Journal of Trends and Challenges in Artificial Intelligence

ASPUR PUBLISHING

Vol. 02, No. 04 (2025) 109-116, DOI: 10.61552/JAI.2025.04.001 - http://jai.aspur.rs

IDENTIFICATION OF UNKNOWN DISEASES USING AI

Jayendra Jadhav[1]
Merwin Pinto
Diya Oswal
Vidal Shah
Aiviya Oswal
Rahul Papalkar

Received 07.07.2024.
Revised 14.09.2024.
Accepted 08.10.2024.

Keywords:

Machine Learning, Diseases, Covid-19, Linear regression, Symptoms, Prediction.

Original research

A B S T R A C T

The Coronavirus was a major health problem in the world. The rapid growth of the healthcare sector reveals the need for early diagnosis and management. AI provides solutions by analysing patient and clinical data to improve diagnosis. In this study, we reviewed the literature study on the use of symptom data to identify unknown diseases. Our Project focuses on accurately identifying the disease based on the patient's symptoms and patient data, ensuring timely treatment and better outcomes using ML models, our project emphasis on utilization of Naive Bayes model, Logistic regression and, random forest models.

© 2025 Journal of Trends and Challenges in Artificial Intelligence

1. INTRODUCTION

Artificial intelligence (AI) is becoming a game-changing force that will transform management and diagnostics in many industries, including healthcare. AI algorithms examine immense amounts of patient data, prescriptions, medicines, symptoms, variety of diagnoses, to find variety pattern and link histories for researches. AI-powered predictive models can help medical professionals detect diseases early using machine learning and data mining techniques (Keniya et al., 2020). This enables rapid intervention, individualized health planning and better outcomes for patients. AI-based decision-making systems can also improve resource allocation, hospital decision- making, and overall efficiency and effectiveness specially during covid many researches came up to solve decision making problems (Tiwari et al., 2020a). By widely forecasting a diseases we can predict the probability of a patient's illness by studying just studying and researching the patient's symptoms and the medications prescribed for that particular patient. Naive Bayes produced promising results to predict Covid-19 future trends with less Mean Absolute Error (MAE) and Mean Squared Error (MSE). The less value of MAE and MSE strongly represent the effectiveness of the Naïve Bayes regression technique. Although, the global footprint of this pandemic is still uncertain (Tiwari et al., 2020b). The disease can be treated before it spreads and infects everyone. Machine learning is used to predict diseases. This technique is

[1] Corresponding author: Jayendra Jadhav
Email: jayendra071985@gmail.com

used to predict the disease using different ML models, we input data sets containing symptoms and prescribed drugs and it calculates the data and tries to predict the disease. This process also records model accuracy to show how well some models would be useful in predicting certain types of diseases. Internet of Things (IoT) has the potential to play a pivotal role, and this present paper attempts to develop a novel system that implements the most efficient machine learning (ML) algorithm and takes input from the patients such as symptoms, audio recordings, available medical reports, and other histories of illnesses to accurately and holistically predict the disease that the patients are suffering from (Siddiqui et al., 2023).

1.1 About the research

Research on predicting unknown diseases based on symptoms is necessary due to tremendous growth in healthcare, and to move forward in the healthcare department and to keep up with the growing importance of early diagnosis and disease management.

The traditional methods of diagnosis in the healthcare sector may cause delayed diagnosis, which leads to poor medical outcomes. Therefore, early detection plays a crucial role as reinforcement. Artificial intelligence (AI) is becoming a game-changing force that is transforming management and diagnosis across many industries, including healthcare. AI-driven predictive models can aid medical professionals in detecting diseases early by utilizing machine learning and data mining methods. This allows for prompt intervention, individualized healthcare planning, and improved patient outcomes. Various intelligent decision support systems can also enhance resource allocation, decision-making in hospitals, and overall efficiency and effectiveness. Machine learning (ML) techniques could also be applied to Twitter data to identify patterns and trends that would be indicative of an emerging epidemic. For example, natural language processing (NLP) techniques could be used to analyse the language used in tweets to identify keywords and phrases that are commonly associated with a particular disease (Potnis & Tiple, 2023; Shu et al., 2020).

