

**ANALISIS PERFORMA DAN INTERPRETASI VISUAL  
MODEL *INCEPTION-RESNET V2*  
PADA CITRA *MAMMOGRAM***

**SKRIPSI**



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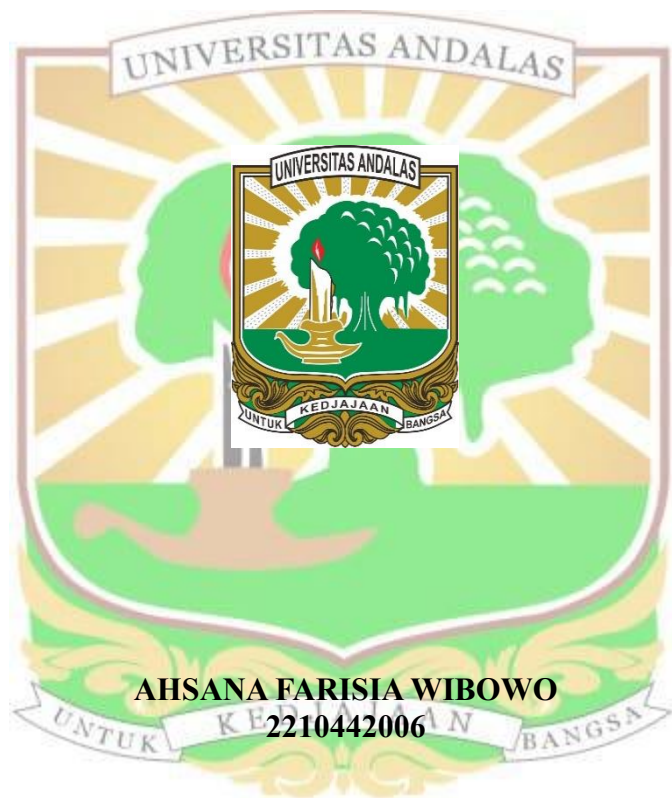
**DEPARTEMEN FISIKA  
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UNIVERSITAS ANDALAS  
PADANG**

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**Karya tulis sebagai salah satu syarat  
untuk memperoleh gelar Sarjana Sains  
dari Universitas Andalas**



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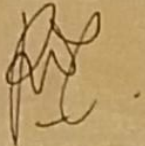
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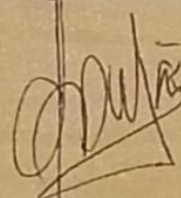
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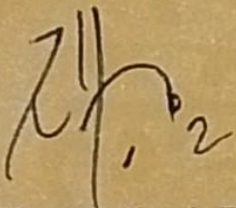
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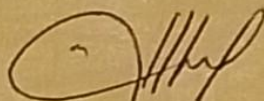
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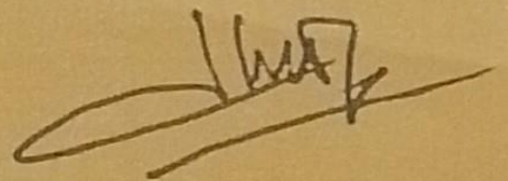
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# ANALISIS PERFORMA DAN INTERPRETASI VISUAL MODEL *INCEPTION-RESNET V2* PADA CITRA *MAMMOGRAM*

## ABSTRAK

Kanker payudara merupakan salah satu penyebab utama kematian pada wanita di dunia. Deteksi dini melalui mamografi berperan penting dalam meningkatkan peluang keberhasilan pengobatan, namun interpretasi citra *mammogram* masih berpotensi menghasilkan kesalahan diagnosis. Perkembangan *deep learning*, khususnya *Convolutional Neural Network* (CNN), memberikan peluang untuk meningkatkan akurasi klasifikasi citra *mammogram*. Penelitian ini bertujuan menganalisis grafik hasil pelatihan dan validasi, matriks konfusi dan metrik klasifikasi data uji, kurva *Receiver Operating Characteristic* (ROC), serta menginterpretasikan visualisasi *Gradient-weighted Class Activation Mapping* (Grad-CAM) pada model *Inception-ResNet V2* dalam mengklasifikasikan citra *mammogram* ke dalam kelas normal dan abnormal (tumor). Data yang digunakan terdiri atas 3.000 citra *mammogram* dua dimensi, meliputi 2.800 citra dari platform *Kaggle* dan 200 citra klinis dari RSUP Dr. M. Djamil Padang. Data dibagi menjadi 2.100 citra data latih (70%), 450 citra data validasi (15%), dan 450 citra data uji (15%). Data diolah menggunakan bahasa pemrograman *Python* yang dijalankan di *Google Colab*. Hasil penelitian menunjukkan bahwa grafik pelatihan dan validasi memiliki pola yang konsisten tanpa indikasi *overfitting* yang signifikan. Berdasarkan matriks konfusi, model mampu mengklasifikasikan citra dengan akurasi 92,00%, presisi 91,63%, *recall* 92,44%, spesifisitas 91,56%, dan *F1-score* 92,04%. Analisis kurva ROC menghasilkan nilai AUROC sebesar 98,11%, yang menunjukkan kemampuan diskriminasi sangat baik dalam membedakan citra normal dan abnormal. Visualisasi Grad-CAM memperlihatkan bahwa model memfokuskan perhatian pada area jaringan payudara yang relevan dengan proses klasifikasi. Dengan demikian, model *Inception-ResNet V2* menunjukkan performa klasifikasi yang baik serta interpretabilitas yang memadai untuk mendukung analisis citra *mammogram* sebagai alat bantu deteksi kanker payudara.

Kata kunci: Kanker payudara, mamografi, *deep learning*, *Inception-ResNet V2*, Grad-CAM.

# **PERFORMANCE ANALYSIS AND VISUAL INTERPRETATION OF THE INCEPTION-RESNET V2 MODEL ON MAMMOGRAMS**

## ***ABSTRACT***

*Breast cancer is one of the leading causes of death among women worldwide. Early detection through mammography plays an important role in improving treatment outcomes, however the interpretation of mammogram images remains prone to diagnostic errors. Advances in deep learning, particularly Convolutional Neural Network (CNN), have provided opportunities to improve the accuracy of mammogram image classification. This study aimed to analyze the training and validation curves, confusion matrix and classification metrics, Receiver Operating Characteristic (ROC) curve, and Gradient-weighted Class Activation Mapping (Grad-CAM) visualizations of the Inception-ResNet V2 model in classifying mammogram images into normal and abnormal (tumor) categories. The dataset consisted of 3,000 two-dimensional mammograms, including 2,800 images from the Kaggle platform and 200 clinical images from Dr. M. Djamil General Hospital, Padang. The data were divided into 2,100 training images (70%), 450 validation images (15%), and 450 testing images (15%). The data were processed using the Python programming language executed on the Google Colab platform. The results showed that the training and validation curves exhibited consistent patterns without significant overfitting. Based on the confusion matrix, the model achieved an accuracy of 92.00%, precision of 91.63%, recall of 92.44%, specificity of 91.56%, and F1-score of 92.04%. ROC analysis yielded an AUROC of 98.11%, indicating excellent discrimination between normal and abnormal images. Grad-CAM visualizations demonstrated that the model focused on relevant breast tissue regions during the classification process. Therefore, the Inception-ResNet V2 model showed good classification performance and adequate interpretability to support mammograms analysis as an aid for breast cancer detection.*

**Keywords:** Breast cancer, mammography, deep learning, Inception-ResNet V2, Grad-CAM