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Self Management of Asthma Disease Using Machine Learning Techniques

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Abstract*— The symptoms of asthma can alter. There is no existing cure for asthma. Asthma affects more than 25 million Americans today. This number includes more than a million children. Patients with asthma risk dying if they don't obtain therapy. A long-term symptom of asthma is a sudden worsening of symptoms that can be unpredictable and even fatal. In this work, we use supervised machine learning and the Random Forest method to achieve better outcomes in the self-management of asthma. Machine learning typically uses this random forest approach for classification and regression problems. In our research, we found that both probabilistic and discriminant classifiers were capable of producing outstanding accuracy (AUC>0.87) for early warning.

Keywords: Asthma, Machin Learning, Healthcare, Probabilistic Classifie.

I. INTRODUCTION

Deep learning may be a subset of machine learning (ML) techniques that mimics the neuronal networks seen in the human brain. In order to develop more intriguing options for diagnosing and treating patients, therapeutic facilities must be made public. Deep learning in healthcare enables people to analyse enormous, intricate, and clinically relevant collections of diseased data. Bronchial asthma is a common, chronic, semi-permanent lung condition that can be brought on by a variety of things, including allergens, psychological factors, activity agents, exercise, metabolic process infections, local pollutants, and medicines.The use of AI in the diagnostic process is supported by the physician's undeniable competence, and both efforts are made to avoid wasting time. As a result, diagnosis is quick, reliable, precise, and founded on lore. In this situation, Deep Learning uses an automatic system to evaluate the knowledge and may also speed up the diagnosis process. This study aimed to determine the effectiveness of CNN for improving diagnostic precision in adult bronchial asthma diagnosis and to compare the similarity of the prognostication production of a list of challenges. CNN's deep learning technology has triumphed majestuously in the diagnosis of several illnesses. In addition to ensuring its dependability, revealing the CNN to release the learned feature as an explainable type also admits the validation about the model's validity and further a training data by without human interaction. The study included a wide range of challenging determinants that contribute to bronchial asthma. Environmental, chemical, and genetic elements were taken out of them. These agents have a big impact on how the disease develops and persists. According to CNN, one of these factors affects teens the most.

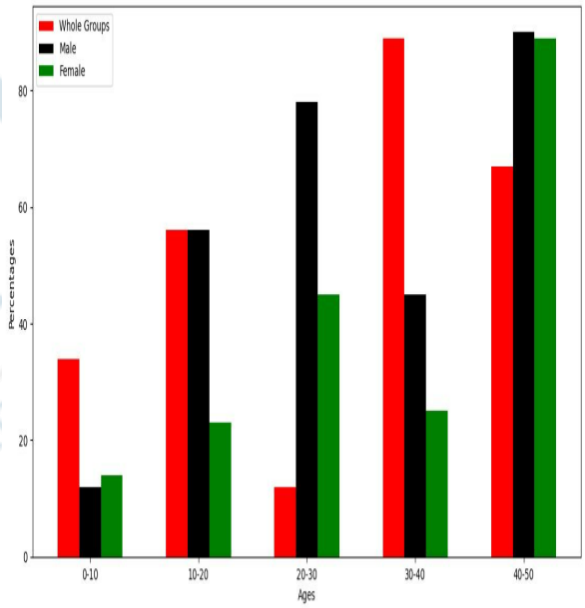

Figure 1: graph for individual groups based on age

The above graph shows that age wise effected groups by asthma disease. In the above graph it clearly shows that the 40-50 age groups having highest rate of asthma. The 40-50 age groups is effected by asthma disease , in this both male and female are having equal rate of asthma. The age group 0-10 is the least group effected by asthma disease.

II. RELATED WORK

In [1] Asthma guidelines have suggested in[1] assisted self-management for thirty years; improving the current inadequate implementation will need dedication from healthcare professionals, patients, and organisations.

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In [2] Effective illness self-management reduces the burden of asthma on patients and the healthcare system as a whole. In theory, mobile health apps should make it possible for patients to effectively manage their asthma and lead better lives.

In [3] The first app to use Symptonet, our AI engine that aids patients in managing their asthma, is myAsthma. By analysing symptoms, Symptonet intelligently delivers better results. For instance, Symptonet can identify patients who are using their rescue inhaler more frequently than necessary and provide them with additional guidance on how to control their symptoms.

In [4] The new iPhone software was created by physician and researcher Sam Pejham, Clinical Faculty at the UCSF Medical School, and Director of Tri-Valley Pediatrics. The free software enables users to quickly and simply keep a diary-style record of their asthma symptoms, meds, and triggers.

In [5] The widespread use of intelligent mobile platforms, a burgeoning ecosystem of sensors, including passive location monitoring, and the capacity to make use of external data sources present an opportunity to gather personal data on people in a depth that has never before been possible. Mobile health technologies could be used for research to improve our understanding of common diseases like asthma as well as management of chronic diseases..

In [6] The widespread use of intelligent mobile platforms, a burgeoning ecosystem of sensors, including passive location monitoring, and the capacity to make use of external data sources present an opportunity to gather personal data on people in a depth that has never before been possible.

In [7] In accordance with the UK's "pay-for-performance" Quality and Outcomes Framework, the annual recording of the RCP3Q morbidity score is rewarded.The final version of the combined NICE/BTS/SIGN guideline for the diagnosis, management, and monitoring of chronic asthma was published

In [8] December 2021. Series B (Statistical Methodology) of the Journal of the Royal Statistical Society was first published as the Supplement to the Journal of the Royal Statistical Society in 1934, the Society's centenary year.

In [10] By adopting the new technology and continuous monitoring, the diseases can be identified at the initial stage that can be avoided and limit the yield loss to a greater extent.

