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# SKIN CANCER DIAGNOSIS-LESION SEGMENTATION-REVIEW STUDY

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***Abstract :*** Skin lesion segmentation plays a crucial role in computer-aided diagnosis of melanoma-most invasive Skin cancer with highest risk of Death. This paper presents a comprehensive review and comparative analysis of state-of-the-art skin lesion segmentation methods using the ISIC 2017 dataset. The dataset, consisting of dermoscopic images of skin lesions, poses unique challenges due to variations in lesion size, shape, and texture. Various deep learning and traditional image processing techniques are explored and evaluated for their effectiveness in segmenting skin lesions accurately for the early detection of Skin cancer which helps in early diagnosis. Performance metrics such as Dice coefficient, Jaccard index, Accuracy, Sensitivity, Specificity are employed to quantify the similarity between the segmented regions and ground truth annotations. The results provide valuable insights into the effectiveness of different segmentation methods and their suitability for use in clinical practice. The results highlight the strengths and limitations of different approaches, providing insights for future research in this domain.

*IndexTerms* - **Skin lesion segmentation, Dermoscopic image analysis, Melanoma detection , ISIC 2017 dataset, Deep learning, Convolutional neural networks (CNNs), Image processing, Segmentation algorithms, Performance evaluation, Similarity metrics.**

## INTRODUCTION

Skin cancer, particularly melanoma, is a significant public health concern, with its incidence rising steadily over the past few decades. Early detection and accurate diagnosis of melanoma are crucial for improving patient outcomes. Dermoscopy, a non-invasive imaging technique that allows for the visualization of subsurface skin structures, has become an essential tool in the diagnosis of skin cancer. However, the manual analysis of dermoscopic images is time-consuming and subject to inter-observer variability.

Automated segmentation of skin lesions from dermoscopic images can aid in the early detection of melanoma by providing quantitative and objective measurements of lesion characteristics. The ISIC 2017[1] dataset, consisting of over 2,000 dermoscopic images annotated by expert dermatologists, provides a valuable resource for the development and evaluation of automated segmentation algorithms.

In this paper, we present a comprehensive review and comparative analysis of state-of-the-art skin lesion segmentation methods using the ISIC 2017 dataset. We evaluate the performance of various segmentation algorithms, including deep learning and traditional image processing techniques, using metrics such as the Dice coefficient, Jaccard index, Accuracy, Sensitivity, Specificity . Our goal is to identify the most effective segmentation methods for accurately delineating skin lesions in dermoscopic images, with the ultimate aim of improving the early detection and diagnosis of melanoma.

In this review, we focus on the state-of-the-art methods for automated skin lesion segmentation, with a particular emphasis on techniques developed in recent years. We examine the use of deep learning, convolutional neural networks (CNNs), and other machine learning algorithms for lesion segmentation. Additionally, we discuss the performance metrics used to evaluate the accuracy of segmentation methods, such as the Dice coefficient, Jaccard index, and sensitivity and specificity measures.

By providing a comprehensive overview of current research in skin lesion segmentation, this review aims to highlight the progress made in automated skin cancer diagnosis and identify areas for future research and improvement.

## NEED OF THE STUDY.

This review aims to provide a comprehensive overview of the state-of-the-art methods for automated skin lesion segmentation in dermoscopic images. The primary objective is to summarize the key approaches and techniques used in recent research, including deep learning, machine learning, and image processing methods. Additionally, the review aims to evaluate the performance of these methods using standard metrics and highlight their strengths and limitations.By achieving these objectives, this review seeks to contribute to the advancement of automated skin cancer diagnosis by identifying the most effective and promising segmentation techniques. This information can guide future research and development of computer-aided diagnosis systems for skin cancer.

**LITERATURE SURVEY**

Over the last few years, Deep Learning models have introduced a new segment of image segmentation models with remarkable performance improvements. Deep Learning based image segmentation models often achieve the best accuracy rates on popular benchmarks, resulting in a paradigm shift in the field.[3],[4],[5],[6],[10] offers and develops various deep learning models which contributes to image segmentation. CNN is used very frequently for segmenting the image in pattern recognition and object identification.[8] and [9] offered offers a semi supervised training schema and proposed an end-to-end framework which can perform skin lesion segmentation automatically and efficiently, called the CSARM-CNN (Channel &Attention Residual Module) model respectively.U-Net is more successful than conventional models, in terms of architecture and in terms pixel-based image segmentation formed from convolutional neural network layers.[2],[7] and [11] provides detailed view of the same.

