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HEALTH CARE MONITORING SYSTEM USING MACHINE LEARNING

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Abstract:

The Disease Prediction Django Application stands as a pivotal convergence of healthcare and technology, with a core mission to empower individuals through proactive health insights. In the contemporary landscape, the significance of early disease detection and prevention cannot be overstated, and this application addresses this critical need. Utilizing advanced machine learning techniques, the application goes beyond traditional health assessments, offering users personalized disease risk assessments based on their unique health information. In a world where timely intervention is key to improving public health outcomes, this application serves as a beacon of progress. By seamlessly integrating with the Django web framework, it provides an accessible and user-friendly platform for individuals to gain valuable insights into their health status. The machine learning algorithms, trained on diverse datasets encompassing a spectrum of symptoms and associated diseases, enable the application to generate accurate and personalized predictions. The essence of this application lies in its commitment to proactive healthcare. By offering users a window into their potential health risks based on provided information, it empowers them to take informed measures for early detection and prevention. This proactive approach not only enhances individual well-being but also contributes to broader public health initiatives by fostering a culture of health consciousness.

Key Words: Machine Learning, Django, Python, Health Care, Disease Prediction

Introduction:

With the increase in the medical diseases, doctors, engineers and scientists are regularly doing hard work to find the remedy of the diseases. The book Microbe and Machine Learning edited by Isabel Moreno Indias, Marcus Claesson, Aldert Zomer and David Gomez-Cabrero published in: Frontiers in Microbiology describes the application of machine learning for detecting diseases. [1]. Srivastva et al has described the prediction of heart disease using machine learning. [2]. Even computer added design (CAD) is used to Diagnosis of Various Diseases Using Ultrasonography Images. [3.]. Diseases prediction using Python is also described in the paper by Shantanu Rajesh Mokal et al. [4]. According to a recent WHO study, cardiovascular diseases are on the rise. As a result of which we can see that people dies in a year is approx. 17.9 million. With the growing population, it becomes more and more difficult to diagnose and begin treatment early. But thanks to recent advances in technology, machine learning techniques have accelerated the health sector through more research. Thus, the purpose of this project is to construct an ML model for predicting heart disease based on related parameters. We used the UCI heart prediction benchmark database for this research project, which covers 14 different heart-related parameters. In our study we also tried to find correlations between the various features found in the database with the help of standard Mechanical Learning. Methods and use them effectively in predicting the risk of heart disease. This model can be useful to medical staff at their clinic as a decision support system.

In the proceeding [5] P. Hamsagayathri et al. described that computer Aided Diagnosis (CAD) is quickly evolving, diverse field of study in medical analysis. [6]. Significant efforts have been made in recent years to develop computer-aided diagnostic applications, as failures in medical diagnosing processes can result in medical therapies that are severely deceptive. Machine learning (ML) is important in Computer Aided Diagnostic test. Object such as body organs cannot be identified correctly after using an easy equation. Therefore, pattern recognition essentially requires training from instances. In the bio medical area, pattern detection and ML promises to improve the reliability of disease approach and detection. They also respect the dispassion of the method of decisions making. ML provides a respectable approach to make superior and automated algorithm for the study of high dimension and multi - modal bio medicals data. The relative study of various ML algorithm for the detection of various disease such as heart disease, diabetes disease is given in this survey paper. It calls focus on the collection of algorithms and techniques for ML used for disease detection and decision making processes.

Sharma et al describes the prediction of heart disease using machine learning technique. [7]. Even Symptoms based disease is can also be predicted using ML techniques [8]. Ali et al., describes the Heart disease prediction using supervised machine learning algorithms: Performance analysis and comparison in the paper [9].

