

# Skin Lesion Segmentation and Classification using Deep Learning

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## Introduction

Skin cancer is one of the most common cancers worldwide, with melanoma being the most dangerous form. Early detection significantly improves survival rates, but accurate diagnosis requires expert dermatological knowledge.

Dermoscopy improves visualization of skin lesions, but access to specialists is limited. Automated deep learning systems provide a promising solution for early screening.

However, challenges remain:

Poor lesion segmentation due to artifacts

Severe class imbalance (melanoma is rare)

## Research Question

1. Does lesion segmentation improve classification performance?
2. Which imbalance technique works best (SMOTE, class weighting, GAN)?
3. How does segmentation interact with imbalance strategies?
4. What is the trade-off between sensitivity and accuracy?

## Dataset

HAM10000 Dataset  
 10,000+ dermoscopic images  
 7 lesion classes  
 Includes segmentation masks  
 ✓ High class imbalance (melanoma rare)  
 Kaggle Skin Lesion Dataset

## Methodology

1. Data preprocessing (resize, normalize, augmentation)
2. Perform lesion segmentation using cGAN
3. Extract lesion region from images
4. EfficientNet classifier
5. Apply imbalance techniques:
  - Class weighting
  - SMOTE
  - GAN augmentation
6. Compare performance across methods

## Next Steps

1. Implement segmentation using cGAN
2. Train EfficientNet on raw vs segmented images
3. Apply imbalance techniques
4. Compare performance metrics
5. Optimize model for clinical reliability

## Literature Review

1. CNNs achieved dermatologist-level performance (Esteva et al., 2017)
2. U-Net is widely used for segmentation (Ronneberger et al., 2015)
3. EfficientNet improves accuracy with fewer parameters (Tan & Le, 2019)
4. SMOTE and GANs address class imbalance (Chawla et al., 2002)

## References

1. Esteva et al., 2017
2. Ronneberger et al., 2015
3. Goodfellow et al., 2014
4. Tan & Le, 2019
5. Chawla et al., 2002

## Technologies