As technology advances, machine learning is becoming increasingly popular and is frequently used by business professionals to solve real-life problems. Machine learning encompasses the systematic examination of algorithms and statistical models that allow computers to execute tasks by recognizing patterns and making assumptions, independent of direct instructions (Potnis & Tiple, 2023). In the field of healthcare, this technology has the potential to tackle a range of challenges effectively. Coming to the aspect of our Project, with enough data, disease prediction using an algorithm can be simple and inexpensive. Predicting diseases based on symptoms and drug prescription plays an important role in predicting various kinds of diseases from which we can prevent future pandemics like COVID-19. In our project, we attempt to accurately forecast an illness based on the patient's symptoms and drug prescription based on those particular symptoms. Thus required treatments for those particular patients could be started by doctors at an early stage

Overall, the project focuses on the implementation of artificial intelligence and machine learning to predict unknown diseases based on symptoms and early detection. This research builds an advanced medical technology and aims to improve diagnosis of diseases by analyzing large data sets of patient's symptoms and treatment information. Inspired by lessons learned from the COVID-19 pandemic (Islam et al. 2020), the aim is to improve healthcare capacity in terms of early diagnosis, personalized intervention and post-crisis disease management. Blockchain-based solutions are transparent, traceable, and secure, businesses would find it easier to use this technology. Currently, most medical and pharmaceutical supply chains are facing significant logistical challenges, including a lack of real-time visibility into shipment locations, uncertainty transportation disruptions thus block chain too could be a better solution and much more could be helped with ref to (Jadhav & Deshmukh, 2022).

1.2 Significance of AI in healthcare

In recent times artificial intelligence (AI) is having a huge impact on health. AI has acing in the healthcare by providing transformative outcomes for all aspects of patient care and management processes in healthcare organizations. Consider it, the best computer to help doctors and hospitals do their jobs better. For example, when you get an X-ray or MRI scan (El Gannour et al., 2020; Minaee et al., 2020) AI can quickly analyze the image and see things that are difficult for humans to see. It can analyze and detect diseases for the doctors at an earlier stage, this means doctors can detect the disease earlier and start treatment sooner. And, additionally virtual nursing assistants, powered by AI, provide around-the-clock access to answers, support nurses, and help patients schedule visits, thereby this helps in reducing the workload on clinical staff and allowing them to focus more on the patient's treatment. Additionally, AI's predictive analytics capabilities allow for the prediction of disease risk factors before symptoms appear, enabling preventive measures to be taken early on specially in vast regions and locations (Farooqui et al., 2020). Lastly, AI contributes to enhanced drug development for rare diseases by identifying patient subpopulations most likely to respond to specific treatments, making clinical trials more efficient. Overall, AI's role in predicting unknown diseases is pivotal, revolutionizing healthcare by enhancing disease detection, treatment, and personalized medicine in AI and machine learning, Blockchain technology too offered a very significant potential for innovative improvements in the healthcare sector. Merging the analytic prowess of machine learning with the robust security features of Blockchain allowed significant improvements within healthcare infrastructures and was a great change in the health industry (Jadhav & Deshmukh, 2024).

2. LITERATURE REVIEW

In this study, we will review a literature overview on the Unknown Disease Prediction using Symptoms and drugs dataset.

2.1 An Overview on Unknown Diseases Identification using machine Learning.

Before We dive into the disease identification, we must examine the various datasets of symptoms as they are the main aspects of our project to predict a certain disease when the name of disease isn't known. Disease prediction means predicting the probability of a patient's disease by examining the combinations of the patient's symptoms. Predicting diseases is crucial today, as there are a lot of unknown illnesses that require extensive investigation. Dangerous diseases are a threat to human mankind and one's health, thus disease prediction is an important step to avoid pandemics and further spread of diseases. Thus, immediate medical treatment can cure the disease before it spreads and infects everyone.

In order to implement Disease Prediction Machine Learning is used. This technology is used to predict the disease by using various types of ML models, we feed in the Datasets containing symptoms and it calculates the data and tries to predict the Disease. During this process the accuracy of the model is also Recorded to show how well certain models would be Helpful in predicting certain types of disease.

2.2 Working of AI ML for Disease prediction

Figure 1 shows the steps of how ML Models are prepared and can be used to detect various diseases. Data Collection - Data preparation - data extraction - training a model - feature extraction - preparing data for our Machine learning model.