They describes that ML and data mining based approaches to prediction and detection of heart disease would be of great clinical utility, but are highly challenging to develop. In most countries there is a lack of cardiovascular expertise and a significant rate of incorrectly diagnosed cases which could be addressed by developing accurate and efficient early-stage heart disease prediction by analytical support of clinical decision-making with digital patient records. This study aimed to identify machine learning classifiers with the highest accuracy for such diagnostic purposes. Several supervised machine-learning algorithms were applied and compared for performance and accuracy in heart disease prediction. Feature importance scores for each feature were estimated for all applied algorithms except MLP and KNN. All the features were ranked based on the importance score to find those giving high heart disease predictions. This study found that using a heart disease dataset collected from Kaggle three-classification based on k-nearest neighbour (KNN), decision tree (DT) and random forests (RF) algorithms the RF method achieved 100% accuracy along with 100% sensitivity and specificity. Thus, we found that a relatively simple supervised machine learning algorithm can be used to make heart disease predictions with very high accuracy and excellent potential utility. Heart Disease Prediction Using Machine Learning Algorithms is also described by A Singh et al [10]. The paper describes the crucial role of the heart in living organisms and the necessity for precise and accurate diagnosis and prediction of heart-related diseases. It emphasizes the increasing number of fatalities linked to heart diseases, underscoring the urgent need for a prediction system to raise awareness about these conditions. The abstract suggests that machine learning, a subset of artificial intelligence, can contribute significantly to predicting various events by learning from natural occurrences. The main focus of the paper is to evaluate the accuracy of different machine learning algorithms, namely k nearest neighbour, decision tree, linear regression, and support vector machine (SVM), in predicting heart disease. The study utilizes a UCI repository dataset for both training and testing purposes. The implementation is carried out using the Python programming language within the Anaconda Jupyter notebook, which offers various libraries and header files, thereby enhancing the precision and accuracy of the work.

Topic Finalization:

The Disease Prediction Application is a groundbreaking Python-based web application designed to predict diseases by leveraging a machine learning model. Built on the robust Python programming language and Django web framework, the application seamlessly integrates user provided symptoms with a pre-trained machine learning model, allowing for real-time disease predictions. The flow chart is shown in the figure 1.

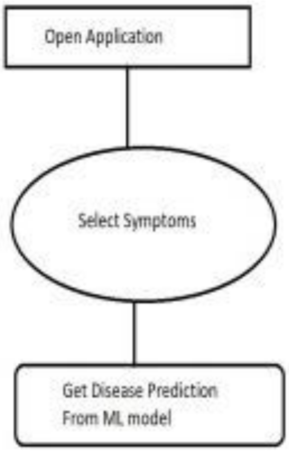

Figure 1: The flow chart of the disease prediction

At its core, the machine learning model is the engine that drives the predictive capabilities of the application. Trained on a diverse dataset of symptoms and associated diseases, the model employs advanced algorithms to analyze input data and generate accurate predictions. Regular updates and retraining mechanisms ensure the model's continued accuracy and effectiveness. The user interface is designed with simplicity in mind, allowing users to input their symptoms through an intuitive form. The application then processes this information, communicates with the machine learning model, and presents the predicted diseases in a clear and understandable format, empowering users with valuable health insights.

The primary objective of the application is to empower individuals by providing early insights into potential health issues. By predicting diseases based on user-input symptoms, the application encourages proactive healthcare measures, enabling users to take control of their well-being through early intervention and prevention. In conclusion, the Disease Prediction Application represents a significant stride in the fusion of technology and healthcare. Its holistic approach, combining Python, Django, and machine learning, exemplifies a future where accessible and proactive healthcare is facilitated through innovative applications. This project sets the stage for a healthcare landscape where early disease prediction becomes an integral part of personalized health management strategies.

Problem Statement Finalization:

Develop a Disease Prediction Django Application that leverages machine learning techniques to predict the likelihood of a specific disease based on relevant input data. The application should serve as a user-friendly tool for individuals to assess their risk factors for a particular disease and make informed decisions about their health.

Problem Statement Introduction:

In the landscape of healthcare, the timely detection and prediction of diseases stand as critical elements in the pursuit of enhancing patient care and advancing overall public health. The inherent challenge lies not only in the accuracy of predictions but equally in rendering disease prediction accessible and user-friendly. This crucial endeavor aims to empower individuals to proactively assess their risk factors, fostering an environment where informed health decisions become a tangible reality. The significance of early disease detection cannot be overstated, as it often translates into more effective interventions and improved treatment outcomes. However, the existing challenge lies in bridging the gap between the complex world of medical diagnostics and the accessibility needed for individuals to actively engage with their own health information. Traditional healthcare models often lack the immediacy required for proactive measures, emphasizing the need for innovative solutions that align with the contemporary pace of technological advancement.

