactics and client behaviour in the future. The authors suggest a multidimensional paradigm for analysing the effect of AI that includes intelligence levels, task kinds, and whether AI is integrated in a robot [6], based on not just existing research but also substantial interactions with practise. Healthcare organisations and pharmaceutical firms are under pressure to save costs, enhance coordination and results, and become more patient-centric in the changing healthcare environment. Because there are now extremely effective and incredibly cheap generic pharmaceuticals accessible for many prevalent diseases—diabetes, heart disease, depression—pharmaceutical companies are compelled to focus on costlier treatments for smaller patient groups (80 percent of drugs dispensed in the U.S. are generic). Advanced analytics are required to distinguish marketing plans, forecast the future, and drive revenue development. Currently, the majority of marketing analyses segment by product, treatment, stage, application, mode of administration, end user, and other factors. The projection of the potential and total addressable markets might show more insightful marketing trends by taking into consideration the medical qualities of the condition and epidemiology. The most realistic demand for certain medications or treatments might be identified by modelling the relevant components and measuring how they effect the patient journey inside the usual healthcare system. Advanced analytics will be focused on what you really accomplish for marketing growth, which will be in line with the marketing strategy's metrics.

7. AI in Forecasting

To maximize forecasts, an AI-based forecasting system employs a collection of machine learning algorithms. Using contemporary forecasting tools, these changes may now be predicted weeks in advance. Several months ahead of time, a new AI-based technique can forecast these changes with about 95% accuracy. One of the most significant aspects of a precise demand prediction is that manufacturers and suppliers make and provide the appropriate number of pharmaceutical products.

8. Machine Learning

Machine learning approaches have been widely used in bioinformatics, as well as many other areas. Because of the difficulty and cost of biological studies, advanced machine learning algorithms have been developed for this application field. The essential ideas of machine learning, such as feature evaluation, unsupervised vs supervised learning, and classification types, are covered in this chapter [7]. In the 1990s, machine learning was structured as a separate field and began to thrive. The goal of the field shifted from artificial intelligence to practical problems that could be solved. It switched its attention away from the symbolic techniques it had received from AI and toward statistics and probability theory methodologies and models. It also benefited from the growing

availability of digital data and the capacity to disseminate it over the Internet [8].

9. Demand Forecasting in Healthcare System

Demand forecasting is described as the ongoing activity of predicting which health commodity will be purchased, where, when, by whom, and in what amounts in the context of the health supply chain [9]. Decision-making for all stakeholders in order to increase healthcare accessibility and availability. Demand forecasting for health commodities begins with the conception of the product during the research and development stage and continues throughout the product life cycle and value chain [10]. Forecasting has its own set of advantages and disadvantages, and to optimise the benefits of forecasting, planners must be actively involved. The current epidemic and global health crises have caused enormous disruptions in the health supply chain, both upstream and downstream. The fire has been fueled by acute shortages, logistical obstacles, and travel limitations. As a result of these disruptions, accurate short-term predictions have become a crucial managerial decision-making tool, and mid- to long-term forecasting is critical for supply chain planning. The correct information may make all the difference when it comes to providing the right treatment, goods, and services, and health supply chains should strive to go beyond prediction to forecasting. Forecasting, as an important part of the planning and execution process, may help supply chain operations by identifying future occurrences. Public healthcare organisations, which make up a large component of the healthcare delivery system, have been involved in a number of innovative projects addressing the buying and logistics supply chain. Due to the demand to enhance the performance of government services, this has gotten a lot of attention.

