iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** II **Month of publication:** February 2024

DOI: https://doi.org/10.22214/ijraset.2024.58689

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue II Feb 2024- Available at www.ijraset.com

Clear View Cancer-AI

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Abstract: ***Brest tumor is one of the most dangerous diseases in females. There are a variety of breast cancer; the type of breast cancer depends on which cells turn into cancer. It is so crucial to identify the disease in the early stage so that it can be treated comfortably. Machine learning Machine learning stands out as an exceptionally potent tool to detect cancer in breast. Machine learning facilitates the training of machine and creating some models which can predict the chances of breast cancer . Among the prevalent techniques in machine learning classifier for breast cancer identification are SVM, Naive Bayes, Logistic regression, KNN, Random Forest, AdaBoost, Random Forest, Decision tree, and XGBoost. The motive of this research is to find out the best machine-learning technique which provides the most accuracy for the detection of breast cancer. The precision of machine learning models can differ for dissimilar datasets. This research has been tested across various datasets of large and small sizes and after analyzing the accuracies of these machine learning techniques the conclusion is drawn. Keywords: Machine Learning, Breast Cancer, Tumor, Naive Bayes, SVM, KNN, Logistic regression;***

I. INTRODUCTION

Cancer is a condition in which the body's cells grow uncontrollably and form a mass of tissue generally known as tumors. The speed of division of these cells is much faster compared to healthy cells in the body. According to statistics, breast tumor is the most general tumor in women; every 1 out of 3 females diagnosed with cancer is a breast cancer patient. A survey conducted by WHO shows that in 2020 over 2.3 millions women were diagnosed with breast cancer among which 6,85000 deaths were reported globally. Despite advances of technology in the medical field, it is still the second-leading cause of cancer deaths in females. The awareness of breast cancer is very low, which is why most people ignore it, and it costs them their lives. Breast cancer usually starts from the cells present in the milk-producing ducts (invasive ducal carcinoma), and it easily spreads all over the breast. It may also originate in glandular tissue referred to as globules, a condition known as invasive globular carcinoma, or in other cells or tissues with in the breast. Many factors can increase the chances of breast cancer in females; some of them are lifestyle, heredity, and ionizing radiation. Even though it is still debatable, some females with little or no exposure to the risk factors of cancer get affected by it, while others with direct exposure to the causes are safe. It can affect any female, even if there is no family history of cancer gene inheritance. Only 5 to 10% of cases of breast cancer include inheritance from one generation to another. Two of the most popularly inherited genes that cause breast cancer are breast cancer gene 1 (BRCA1) and breast cancer gene 2 (BRCA2). The percentage of patient diagnosed with breast cancer are increasing by 0.5% every year. It is important to have an awareness about the disease so that it will be easy to detect the disease and take necessary actions to cure it.

Diseases can be dangerous and even life-threatening if it is not diagnosed in the early stage. Most cancer patients lose their lives because of the failure to detection of the disease before it becomes incurable. Having an effective technique is one of the most important thing for the diagnosis of breast cancer among females so that the doctor can plan the treatment accordingly. The traditional way of diagnosis of breast cancer is time consuming as well as requires a lot of human efforts. Machine learning algorithms provides an efficient way to detect breast cancer with more accuracy and decreases the chances of human errors. With the help of machine learning, different models can be trained and the results will be out in less time.

II. LITERATURE SURVEY

Machine Machine Learning is an efficient method to detect breast cancer as it uses various classifiers such as SVM, Decision Trees, KNN, and Naive Bayes to aid diagnosis. However, the question arises that which classifier gives the most accurate results as accuracy of different classifiers may differ. Many studies and researches were conducted in past to find out the most optimal machine learning algorithm which will provide more accurate results. The motivation of every research is to find the best solutions so that the cancer can be diagnosed in early stage. This section describes some past researches on breast cancer detection using machine learning.

"Explainable AI in Breast Cancer Detection: A Post-2020 Perspective" by Gupta, S, et al. [1] assert the pivotal role of Explainable AI (XAI) in advancing breast cancer detection models.