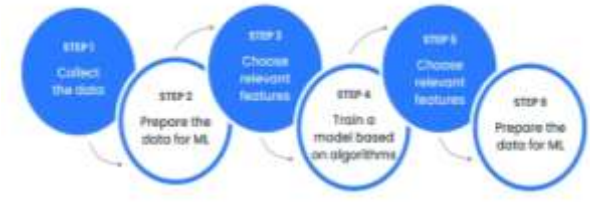

Figure 1. Steps for Disease prediction

Data collection is nothing but collection of raw data from various Data sources or datasets. After this data collection is complete, we further move to data filtering and data cleaning. After data has been cleaned the data extraction Process is started so as to choose the crucial data which could be utilized in our model. After data extraction we try to train our model using this data and capture various features and accuracies given by our model and further train our model with more data. And finally, when we are satisfied with the progress, we would prepare that similar type data for further processing. This is the process of ML model making of how it could be used to predict diseases (Figure 2).

Figure 2. Applications of AI and ML

Because AI and ML systems evaluate large volumes of data and identify intricate patterns within it, they aid in the early identification of disease. Various data formats and medical applications could require different algorithms. As illness detection processes begin, machine learning algorithms focus on risk assessment, early identification, and predictive analysis of a certain condition.

2.3 Types of Machine learning techniques available used to train models

Supervised learning, unsupervised learning, and deep learning are a few of the methods used in machine learning (ML), which is the process of teaching models to identify patterns and generate predictions or judgments (Grampurohit & Sagarnal, 2020).

In supervised learning, models undergo training on labelled data, with a target label provided to each example. It allows the model to learn connections between input features and output labels for tasks like regression and classification. Learning a mapping from input features to output labels is the aim of supervised learning, which enables the model to perform classifications or predictions on fresh, unobserved data.

Types of Supervised Learning:

1. In classification tasks, the objective is to allocate labels or categories to input data points. For instance, categorizing emails as either spam or non-spam, or categorizing images of animals into distinct species. Some common machine learning algorithms include logistic regression, decision trees, random forests, support vector machines (SVM), and neural networks.
2. Regression involves predicting continuous values based on input features. For instance, forecasting housing prices utilizing factors such as square footage, bedroom count, and geographic location. Common regression algorithms encompass linear regression, decision trees, and neural networks.
3. The Support Vector Machine (SVM) is utilized for both classification and regression purposes. It identifies the optimal hyperplane that divides data points into distinct classes. It is capable of processing both linear and non-linear data through the process of mapping them into a higher-dimensional space. It is effective for analysing both categorical and continuous data types, as it is proficient in identifying optimal decision boundaries

and managing high-dimensional data (Farooqui & Ahmad, 2020).

Unsupervised learning utilizes unlabelled data to reveal latent patterns or structures, with typical activities encompassing clustering to classify similar data points and dimensionality reduction to condense data without loss of crucial information.

Types of Unsupervised Learning:

1. Clustering: In clustering, data points are grouped together into clusters based on patterns or similarities present in the data. Common clustering algorithms include K-means clustering, hierarchical clustering, and DBSCAN.
2. Association Rule Learning: Association rule learning is utilized to identify significant relationships or associations among variables within extensive datasets. One common algorithm within this category is the Apriori algorithm, which is utilized in market basket analysis. It can also be employed for associating medicines with their corresponding symptoms.

Deep learning is a specialized branch of machine learning focused on neural networks with numerous layers, aimed at identifying patterns in complex datasets. It plays a pivotal role in tasks like image recognition, natural language processing (NLP), and speech recognition. By using neural network models with deep architectures, deep learning uncovers intricate patterns from high-dimensional data (Keniya et al., 2020).

Common deep learning techniques include Convolutional Neural Networks (CNNs) for image recognition even can predict if pneumonia is present in the Chest state as per covid 19 ML prediction (Militante et al., 2020). Recurrent Neural Networks (RNNs) is used for sequential data like text or time-series, and Long Short-Term Memory (LSTM) networks for capturing long-term dependencies. Other key methods include Generative Adversarial Networks (GANs), which generate synthetic data, and Transformer models, widely used in NLP tasks. Convolutional neural networks demonstrated their potential and established themselves as one of the most prominent deep learning algorithms and powerful techniques for detecting anomalies, irregularities, and diagnostics in chest radiography During a pandemic crisis, researchers focus on analysing appropriate COVID-19 diagnoses by implementing a Convolutional Neural Network (CNN) (Potnis & Tiple, 2023).