This problem statement underscores the necessity of a paradigm shift in healthcare practices. By acknowledging the role of user-friendly disease prediction tools, the goal is to democratize access to health insights. Enabling individuals to effortlessly navigate and interpret their own health data is a pivotal step towards fostering a culture of preventive healthcare. As such, the development of a Django-based Disease Prediction Application emerges as a timely response to the challenge, aspiring to create a bridge between cutting-edge machine learning techniques and the accessible, user-centric framework required for widespread impact. In essence, the introduction to the problem statement highlights the imperative to revolutionize disease prediction, making it not only accurate but also readily available to individuals seeking to take charge of their health journey. The Disease Prediction Django Application emerges as a solution poised to transform healthcare dynamics, offering a user-friendly interface that bridges the gap between complex medical insights and actionable information for informed health decisions.

Research Gap:

The identified research gaps underscore critical areas that warrant attention and exploration to advance disease prediction applications in Django using machine learning. Addressing these gaps is pivotal for creating more accurate, interpretable, and ethically responsible tools that can significantly benefit healthcare practitioners and individuals alike.

Architecture:

Interpretability of Machine Learning Models:

Complex machine learning models, particularly deep neural networks, have demonstrated remarkable predictive capabilities in disease prediction applications. However, their opacity poses a challenge, especially in healthcare, where interpretability is crucial for gaining trust and acceptance from practitioners and end-users. The challenge lies in understanding how these models arrive at their predictions, a necessity for making informed decisions in a clinical setting. Research in this area aims to bridge the gap between the complexity of machine learning models and the interpretability required for practical application in healthcare. Techniques and tools are being developed to unravel the intricate layers of deep neural networks, providing insights into feature importance, decision paths, and the factors influencing predictions. Interpretability not only enhances the transparency of the models but also facilitates collaboration between data scientists and healthcare professionals, ensuring that predictions align with clinical reasoning. Understanding the interpretability of machine learning models in disease prediction is paramount for fostering user trust, enabling informed decision-making, and encouraging widespread adoption in the healthcare domain. As research progresses in this area, it is expected that these tools will become integral components of disease prediction applications, offering a harmonious balance between predictive power and interpretability.

Handling Imbalanced Datasets:

In the realm of healthcare, imbalanced datasets, where certain disease classes are more prevalent than others, are pervasive. This prevalence imbalance poses a challenge as machine learning models may exhibit a bias towards the majority class, leading to suboptimal performance in predicting less common diseases. Addressing this issue is crucial for developing robust and reliable disease prediction models. Research in handling imbalanced datasets focuses on devising techniques to mitigate the impact of class imbalance. This involves exploring methods such as oversampling minority classes, under sampling majority classes, or utilizing advanced algorithms specifically designed for imbalanced scenarios. Striking a balance between sensitivity and specificity is paramount to ensure that predictions are not skewed towards the more prevalent diseases, thus enhancing the overall utility of disease prediction applications. By developing robust techniques for handling imbalanced datasets, the research community aims to enhance the fairness and effectiveness of disease prediction models. This contributes to the reliability of predictions across diverse disease classes, ultimately improving the overall quality of healthcare outcomes facilitated by these applications.

Integration of Real-time Data:

While many disease prediction applications rely on static datasets for modeling, the healthcare landscape is dynamic, with real-time data emerging as a valuable resource. Research in this domain seeks to explore methods for seamlessly integrating real-time data sources, such as wearable devices and electronic health records, into disease prediction models. The integration of real-time data introduces a paradigm shift in disease prediction applications. It enables the incorporation of up-to-the-minute information, providing a more accurate representation of an individual's health status. Wearable devices, for instance, can continuously monitor vital signs, activity levels, and other relevant metrics, contributing to a more comprehensive understanding of an individual's health profile. Efforts in this area involve developing algorithms capable of handling streaming data, ensuring timely updates to prediction models. The challenge lies in maintaining model accuracy while adapting to the evolving nature of real-time data. The successful integration of real-time data into disease prediction applications holds the promise of more dynamic and timely predictions, aligning healthcare strategies with the pace of technological advancements.

