



UNDERGRADUATE THESIS

**DETECTION OF FOOT-AND-MOUTH DISEASE
(FMD) IN CATTLE USING THE INCEPTIONV3-
CBAM MODEL WITH HYPERPARAMETER
OPTIMIZATION USING BAYESIAN
OPTIMIZATION**

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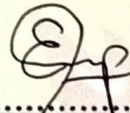
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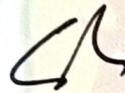
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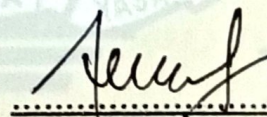
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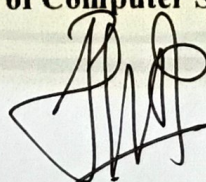
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ABSTRACT

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Advisor : 1. Eka Prakarsa Mandyartha, S.Kom., M.Kom.
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ABSTRACT

Foot-and-Mouth Disease (FMD), known locally as Penyakit Mulut dan Kuku (PMK), poses a serious threat to cattle productivity in Indonesia, particularly in Tuban Regency, where active cases continued to rise throughout 2025. The disease causes sudden death in calves (pedet) due to acute myocarditis, especially in those under two months of age, characterized by the pathognomonic “tigroid heart” myocardial lesions, which are frequently fatal. This study develops an image-based early detection model for FMD using the InceptionV3 architecture, combined with the Convolutional Block Attention Module (CBAM), to enhance the focus on critical features such as lesions on cattle’s gums, nose, and hooves. Hyperparameter optimization was performed using Bayesian Optimization, and model performance was evaluated through 5-fold Cross-Validation. The dataset consists of 3,000 field-collected images obtained in collaboration with the Department of Food Security, Agriculture, and Fisheries of Tuban Regency. These images were manually cropped, resized to 299×299 pixels, and normalized to the range [-1, 1]. The evaluation results show that the baseline model achieved a mean accuracy of 97.17% with a standard deviation of 0.0099, along with a precision of 97.15%, recall of 97.19%, and F1-score of 97.16%. After optimization, the model’s performance improved to a mean accuracy of 97.50% with a lower standard deviation of 0.0063, precision of 97.48%, recall of 97.53%, and F1-score of 97.49%. The 0.33% increase in accuracy and reduced standard deviation indicate that the optimized model is not only more accurate but also more stable. The best model (from fold 5 in the optimized scenario) was implemented in an Android application using TensorFlow Lite, supporting offline detection via real-time camera access or gallery uploads with a simple and user-friendly interface for farmers. This research demonstrates that Bayesian Optimization significantly improves all evaluation metrics of the InceptionV3-CBAM model, enabling effective early detection of FMD to reduce disease spread and livestock mortality, particularly among calves. Future improvements may include dataset expansion and cloud system integration for continuous monitoring.

Keywords : Android Application, Bayesian Optimization, Foot-and-Mouth Disease (FMD), Image-based Detection, InceptionV3-CBAM

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The author recognizes that this thesis has areas for improvement and welcomes any constructive feedback or suggestions. Finally, with all the author's limitations, may this thesis be beneficial to all parties in general and to the author in particular.

Surabaya, May 13, 2026

Author

TABLE OF CONTENTS

APPROVAL SHEET	iii
APPROVAL SHEET	v
STATEMENT OF ORIGINALITY	vii
ABSTRACT	ix
ACKNOWLEDGEMENTS.....	xi
TABLE OF CONTENTS.....	xiii
LIST OF FIGURES	xv
LIST OF TABLES	xvii
LIST OF CODE PROGRAM	xix
CHAPTER I INTRODUCTION.....	1
1.1 Background	1
1.2 Problem Statement	3
1.3 Objectives.....	4
1.4 Benefits of the Research.....	4
1.5 Scope and Limitations.....	4
CHAPTER II LITERATURE REVIEW.....	5
2.1 Previous Research	5
2.2 Foot-and-Mouth Disease (FMD).....	7
2.3 Artificial Intelligence	8
2.4 Machine Learning	8
2.5 Deep Learning.....	9
2.6 Convolutional Neural Network (CNN).....	9
2.7 InceptionV3 Architecture.....	13
2.8 Convolutional Block Attention Module (CBAM).....	18
2.9 K-Fold Cross Validation	21
2.10 Bayesian Optimization.....	22
2.11 Confusion Matrix	24
2.12 Standard Deviation.....	25
CHAPTER III RESEARCH METHODOLOGY.....	27
3.1 Data Collection.....	28

