**Submission 1**

**Critical Review Report for a research paper**

Name: Abu Bakar Hasnath

Id: 20301037

Paper Title: Skin Lesion Detection and Classification Using Machine Learning: A Comprehensive Approach for Accurate Diagnosis and Treatment

**Paper Link:** <https://www.researchgate.net/publication/378538284_Skin_Lesion_Detection_and_Classification_Using_Machine_Learning_A_Comprehensive_Approach_for_Accurate_Diagnosis_and_Treatment>

1. **Summary**

Cutaneous abnormalities, known as skin cancer, include a broad spectrum of skin irregularities that necessitate proper identification and immediate treatment. It has been proven that early detection of skin irregularities can play an important role for medical personnel in treating cancer patients effectively. Unfortunately, early detection is limited by manual segmentations of skin cancer from images, and it is time-consuming and labor-intensive. Skin irregularities come in different shapes and sizes; it is difficult for a human to detect abnormal cells from normal skin; for this reason, classification of irregular regions from images is difficult for humans. On top of that, manual detection of skin cancer can lead to ill-defined soft tissue boundaries. For all of the above reasons, obtaining accurate segmentation of tumors is pervasive and expensive. To solve these challenges. This paper showed performance analysis for skin cancer classification first using the Fuzzy C-Means clustering algorithm and then using six traditional classifiers, namely Support Vector Machine (SVMs), acquiring the highest accuracy of 94.8%. At the same time, the decision tree gave 94.1%, and finally, K-Nearest Neighbors(KNN) gave 93.7%.

* 1. **Motivation**

As Computer Hardware technology has become readily available, businesses and institutions worldwide are using dedicated graphical user interfaces (GPU) to carry out heavy computation tasks; these sophisticated hardware are used in large data centers to run heavy machine learning models to tackle different challenges, especially in the field of health and medicine. To better use this expensive hardware and for power-saving purposes, it is crucial to determine which algorithms are most suitable for each task. Thus, it is necessary for us to decide which algorithm, model, or approach we should use to classify skin cancer.

* 1. **Contribution**

Firstly, this paper made a general performance comparison by analyzing Fuzzy-C-Means' accuracy, six traditional classifiers, and the Convolutional Neural Network (CNN). Secondly, this paper proposes a new method to identify regions of interest (ROI). Finally, they proposed two novel models that can segment and detect skin cancer.

* 1. **Methodology**

The dataset was collected from the HAM10000 dataset for training machine learning models. Decision trees, Random forests, K-Nearest Neighbors, and SVM models are evaluated. With the highest accuracy given by Support vector machines (SVMs). Models trained with different hyperparameters for comparison and precision.

* 1. **Conclusion**

Machine learning models achieved high accuracy in skin lesion classification. Vm had the highest accuracy at 94.8% in classifying skin conditions. Challenges in dermatofibroma classification were observed across all models. The potential of machine learning in dermatology for accurate skin lesion identification.

1. **Limitations**
   1. **First Limitation**

The study focuses on traditional classifiers and an improved CCN architecture, but it could not explore the performance of transformer-based approaches for classifying Brain cancer cells.

* 1. **Second Limitation**

This study explores the models' performance on a dataset produced from the same source. A broader study on a hybrid dataset is required to suggest a specific model or approach that the healthcare industry can implement.

1. **Synthesis**

Researchers worldwide are continuously finding new ways to implement deep learning and machine learning in the field of healthcare. All these techniques use pattern recognition, which showed promising results; the proposed method architecture in the paper can be extended to handle more complex cancer cell classification as breakthroughs keep occurring in the field of computer vision. A thorough investigation must be done on multi-modal data by combining RGB data from colored MRI images. We can optimize the training process by manually drawing the region of interest (ROI) with the help of a certified doctor. Furthermore, more transformer-based models, such as vision transformers, are needed.