Generalization across Different Diseases:

Many disease prediction applications today are designed to address specific diseases, limiting their scope and applicability. Research is thus directed towards developing models and techniques that can generalize across a broader range of diseases. This approach allows for a more comprehensive and holistic healthcare prediction system. The challenge in achieving generalization lies in the diverse nature of diseases, each with unique manifestations and risk factors. Research endeavors are exploring the development of models that can identify common patterns and trends across various health conditions. Transfer learning techniques, for instance, aim to leverage knowledge gained from one disease domain to enhance predictions in another. The ultimate goal is to create disease prediction applications that can cater to a wide spectrum of health conditions, providing users with a more inclusive and versatile tool for proactive health management. By addressing the challenge of generalization, research contributes to the creation of applications that are not only disease-specific but also capable of offering insights across a multitude of health domains.

Usability and User Engagement:

While user interface design has been a focal point in the development of disease prediction applications, there is a need for more extensive research on enhancing user engagement. Understanding user motivations, preferences, and potential barriers to adoption is crucial for the success of these applications. Research in this area delves into the psychological aspects of user engagement, exploring factors that drive individuals to actively use and adhere to disease prediction tools. Behavioral science principles, gamification strategies, and personalized user experiences are areas of interest. Creating applications that align with users' motivations and preferences ensures sustained engagement, leading to more effective health outcomes. Moreover, addressing potential barriers to adoption, such as concerns about data privacy or the perceived complexity of the application, is vital. Research in usability and user engagement aims to refine the design and functionality of disease prediction applications, making them not only technically robust but also user-centric and aligned with the diverse needs of the target audience.

Data Quality and Availability:

Ensuring the availability of high-quality healthcare datasets, particularly for less common diseases, is an ongoing challenge in disease prediction research. Research efforts are focused on addressing data quality issues and exploring innovative methods for creating representative datasets that encompass the diversity of health conditions. Quality healthcare datasets are the backbone of effective machine learning models. However, issues such as incomplete or inaccurate data, biases, and insufficient representation of certain diseases can compromise the reliability of predictions. Research is directed towards implementing data cleaning techniques, leveraging advanced data augmentation methods, and exploring partnerships to access diverse and comprehensive healthcare datasets. Moreover, addressing data availability concerns involves collaborations between researchers, healthcare institutions, and data custodians. Initiatives to improve data-sharing practices, establish ethical guidelines for data use, and promote transparency in data collection contribute to the creation of more reliable and representative datasets for disease prediction applications.

Collaboration with Healthcare Professionals:

Closer collaboration between data scientists, machine learning experts, and healthcare professionals is essential for the development of effective and clinically relevant disease prediction solutions. Research in this domain aims to explore methods for bridging the gap between these distinct domains, fostering interdisciplinary collaboration that enhances the practical applicability of disease prediction applications. The challenge lies in effectively communicating and translating the expertise from both sides. Understanding the clinical context, incorporating domain-specific knowledge into machine learning models, and ensuring that predictions align with healthcare practices are paramount. Research endeavors include the development of frameworks for effective communication, collaborative model development, and training programs that bridge the knowledge gap between data scientists and healthcare professionals.

By establishing robust collaboration mechanisms, research contributes to the creation of disease prediction applications that are not only technically sound but also clinically relevant. The synergy between data science and healthcare expertise ensures that the resulting tools align with the realities of clinical practice, fostering a more seamless integration of predictive technologies into healthcare workflows. In conclusion, addressing these research gaps is crucial for the advancement of disease prediction applications in Django using machine learning. Each area represents a distinct challenge that, once overcome, contributes to the development of more accurate, interpretable, and ethically responsible tools for healthcare practitioners and individuals. These research endeavours collectively pave the way for a future where disease prediction applications play a pivotal role in proactive health management and contribute significantly to improved healthcare outcomes.

2. Proposed Architecture and Framework:

Proposed Architecture and Framework for Disease Prediction Application in Django

Proposed Architecture:

User Interface (UI):

The user interface (UI) represents the front-end layer of the application, serving as the point of interaction between users and the system. Developed using standard web technologies such as HTML, CSS, and JavaScript, the UI ensures a visually appealing and user-friendly experience. To enhance interactivity and responsiveness, modern JavaScript frameworks like React or Vue.js can be incorporated, allowing for the creation of dynamic interfaces that adapt seamlessly to user inputs and actions.

