

# **A Study of Denoising Techniques for Improved NSCLC Classification Using WSI Histopathology Images**

A PROJECT REPORT

*Submitted by*

<b>Roll Number</b>	<b>Registration Number</b>	<b>Student Code</b>	<b>Student Name</b>
<b>23010201040</b>	<b>23012005155 of 2023-2024</b>	<b>BWU/MCA/23/043</b>	<b>Anwasha Pramanik</b>
<b>23010201009</b>	<b>23012005124 of 2023-2024</b>	<b>BWU/MCA/23/010</b>	<b>Avik Kumar Maiti</b>
<b>23010201023</b>	<b>23012005138 of 2023-2024</b>	<b>BWU/MCA/23/025</b>	<b>Subrata Dolui</b>
<b>23010201010</b>	<b>23012005125 of 2023-2024</b>	<b>BWU/MCA/23/011</b>	<b>Purajit Bera</b>

*in partial fulfilment for the award of the degree*

*of*

**Master of Computer Applications**

*in*

Department of Computational Sciences

**BRAINWARE UNIVERSITY**

398, Ramkrishnapur Road, Barasat, North 24 Parganas, Kolkata - 700125



May, 2025

**A Study of Denoising Techniques for Improved NSCLC  
Classification Using WSI Histopathology Images**

*Submitted by*

<b>Roll Number</b>	<b>Registration Number</b>	<b>Student Code</b>	<b>Student Name</b>
<b>23010201040</b>	<b>23012005155 of 2023-2024</b>	<b>BWU/MCA/23/043</b>	<b>Anwesh Pramanik</b>
<b>23010201009</b>	<b>23012005124 of 2023-2024</b>	<b>BWU/MCA/23/010</b>	<b>Avik Kumar Maiti</b>
<b>23010201023</b>	<b>23012005138 of 2023-2024</b>	<b>BWU/MCA/23/025</b>	<b>Subrata Dolui</b>
<b>23010201010</b>	<b>23012005125 of 2023-2024</b>	<b>BWU/MCA/23/011</b>	<b>Purajit Bera</b>

*in partial fulfilment for the award of the degree*

*of*

**Master of Computer Applications**

*in*

**Department of Computational Sciences**



**BRAINWARE UNIVERSITY**

398, Ramkrishnapur Road, Barasat, North 24 Parganas, Kolkata - 700125



**BRAINWARE UNIVERSITY**

*398, Ramkrishnapur Road, Barasat, North 24 Parganas, Kolkata - 700 125*

**Department of Computational Sciences**

**BONAFIDE CERTIFICATE**

Certified that this project report “**A Study of Denoising Techniques for Improved NSCLC Classification Using WSI Histopathology Images**” is the bonafide work of “**Anweshha Pramanik, Avik Kumar Maiti, Subrata Dolui, Purajit Bera**” who carried out the project work under my supervision.

**SIGNATURE**

**SIGNATURE**

**DR. JAYANTA AICH**

Head of the Department  
Department of Computational Sciences  
Brainware University  
398, Ramkrishnapur Road, Barasat, North  
24 Parganas, Kolkata – 700125.

**DR. SUBRATA SINHA**

SUPERVISOR  
Professor  
Department of Computational Sciences  
Brainware University  
398, Ramkrishnapur Road, Barasat, North  
24 Parganas, Kolkata – 700125.

-----  
**External Examiner**

-----  
**Internal Examiner**

# ACKNOWLEDGEMENT

**Project Title:** “A Study of Denoising Techniques for Improved NSCLC Classification Using WSI Histopathology Images.”

**Project Group ID:** MCA23A011

We, the project team, would like to extend our heartfelt appreciation to Prof. (Dr.) Subrata Sinha, Professor in the Department of Computational Sciences at Brainware University, for his exceptional guidance, unwavering support, and continuous motivation throughout the duration of our project. His expertise and thoughtful feedback were instrumental in the successful execution of our work.

We are equally grateful to Dr. Jayanta Aich, Head of the Department of Computational Sciences, for providing us with the necessary resources and a supportive academic environment that greatly facilitated our project’s development.

We also sincerely thank all the faculty members and staff of the Department of Computational Sciences for their cooperation and valuable input. Their constructive suggestions and encouragement played a vital role in keeping us focused and enhancing the quality of our work.

Our deepest thanks go to our families, friends, and peers, whose constant support and encouragement inspired us to remain dedicated and strive for excellence throughout this journey.

Lastly, we express our sincere gratitude to Brainware University for offering us the opportunity to pursue this project as part of our academic curriculum, and for fostering a culture of innovation and learning.

