AI Driven Predictive Model for Tailored Treatment Plan

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Abstract — Personalized medicine in healthcare has emerged as a promising approach to closing the gap in patient outcomes. Leveraging artificial intelligence (AI) technology, particularly predictive models, offers a way to customize treatments based on patient characteristics, thus optimizing treatment for health and reducing adverse effects. This article provides a comprehensive review of existing intelligence based predictive models in healthcare, focusing on their application in clinical strategies. Different methods, data sets and results were used in this study. Develops research studies and highlights strengths, limitations, and potential ways to develop AI driven predictive models to aid clinical practice. It also explores the ethical and practical implications of using such models in the clinical setting, including data privacy, algorithmic bias, and governance issues. This study contributes to the ongoing debate about the potential replacement of cognitive skills in healthcare by providing a critical review of current methods and suggesting paths forward for research and future use. By leveraging the power of AI- powered predictive models, doctors can move closer to personalized medicine, ultimately improving patient outcomes and enhancing the quality of care.

Keywords: Artificial Intelligence (AI), Healthcare, Predictive Analysis, Patient Risk Stratification, Tailored Treatment, Diagnostic Accuracy

I. INTRODUCTION

Traditionally, most Ai-driven predictive modelling in healthcare has taken the approach of using the same treatment to different patients all across. However, with the evolution of artificial intelligence (AI), specifically the emergence of personalized predictive modelling for individualized treatment options, there is a bright prospect. The algorithms of Artificial Intelligence can scan and manage vast health records in a very valid and swift manner in order to retrieve pertinent facts concerning a patient's profile, disease, family background, genetic make-up, and present health status. It follows, legitimate analysis, clinical assessment, and imaging are associated with increased probability of early diagnosis and more precise treatment activities aimed at prompt and adequate response. Determining how effective a specific treatment is likely to be: in this case, AI systems can cross-reference patient data to look for mutual relationships allowing the determination of the best course of action.

Targeted treatments allow the health system to improve treatment outcomes while avoiding or decreasing negative side effects through tailoring strategies for each patient’s needs. This makes it possible to take proactive measures such as preventive interventions and aggressive diagnosis methods with a view of future possibilities. It is important to include individualized care: clearly, there are disadvantages in the typical healthcare practicum.

Most conventional methods include a trial-and-error approach which exposes patients to unnecessary therapies and further problems. Moreover, this uniformity ethic is also not very beneficial since there are genetic and biological differences which even further worsen the treatment efficacy. Ai-driven predictive modelling signifies a significant change in the healthcare industry. By harnessing its exceptional analytical capabilities, AI can extract crucial insights from intricate medical data, opening doors to precision medicine, which involves customizing treatment plans based on an individual's genetic makeup, disease profile, and overall health condition. Enhanced treatment results: achieving optimal effectiveness while minimizing the likelihood of negative side effects.

II. LITERATURE REVIEW

Specialists have examined many methodologies in the field of feeling examination with an end goal to more readily grasp human feelings and ways of behaving. Johnson et al. [1] experiences into the use of artificial intelligence in medical services underscore the innovation's basic job in quiet information examination and in giving clinical experts wise data. Since man-made intelligence is so great at inspecting way of life, nourishment, and ecological elements, it can assist with determining wellbeing status and diminish the probability of erroneous findings and clinical misrepresentation. Computerized reasoning (simulated intelligence) in medical care incorporates clinical choice help in light of proof, unfriendly occasion ID, and prescient examination utilizing information from electronic wellbeing records (EHRs).

Rezayi et al [2] as shown by the Coronavirus pandemic, man-made intelligence-based advances, for example, Locater have been especially useful continuously recognizable proof of foodborne sicknesses and plague expectation. Besides, computer-based intelligence frameworks have been ably intended to estimate the aftereffects of bosom malignant growth medicines, improving customized medication. Liao et al [3] have been finished on the viability of man-made intelligence approaches in modified treatment for neoplasms.