3.2	Data Preprocessing	30
3.3	K-Fold Cross Validation	34
3.4	InceptionV3-CBAM Architecture.....	35
3.5	Hyperparameter Optimization Using Bayesian Optimization	51
3.6	Testing Scenarios	51
3.7	Model Evaluation	52
3.8	Save Best Model.....	53
3.9	Model Implementation	53
3.10	Analysis of Results and Conclusion.....	54
CHAPTER IV RESULTS AND DISCUSSION		55
4.1	Data Collection.....	55
4.2	Data Preprocessing	56
4.3	K-Fold Cross Validation	59
4.4	InceptionV3-CBAM Model	60
4.5	Bayesian Optimization	64
4.6	Model Evaluation	69
4.7	Model Evaluation Results	72
4.8	Android Application Implementation	79
4.8.1.	Conversion of the Best Model to TensorFlow Lite	80
4.8.2.	Model Integration into the Android Application.....	80
4.8.3.	User Interface (UI) of the Application.....	84
CHAPTER V CONCLUSION		93
5.1	Conclusions	93
5.2	Suggestions.....	94
BIBLIOGRAPHY		95
ATTACHMENT.....		99

LIST OF FIGURES

Figure 2. 1 Architecture of Convolutional Neural Network (CNN)	10
Figure 2. 2 Convolution Operation	10
Figure 2. 3 Polling Layer.....	11
Figure 2. 4 Fully Connected Layer.....	12
Figure 2. 5 InceptionV3 Architecture	14
Figure 2. 6 Inception Module A	15
Figure 2. 7 Asymmetric Convolution $7 \times 7 \rightarrow 1 \times 7$ and 7×1 (Module B)	16
Figure 2. 8 Expanded Filter Bank on an 8×8 Grid for High-Dimensional Features	17
Figure 2. 9 Convolutional Block Attention Module (CBAM).....	19
Figure 2. 10 Channel Attention Module (CAM).....	19
Figure 2. 11 Spatial Attention Module (SAM)	20
Figure 2. 12 Process of K-Fold Cross Validation	21
Figure 2. 13 Illustration of Bayesian Optimization Surrogate Model.....	23
Figure 3. 1 Research Stages	27
Figure 3. 2 Cattle Gum Comparison: FMD and Healthy	28
Figure 3. 3 Cattle Nose Comparison: FMD and Healthy.....	29
Figure 3. 4 Cattle Hooves Comparison: FMD and Healthy.....	29
Figure 3. 5 Results of Manual Cropping.....	30
Figure 3. 6 Resizing Results.....	31
Figure 3. 7 Normalized Image Patch.....	31
Figure 3. 8 InceptionV3-CBAM Feature Extraction Flow	35
Figure 3. 9 Stem Block Layer	36
Figure 3. 10 Result of 3×3 MaxPool with Stride 2 on Table 3.9	37
Figure 3. 11 Inception Module A Layer.....	38
Figure 3. 12 Result of 3×3 AvgPool with padding='same' on Table 3.10	39
Figure 3. 13 Grid Size Reduction A Layer.....	40
Figure 3. 14 Inception Module B Layer.....	41
Figure 3. 15 Grid Size Reduction B Layer.....	43
Figure 3. 16 Inception Module C Layer.....	44

