CERTIFICATE

I certify that the thesis entitled "**Recommender System of conductive ink of printed electronics applications using Deep Neural Networks**" submitted for the degree of Doctor of Philosophy (Ph.D.) in Computer Science and Engineering is the record of research work carried out by **Mrs. N.Alagusundari (18PHEOP001)** during the period of her study from 2018 to 2024 in the Department of Computer Science and Engineering at Avinashilingam Institute for Home Science and Higher Education for Women Coimbatore, under my guidance and supervision, and the thesis has not formed the basis for the award of any Degree/Diploma/Associateship/Fellowship or other similar titles of any Candidate of this Institute or any other University/Institutionof Higher Learning.

28/10/2024

Signature of the Head of the Department

28/10/2024

Signature of the Supervisor

28/10/24

Signature of the Dean

DECLARATION

I, **Mrs. N.Alagusundari** hereby declare that the thesis entitled "**Recommender System of conductive ink of printed electronics applications using Deep Neural Networks**" submitted to the Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore in the partial fulfillment of the requirements for the award of Doctor of Philosophy (Ph.D.) in Computer Science and Engineering is the record of original and independent research work carried out by me during the period from 2018 to 2024 under the guidance of **Dr. S. Sivakumari M.E., Ph.D.,** Professor,, Department of Computer Science and Engineering, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore and has not formed the basis for the award of anyDegree/Diploma/Associateship/Fellowship or any other similar titles in this Institute or any other University or other similar Institution of Higher Learning.

28/10/2024

Signature of the Supervisor

Signature of the Research Scholar

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N. Alagusundari

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LIST OF ABBREVIATIONS

1D CNN	D Convolutional Neural Network
ANN	Artificial Neural Network
BCR	Balanced Classification Rate
BP	Back Propagation
CART	Classification and Regression Tree
CNN	Convolutional Neural Network
DRNN	Deep Recurrent Neural Network
DT	Decision Tree
FCNN	Fully Connected Neural Network
FDM	Fused Deposition Modeling
FFNN	Feed Forward Neural Network
FN	False Negative
FP	False Positive
GSM	Grams per Square Meter
HC	Hierarchical Clustering
KNN	K-Nearest Neighbor
LCIC	Learning-Based Cell Injection Control
LM	Levenberg-Marquart
LMA	Levenberg-Marquart Algorithm
MCR	Miss Classification Rate
ML	Machine Learning
MLP	Multilayer Perceptron
MLPNN	Multilayer Perceptron Neural Network
NN	Neural Network

PCBs	Printed Circuit Boards
PE	Printed Electronics
PSO	Particle Swarm Optimization
RBF	Radial Basis Function
RF	Radio Frequency
RFID	Radiofrequency-Identification
SP	Screen Printing
SVM	Support Vector Machine
SVR	Support Vector Regression
TN	True Negative
TP	True Positive
XGBoost	Extreme Gradient Boosting

LIST OF SYMBOLS

$x_1, x_2, \ldots x_n$	Input feature
$X_{i,d}^{pbest,t}$	Historical optimal fitness value of each particle in the optimization process
*	Convolution operation
$G_d^{best,t}$	Global best position
A	Input data
c1and c2	Acceleration coefficients
D	Dimension of the search space
E	Error
F	Kernel
J	Jacobian matrix
Max(z)	Maximum value
min(z)	Minimum value
U	Net input
$w_1, w_2, \ldots w_n$	Weight
w_{new}	New weight
w_{old}	Old weight
X	Convolution layer output
Y	Output
Z	Original value
z_{norm}	Normalized value
Δw	Change in weight
H	Learning rate
Φ	Activation function
ω	Inertia weight