Ladbury et al [4] approaches including rule-based calculations, profound learning, and normal language handling (NLP) show potential for redoing malignant growth treatments in view of drug reaction and genomic data. Allami et al [5] By making it more straightforward to recognize hereditary changes, transformations, and sub-atomic markers connected to diseases, these calculations work on the advancement of individualized treatment plans Mehta et al [6] Besides, simulated intelligence has a great many applications in clinical oncology, including forecast, therapy choice, drug disclosure, and disease diagnostics.

Fron et al [7] analyse and visualize patients, AI calculations specifically, profound learning perform better while assessing clinical pictures and patient information. Liefaard et al [8] discuss dissecting interdisciplinary patient information, man-made intelligence driven accuracy medication additionally can possibly change ailment the board and treatment George et al [9]. Man-made brainpower frameworks are amazingly exact at recognizing growths and estimating the course of cellular breakdown in the lungs.

Fiorino et al [10]. These calculations look to work on the adequacy and accuracy of cellular breakdown in the lungs location and treatment arranging by using genomic profiling and picture examination. Moreover, clinical exploration regularly utilizes man-made intelligence strategies including AI, profound learning, brain organizations, and normal language handling to upgrade indicative capacities and break down different information sources. By and large, custom-made treatment, sickness the board, and better tolerant results are totally made conceivable by the assembly of man-made intelligence and medical services. For artificial intelligence to be broadly utilized in medical services, addressing moral issues and assurance the solidness and steadfastness of simulated intelligence algorithms is as yet significant. The condition of exploration on the use of man-made brainpower (artificial intelligence) in medical care focuses to various significant issues that should be settled to successfully coordinate and use computer-based intelligence. An exhaustive assessment of a few distributions uncovers repetitive subjects and deficiencies in a scope of regions connected with man-made intelligence driven custom-made medication and medical care arrangements. A typical issue, most importantly, is the absence of straightforwardness encompassing the procedures used to prepare expectation models in light of man-made consciousness.

Many articles don't give sufficient data about the techniques used to prepare man-made intelligence models for sickness finding and recognition. This haziness deters cognizance and trust in manmade intelligence frameworks, obstructing their take-up and productivity. Second, certain ailments — like malignant growth — are offered a great deal of consideration to the detriment of other ailments. This limited centre lessens simulated intelligence's expected impact and handiness in medical services across many disciplines and patient populaces.

III. Proposed Solution

To resolve all the problems in personalized treatment in healthcare we have trained a model using a dataset on heart attack using various algorithms like classification, regression and checked accuracy of various models like PCA (principal component analysis), normalization, outlier removal, transformation, feature selection and verified numerous parameters like accuracy, AUC (area under curve), Recall value, precision, F1 score, Kappa, MCC. The most accurate model is random tree classifier with accuracy of 0.988 and precision 0.994 and the least accurate model is Dummy classifier with accuracy 0.513 but with highest recall value of 1.000

Model	Accuracy	AUC	Recall	Prec.	F1	Kappa
Random F	0.9888	0.9985	0.9835	0.9949	0.9889	0.9776
Extra Tree	0.9818	0.9989	0.9862	0.979	0.9824	0.9636
Extreme G	0.979	0.9932	0.9809	0.9787	0.9796	0.958
Decision T	0.9776	0.9777	0.9782	0.9785	0.9781	0.9553
Light Gradi	0.9776	0.9957	0.9782	0.9787	0.9782	0.9552
Gradient B	0.947	0.989	0.9593	0.9394	0.949	0.8939
Ada Boost	0.8927	0.9613	0.9131	0.8843	0.8972	0.785
Logistic Re	0.8438	0.9072	0.8941	0.8197	0.8543	0.6867
Ridge Clas	0.8284	0	0.9075	0.7903	0.844	0.6553
Linear Disc	0.8284	0.9069	0.9075	0.7903	0.844	0.6553
Quadratic	0.8257	0.9193	0.8506	0.8197	0.8335	0.6507
Naive Bay	0.8117	0.8998	0.853	0.7971	0.8228	0.6224
K Neighbo	0.7127	0.82	0.6931	0.7356	0.713	0.4259
SVM - Line	0.6639	0	0.7	0.6286	0.6347	0.3285
Dummy Cl	0.5132	0.5	1	0.5132	0.6783	0

Table 1 Performance of Models

When the RF model is being trained it showed a mean accuracy of 0.9791 with precision 0.9799.