The paper accentuates the critical importance of model interpret ability, elucidating how XAI techniques bolster the transparency of AI-driven diagnostics. By delving into the mechanisms underlying AI decision- making, the authors highlight how XAI methods offer invaluable insights, thereby cultivating trust among healthcare professionals. This trust is paramount for the seamless integration of AI technologies into clinical settings, facilitating more informed and accountable breast cancer diagnoses.

Gupta and colleagues underscore that XAI not only enhances the accuracy of breast cancer detection algorithms but also provides clinicians with comprehensible explanations regarding the decisions made by these models. This interpret ability empowers healthcare practitioners to validate AI-generated recommendations, enabling them to make well-informed clinical judgments. Moreover, the authors emphasize that the transparent nature of XAI instills confidence in both patients and clinicians, mitigating concerns related to the "black box" nature of traditional machine learning approaches.

"Comparative Analysis of Machine Learning Algorithms for Breast Cancer Diagnosis" by Gupta, S., et al. [2], the authors delve into an extensive exploration of methodologies, advancements, challenges, and opportunities within the realm of breast cancer detection. Their discourse encompasses both traditional and emerging techniques, highlighting advancements in medical imaging and the pivotal role played by artificial intelligence (AI). By offering a comprehensive overview, the paper equips readers with an up-to-date understanding of the evolving landscape of breast cancer diagnosis. Such insights empower researchers and practitioners to make well-informed decisions in the development of diagnostic tools and methodologies. Furthermore, the comparative analysis presented within the study aids in elucidating the strengths and limitations of various machine learning algorithms employed in breast tumor recognition. Ultimately, this research serves as a valuable resource, guiding efforts aimed at enhancing the accuracy, efficiency, and accessibility of diagnostic approaches for combating breast cancer.

"Advancements in Breast Cancer Detection Using Multi-Modal Imaging" by Kim, H., et al. [3], the authors delve into the intersection of explainable AI (XAI) and multi-modal imaging within the context of breast cancer detection. Central to their discussion is the imperative for interpret ability in navigating the complexities inherent in multi-modal imaging datasets. Through their exploration of XAI, the paper elucidates how this approach augments the comprehension of decision-making processes inherent in multi-modal approaches.

The authors assert that transparent AI models play a pivotal role in facilitating the integration of diverse imaging techniques, thereby furnishing clinicians with accessible insights into the diagnostic reasoning behind AI-driven recommendations. By emphasizing interpret ability, the paper not only advances the discourse surrounding breast cancer diagnostics but also contributes to the responsible utilization of advanced imaging technologies.

"Deep Learning for Breast Cancer Detection: A Comprehensive Review" by Zhang, L., et al. [4], the authors meticulously analyze the significance of explainable AI (XAI) within the realm of deep learning for breast cancer detection. They elucidate the challenges and advancements in incorporating XAI into deep learning models, stressing interpret ability's crucial role for clinical acceptance. The paper posits that transparent and interpret able AI systems not only boost diagnostic accuracy but also instill trust among healthcare professionals. This emphasis on interpret ability is poised to facilitate the responsible adoption of deep learning in breast cancer detection beyond 2020, promising improved outcomes in diagnosis and treatment.

"Recent Advances in Genomics Biomarkers for Early Breast Cancer Detection" by Lee, J., et al. [5], the authors delve into the latest breakthroughs in genomics biomarkers aimed at enhancing early breast cancer detection. This comprehensive review sheds light on cutting-edge advancements post-2020, particularly focusing on molecular-level insights. Through an exploration of emerging genomics markers, the paper offers a thorough understanding of their potential impact on early diagnosis, underscoring their significance in improving patient outcomes.

"Breast Cancer Prediction Using Machine Learning" by Ramik Rawal [6], the author investigates the application of machine learning algorithms for predicting breast cancer. Likely, Rawal explores various predictive models trained on features extracted from medical data to classify instances as malignant or benign. The study may involve pre processing techniques, feature selection, and the evaluation of classification performance metrics. Rawal's research aims to contribute to the development of accurate and efficient diagnostic tools, potentially facilitating early detection and improving patient outcomes in breast cancer management through the integration of machine learning methodologies.