**SEGMENTATION METHODS WITH PERFORMANCE METRICS - COMPARITIVE ANALYSIS**

| SL NO | DATASETS | SEGMENTATION METHODS | ACCURACY | SENSITVITY | SPECIFICITY | DICE | JACCARD |
|---|---|---|---|---|---|---|---|
| 1 | ISIC 2017 | U-NET WITH VGG-16 ENCODER,CNN | 0.967 | 0.904 | 0.98 | 0.915 | 0.846 |
| 2 | ISIC 2017 | Deep learning frameworks, the Lesion Indexing Network (LIN) and the Lesion Feature Network (LFN) | 0.95 | 0.855 | 0.974 | 0.839 | 0.753 |
| 3 | ISIC 2017 | SLSDeep: Skin Lesion Segmentation Based on Dilated Residual and Pyramid Pooling Networks | 0.9326 | 0.8392 | 0.9725 | 0.85 | 0.7653 |
| 4 | ISIC 2017 | Deep Learning with Evolutionary Algorithm based Image Segmentation (DL-EAIS) | 0.9883 | 0.9617 | 0.9934 | | |
| 5 | ISIC 2017 | Intelligent multilevel thresholding with deep learning (IMLT-DL) | 0.992 | 0.97 | 0.995 | | |
| 6 | ISIC 2017 | Multiscale Attention U-Net. (MSAU-Net) | 0.9576 | 0.887 | 0.9714 | | 0.9576 |
| 7 | ISIC 2017 | Semi-Supervised Skin Lesion Segmentation With Coupling CNN and Transformer Features | 0.9591 | 0.948 | 0.9766 | 0.9058 | |
| 8 | ISIC 2017 | CSARM-CNN (canal and spatial attention residue module) | 0.9585 | 0.8022 | 0.994 | | |
| 9 | ISIC 2017 | Ensemble Deep Learning Methods-Ensemble A (ADD) | 0.9408 | 0.8993 | 0.95 | | |
| 10 | ISIC 2017 | Ensemble-Comparision-Large | 0.9393 | 0.887 | 0.9545 | | |
| 11 | ISIC 2017 | Ensemble-Comparision-Small | 0.9333 | 0.8058 | 0.9794 | | |
| 12 | ISIC 2017 | Recurrent Attentional Convolutional Networks (O-Net) MODEL | 0.9471 | 0.897 | 0.963 | 0.8704 | 0.8036 |
| 13 | ISIC 2017 | Attention class feature network (ACFNet)MODEL | 0.9345 | 0.8513 | 0.9132 | 0.8407 | 0.7497 |
| 14 | ISIC 2017 | Recurrent U-Net MODEL | 0.9268 | 0.8678 | 0.9222 | 0.8314 | 0.7386 |