Fold	Accuracy	AUC	Recall	Prec.		Kappa
0	0.9583	0.9888	1	0.925	0.961	0.9164
1	0.9444	0.9977	0.973	0.9231	0.9474	0.8886
2	0.9722	0.9977	0.973	0.973	0.973	0.9444
3	0.9861	1	1	0.9737	0.9867	0.9722
4	1	1	1	1	1	1
5	1	1	1	1	1	1
6	0.9861	0.9992	1	0.9737	0.9867	0.9722
7	0.9718	0.9992	0.9722	0.9722	0.9722	0.9437
8	1	1	1	1	1	1
9	0.9718	0.9992	0.9459	1	0.9722	0.9437
Mean	0.9791	0.9982	0.9864	0.9741	0.9799	0.9581
Std	0.0179	0.0032	0.0182	0.0278	0.017	0.0358

Table 2 Performance of Model (K Fold)

IV. RESULTS AND DISCUSSION

The ROC curve of random forest shows perfect classifier performance, as both curves reach the upper left corner of the graph. This means that the model can perfectly distinguish between positive and negative classes at all thresholds. Predictive Modelling and Decision Support: Creating precise and dependable predictive models that can accurately anticipate the likelihood of a disease, how it will advance, and how a therapy will work is still a challenging task. To maximize treatment outcomes and support clinical decision-making, these models' performance, interpretability, and generalizability must be improved.

The implementation of personalized treatment options gives rise to significant ethical and regulatory concerns pertaining to patient privacy, consent, data security, and fair distribution of healthcare resources. To preserve public confidence and ensure the responsible application of customized treatment plans, it is crucial to strike a balance between the demand for innovation and moral and legal requirements.

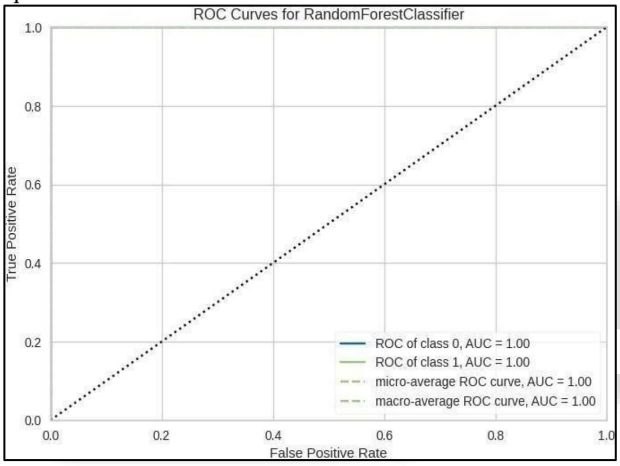

Fig. 1: ROC Curve for RF

Further the results inferred by plotting various graphs based on dataset and the model trained are as follow:

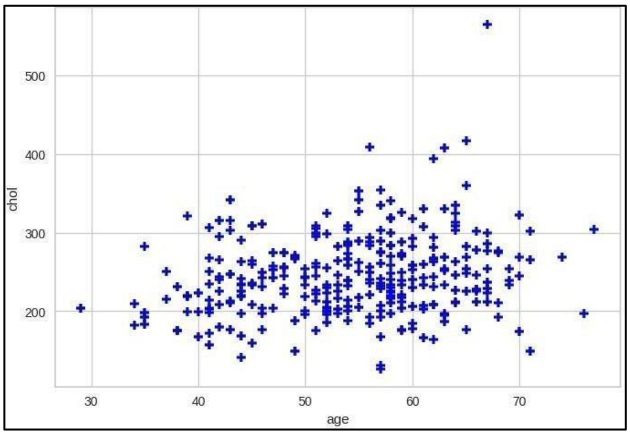

Fig. 2: Visualization of Age and Cholesterol

The graph appears to be a scatter plot, which means it displays the relationship between two variables using data points. In this case:

– X-axis (Horizontal): Likely represents "age" based on the label "age" near the axis.
– Y-axis (Vertical): The label is obscured, but it might represent a measurement related to cholesterol levels given the partial text "chol" near the axis.
– The highest cholesterol is 500 which is between age group of 50-60 and lowest is 200 for age<30, most attained cholesterol level is 250 for 55-60 age group people. 3D Scatter plot

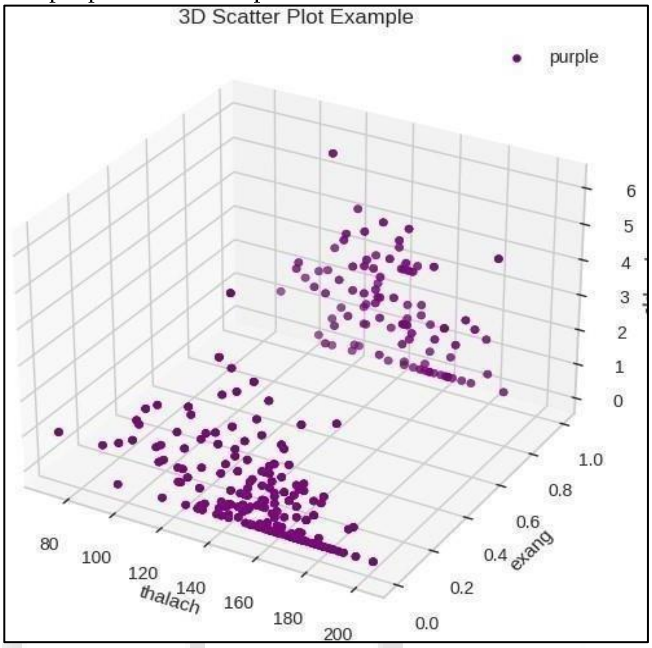

Fig. 3: 3D Scatter Plot of age and cholesterol

There is a numerical value on the x-axis perhaps between 80 and 200 which is maximum heart rate achieved. The y-axis ranges exang ie exercise performed by an individual which is between 0 and 6. It is possible that the third numerical value on the z axis ranges from 0 to 0.8 which is old peak. According to the graph most of the persons with heart disease have heart beat between 140-180bpm and exang from 0 to 10.2

V. CONCLUSION

The paper's aim is to explore the possibilities of AI-driven predictive modelling for individualized care. Current uses of AI in healthcare, approaches for developing AI powered predictive models, possibilities and problems related to AI in healthcare, and potential future avenues for integrating AI with other cutting-edge technologies are all covered in this study. The impact of climate change on the world's food security is a critical issue that needs to be addressed right away. Through the customization of treatment strategies for individual patients, AI driven predictive modelling holds promise in addressing these issues. This paper essentially states that AI-driven predictive modelling may be a more individualized and efficient approach to healthcare than existing methods, which are ineffective because of their general character. Through the customization of treatment strategies for individual patients, AI-driven predictive modelling holds promise in addressing these issues. Large volumes of medical data, such as patient demographics, medical histories, genetic data, and real- time vitals, can be analysed using AI algorithms in this manner. A more precise diagnosis, better treatment choices, and improved patient outcomes are all possible benefits of this thorough investigation. This paper essentially states that AI driven predictive modelling may be a more individualized and efficient approach to healthcare than the existing methods.

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