## **Project Members:**

1. BWU/MCA/23/O43 – ANWESHA PRAMANIK
2. BWU/MCA/23/O10 – AVIK KUMAR MAITI
3. BWU/MCA/23/O25 – SUBRATA DOLUI
4. BWU/MCA/23/O11 – PURAJIT BERA

**DATE:** 27/05/2025

**Department of Computational Sciences**  
**Brainware University**

## **ABSTRACT**

Lung cancer, particularly Non-Small Cell Lung Cancer (NSCLC), remains one of the deadliest cancers worldwide due to late-stage diagnoses and complex histopathological features. The rise of Whole Slide Imaging (WSI) has revolutionized digital pathology, but the presence of image noise significantly impacts the accuracy of automated diagnostic models. This project investigates and compares four classical denoising techniques—Bilateral, Gaussian, Median, and Wiener filters—to enhance the quality of histopathological WSIs for improved lung cancer classification.

High-resolution WSI data, annotated by oncopathologists under an ICMR-funded initiative, were pre-processed, augmented, and subjected to the selected denoising methods. A custom Convolutional Neural Network (CNN) was trained on the filtered datasets to classify lung tissue samples into three categories: Adenocarcinoma, Squamous Cell Carcinoma, and Non-Malignant. The performance of each denoising technique was evaluated using key metrics such as accuracy, precision, recall, F1-score, and AUC.

The results demonstrate that Median and Gaussian filters offer superior noise suppression while preserving structural features critical for classification. These findings highlight the importance of tailored preprocessing strategies in medical image analysis and suggest that effective denoising can significantly enhance the performance and reliability of AI-driven diagnostic systems in digital pathology.

# TABLE OF CONTENTS

Chapter	Title	Page No.
	ABSTRACT	V
	LIST OF TABLES	VIII
	LIST OF FIGURES	IX
1.	INTRODUCTION	1
	1.1 Background	1
	1.2 Overview of Lung Cancer and lung Cancer Variants.	4
	1.3 Identifying Lung Cancer	5
	1.4 Noise in Histopathological Imaging	7
	1.5. Denoising Method	7
	1.6 Utilizing WSI images and AI for Lung Cancer Detection	8
	1.7 Aims and Objective	8
2.	LITERATURE REVIEW	9
3.	MATERIALS AND METHODOLOGY	14
	3.1 Materials	14
	3.1.1 Data set	14
	3.1.2 Jupyter Notebook	15
	3.1.3 ImageScope	15
	3.1.4 Anaconda Prompt	16
	3.1.5 Python	17
	3.2 Methodology	17
	3.2.1 Image Preprocessing	17
	3.2.2 Type of noise in histopathological image	18

3.2.3 Measurement of Level of Noise in WSI Image (in DB)	18
3.2.4 Remove noise from image with appropriate denoising method	19
3.3 Model training and Development	20
3.4 Proposed CNN model Architecture	21
3.5 Evaluation and cross-validation of our proposed model	22
3.6 Flow Chart of The Methodology	23
4. RESULTS AND DECISION	24
4.1 Model Performance	24
4.1.1 Classification curves of the proposed models	24
4.1.2 Confusion Matrix	25
4.1.3 Classification: Precision-Recall Curve	29
5. Conclusion	30
6. References	31

## List of Tables

1.	Table 3.1: Model Summary	20
2.	Table 4.1.: Model Performance on Original Datasets before Denoising	28
3.	Table 4.2: Proposed Model performance on Lung cancer dataset. Adam optimizer with a learning rate of 0.0001.	28



## List of Figures

1. Figure 1.1: Cancer Incidence and Mortality Rates in India (2022)	1
2. Figure 1.2: Mortality in India (2022).	2
3. Figure 1.3(a): Estimated Economic burden by 2050 of major cancer types depicting Lung Cancer leading	3
4. Figure 1.3(b): The Disease and Economic Burden of Cancer in 9 Countries in the Middle East and Africa.	3
5. Figure 1.4: Incidence and Mortality of Lung Cancer.	4
6. Figure.1.5: Classification of NSCLC	5
7. Figure. 3.1: Sample from the used data-set adenocarcinoma and squamous cell carcinoma.	14
8. Figure 3.2: Jupyter Notebook	15
9. Figure 3.3: ImageScope	15
10. Figure 3.4: Anaconda Prompt	16
11. Figure 3.5: Python	17
12. Figure 3.6: Diagram of the Model Architecture.	21
13. Figure 3.7: Diagram of the flowchart of methodology.	23
14. Figure. 4.1: Visualization of (a) Training and Validation accuracy and loss for the Bilateral model (b) Training and Validation accuracy and loss for the Gaussian model (c) Training and Validation accuracy and loss for the Median model (d) Training and Validation accuracy and loss for the Weiner model.	24
15. Figure. 4.2: Confusion matrix of the proposed model before denoising.	25
16. Figure 4.3: Confusion matrix of the proposed model after denoising.	27

17. Figure 4.4: Precision-Recall curve for (a) bilateral model (b) Gaussian model (c) Median model (d) Weiner model. 29