These advancements have driven significant progress in fields like computer vision, NLP, and healthcare. Together, these techniques empower machines to learn from data and support decision-making in a wide range of applications.

2.4 Importance of machine learning in Disease Prediction

Machine learning is essential in disease prediction as it aids medical professionals in identifying new diseases, forecasting treatment outcomes, and making sophisticated risk prediction decisions (Santangelo et al., 2023). Machine learning models possess the capability to analyse and process medical data to forecast the probability of an individual developing a specific disease. Numerous studies have been conducted to investigate the application of machine learning in relation to diagnostic capabilities. Machine learning techniques are utilized in illness datasets to extract features for the purposes of diagnosis, prediction, and prevention of illnesses.

Some important factors in machine learning:

1. Early detection: to identify indications and symptoms of diseases utilizing machine learning at the earliest possible opportunity. Machine learning algorithms are capable of analysing extensive volumes of patient data, including genetic information and medical records. Timely intervention and treatment are facilitated by early detection, which may reduce the severity of the illness (Jadhav & Deshmukh, 2024).
2. Risk assessment: Machine learning models can evaluate a person's likelihood of developing specific diseases based on their lifestyle choices, medical history, and demographic information.

3. METHODOLOGY

This study includes designing a Machine learning model that would try to predict unkown diseases and help us identify the disease, below is the structured methodology to implement it (Figure 3).

Figure 3. Identification of unknown disease Methodology Chart

Identification of unknown disease Methodology Chart is presented on Figure 3, and system architecture diagram is presented on figure 4.

1. Data Collection and Pre-processing: This is the initial step that involves gathering relevant data from various sources about various types of symptoms. The data sources included many electronic health records.
2. Exploratory Data Analysis (EDA): Once we got our data cleaned, we had to analyse the data and understand all the data so as to extract the important characteristics and meaningful features to identify any patterns or trends that might be relevant to the unknown disease.
3. Feature Selection: The data we collected may not always be in the usable format thus we had to select a few

features that we had to use in our project to identify the diseases.

4. Model Development: During model development we built a machine learning model that could identify patterns in the data and learned to differentiate Symptoms and the various demographic data from patients.

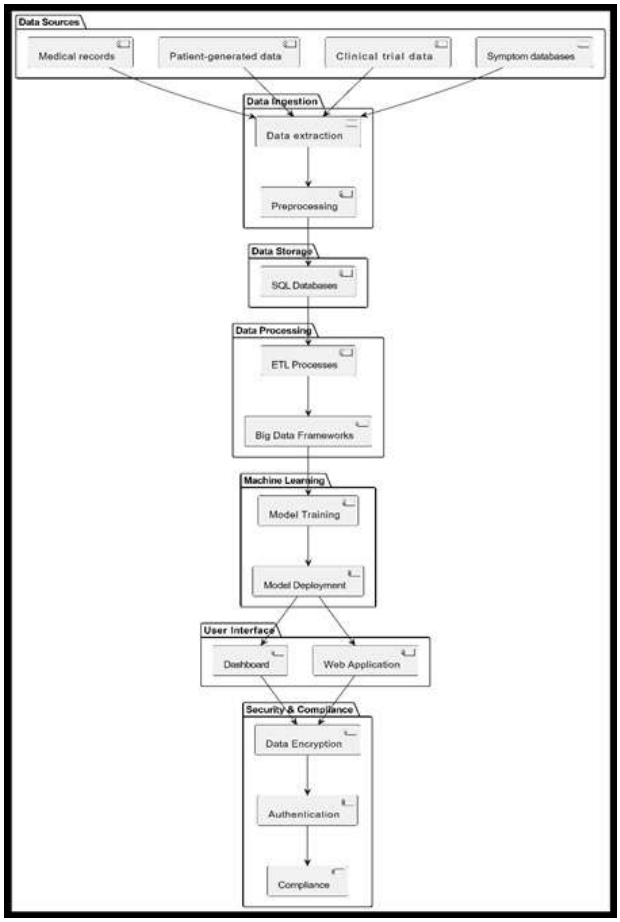

Figure 4. System Architecture Diagram

5. Model Training: This step involves feeding our input data into the AI model so that it could train and test patterns for prediction and identification of results.

6. Model Evaluation and Validation: Once our model was trained, we had to evaluate it which resulted in various accuracy to identify the unknown disease. The accuracy showed us the capability of the model to identify the disease

7. Clinical Validation: After the model is evaluated and validated using the data sets, we provided, we have to mandatorily perform clinical validation to confirm that it works effectively in clinical tests.