Figure 3. 17 Detailed Workflow of CBAM	45
Figure 3. 18 Evaluation Flow	52
Figure 3. 19 Wireframe of the Android-Based FMD Detection Application	53
Figure 4. 1 Dataset of FMD-Infected and Healthy Cattle	55
Figure 4. 2 Results of Manual Cropping	56
Figure 4. 3 Resize Results	58
Figure 4. 4 Confusion Matrix of the Baseline Model	73
Figure 4. 5 Confusion Matrix of the Optimized Model	74
Figure 4. 6 Accuracy and Loss Graph of the Best Model	76
Figure 4. 7 Samples of Healthy and FMD-Infected Cattle Images with Symmetric Cropping.....	77
Figure 4. 8 Confusion Matrix of Symmetric Dataset Testing	77
Figure 4. 9 Classification Report of Symmetric Dataset Testing.....	78
Figure 4. 10 Application Home UI.....	84
Figure 4. 11 Application Home UI.....	85
Figure 4. 12 Gallery Image Upload Detection Menu UI.....	85
Figure 4. 13 Gallery Image Prediction Result UI.....	86
Figure 4. 14 Warning Display Before Real-time Detection.....	88
Figure 4. 15 Real-time Mode UI	89
Figure 4. 16 Camera Position Verification Display	89
Figure 4. 17 Take Picture UI and Prediction Result	90
Figure 4. 18 Take Picture UI When the Object is Irrelevant.....	91

LIST OF TABLES

Table 2. 1 Confusion Matrix	24
Table 3. 1 Composition of the Dataset	28
Table 3. 2 Red Pixel Values Before Normalization	32
Table 3. 3 Green Pixel Values Before Normalization.....	32
Table 3. 4 Blue Pixel Values Before Normalization.....	32
Table 3. 5 Red Pixel Values After Normalization	33
Table 3. 6 Green Pixel Values After Normalization	33
Table 3. 7 Blue Pixel Values After Normalization	34
Table 3. 8 K-Fold Cross-Validation Simulation	34
Table 3. 9 Red Pixel Values After 3×3 Convolution	37
Table 3. 10 Red Pixel Values After 1×1 Convolution	39
Table 3. 11 Bayesian Optimization Search Space.....	51
Table 3. 12 Testing Scenario Configuration	52
Table 3. 13 Comparison of Evaluation Metrics for Testing Scenarios	52
Table 4. 1 Bayesian Optimization Results	68
Table 4. 2 Model Configuration in Evaluation Scenarios.....	69
Table 4. 3 Baseline Model Performance Evaluation.....	73
Table 4. 4 Optimized Model Performance Evaluation.....	75
Table 4. 5 Comparison of Evaluation Metrics Across Testing Scenarios.....	79

LIST OF CODE PROGRAM

Code Program 4. 1 Image Resize Process.....	57
Code Program 4. 2 Normalization Process	58
Code Program 4. 3 K-Fold Cross Validation	59
Code Program 4. 4 Channel Block Attention Module (CBAM).....	60
Code Program 4. 5 InceptionV3-CBAM	62
Code Program 4. 6 K-Fold Evaluation.....	63
Code Program 4. 7 Objective Function for Bayesian Optimization	65
Code Program 4. 8 Bayesian Optimization Initialization	66
Code Program 4. 9 Warm Start	66
Code Program 4. 10 Optimization Process and Best Parameter Retrieval.....	67
Code Program 4. 11 Model Evaluation Function.....	70
Code Program 4. 12 Creation of Confusion Matrix	70
Code Program 4. 13 Creation of Accuracy and Loss Graphs	70
Code Program 4. 14 Storing Evaluation Metrics for Each Fold	71
Code Program 4. 15 Evaluation of Baseline Model and Optimized Model.....	72
Code Program 4. 16 Model Conversion to TFLite.....	80
Code Program 4. 17 TFLite Model Loading.....	81
Code Program 4. 18 Image Resize	81
Code Program 4. 19 Normalization.....	82
Code Program 4. 20 Prediction	83
Code Program 4. 21 Camera Analysis Initialization.....	87
Code Program 4. 22 Image Capture (Take Picture).....	87
Code Program 4. 23 Result Retrieval.....	88