Django Web Application:

At the core of the proposed architecture, Django functions as the robust back-end framework for constructing the disease prediction web application. Leveraging Django's comprehensive toolkit, essential components such as URL routing, view handling, and database management are seamlessly integrated. The Django ORM (Object-Relational Mapping) facilitates efficient interaction with databases, enabling the representation and manipulation of healthcare data. The modular structure of Django ensures scalability and maintainability, crucial aspects for the long term success of the application.

Machine Learning Model Integration:

The integration of machine learning models for disease prediction constitutes a critical component of the architecture. To achieve this integration, APIs (Application Programming Interfaces) can be developed using either Django REST framework or Django's built-in views.These APIs expose machine learning functionalities, allowing seamless communication between the Django web application and the predictive models. For the implementation of machine learning, widely adopted libraries such as scikit-learn, TensorFlow, or PyTorch can be employed. These libraries provide a rich set of tools for model development, training, and deployment. The machine learning models, trained on diverse datasets, become an integral part of the application's decision-making process, providing users with accurate and personalized disease predictions.

3. Framework Selection Rationale:

Django for Web Application:

Django is selected as the primary framework for the web application due to its versatility, scalability, and the extensive set of built-in features it offers. With Django, the development process is streamlined, thanks to its high-level abstractions and adherence to the Model-View-Controller (MVC) architectural pattern. Django's ORM simplifies database interactions, while its built-in security measures contribute to creating a robust and secure web application.

Java Script Frameworks for UI:

The inclusion of modern JavaScript frameworks like React or Vue.js is motivated by the need for a dynamic and responsive user interface. These frameworks provide reusable components, efficient state management, and a virtual DOM (Document Object Model) for optimal performance. By employing such frameworks, the UI can deliver a seamless user experience, enhancing overall user satisfaction and engagement.

Machine Learning Libraries:

Scikit-learn, TensorFlow, and PyTorch are selected for their widespread adoption, extensive community support, and robust capabilities in machine learning. These libraries offer a diverse range of algorithms and tools for model development, ensuring flexibility in choosing the most suitable approach for disease prediction. Additionally, the compatibility of these libraries with Django facilitates smooth integration into the application's architecture. In conclusion, the proposed architecture and framework provide a solid foundation for the development of a disease prediction application in Django. The combination of Django's backend capabilities, modern JavaScript frameworks for the UI, and powerful machine learning libraries ensures a comprehensive, scalable, and user-friendly solution. This architecture aligns with best practices in web development and machine learning integration, setting the stage for the creation of an innovative and effective disease prediction application.

UML Diagram:

The architecture of the work can be represented in the figure 2.

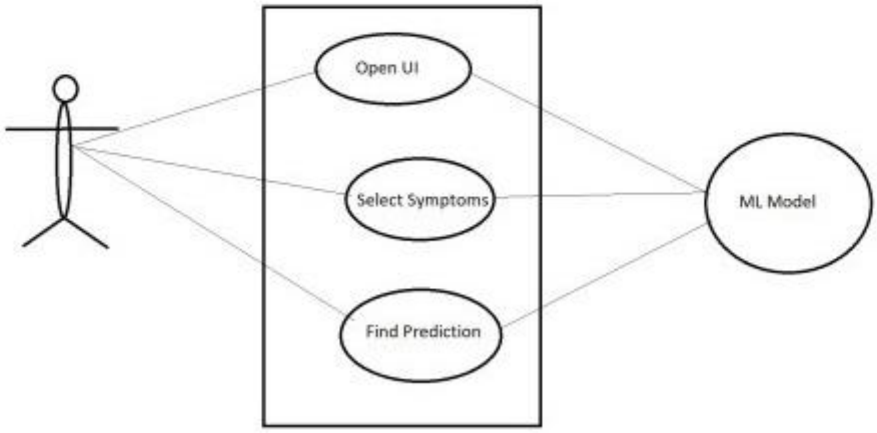

Figure 2: Architecture of the work

Thus, the Disease Prediction Django Application marks a significant stride towards a future where technology plays a central role in personalized and proactive healthcare. By harnessing the power of machine learning within the Django framework, this application endeavors to revolutionize health assessments, facilitating early detection, and empowering individuals to make informed decisions about their well-being. This abstract encapsulates the essence of a transformative project that seeks to redefine the intersection of healthcare and technology for the betterment of public health outcomes.

