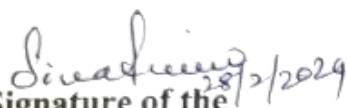
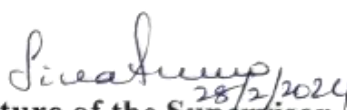


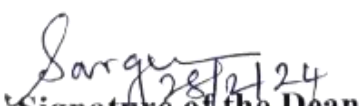
CERTIFICATE

I certify that the thesis entitled “**Study on the Performance of Deep Learning Techniques for the Classification of Parkinson’s Diseases**” submitted for the award of **Doctor of Philosophy (Ph.D.)** by **Mrs. B. Sabeena** is the record of research work carried out by her during the period from **July 2019 to February 2024** under my guidance and supervision, and that this work has not formed the basis for the award of any Degree, Diploma, Associateship, Fellowship or other Titles in this Institute or any other University or Institution of Higher Learning.


Signature of the


Head of the Department


Signature of the Supervisor


Signature of the Dean

DECLARATION

I declare that the thesis entitled “**Study on the Performance of Deep Learning Techniques for the Classification of Parkinson’s Diseases**” submitted by me for the award of Doctor of Philosophy (Ph.D.) is the record of the work carried out by me during the period from July 2019 to February 2024 under the guidance of **Dr. S. Sivakumari** M.E., Ph.D., Professor, Department of Computer Science and Engineering at Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore. And has not formed the basis for the award of any Degree, Diploma, Associateship, Fellowship, Titles in this Institute or any other University or other similar Institution of Higher Learning.


Signature of the Supervisor


Signature of the Research Scholar

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LIST OF ABBREVIATIONS

ACO	- Ant Colony Optimization
AFA	- Adaptive Firefly Algorithm
ANN	- Artificial neural Network
BFO	- bacterial foraging optimization
BOA	- Butterfly Optimization Algorithm
CFS	- Correlation based Feature Selection
CNN	- Convolutional Neural Network
CAD	- Computer-Aided Diagnosis
CSA	- Cuckoo Search Algorithm
DFA	- Detrended Fluctuation Analysis
DLT	- Deep Learning Techniques
DNN	- Deep Neural Network
DT	- Decision Tree
EA	- Evolutionary Algorithm
EDL	- Ensemble Deep learning
ELM	- Extreme learning machine
EMD	- Empirical mode decomposition
EWPT	- Empirical wavelet packet transform
EWT	- Empirical wavelet transform
FCBi-LSTM	- Fuzzy Convolution Bi-Directional Long Short-Term Memory
FCLSTM-CNN	- Fuzzy Convolution Long Short-Term Memory based Convolutional Neural Network
FFNN	- Feed-Forward Neural Network
FMBOA	- Fuzzy Monarch Butterfly Optimization Algorithm

FS	- Feature Selection
GA	- Genetic Algorithm
GNE	- Glottal to Noise Excitation
GQ	- Glottis Quotient
GWO	- Grey Wolf Optimization
HFCC	- Human Factor Cepstral Coefficients
IMFCC	- Intrinsic Mode Function Cepstral Coefficient
KELM	- Kernel Extreme Learning Machine
KNN	- k-Nearest-Neighbor
LFCSA	- Lévy Flights Cuckoo Search Algorithm
LSTM	-Long Short-term Memory
MCC	- Matthews Correlation Coefficient
MFCC	- Mel-Frequency Cepstral Coefficient
MFEA	- Multiple Feature Evaluation Approach
MLT	- Machine Learning Technique
mRMR	- Minimal redundancy maximal relevance
NB	- Naive Bayes
NNMF	- Non-Negative Matrix Factorization,
OBEFS	- Optimization Based Ensemble Feature Selection
OBL	- Opposition Based Learning
OCFA	- Optimized Cuttlefish Algorithm
OCSA	- Optimized crow search algorithm .
PCA	- Principal Component Analysis
PD	- Parkinson Disease
PPE	- Pitch Period Entropy

PSO	- Particle Swarm Optimization
RFE	- Recursive Feature Elimination
RNN	- Recurrent Neural Network
RPDE	- Recurrence Time Density Entropy
SIANN	- space invariant Artificial Neural Network.
SI	- Swarm Intelligence
SRN	- Simple Recurrent Network
SSA	- Salp Swarm Algorithm
SVD	- Singular Value Decomposition
SVM	- Support Vector Machine
TQWT	- Tunable Q-factor Wavelet Transform
UPDRS	- Unified Parkinson's disease Rating Scale
VFER	- Vocal Fold Excitation Ratio
WT	- Wavelet Transform

LIST OF SYMBOLS

- (g_w) - gaussian weighted variable
(F_0) - signal frequency
(fn) - false negative
(fp) - false positive
(tn) - true negative
(tp) - true positive
* - sigmoid function
{ a_i } - dataset is represented
 f_i - fitness value
 f_i^{t+1} - novel feature solutions
 f_{pi} - past data fitness value best solution
 $h_i(t)$ - last two iterations
 h_t^f - forward LSTM result
 h_t - hidden state
 S_{max} - maximum walking
 $x_i^{l,j}$ - convolutional layer
 y_t - classification results
(α) - weighted variable
 F_i - Assess Fitness
 S_a 's - Eigenvector
 S_{fe} - Chosen features count
 a_i - Recorded Features Vector
 c_t - cell state
 f_{best} - feature vector
 f_i^{t+1} - new feature solutions
 f_t - forget gate

g_t – input modulation gate
 i_t – input gate
 o_t – output gate
 up_j^k and low_j^k – upper and lower values
 x_t – input data
 σ_u^2 and σ_v^2 – correspondingly deviation
 \oplus – entry-wise multiplication
 b – bias weight
 FU_i and FV_i – weights
 h_w – cost functions
 J – number of levels
 Q – factor
 r – redundancy
 $s(t)$ – state of cess
 $\tanh(\cdot)$ – hyperbolic tangent
 u and v – normal distribution
 x, z – fused by two classifiers
 $\alpha + \beta + \gamma$ – diagnose PD
 β – attractiveness
 γ – light absorption
 ζ – computed by equation
 $\Pi(a)$ – nonlinear transformation
 Ψ – random vector
 FW_{ih} – fuzzy weight
 St_{Fe} – selected features
 W – initial weights
 $f(f)$ – Objective function
 $prb_a \in$ – probability