

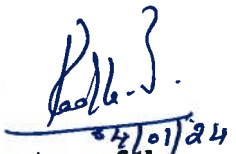
## CERTIFICATE

This is to certify that the thesis entitled “Acute Lymphocytic Leukemia Classification using Enhanced Machine Learning and Deep Learning Algorithms” 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 Saranya Vijayan 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 title to any candidate of any University.

  
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## DECLARATION

I, Saranya Vijayan, hereby declare that the thesis entitled “Acute Lymphocytic Leukemia Classification using Enhanced Machine Learning and Deep Learning Algorithms” 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. V. Radha, M.Sc., PGDCA, PGDOR, B.Ed., M.Phil., Ph.D., 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 title to any candidate of any University.

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**Saranya Vijayan**

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## LIST OF ABBREVIATIONS

Abbreviation	Description
• AHE	Adaptive Histogram Equalization
• AI	Artificial Intelligence
• ALL	Acute Lymphoblastic Leukemia
• ALL-C	Acute Lymphocytic Leukemia Classification
• AML	Acute Myelogenous Leukemia
• ANN	Artificial Neural Networks
• BackGround	BG
• Bagging	Bootstrap Aggregating
• C	Color Feature
• CLAHE	Contrast Limited Adaptive Histogram Equalization
• CLL	Chronic Lymphoblastic Leukemia
• CML	Chronic Myelogenous Leukemia
• CNN	Convolutional Neural Network
• CNN-ESVM	Hybrid CNN and Ensemble SVM
• CNN-ESVM-DCS	Hybrid CNN and Ensemble SVM Using DCS
• CNN-ESVM-DES	Hybrid CNN and Ensemble SVM Using DES
• CNN-SVM	Hybrid CNN and SVM
• CSA-WBC	Combined Segmentation Algorithm for WBC Identification
• CSA-WBC	Combined Segmentation Algorithm for WBC Identification
• D4	Daubeschies Wavelet Transformation
• DL	Deep Learning
• DLC	Deep Learning Classifier / Deep Learning Classification
• DNN	Deep Neural Networks
• DT	Decision Tree
• DWT	Discrete Wavelet Transformation
• DWT-KSVD	Hybrid DWT and KSVD-Based Denoising Algorithm

<b>Abbreviation</b>	<b>Description</b>
• EC	Ensemble Classifier
• ECS	Ensemble Classification System
• EEE-SF	Enhanced Edge Enhancement Algorithm Using Sigmoid Function
• EE-SF	Edge Enhancement Algorithm Using Sigmoid Function
• ESVM	Ensemble System Based on SVM
• ESVM-DCS	ESVM using DSC
• ESVM-DES	ESVM using DES
• ESVM-EDCS	ESVM using Enhanced DCS
• ESVM-EDES	ESVM using Enhanced DES
• EWS-WBC	Enhanced Watershed Segmentation Algorithm to Identify WBC
• F	Optimal Feature Vector
• FN	False Negative
• FoM	Figure of Merit
• ForeGround	FG
• FP	False Positive
• GLCM	Gray-Level Co-occurrence Matrices
• HE	Histogram Equalization
• HH	High High wavelet subband
• HL	High Low wavelet subband
• HVS	Human Visual System
• I	Irregularity of the Nucleus Boundary Feature
• IR	Irrelevant features
• JPEG	Joint Photographic Experts Group
• KM-WBC	KMeans Clustering Algorithm to Identify WBC
• KNN	K-Nearest Neighbour
• K-SVD	K-Singular Value Decomposition
• LH	Low High wavelet subband
• LL	Low Low wavelet subband

<b>Abbreviation</b>	<b>Description</b>
• MF	Markov Filter
• ML	Machine Learning
• MLC	Machine Learning Classifier / Machine Learning Classification
• MLP	MultiLayer Perceptron
• MRMR	Minimum Redundant Maximum Relevant
• MSE	Mean-Squared Error
• MSSI	Mean Structural Similarity Index
• NN	Neural Networks
• NR	non-redundant features
• PFKM	Parameterless Fast K-Means Clustering
• PFKM-WBC	Parameterless Fast KMeans Clustering Algorithm to Identify WBC
• PSNR	Peak Signal to Noise Ratio
• R	Redundant features
• RBC	Red Blood Cells
• RBF	Radial Basis Function
• Re	Relevant features
• ReLu	REctified Linear Units
• RF	Random Forest
• RoC	Region of Competence
• ROI	Region of Interest
• S	Shape Feature
• SEM	Scanning Electron Microscopy
• SFV	Super Feature Vector
• SRe	Strongly Relevant features
• SVD	Singular Value Decomposition
• SVM	Support Vector Machine

Abbreviation	Description
• T	Texture Feature
• TN	True Negative
• TP	True Positive
• UCED	Unified Contrast adjustment, Edge enhancement and Denoising Algorithm
• WBC	White Blood Cells
• WM	Weight Matrix
• WRe	Weakly Relevant features
• WS-WBC	Watershed Segmentation Algorithm to Identify WBC