"Recent Advances in Nano particle-based Contrast Agents for Molecular Imaging of Breast Cancer" by Wang, Y., et al[7]. review advancements in nanoparticle-based contrast agents for molecular imaging of breast cancer. The authors discuss innovations in utilizing nanoparticles to enhance imaging modalities such as MRI, PET, and CT scans for improved detection and characterization of breast cancer at the molecular level. This research contributes to the development of more sensitive and specific imaging techniques, potentially leading to earlier detection and personalized treatment strategies for breast cancer patients.

"Application of Deep Learning in Breast Ultrasound Diagnosis and Imaging: A Review" by Chen, J., et al[8]. provide an overview of the utilization of deep learning techniques in breast ultrasound diagnosis. The authors examine recent advancements in applying deep learning algorithms to analyze ultrasound images for the detection and characterization of breast abnormalities. Through this review, they highlight the potential of deep learning to improve the accuracy and efficiency of breast ultrasound diagnosis, offering insights into the integration of AI technologies into clinical practice for enhanced breast cancer detection and management.

"Methods Used in Computer-Aided Diagnosis for Breast Cancer Detection Using Mammograms: A Review" by Saleem Z. Ramadan [9], the author explores various techniques employed in computer-aided drafting for detecting breast tumor from tomography. The analysis likely discusses algorithms, image processing methods, and the integration of machine learning to enhance diagnostic accuracy and efficiency.

"Reflecting on the history, current state, and prospective directions of breast cancer models for nano medicine advancement" by P. Boix-Montesinos, M.J. Vicent, A. Armiñán, M. Orzáez, and P.M. Soriano-Teruel [10], the authors delve into the historical progression, current status, and potential future pathways of breast cancer models, with a specific focus on their role in driving advancements in nano medicine.

III. METHODOLOGY

The Data set we have used in this research is acquired from kaggle platform. First we need to import some libraries like Numpy, Pandas, matplotlib to implement different machine learning algorithms. Import that data set, now comes to the visualization of the bar graph shows different activities vs the time count, pie chart shows the activities in percentage form to get a better overall time consumption by different activities.

Analyses of various classifiers algorithms gives us an outline of which classifier algorithm works the best and worst or in between and here in this case Logistic Regression classifier algorithms performs the best.

A. Support Vector Machine

To split two classes, a straightforward linear SVM classifier creates a straight line. As a result, data points reflecting one category are shown on one side of the line, while data points reflecting the other category are shown on the other.. This implies that you have the option to select from a limitless array of lines. This makes the linear SVM algorithm superior to other algorithms such as k-nearest neighbor is to choose the best line to classify the data points. A line is selected that separates the data as distant from the cabinet data points as possible. Another reason to use Support Vector Machines (SVMs) is that they can uncover complicated connections within data without needing you to make many changes to the data yourself.

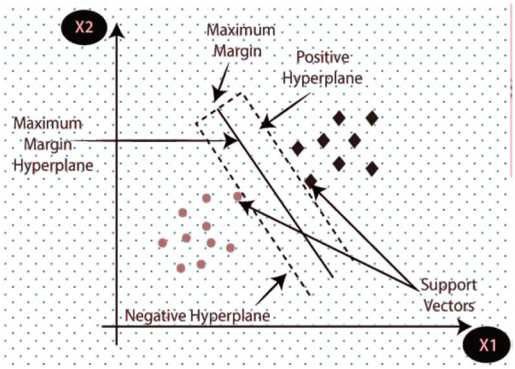


Figure 1: Support Vector Machine

B. Logistic Regression

Logistic Regression, a supervised learning approach, is utilized in binary classification scenarios. It predicts the probability of a binary outcome by incorporating independent variables. Through the logistic function, it converts linear regression results into probabilities ranging from 0 to 1, facilitating predictions of binary events such as "yes" or "no" or "true" or "false."