8. Deployment: After clinical Validation process, the model if passes all the tests in that process would be ready for real-world use to aid in diagnosing the unknown disease.

9. Monitoring and Maintenance: Even after deployment, we made sure to track the model's performance and continue to maintain it to ensure its accuracy and effectiveness over time.

4. RESULTS AND DISCUSSION

We performed various data exploratory methods to manipulate and use our data for the project, we focused on developing a predictive model using patient features and symptom data. The dataset included various symptoms such as Fever, Tiredness, Dry-Cough, Shortness-Of-Breath, Sore-Throat, None_Symptom, Pains, Nasal-Congestion, Runny-Nose, and Diarrhoea, on the other side patient demographic data including Age, Gender, and Severity. During the EDA process we started with Distribution of the symptoms if a symptom was present, it was assigned a value '1' and if the symptom was absent then it was assigned a value '0'

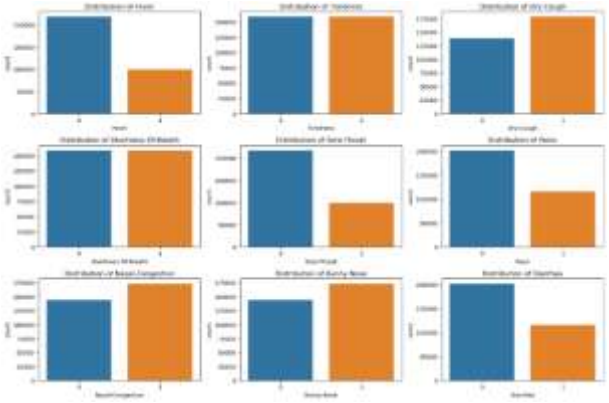

Figure 5. Symptom count for disease presence graphs

Our distribution of symptoms graph showed us a symptom count of both the present and absent symptoms for specific diseases, for example 'fever' the graph explains whether a fever symptom was present in their body (Figure 5). Some people didn't show the symptom in their body whereas some people showed a fever was present in the body. This is an important factor for doctors to note and to take quick action immediately.

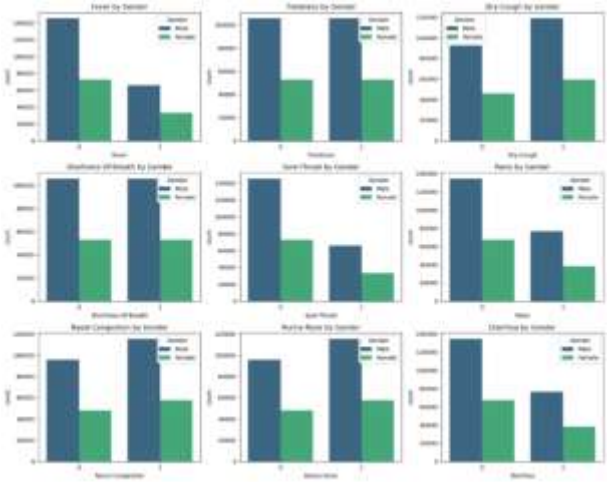

Figure 6. Symptom vs gender wise bar graph.

The gender-based symptom analysis graph provided a brief breakdown of symptom occurrences across different genders, highlighting which genders experienced symptoms and which didn't. This

visualization helped in understanding which genders were prone to which symptoms easily so further deep health research can be done to cure the mysterious diseases faster (Figure 6).

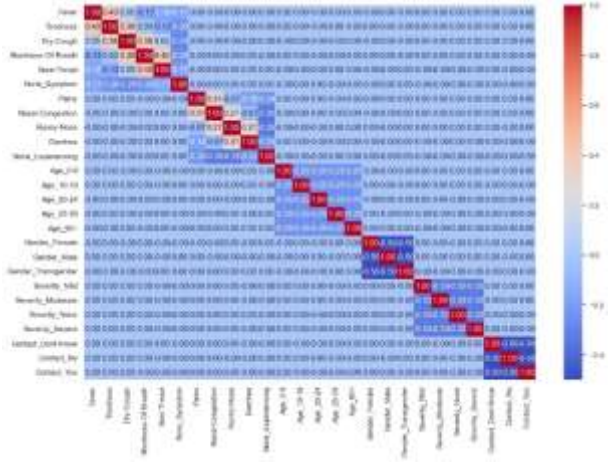

Figure 7. General symptoms and medicines heat map

The Correlation heat map here is based entirely on the dataset where all features are having a correlation with each other (Figure 7). Each symptom here is correlating with each other and they visually display the relationships between the different features available in the dataset. By using these color gradients, these maps highlight strong correlations available, helping to identify future trends and patterns that can inform medical research and treatment strategies.

