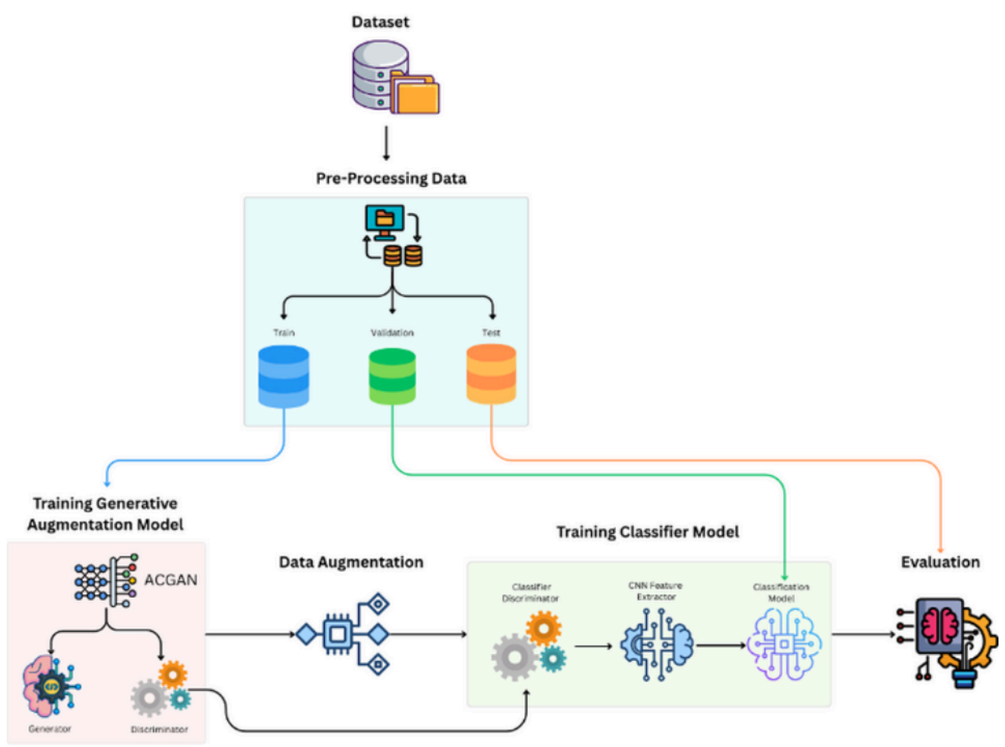
OPTIMALISASI KLASIFIKSI PENYAKIT KULIT DENGAN *HYBRID PRETRAINED* CNN-*DISCRIMINATOR* DAN *GENERATIVE DATA AUGMENTATION* DENGAN *AUXILIARY CLASSIFIER GENERATIVE ADVERSARIAL NETWORKS* (ACGAN)

INTRODUCTION

Skin cancer is one of the three most commonly diagnosed types of cancer globally (Roky et al., 2024). Early detection is crucial because skin cancer can spread to other organs if not treated promptly (Dildar et al., 2021). Skin cancer diagnosis is traditionally performed through biopsy, but this method is expensive, painful, and time-consuming. Therefore, automated detection based on AI technology is a potential solution.