10. Epidemic Forecasting

Real-time epidemic forecasting allows public health officials to estimate disease propagation and case numbers in order to better guide public health measures when outbreaks arise. In the recent decade, several forecasting challenges held by institutions within the US federal government, such as the Centres for Disease Control and Prevention, have sparked increased interest in epidemic forecasting (CDC). As the epidemic spread in 2020, we, like many other organizations, sought to find methods to contribute to the national response[11]. We ended up concentrating almost exclusively on the data side of the equation, following various different avenues in order to develop and make public a range of new indicators that indicate real-time COVID-19 activity in the United States. The Department of Health and Human Services (HHS) enforced COVID-19 reporting by hospitals during the epidemic, which included dozens of data components and put a major load on the nation's 6,000 or so hospitals at a time when they were already strained to their limits.

11. A Predictive Analytics Model for Covid-19 Pandemic

On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a worldwide epidemic. Following the detection of COVID-19 cases in China. Covid -19 is caused by corona virus. Corona viruses are a family of similar viruses that infect mammals and birds. Coronaviruses cause infections of the respiratory system in humans that can vary from moderate to fatal [12]. COVID -19 differs from other SARS and MERS viruses in that it spreads fast through human contact (human-to-person transmission) and leaves roughly 20% of infected individuals as symptom free carriers [13]. To calculate the number of new daily cases and forecast the death rate caused by COVID-19, an Artificial Neural Network (ANN) model was utilised. The goal of the research is to forecast the number of confirmed cases and fatalities in the current pandemic for various nations. The covid -19 cases at different countries are represented in figure:4.

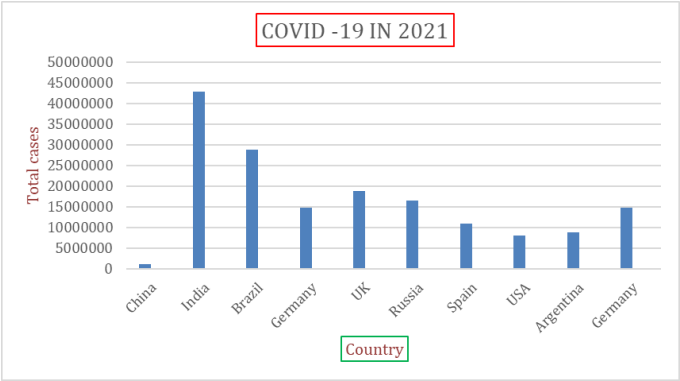

Fig. 4. Covid-19 cases at different country.

12. Application of Ai in Predictive Forecasting:

All major health insurers, integrated delivery systems, and a wide range of other healthcare organizations in the United States use predictive forecasting. Currently, these parties are most known for their use of predictive modelling for sickness management, i.e., detecting and intervening with patients who are likely to incur substantial costs. Some predictive model providers explicitly admit that their tools may be used to detect high-risk individuals or to identify those who will stay healthy. Predictive analytics has the ability to transform the health-care industry. Demand knowledge is critical for designing future markets, particularly in developing markets that are characterized by uncertainty. Accurate mid- and long-term projections will aid in the development of robust and proactive health supply chains, as well as the delivery of health benefits to the general public [14]. Many critical activities might prevail when biological data is acquired from many sources over a lengthy period of time; examples include clinical data integration, comparison, and dispute resolution [15]. Setting sales targets and evaluating sales performance, price optimization in response to market fluctuations and inflation, financial maintenance, hiring of required specialists, long-term financial planning and funds acquisition, business expansion decision-making, and annual strategic planning are all tasks that must be completed using predictive forecasting in pharmaceutical products. Epidemic forecasting is a technique for identifying groups at higher risk of contracting the disease

under investigation. Provides timely information about ongoing investigations to decision-makers, the media, the public, and others. Aids in the implementation or modification of control and preventative measures.

13. Conclusion

The use of predictive models for prediction tasks has a long history. One of the most crucial parts of prediction is accuracy. Accurate forecasting enabled by AI improves pharmaceutical marketing, reduces patient health risks, and improves the healthcare system. In the health-care profession, diagnosing acute disorders and forecasting their recurrence is critical. Health Care systems assist people in living a healthier life by predicting illness recurrence and offering health advice.

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