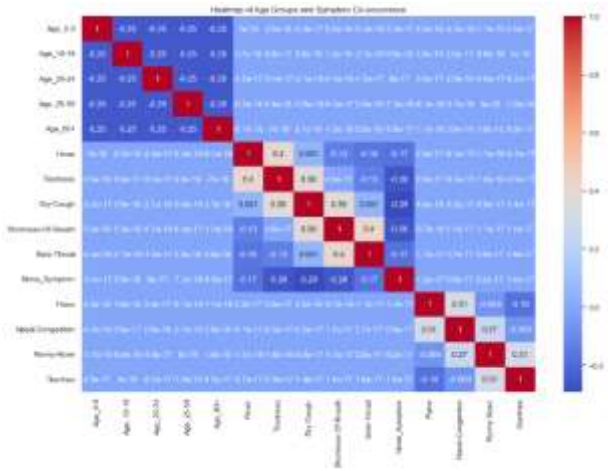

Figure 8. Age group and symptom co-occurrence heat map

Correlation heat maps based on age and disease symptoms visually display the relationships between the different age groups and the presence of various symptoms we provided in the dataset (Figure 8). By using color gradients, these maps highlight strongly age correlations with the symptoms provided with the age groups present in the data, helping to identify future trends and patterns that can inform medical research and treatment strategies.

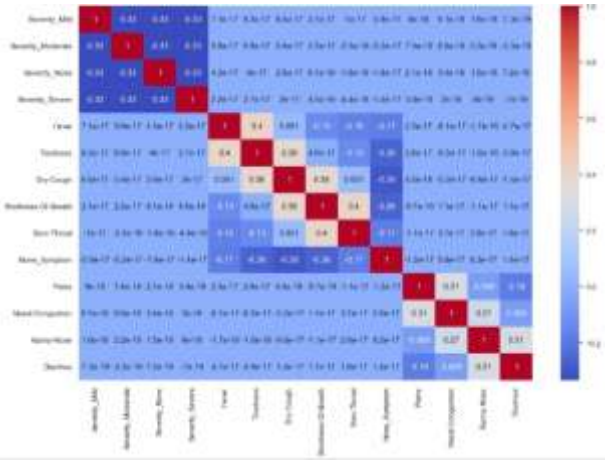

Figure 9. Severity and symptom co-occurrence heat map

Correlation heat map based on severity and disease symptoms here visually displays the relationships between the different severity types and the various symptoms provided in the dataset (Figure 9).

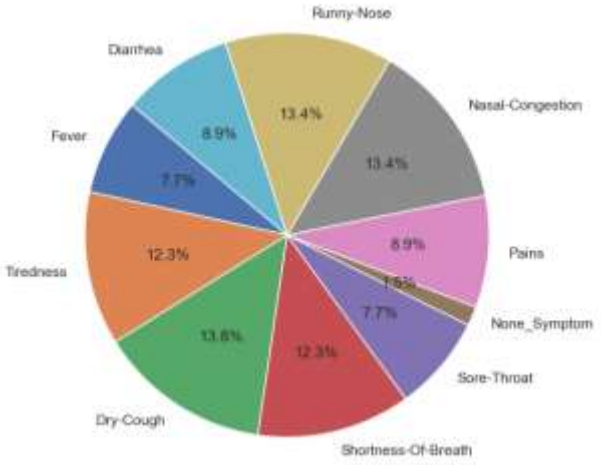

Figure 10. Symptom Occurrence by Percentage

By using color gradients, these maps highlight all the probable Severity correlations with the symptoms provided in the data, helping to identify future severity and symptom patterns (Figure 10).

5. IMPLEMENTATION AND RESULTS

For model development we implemented a various ML Technical models like Logistic Regression model, Random Forest and Naive Bayes Models.

The logistic regression model was chosen for its effectiveness to provide insights towards our different features. The graphs show the count of each disease by severity level, making it easier to understand how many symptoms fall into each severity category. This approach helps us see the big picture and pinpoint key patterns in symptom severity across different diseases.