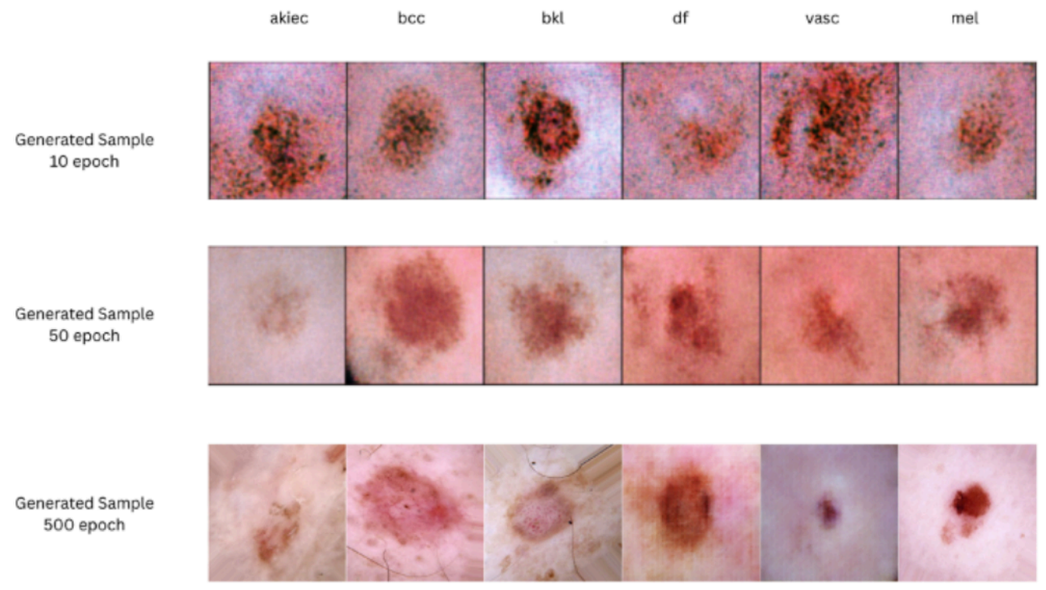
The most suitable deep learning model for image processing at this time is CNN (LeCyun et al., 1998. Previous researchers released a dataset called HAM10000 (Tschandl et al., 2018). However, this dataset has several challenges, namely class imbalance. The expected more effective approach is to utilize generative technology such as GANs (Goodfellow et al., 2014) on the images in the dataset instead of conventional data augmentation and utilize the discriminator as a classifier model by combining it with a pretrained CNN variant.

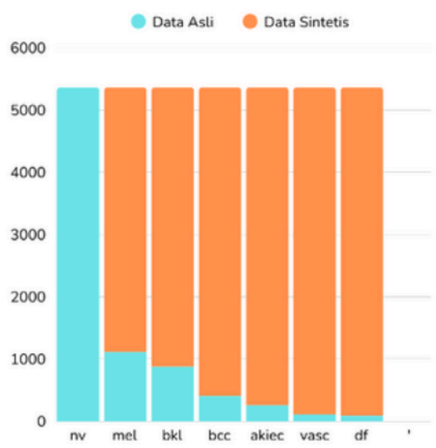
METHODOLOGY



This research method begins with dataset and preprocessing, which is resize, normalize, and divided into train, validation, and test sets. The train data is then augmented using ACGAN to generate class-balanced synthetic data. The combined data (original + synthetic) is used to train a classification model, where the ACGAN discriminator is combined with a CNN feature extractor as the classifier. The evaluation process is performed only on the original data in the validation and test sets, with accuracy, precision, recall, and F1-score metrics to assess model performance.

RESULTS





The synthetic image obtained an FID value of 118 and was then combined with the original data in the training subset. Then, training was carried out on the ResNet discriminator model that had gone through hyperparameter tuning optimization using Bayesian optimization.

Model	*Augmentasi*	*Accuracy*	*Precision*	*Recall*	*F-1 Score*
ResNet50	Konvensional	86.43%	78.12%	69.47%	71.14%
CNN-GAN (Sharma & Mehta, 2024)	GAN	89%	90%	88%	89%
QuadRes-Net dan *PentRes-Net*(Dillshad et al., 2025)	Konvensional	90.80%	91.27%	91.38%	91.32%
ResNet-Discriminator (Proposed Model)	**ACGAN**	**93.61%**	**93.38%**	**93.69%**	**93.39%**

Compared with several models with conventional and state of the art augmentation, the proposed model shows better performance in the evaluation section.

CONCLUSION

ACGAN has proven effective in addressing data imbalance in the HAM10000 dataset by generating representative synthetic images for minority classes through training up to 500 epochs. This synthetic data integration creates a more balanced data distribution and significantly improves classification performance compared to conventional augmentation. The best results were obtained with the proposed model (ResNet50 + ACGAN Discriminator) with an accuracy of 93.61%, a precision of 93.38%, a recall of 93.69%, and an F1-score of 93.39%.

SELECTED REFERENCE

Odena, A., Olah, C., & Shlens, J. (2017). Conditional image synthesis with auxiliary classifier gans. 34th International Conference on Machine Learning, ICML 2017, 6, 4043–4055.

Alam, T. M., Shaukat, K., Khan, W. A., Hameed, I. A., Almuqren, L. A., Raza, M. A., Aslam, M., & Luo, S. (2022). An Efficient Deep Learning-Based Skin Cancer Classifier for an Imbalanced Dataset.

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