

**PET ANIMAL IDENTIFICATION AND VERIFICATION  
USING EAR VEIN BIOMETRICS**

Dulaj Viduranga Athapaththu Disanayaka

179316K

Degree of Master of Science/ Master of Engineering

Department of Computer Science and Engineering

University of Moratuwa

Sri Lanka

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Dulaj Viduranga Athapaththu Disanayaka

179316K

This dissertation submitted in partial fulfillment of the requirements for the Degree  
of MSc in Computer Science specializing in Data Science

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## DECLARATION

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## **ABSTRACT**

With the current technological advances in almost all the fields across the world, humankind has never been more connected and affiliated to the global society. Part of this advancement has led to transpire a number of social issues that was obscured from our view in the history. Along with racial, gender, and religious issues that came to light, animal wellbeing is also being discussed hugely and improved rapidly in the past couple of years.

This research is intended to provide a novel approach to tackle two issues the society have related to animal wellbeing. Namely, pet insurance fraud and pet theft.

Both of these problems arise due to the fact that there is no solid and well standardized method to identify and validate the identity of pet animals. Almost all the situations that a pet's identity needs to be validated, the owner's statement alone is considered as confirmation. This not only is invalid; but also, it has led to a huge number of insurance fraud and also theft.

We provide a method to capture and validate the identity of any animal using ear vein imaging biometrics. Due to the fact that vein patterns of any individual are unique; and the ear vein capturing method can be extremely simple and fast, the expected solution will provide a versatile and practical solution to the aforementioned problems.

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## LIST OF ABBREVIATIONS

Abbreviation	Description
2D	2 Dimensional
2FA	2 Factor Authentication
3D	3 Dimensional
AUC	Area Under the Curve
CLAHE	Contrast Limited Adaptive Histogram Equalization
CMOS	Complementary metal–oxide–semiconductor
CNN	Convolutional Neural Networks
DHS	Department of Homeland Security
DNN	Deep Neural Networks
FAR	False Acceptance Rate
FBI	Federal Bureau of Investigation
FIR	Far-Infrared
FPS	Frames Per Second
FRR	False Rejection Rate
ICA	Independent Component Analysis
ID	Identification
IR	Infrared
ISO	International Organization for Standardization
LDA	Local Discriminant Analysis
LED	Light Emitting Diode
MIR	Mid-Infrared
ML	Machine Learning
MP	Mega Pixel
NBIS	NIST Biometric Image Software
NIR	Near-Infrared
NIST	National Institute of Standards and Technology
NN	Neural Networks
OTP	One Time Password
PCA	Principal Component Analysis
RELU	Rectified Linear Unit
RGB	Red-Green-Blue
ROC	Receiver Operating Characteristic
SVM	Support Vector Matching

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