Naive Bayes This model is particularly useful for highlighting which symptoms are most indicative of

specific diseases, aiding in accurate and precise diagnosis (Figure 11).

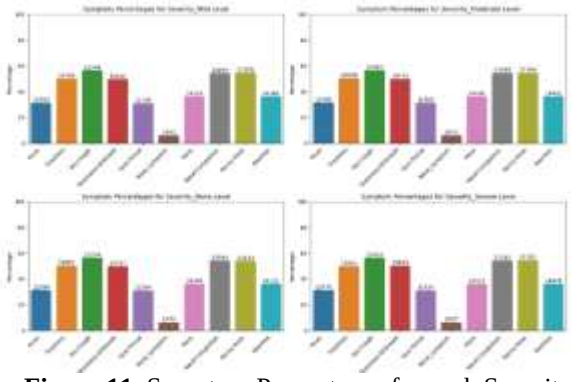

Figure 11. Symptom Percentages for each Severity level

On the other hand, the Random Forest model, with its ensemble of decision trees, offers a very good performance and handles large datasets effectively (Paul et al. 2022). By generating feature importance scores, it helps us identify the most critical symptoms for each disease.

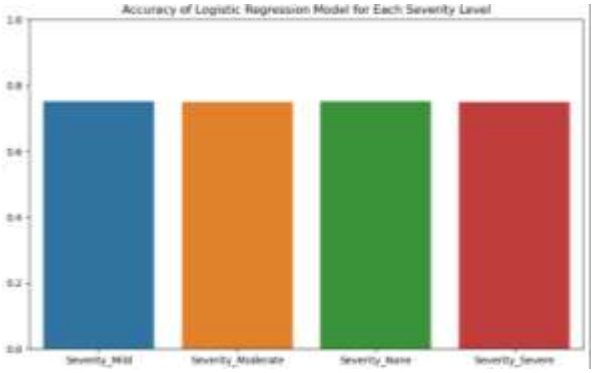

Figure 12. Logistic Regression Model Accuracy for Each Severity Level

The graphs display the distribution of diseases by severity level, making it easier to understand how symptoms are categorized in terms of severity. This combined approach allows us to see and uncover key patterns in symptom severity across different diseases, leveraging the strengths of each model for comprehensive insights. Upon evaluating Logistic Regression model, Random Forest and Naive Bayes Models. It achieved an accuracy of 75% and an F-1 score of 64%. Based on the provided symptoms and demographic information, the results demonstrated a respectable degree of accuracy and a balance between precision and recall, making it a valuable tool for forecasting the severity of illnesses (Figure 12).

6. FUTURE WORK

Our AI tool for identifying unknown diseases is to become a very crucial tool for healthcare facilities and professionals worldwide, this tool aids in enhancing disease detection by analysing patient symptoms and demographic data. It empowers doctors and health professionals to diagnose diseases with faster speed and precision. In addition to diagnosis, our tool's robust patient data analysis capabilities significantly improve the understanding of disease impacts on patients with similar symptoms allowing healthcare providers to immediately recognize patterns and characteristics of mysterious diseases, as a result, doctors can develop and implement effective treatment strategies well in advance, ultimately improving patient outcomes and accelerating the path to recovery. Our AI tool would be represented as a great advancement in medical diagnostics, offering a comprehensive approach to managing emerging health threats.

7. CONCLUSION

The projects involved planning, requirements gathering, data collection, pre-processing, exploratory data analysis, model development, evaluation, interpretation, deployment, user interface development, and testing with the goal of addressing the difficulties associated with analysing a large number of potential diseases. The studies showed how machine learning may be used in the healthcare sector to improve informed diagnosis decisions, patient care, and medical outcomes. In order recognize disease seriousness, the team utilized techniques like logistic regression, a random forest, and naive bayes. All of these approaches achieved an accuracy of 75 percent with F-1 scores of 64..

References:

El Gannour, O., Hamida, S., Cherradi, B., Raihani, A., & Moujahid, H. (2020, December). Performance evaluation of transfer learning technique for automatic detection of patients with COVID-19 on X-Ray images. In *2020 IEEE 2nd International Conference on Electronics, Control, Optimization and Computer Science (ICECOCS)* (pp. 1-6). IEEE.

