CERTIFICATE

This is to certify that the Thesis entitled **"An Optimized Convolutional Neural Network-based Ensemble Classification and Regression Framework for Classifying the Stages of Diabetic Retinopathy"** submitted to Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, in partial fulfilment of the requirements for the award of the **Degree of Doctor of Philosophy in Computer Science,** is a record of original research work done by **Valarmathi. S** during the period of her study in the Department of Computer Science at Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, under my Supervision and Guidance and the thesis has not formed the basis for the award of any Degree/ Diploma/ Associateship/ Fellowship or other similar titles to any candidate of any University.

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DECLARATION

I, Valarmathi S, hereby declare that the thesis entitled **"An Optimized Convolutional Neural Network-based Ensemble Classification and Regression Framework for Classifying the Stages of Diabetic Retinopathy"** submitted to Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, in partial fulfilment of the requirements for the award of the **Degree of Doctor of Philosophy in Computer Science**, is a record of original research work done by me during the period of my study under the Supervision and Guidance of **Dr. (Mrs.) R. Vijayabhanu, MCA, M.Phil., Ph.D.,** Assistant Professor (SG), Department of Computer Science at Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, and it has not formed the basis for the award of any Degree/ Diploma/ Associateship/ Fellowship or other similar titles to any candidate of any University.

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Valarmathi. S

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LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
DL	Deep Learning
DR	Diabetic Retinopathy
CNN	Convolutional Neural Network
MSA	Multi-Scale Attention
ResNet	Residual Neural Network
GAN	Generative Adversarial Network
MLP	Multilayer Perceptron
MBA	Mine Blast Algorithm
OD	Optic Disc
CAD	Computer Aided Design
SVM	Support Vector Machine
KNN	K-Nearest Neighbor
ML	Machine Learning
NN	Neural Networks
DNN	Deep Neural Networks
BP	Back-Propagation
FC	Fully Connected
ReLU	Rectified Linear Unit
BN	Batch Normalization
SM	Soft Max
ILSVRC	ImageNet Large Scale Visual Recognition Challenge
MA	Microaneurysms
HE	Hemorrhages

ABBREVIATION	DESCRIPTION
EXs	Exudates
DWT	Discrete Wavelet Transform
K-SVD	K-Singular Value Decomposition
DWT_K-SVD	Discrete Wavelet Transform with K-Singular Value Decomposition
HE	Histogram Equalization
AHE	Adaptive Histogram Equalization
CLAHE	Contrast Limited Adaptive Histogram Equalization
GB	Gradient Boosting
RF	Retinal Fundus
MSFP	Multi-Scale Feature Pyramid
MSA-ResNetGB	Multi-Scale Attention-based Residual Network with Gradient Boosting
ASPP	Atrous Spatial Pyramid Pooling
SGAN-ECR	Special Generative Adversarial Network with Ensemble Classification Regression
SGAN-OECR	Special Generative Adversarial Network with Optimized Ensemble Classification Regression
APTOS	Asia Pacific Tele-Ophthalmology Society
IDRiD	Indian Diabetic Retinopathy Image Dataset
GPU	Graphics Processing Unit
DME	Diabetic Macular Edema
NPDR	Non-Proliferative Diabetic Retinopathy
PDR	Proliferative Diabetic Retinopathy
MSE	Mean Square Error
PSNR	Peak Signal-to-Noise Ratio
SSIM	Structural Similarity Index Measure

ABBREVIATION	DESCRIPTION
WF	Wiener Filter
GOMP	Greedy Orthogonal Matching Pursuit
db2	Daubechies 2
IDWT	Inverse Discrete Wavelet Transform
BE	Blood Vessel Enhancement
CDF	Cumulative Distribution Function
BS	Block Size
CL	Clip Limit
dB	Decibel
TP	True Positive
TN	True Negative
FP	False Positive
FN	False Negative
IR	Instance Regularization
MBOA	Mine Blast Optimization Algorithm
EMBOA	Enhanced Mine Blast Optimization Algorithm