In [11] A texture characteristic known as CT may be used to quantify the changes in an image's texture. This helps identify items in the same field of view by differences in colour and brightness. HG is a term used to describe how consistent the texture of an area is. CR counts the pixel-to-pixel linear relationships based on which uniformity in picture areas is defined. Variations in brightness or grey level values are the roughness or bumpiness in this instance. These are the many texture attributes that need to be evaluated for categorization purposes.

In [12] Images from the dataset are first transformed to HSV images for use in image pre-processing to locate exudates. Color space conversion is the process of converting an image from one colour space to another, with the purpose of making the translated image as close as possible to the original in terms of appearance.

In [13] Machine learning techniques are used to provide predictive modelling for innumerable applications and requirements. Machine learning approaches can be categorised as 'general purpose' and 'universal' according on the specific task at hand. According to the needs, facts and focus of the problem several solutions will be appropriate.

III. METHODOLOGY

Random forest is a classifier that, as its name suggests, employs a number of decision trees on various subsets of the provided dataset and averages the outcomes to improve the expected accuracy of the dataset. The random forest forecasts the outcome based on whose guesses obtained the most overall votes rather than using predictions from a single decision tree.

The below diagram explains the working of the random forest algorithm diagram:

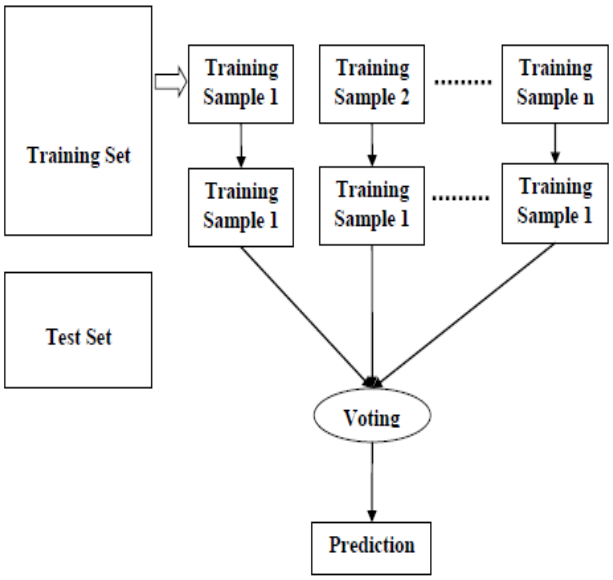

Figure 2: working of random forest algorithm

The dataset from the Asthma Mobile Health Investigation (AMHS) that was utilized in our review is portrayed first, and afterward the strategies made to examine the information is depicted. Coming up next are the major systemic advances::

- Information pre-handling and naming,
- highlight extraction,
- highlight choice,
- arrangement, and model assessment

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IV. RESULTS AND DISCUSSION

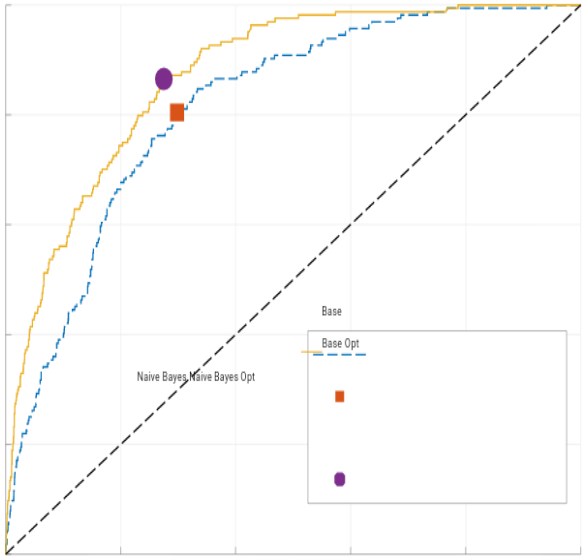

Figure 3: Base model vs best model

The naive Bayes classifier was the best performing algorithm. The model adopted from the median model with 500 plus evaluations was the prior representative naïve Bayes classifier every point in the ROC corresponds to choosing varieties of threshold for distinguishing in the study we have taken the optimal threshold(one with largest GMA).

The optimal model had a GMA of 0.792, with a sensitivity of 0.866, a specificity of 0.725, an AUC of 0.871, and the ROC curve displayed.

V. CONCLUSION AND FUTURE SCOPE

We demonstrated the value of machine learning techniques for supporting asthma self-management using the AMHS dataset, where the results of the information driven strategies were reliable with clinical information. More specific, we found that a discriminant classifier and a probabilistic classifier, the two of which could deliver great precision (AUC > 0.87) for early advance notice. Our examination has exhibited the strategy's true capacity for consolidating unpredictably inspected information into rundown factors and empowering correlations between time spans with differing information accessibility. Our future exploration needs to expand this information examination by using 3-digit ZIP code contributions to interface verifiable climate information, make segment, local, and occasional models, research connections among feelings and images, and research more muddled models. Additionally, this analysis did not include data from temporally outlying periods or from the transition between unstable and stable periods; nevertheless, multi-scale models in future models could be employed to include these data points.

By tying historical weather data to 3-digit ZIP code prefixes, developing geo-graphic, and migratory sub-models, examining relationships among emotion and symptom, and tough more advanced models, our future work seeks to further the analysis of this dataset. Additionally, this research did not include data from temporally outlying periods or from the transition between unstable and stable periods. Future models could use multi-scale models to include these data points. The Asthma virtual Health Study (A-MHS), a publicly accessible m-Health dataset, was used in this study to create early warning systems that will improve asthma self-management.

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