C. K-Nearest Neighbor

The K-Nearest Neighbors (K-NN) algorithm is a straightforward supervised learning method. It classifies new data points based on their similarity to existing cases. K-NN retains all data and categorizes new points accordingly. In contrast, artificial neural networks (ANNs) determine classification by identifying nearest data points, often measured using Euclidean distance.

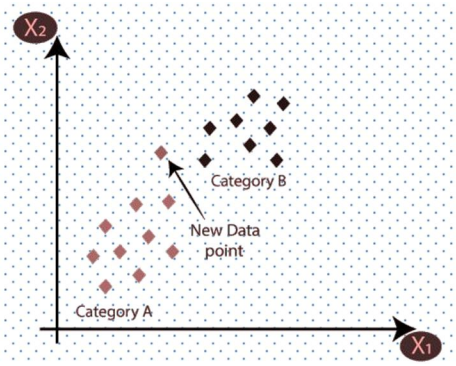


Figure 2: K-Nearest Neighbour

D. Naïve Bayes

Naive Bayes is a probabilistic machine learning algorithm based on Bayes' Theorem. It assumes independence among features and calculates the probability of a class given certain features. This algorithm is widely used in text classification, spam filtering, and sentiment analysis due to its simplicity and efficiency.

E. Decision Tree

A decision tree is a flowchart-like structure used in decision analysis to represent a series of decisions and their possible consequences. It is a graphical representation of a decision-making process, where each node represents a decision, each branch represents a possible outcome or choice resulting from that decision, and each leaf node represents a final outcome or decision. Decision trees are commonly used in various fields such as machine learning, statistics, and operations research to model and analyze decision-making problems.

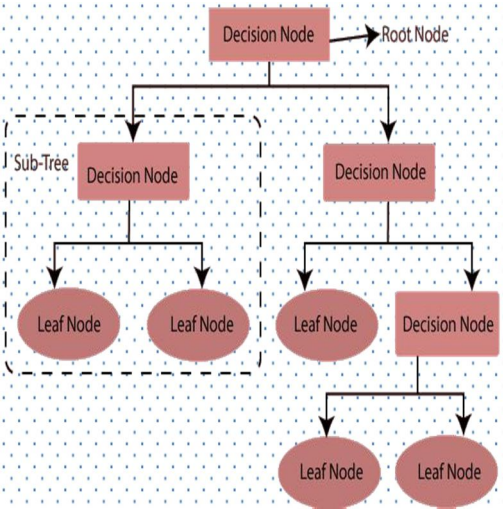


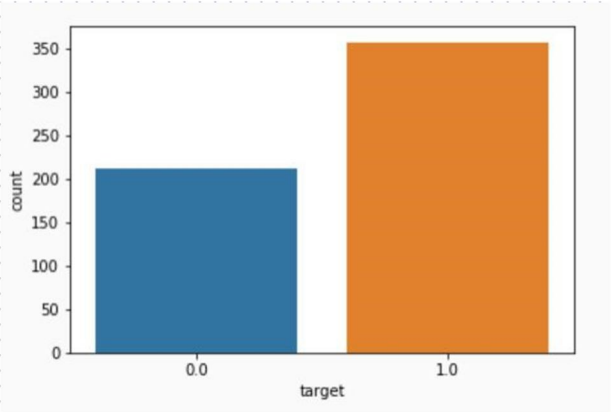
Figure 2: Decision Tree

IV. OUTPUT

The results of this entire research i.e the accuracies of different machine learning algorithm are as follows:
Support Vector Machine:0.9385964912280702
Logistic Regression: 0.956140350877193
K-Nearest Neighbor: 0.9385964912280702
Naive Bayes: 0.9473684210526315 Decision Tree: 0.9473684210526315
These accuracies are calculated using the formula :

$$Accuracy = \frac{Number\ of\ Correct\ predictions}{Total\ number\ of\ predictions\ made}$$

Following graph shows total count of malignant and benign tumor patients:



V. CONCLUSION

This research was purely based on finding the most optimal machine learning algorithm among all so that the results will be more accurate. We have analyzed different machine learning algorithms like SVM, Logistic Regression, KNN, Naive Bayes, and Decision Tree and we are able to get most accurate results from Logistic Regression i.e 95.6%. Therefore this research helped us to conclude that Logistic Regression is most optimal machine learning algorithms among these five. Although it is giving the most optimal solution but there is always room for improvement and in future it can be optimized more using new technologies.