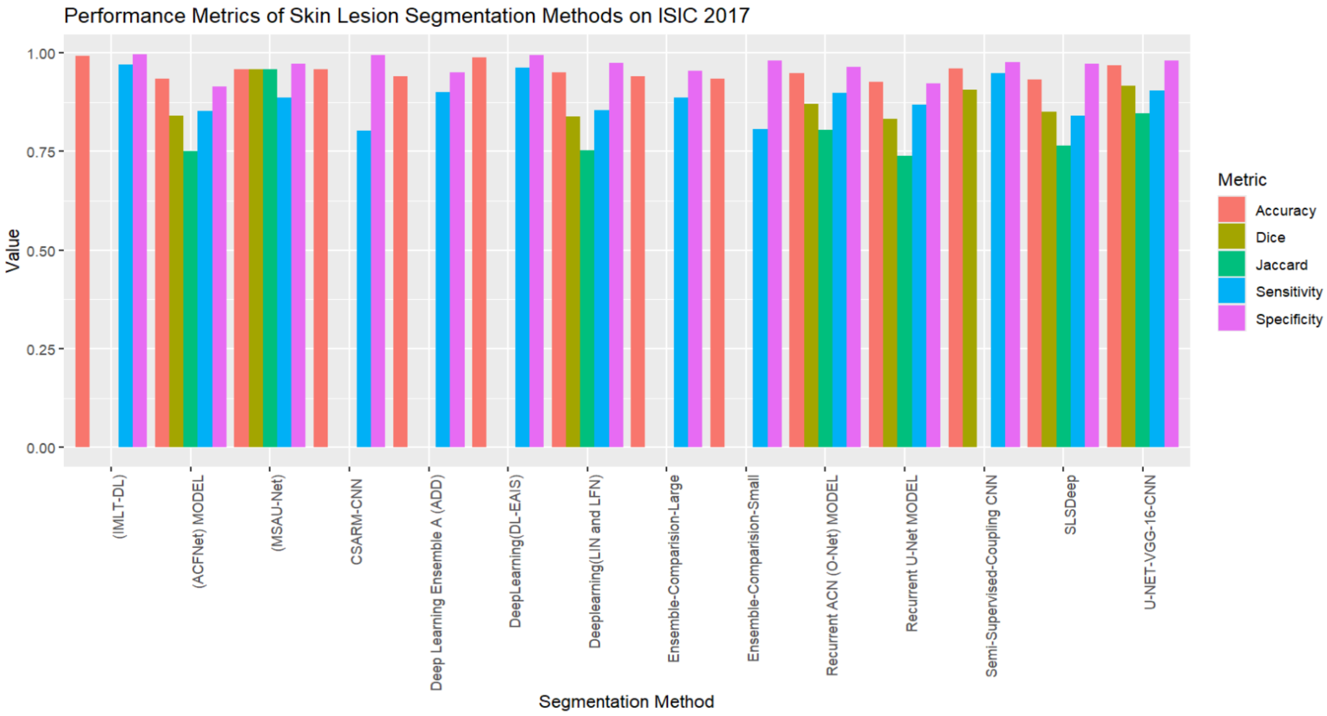


**FIG 1 : GRAPH REPRESENTING PERFORMANCE METRICS OF DIFFERENT SEGMENTATION METHODS**

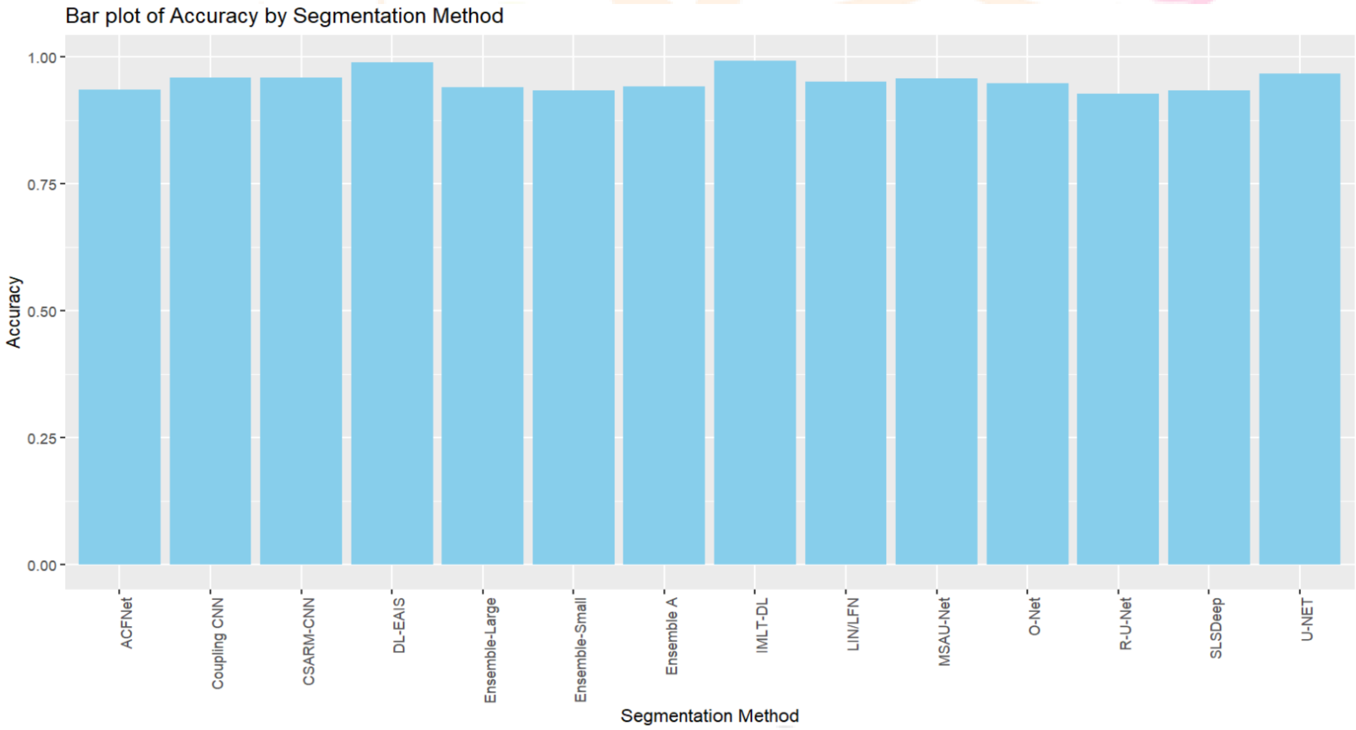


**FIG2: BARPLOT OF ACCURACY ACHIEVED BY DIFFERENT SEGMENTATION METHODS**

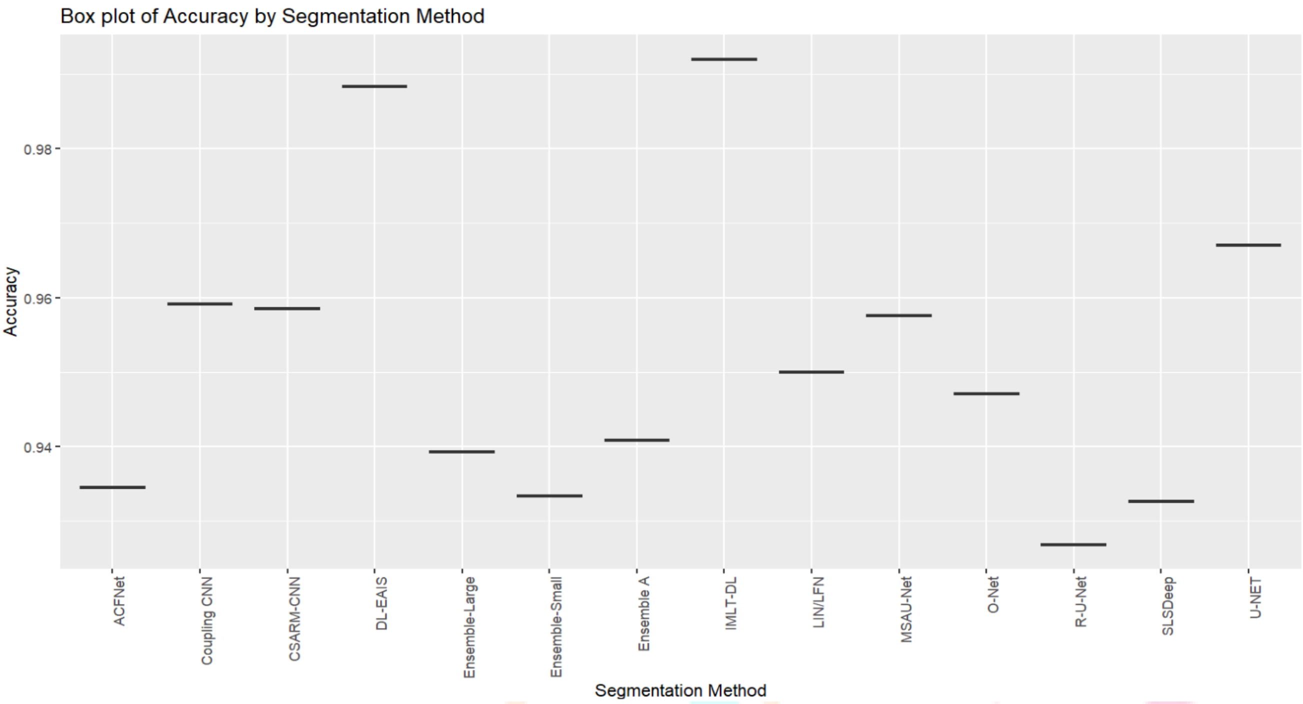


**FIG3: BOX PLOT OF ACCURACY BY SEGMENTATION METHOD**

## CONCLUSION

Based on the performance metrics of various skin lesion segmentation methods on the ISIC 2017 dataset, it is evident that deep learning approaches have shown remarkable effectiveness in this task. Techniques such as U-Net with VGG-16 encoder, the Lesion Indexing Network (LIN), the Lesion Feature Network (LFN), and others have achieved high values for metrics like Dice similarity coefficient, sensitivity, and specificity.

The results indicate that models like DL-EAIS and IMLT-DL have particularly stood out with high overall performance. These findings suggest that these models hold great promise for accurate and efficient skin lesion segmentation, which is crucial for early detection and treatment of skin cancer.

Moving forward, further research could focus on enhancing the generalization capabilities of these models to make them more robust across different datasets and clinical settings. Additionally, exploring the interpretability of these models could provide insights into the features they learn and help improve their performance and clinical applicability.

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