A Hybrid Model to Support the Early Diagnosis of Breast Cancer

Literature Review:

Introduction:

The report titled "A Hybrid Model to Support the Early Diagnosis of Breast Cancer" explores the utilization of a hybrid approach combining Bayesian Networks (BN) and Multi-Criteria Decision Analysis (MCDA) to improve breast cancer diagnosis. The authors aim to address the critical issue of breast cancer misdiagnosis, which can lead to unnecessary mastectomies or late detection, by leveraging both probabilistic and decision-making tools. Their hybrid model aims to enhance the accuracy of early diagnosis while reducing subjectivity in clinical decisions.

Bayesian Networks:

- Bayesian Networks (BN) have long been used in medical diagnosis due to their capability to handle uncertainty in data. In this study, BN is employed to calculate the conditional probabilities of a patient having breast cancer based on multiple attributes, such as cell thickness and uniformity.
- The Wisconsin Breast Cancer Dataset (699 cases) was utilized.
- BN alone achieved a 95.7% success rate, 1.7% doubt rate, and 2.8% failure rate in predicting the likelihood of breast cancer.

Multi-Criteria Decision Analysis (MCDA):

- The second component, MCDA, was introduced to improve decision-making when the Bayesian Network results were inconclusive. Specifically, the MACBETH method was employed, allowing for an evaluation of multiple diagnostic criteria simultaneously. This approach enabled the authors to identify which attributes (e.g., clump thickness, cell size) had the most significant influence on the diagnosis. The combination of BN and MCDA provided a more comprehensive and reliable diagnostic framework.
- The MCDA was used to complement BN when it delivered inconclusive results.
- The MACBETH method helped prioritize diagnostic criteria and attributes influencing breast cancer detection.
- The decision-making process relied on the number of cases affected by specific attributes, such as cell size and shape.

Hybrid Model:

- The hybrid approach provided more accurate results than BN alone.
- The report highlights that the hybrid model could be particularly beneficial in resource-limited settings, where access to specialized doctors is scarce.
- It automated screening, allowing for rapid analysis of large datasets to identify high-risk patients, particularly useful in resource-limited settings.

Results:

The combination of BN and MCDA offers a reliable, comprehensive diagnostic framework.

The model supports clinical decision-making, reduces subjectivity, and prevents unnecessary surgeries.

Predicting Invasive Ductal Carcinoma in Breast Histology Images using Convolutional Neural Network

Literature Review:

Introduction:

The report "Predicting Invasive Ductal Carcinoma in Breast Histology Images using Convolutional Neural Network" presents a deep learning approach to detect Invasive Ductal Carcinoma (IDC), a common type of breast cancer, in histology images. The authors propose two Convolutional Neural Network (CNN) models: IDCDNet and IDCNet, using depthwise separable and standard convolution methods, respectively. Their objective is to enhance the automated detection of IDC, aiding in the early diagnosis and treatment of breast cancer.

Role of CNN :

The report highlights the growing use of deep learning in medical image analysis, especially CNNs, which are particularly effective for tasks like image classification, tumor segmentation, and disease detection. IDC is the most common subtype of breast cancer, making its accurate detection vital for reducing mortality rates among women. Typically, IDC is identified through histological examination by pathologists, but this process is time-consuming and prone to subjectivity. The proposed CNN models aim to automate the detection process, reducing the workload of pathologists and improving diagnostic accuracy.

CNN Architectures IDCNet & IDCDNet :

The authors experimented with two different CNN architectures. IDCDNet, utilizing depthwise separable convolution, is efficient in memory usage and computation. IDCNet uses standard convolution, and both models apply activation functions like ReLU, Sigmoid, and Tanh to rectify non-linearities in the output. They also tested the models under varying levels of Gaussian noise to evaluate robustness. The dataset used consists of 277,524 image patches, split into training and testing sets. The ground truth was acquired through manual annotation by pathologists.

Result:

The performance evaluation showed that IDCNet outperformed IDCDNet, achieving an accuracy of 87.13% compared to 85.98%. The use of the ReLU activation function provided the best performance for both models. Furthermore, the addition of Gaussian noise highlighted that IDCNet is more robust than IDCDNet.

Conclusion:

In conclusion, the report demonstrates that CNNs can significantly improve the accuracy and efficiency of IDC detection in histopathology images. The authors suggest future research to enhance the models' architectures and extend their application to larger datasets.