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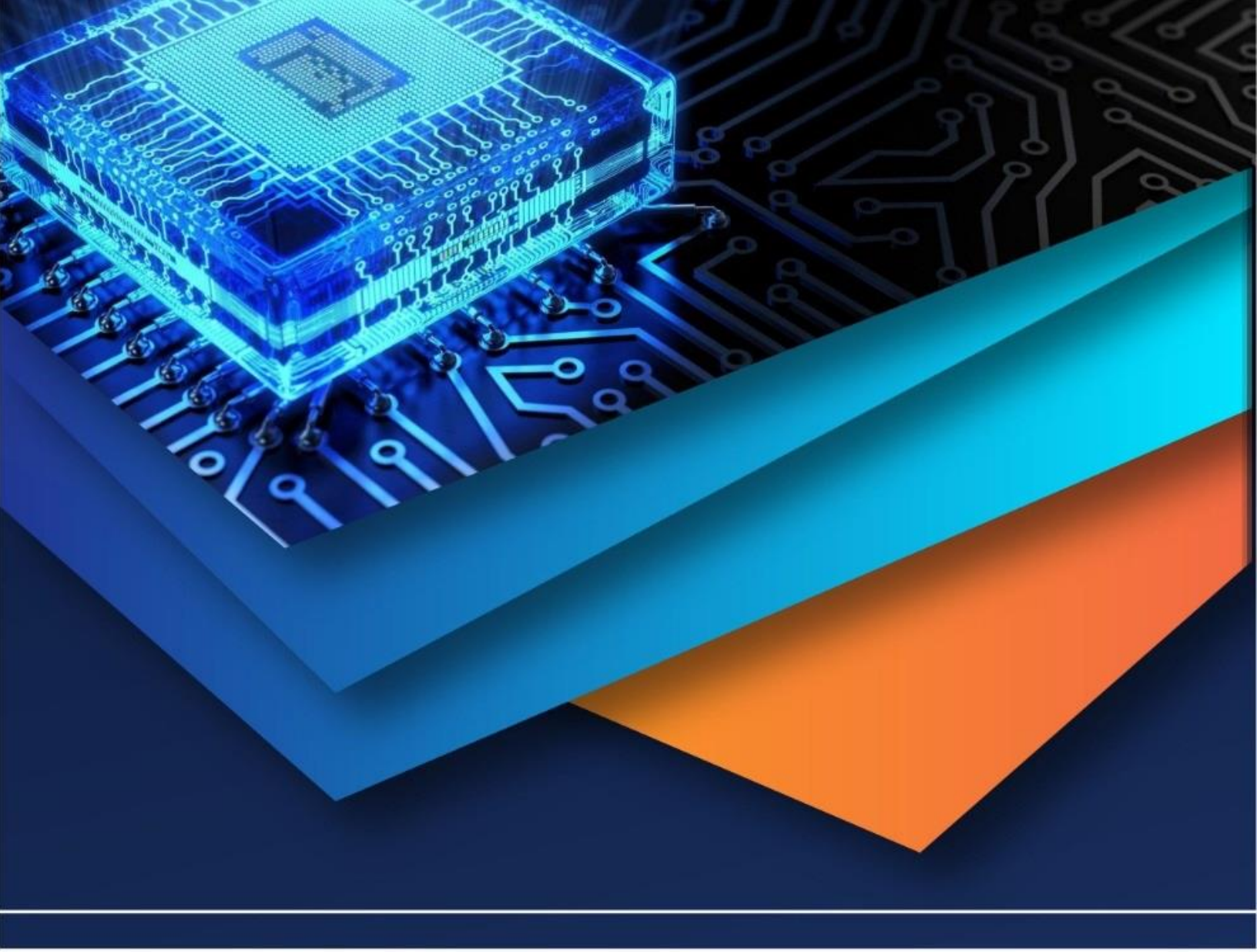

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