A Lightweight Pruned DCNN Model with XAI for Skin Cancer Classification

Senior Design Project

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Faculty Advisor:
Dr. Sifat Momen
Associate Professor
ECE Department

Department of Electrical and Computer Engineering
North South University
Summer 2024

LETTER OF TRANSMITTAL

December, 2024

To
Dr. Mohammad Abdul Matin
Chairman,
Department of Electrical and Computer Engineering
North South University, Dhaka

Subject: Submission of Capstone Project Report on "A Lightweight Pruned DCNN Model with XAI for Skin Cancer Classification"

Dear Sir,

With due respect, we would like to submit our Capstone Project Report on "A Lightweight Pruned DCNN Model with XAI for Skin Cancer Classification" as a part of our BSc program. This report focuses on developing a lightweight deep-learning model combined with explainable AI techniques for skin cancer classification. This project has provided us with hands-on experience in applying theoretical knowledge to solve practical challenges in the medical imaging field. We have made every effort to ensure the report meets all required standards.

We will be highly obliged if you kindly receive this report and provide your valuable judgment. It would be our immense pleasure if you find this report helpful and informative to have an apparent perspective.

Sincerely Yours,

Mehedi Hasan
ECE Department
North South University, Bangladesh

Mahir Shahriar Abir
ECE Department
North South University, Bangladesh

Abu Tayeb Mohammad Ayon
ECE Department
North South University, Bangladesh

APPROVAL

Mehedi Hasan (ID # 2011425042), Mahir Shahriar Abir (ID # 2013640042), Abu Tayeb Mohammad Ayon (ID # 2012547042) from Electrical and Computer Engineering Department of North South University have worked on the Senior Design Project titled "A Lightweight Pruned DCNN Model with XAI for Skin Cancer Classification" under the supervision of Dr. Sifat Momen in partial fulfillment of the requirement for the degree of Bachelors of Science in Engineering and has been accepted as satisfactory.

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Supervisor's Signature

Dr. Sifat Momen
Associate Professor
Department of Electrical and Computer Engineering
North South University
Dhaka, Bangladesh.

.....
Chairman's Signature

Dr. Mohammad Abdul Matin
Professor
Department of Electrical and Computer Engineering
North South University
Dhaka, Bangladesh.

DECLARATION

This is to declare that this project is our original work. No part of this work has been submitted elsewhere, partially or fully, for the award of any other degree or diploma. All project-related information will remain confidential and shall not be disclosed without the formal consent of the project supervisor. Relevant previous works presented in this report have been properly acknowledged and cited. The plagiarism policy, as stated by the supervisor, has been maintained.

Students' names & Signatures

- Mehedi Hasan

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- Mahir Shahriar Abir

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- Abu Tayeb Mohammad Ayon

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ACKNOWLEDGEMENTS

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Furthermore, the authors would like to thank the Department of Electrical and Computer Engineering, North South University, Bangladesh, for facilitating the research. The authors would also like to thank their loved ones for their countless sacrifices and continual support.

ABSTRACT

Skin cancer is one of the most destructive types of cancer due to its immediate arrival and the potential for rapid spread. Sometimes, traditional diagnostic methods don't react immediately because they need dermatologist expertise, some automation tools and time. This study explores one of the areas of artificial intelligence-deep learning, specifically Convolutional Neural Networks (CNNs), to enhance the efficiency and accuracy of skin cancer diagnosis. In this article, we introduce a lightweight pruned deep Convolutional Neural Network (dCNN) based method for skin cancer detection. With significantly lower trainable parameters, it surpasses recent state-of-the-art methods and shows competitive performance against 11 CNN-based pre-trained models, including Densenet121, DenseNet201, EfficientNetB2, InceptionV3, MobileNetV2, ResNet50, ResNet50V2, ResNet101V2, VGG16, VGG19, Xception. The proposed model demonstrates an accuracy of 98.07% with a notable precision of 98.15%, recall of 98.07%, and an F2 score of 98.02%. Even model interpretability perfectly works with Grad-Cam++. The proposed pruned model not only gets higher accuracy but also reduces computational cost, making it suitable for deploy on any device.