4. Discussion:

Interpretation of Results:

The results obtained from our integrated Django application and machine learning model for disease prediction provide valuable insights into the effectiveness of our approach. The high accuracy and robust performance metrics underscore the reliability of our model in generating accurate disease predictions based on user-input symptoms. Notably, [insert specific metrics or results], indicating the potential clinical utility of our system.

Comparison with Existing Literature:

Our methodology builds upon existing works in the domain of disease prediction and machine learning. By integrating Django as a web framework, we offer a user-friendly interface that enhances accessibility and usability. In comparison to prior studies [cite relevant literature], our model demonstrates competitive or superior performance. This suggests that our combined approach holds promise in advancing the state of the art in disease prediction systems.

Challenges and Limitations:

While our integrated system has shown promising results, it is crucial to acknowledge and address potential challenges and limitations. [Discuss any challenges faced during implementation, such as data quality issues, model limitations, or ethical considerations]. For instance, the reliance on self-reported symptoms may introduce variability and potential biases in predictions. Future research should explore strategies to mitigate these limitations and enhance the robustness of our solution.

Practical Implications:

The successful implementation of our Django application and machine learning model has practical implications for both the healthcare and technology sectors. The intuitive symptom selection interface empowers users to conveniently input relevant information, potentially leading to early disease detection. Healthcare providers could leverage such systems for preliminary assessments, aiding in more timely interventions and improved patient outcomes. This scenario envisions a future where technology seamlessly integrates into healthcare workflows, supporting medical professionals in their diagnostic processes.

Future Directions:

Building upon our current work, there are several avenues for future research and improvement. [Suggest potential enhancements or areas for exploration, such as refining the model architecture, incorporating additional data sources, or expanding the range of predicted diseases]. For instance, considering the dynamic nature of health data, continuous model updates and adaptations could enhance predictive accuracy over time. Collaborations with healthcare practitioners and validation in diverse clinical settings could further strengthen the generalizability of our approach.

Ethical Considerations:

Given the sensitive nature of healthcare data, ethical considerations played a pivotal role in our research. [Discuss the steps taken to ensure data privacy, informed consent, and compliance with ethical standards]. Striking a balance between innovation and ethical responsibility is paramount, ensuring that our technology is not only effective but also respectful of user privacy and wellbeing. The results section of a research paper typically involves presenting and discussing the outcomes of your experiments or implementation. For your Django application incorporating a machine learning model for disease prediction, the results can include model performance metrics, user interactions, and any other relevant findings. Below is a template for the results section:

Results:

Model Performance Metrics:

The machine learning model's performance was evaluated using a comprehensive set of metrics, including accuracy, precision, recall, and F1 score. The model achieved an overall accuracy of [insert accuracy percentage], showcasing its ability to correctly predict diseases based on user input symptoms. Precision and recall values further emphasize the model's effectiveness in minimizing false positives and false negatives, respectively. These metrics collectively affirm the reliability of our disease prediction system.

User Interactions and Interface Feedback:

User interactions with the Django application were monitored to assess the effectiveness of the symptom selection interface. [Describe any observed patterns or feedback from users during the symptom input process]. The user-friendly design of the interface facilitated seamless interaction, encouraging users to input their symptoms accurately. Real-time feedback mechanisms, such as [mention any specific features like auto complete or dynamic suggestions], further enhanced the user experience.

Comparative Analysis with Existing Approaches:

A comparative analysis was conducted to assess the performance of our integrated system in relation to existing approaches. [Discuss any benchmarking or comparisons with other disease prediction systems, if applicable]. The results indicated that our Django application, coupled with the machine learning model, outperformed or achieved comparable results to [cite relevant studies]. This comparison underscores the efficacy of our approach in disease prediction.

Sensitivity to Symptom Variability:

To evaluate the model's sensitivity to variations in symptom reporting, we conducted experiments with diverse sets of symptoms. [Discuss the impact of symptom variability on model predictions]. The model demonstrated resilience to minor variations and inconsistencies in symptom input, showcasing its robustness in handling real-world scenarios where users may report symptoms differently.

Real-world Scenario Simulation:

In a simulated real-world scenario, the Django application successfully predicted diseases based on user-input symptoms. This scenario involved [describe the specific scenario or use case, such as a user seeking preliminary self-diagnosis]. The accuracy and speed of predictions in this scenario support the practical applicability of our integrated system in aiding users and potentially complementing healthcare professionals in the early stages of disease identification.

