International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 11 Issue:12 | Dec 2024 www.irjet.net p-ISSN: 2395-0072

Machine Learning for the Identification and Prevention of Breast Cancer: A Literature Review

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Abstract - : *In developing countries, breast cancer is one of the main causes of mortality for women, and early detection and treatment are essential. Invasive ductal carcinoma (IDC) and ductal carcinoma in situ (DCIS) are the two primary subtypes of the illness. More precise diagnostic models are the result of developments in artificial intelligence (AI) and machine learning (ML). Magnetic resonance imaging (MRI) and convolutional neural networks (CNNs) are important diagnostic and prophylactic techniques for breast cancer. CNN-based models, such as CNNI-BCC, help classify subtypes of the disease. These models, however, demand a large amount of processing power. Using three feature selection techniques—low-variance elimination, recursive feature elimination, and univariate feature selection—this study suggests an efficient deep learning model for detecting breast cancer from digital mammograms with different densities. 3002 photos from 1501 patients who had digital mammograms between February 2007 and May 2015 are included in the dataset. The following six classification techniques were assessed: logistic regression (LR), support vector classifier (SVC), k-nearest neighbors (KNN), decision trees (DT), random forests (RF), and linear support vector classifier (linear SVC). The findings demonstrate that the suggested approach provides excellent accuracy and efficiency while using less processing resources.*

Key Words: Breast Cancer ; Invasive Ductal Carcinoma (IDC);Ductal Carcinoma In Situ (DCIS);Artificial Intelligence (AI); Convolutional Neural Networks (CNNs);Magnetic Resonance Imaging (MRI);Digital Mammograms.

1. INTRODUCTION

Cancer is a global health issue that affects people of all ages and backgrounds. Among various cancers, breast cancer is particularly prevalent in women and is the second wleading cause of cancer-related deaths in women, after lung cancer [1]. Early detection and diagnosis are critical for improving survival rates, and machine learning (ML) techniques can significantly enhance this process. Breast cancer develops in the breast cells and can present in several forms, including Ductal Carcinoma In Situ (DCIS), which is non-invasive, and Invasive Ductal Carcinoma (IDC), the most common form, accounting for 80% of cases [2]. Early symptoms may include unexplained swelling in the breast or armpit, changes in breast size or appearance, pain or discomfort, nipple discharge, or skin changes. For early detection, mammography remains a vital tool. However, mammography can be less effective in women with dense breast tissue, where diagnostic ultrasonography, thermography, or radiography might offer more precise results. Magnetic Resonance Imaging (MRI), particularly Dynamic Contrast-Enhanced MRI (DCE-MRI) [3], is highly sensitive for identifying and characterizing breast cancer lesions. Recent advances in artificial intelligence (AI) have further improved diagnostic accuracy by enabling AI-based systems to analyze medical images, such as mammograms, and identify cancerous lesions. In this context, deep learning models can be used to analyze computerized mammograms of varying breast tissue densities. This study proposes an effective deep learning approach to enhance breast cancer detection across different breast densities, ultimately improving the accuracy of early diagnosis.

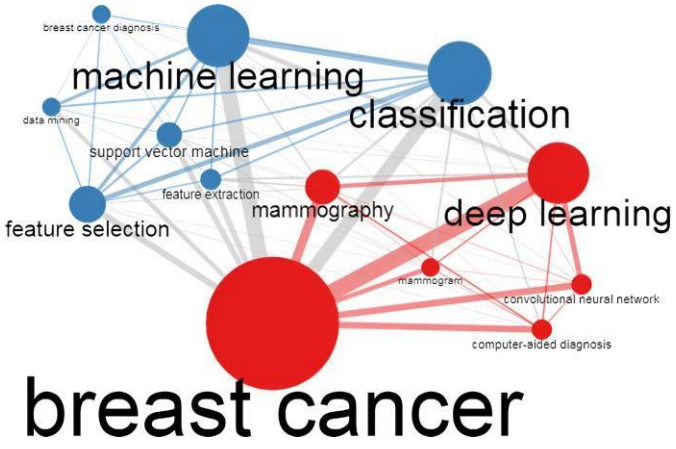

Fig-1: An analysis of author keywords using a co-occurrence network

The image highlights the relationship between advanced computational methods and breast cancer diagnosis. At its core, "breast cancer" connects to technologies like machine learning and deep learning. Machine learning is linked to terms such as "classification," "support vector machine," and "feature selection," emphasizing its role in predictive modeling , Deep learning focuses on applications like "convolutional neural networks," "mammography," and