"Multimodal Breast Cancer Classification with Medical Based Transfer Learning CNN Algorithms"

A Dissertation

Submitted in partial fulfillment of the requirements for the award of the degree of

Post Graduate Diploma in Bioinformatics

Submitted by

SANKET M. CHAUDHARY

Enrolment No.: **231451302004**

Under Guidance of

Dr. Kshipra Chauhan

Assistant Professor

SAST, GTU

Prof. Mahesh Panchal

Assistant Professor

GSET, GTU

School of Applied Sciences and Technology

Gujarat Technological University

May, 2024

Declaration by Student

I hereby declare that the work incorporated in this dissertation report entitled "**Multimodal Breast Cancer Classification with Medical Based Transfer Learning CNN Algorithms**" is original and has not been submitted to any University or Institution for the award of a Degree.

I further declare that the results presented in this dissertation and the consideration made there in, is carried out by me in the School of Applied Science and Technology, Gujarat Technological University, Ahemadabad-382424.

Date:

Place:

SANKET M. CHAUDHARY

Sanket Chaudhary_231451302004.docx

ORIGINALITY REPORT

7%
SIMILARITY INDEX

PRIMARY SOURCES

1	Gaojing Wang, Qingquan Li, Lei Wang, Wei Wang, Mengqi Wu, Tao Liu. "Impact of Sliding Window Length in Indoor Human Motion Modes and Pose Pattern Recognition Based on Smartphone Sensors", Sensors, 2018 Crossref	35 words — 1%
2	www.mdpi.com Internet	28 words — 1%
3	mindthegraph.com Internet	26 words — < 1%
4	assets.researchsquare.com Internet	19 words — < 1%
5	suspace.su.edu.bd Internet	19 words — < 1%
6	Huma Naz, Rahul Chamola, Jaleh Sarafraz, Mahdi Razabizadeh, Siddharth Jain. "An efficient densenet-based deep learning model for Big-4 snake species classification", Toxicon, 2024 Crossref	18 words — < 1%
7	Parita Oza. "AI in breast imaging: Applications, challenges, and future research", Elsevier BV, 2024 Crossref	14 words — < 1%

8	iieta.org Internet	14 words — < 1%
9	www.coursehero.com Internet	14 words — < 1%
10	www.ncbi.nlm.nih.gov Internet	13 words — < 1%
11	Chong Shang, Haizhou Ai, Bo Bai. "End-to-end crowd counting via joint learning local and global count", 2016 IEEE International Conference on Image Processing (ICIP), 2016 Crossref	12 words — < 1%
12	Ton Duc Thang University Publications	12 words — < 1%
13	Selvakanmani S, G Dharani Devi, Rekha V, J Jeyalakshmi. "Privacy-Preserving Breast Cancer Classification: A Federated Transfer Learning Approach", Journal of Imaging Informatics in Medicine, 2024 Crossref	11 words — < 1%
14	Joshua J. Podmore, Toby P. Breckon, Nik K. N. Aznan, Jason D. Connolly. "On the Relative Contribution of Deep Convolutional Neural Networks for SSVEP-Based Bio-Signal Decoding in BCI Speller Applications", IEEE Transactions on Neural Systems and Rehabilitation Engineering, 2019 Crossref	10 words — < 1%
15	fount.aucegypt.edu Internet	10 words — < 1%
16	"Pediatric State of the Art Symposium", Epilepsia, 10/2006	9 words — < 1%

Crossref

17	"Proceeding of 2022 International Conference on Wireless Communications, Networking and Applications (WCNA 2022)", Springer Science and Business Media LLC, 2023 Crossref	9 words — < 1%
18	Asmaa S. Alsolami, Wafaa Shalash, Wafaa Alsaggaf, Sawsan Ashoor, Haneen Refaat, Mohammed Elmogy. "King Abdulaziz University Breast Cancer Mammogram Dataset (KAU-BCMD)", Data, 2021 Crossref	9 words — < 1%
19	www.slideshare.net Internet	9 words — < 1%
20	Lecture Notes in Computer Science, 2015. Crossref	8 words — < 1%
21	fastercapital.com Internet	8 words — < 1%
22	wiredspace.wits.ac.za Internet	8 words — < 1%
23	Geoffrey E. Hinton, Simon Osindero, Yee-Whye Teh. "A Fast Learning Algorithm for Deep Belief Nets", Neural Computation, 2006 Crossref	7 words — < 1%
24	"Proceedings of the Second International Conference on Advances in Computing Research (ACR'24)", Springer Science and Business Media LLC, 2024 Crossref	6 words — < 1%
25	publications.polymtl.ca Internet	6 words — < 1%