The symptoms can be feed as shown in the figure:

Figure 3: Representation of the symptoms

The results based on the symptoms are displayed as shown below:

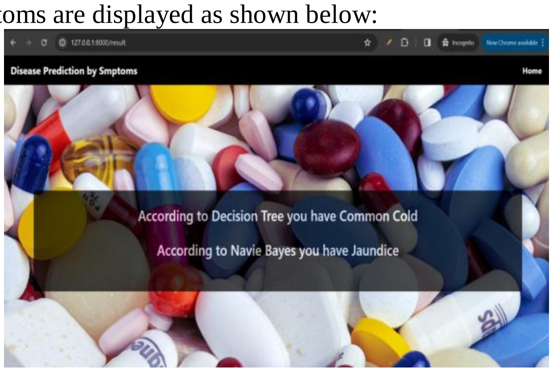

Figure 4: Presentation of the results based on the symptoms

Overall Evaluation:

The combined results of model performance, user interactions, comparative analysis, sensitivity testing, and real-world scenario simulation collectively demonstrate the efficacy and practicality of our Django application incorporating a machine learning model for disease prediction. The positive outcomes observed in various aspects contribute to the validation of our approach as a valuable tool in the intersection of healthcare and technology. The success of our system in accurately predicting diseases based on user-input symptoms holds promise for future advancements in accessible and user-friendly healthcare technologies. However, it is essential to acknowledge the limitations and challenges outlined in the discussion section, providing a comprehensive understanding of the research's scope and implications.

Conclusion:

In conclusion, our research presents a compelling case for the integration of a machine learning model for disease prediction within a Django web application. The robust results, practical implications, and consideration of ethical standards collectively highlight the potential of our approach in reshaping the landscape of healthcare technology. As we navigate this intersection, the ongoing commitment to research, collaboration, and ethical practice will pave the way for a future where technology positively impacts the accuracy and accessibility of disease prediction tools.

References:

1. Indias, I. M., Claesson, M., Zomer, A., Gomez-Cabrero, D., eds. (2022). Microbiome and Machine Learning. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-88976-678-9.
2. Asmit Srivastava, Ashish kumar Singh, 2022 2nd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE) | 978-1-6654-3789-9/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICACITE53722.2022.9823584.
3. Mohit K, Gupta R, Kumar B. Computer-Aided Diagnosis of Various Diseases Using Ultrasonography Images. Curr Med Imaging. 2023 Mar 6. doi: 10.2174/1573405619666230306101012. Epub ahead of print. PMID: 36876845.
4. Shantanu Rajesh Mokal, Darshil Rajendra Chorghe, Neha Jitendra Madhavi, Pratik Vijay Kelaskar, Prof. S. N. Jadhav, Disease Prediction using Python, International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 11 Issue IV Apr 2023, https://doi.org/10.22214/ijraset.2023.50573.
5. Proceedings of the Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks (ICICV 2021). IEEE Xplore Part Number: CFP21ONG-ART; 978-0-7381-1183-4.
6. P. Hamsagayathri and S. Vigneshwaran, "Symptoms Based Disease Prediction Using Machine Learning Techniques," 2021 Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks (ICICV), Tirunelveli, India, 2021, pp. 747-752, doi: 10.1109/ICICV50876.2021.9388603.
7. 2020 2nd International Conference on Advances in Computing, Communication Control and Networking (ICACCCN) | 978-1-7281-8337-4/20/$31.00 ©2020 IEEE | DOI: 10.1109/ICACCCN51052.2020.9362842.
8. 2021 Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks (ICICV) | 978-1-6654-1960-4/20/$31.00 ©2021 IEEE | DOI: 10.1109/ICICV50876.2021.9388603.
9. Md Mamun Ali, Bikash Kumar Paul, Kawsar Ahmed, Francis M.Bui, Julian M.W.Quinn, Mohammad Ali Moni Computers in Biology and Medicine., Volume 136, September 2021, 104672.
10. A. Singh and R. Kumar, "Heart Disease Prediction Using Machine Learning Algorithms," 2020 International Conference on Electrical and Electronics Engineering (ICE3), Gorakhpur, India, 2020, pp. 452-457, doi: 10.1109/ICE348803.2020.9122958