Farooqui, M. E., & Ahmad, D. J. (2020). Disease prediction system using support vector machine and multilinear regression. *International Journal of Innovative Research in Computer Science & Technology (IJIRCST) ISSN*, 2347-5552.

Grampurohit, S., & Sagarnal, C. (2020, June). Disease prediction using machine learning algorithms. In *2020 international conference for emerging technology (INCET)* (pp. 1-7). IEEE.

Islam, M. N., Inan, T. T., Rafi, S., Akter, S. S., Sarker, I. H., & Islam, A. N. (2020). A systematic review on the use of AI and ML for fighting the COVID-19 pandemic. *IEEE Transactions on Artificial Intelligence*, *1*(3), 258-270. DOI:10.1109/TAI.2021.3062771

Jadhav, J. S., & Deshmukh, J. (2022). A review study of the blockchain-based healthcare supply chain. *Social Sciences & Humanities Open*, *6*(1), 100328.

Jadhav, J., & Deshmukh, J. (2024). Synergizing Machine Learning and Blockchain for Pioneering Early Disease Detection: A Focused Study on COVID-19 Diagnosis. *Available at SSRN 4794594*. DOI: 10.35248/2168-9784.24.13.472

Keniya, R., Khakharia, A., Shah, V., Gada, V., Manjalkar, R., Thaker, T., ... & Mehendale, N. (2020). Disease prediction from various symptoms using machine learning. *Available at SSRN 3661426*.

Militante, S. V., Dionisio, N. V., & Sibbaluca, B. G. (2020, October). Pneumonia and COVID-19 detection using convolutional neural networks. In *2020 Third International Conference on Vocational Education and Electrical Engineering (ICVEE)* (pp. 1-6). IEEE. , doi: 10.1109/ICVEE50212.2020.9243290.

Minaee, S., Kafieh, R., Sonka, M., Yazdani, S., & Soufi, G. J. (2020). Deep-COVID: Predicting COVID-19 from chest X-ray images using deep transfer learning. *Medical image analysis*, *65*, 101794.

Paul, S., Ranjan, P., Kumar, S., & Kumar, A. (2022, January). Disease predictor using random forest classifier. In *2022 International conference for advancement in technology (ICONAT)* (pp. 1-4). IEEE.

Potnis, N., & Tiple, B. (2023). Machine Learning Techniques for Disease Prediction. In *ITM Web of Conferences* (Vol. 57, p. 01004). EDP Sciences.

Santangelo, O. E., Gentile, V., Pizzo, S., Giordano, D., & Cedrone, F. (2023). Machine learning and prediction of infectious diseases: a systematic review. *Machine Learning and Knowledge Extraction*, *5*(1), 175-198.

Shu, K., Mahudeswaran, D., Wang, S., Lee, D., & Liu, H. (2020). Fakenewsnet: A data repository with news content, social context, and spatiotemporal information for studying fake news on social media. *Big data*, *8*(3), 171-188.

Siddiqui, S. A., Ahmad, A., & Fatima, N. (2023). IoT-based disease prediction using machine learning. *Computers and Electrical Engineering*, *108*, 108675.

Tiwari, D., Bhati, B. S., Al-Turjman, F., & Nagpal, B. (2022b). Pandemic coronavirus disease (Covid-19): World effects analysis and prediction using machine-learning techniques. *Expert Systems*, *39*(3), e12714.

Tiwari, S., Chanak, P., & Singh, S. K. (2022a). A review of the machine learning algorithms for COVID-19 case analysis. *IEEE Transactions on Artificial Intelligence*, *4*(1), 44-59.

Jayendra Jadhav
Vishwakarma University,
India.
jayendra071985@gmail.com
ORCID: 0000-0001-6767-6580

Merwin Pinto
Vishwakarma University,
India.
merwinpinto5@gmail.com
ORCID: 0009-0007-3200-9308

Diya Oswal
Vishwakarma University,
India.
diyaoswal03@gmail.com
ORCID: 0009-0009-6394-917X

Vidal Shah
Vishwakarma University,
India.
vidalshah@gmail.com
ORCID: 0009-0002-0985-7900

Aiviya Oswal
Vishwakarma University,
India.
aiviyaoswal0304@gmail.com
ORCID: 0009-0003-7389-5343

Rahul Papalkar
Vishwakarma University,
India.
Rahul.papalkar@vupune.ac.in
ORCID: 0000-0002-2888-3525