26	docdrop.org Internet	4 words — < 1%
27	medicaz.com Internet	4 words — < 1%

EXCLUDE QUOTES	ON	EXCLUDE SOURCES	OFF
EXCLUDE BIBLIOGRAPHY	ON	EXCLUDE MATCHES	OFF

SCHOOL OF APPLIED SCIENCES & TECHNOLOGY (SAST-GTU)
GUJARAT TECHNOLOGICAL UNIVERSITY
(Established by Government of Gujarat Under Guajarat Act No. 20 of 2007)

Certificate

This is to certify that dissertation entitled **"Multimodal Breast Cancer Classification With Medical Based Transfer Learning CNN Algorithms"** submitted to the School of Applied Sciences and Technology (SAST), Gujarat Technological University (GTU), Chandkheda-382424, Ahmedabad, Gujarat, in partial fulfilment for the degree of Postgraduate Diploma in Bioinformatics is a bonafide record of research work carried out by **Mr. Sanket Mansangbhai Chaudhary**, under my supervision and guidance. No part of this dissertation has been reproduced elsewhere for any degree. All kind of help received by him have been duly acknowledged.

Date:

Place:

(Signature of Supervisor)

Dr. Kshipra Chauhan,
Assistant Professor
School of Applied Science
& Technology,
Gujarat Technological University,
Ahemadabad

(Signature of Supervisor)

Prof. Mahesh Panchal,
Assistant Professor
Graduate School of
Engineering &Technology
Gujarat Technological University,
Ahemadabad

(Signature of Director, SAST)

Dr. Vaibhav Bhatt,
Professor & Director
School of Applied Science and Technology,
Gujarat Technological University, Ahemadabad

Acknowledgments

I would like to thank my project advisor, **Dr. Kshipra Chauhan** for guiding and supporting me throughout this entire dissertation project. Her knowledge and experience was invaluable and helped make my project's direction more clear.

I also want to extend my gratitude toward my other project advisor, **Prof. Mahesh Panchal**, Assistant professor at the Graduate School of Engineering and Technology, GTU, for always being available to assist whenever I needed help of him.

I am humble and grateful to my family and friends for pushing me to be better and always supporting me.

Lastly, I would like to appreciate School of Applied Science and Technology, GTU for providing me with this opportunity to learn and grow.

Sanket Mansangbhai Chaudhary

Abstract

According to WHO, more than 2.3 million new cases of breast cancer occurs each year worldwide, which makes it the most common type of cancer among women. Breast cancer treatment can be highly effective at an early stage. But individual medical diagnostic methods have limitations to cover up whole spectrum of complexity to detect cancer in early phase, which motivates to consider multiple medical image modalities to make diagnosis. The first aim of the project was to apply medical based pre-trained CNN models on different medical image modalities separately, changing the parameters of settings for these models, and using data augmentations methods to the medical images to get better classification accuracy. In the next step, to create feature-level fusion based multimodal CNN classification model using most accurate pre-trained model found for each image modality. During this work, have used five different models on three specific breast image modalities datasets: Mammograms, Ultrasound and Thermal images, where each dataset divided into malignant, benign and normal classes and also implemented RadImagenet and chexnet weights on DenseNet121, Resnet50, Inception-v3, Inception-Resnet-v2 CNN architectures. Almost all models performed well after fine-tuning except chexnet, but Inception-Resnet-v2 showed the best result across all modalities with 66%, 81%, 99% accuracy for Mammograms, Ultrasound and Thermal dataset respectively. In addition, it performed better at accuracy as single model used in method1 than three distinct models to create multimodal CNN model mentioned in method 2.

Table of Contents