



Department of Electrical and Computer Engineering
North South University

Senior Design Project

ENHANCING IMAGES FOR COLOR VISION DEFICIENCY (CVD) USING DEEP LEARNING

TANEEM AHMED	ID# 2013102042
SIDDHARTHA SANKAR SAHA	ID# 2011567042
MAHBUB MORSHED RIFAT	ID# 2011415042

Faculty Advisor:

Dr. Mohammad Ashrafuzzaman Khan (AZK)

Associate Professor

ECE Department

Spring, 2024

LETTER OF TRANSMITTAL

June 01, 2024

To

Dr. Rajesh Palit

Chairman,

Department of Electrical and Computer Engineering

North South University, Dhaka

Subject: Submission of Capstone Project Report on “Enhancing Images for Color Vision Deficiency (CVD) using Deep Learning”

Dear Sir,

With due respect, we would like to submit our **Capstone Project Report on “Enhancing Images for Color Vision Deficiency (CVD) using Deep Learning”** as a part of our BSc program. This report presents our original research on color-deficient observers using a deep-learning approach. The project was a valuable learning experience for us, as it allowed us to apply our knowledge and skills to a challenging problem in the real world. We made every effort to produce a high-quality report that meets all of the requirements.

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 useful and informative to have an apparent perspective.

Sincerely Yours,

.....
Taneem Ahmed ECE
Department
North South University, Bangladesh

.....
Siddhartha Sankar Saha ECE
Department
North South University, Bangladesh

.....
Mahbub Morshed Rifat ECE
Department
North South University, Bangladesh

APPROVAL

Taneem Ahmed (ID # 2013102042), Siddhartha Sankar Saha (ID # 2011567042) and Mahbub Morshed Rifat (ID # 2011415042) from Electrical and Computer Engineering Department of North South University, have worked on the Senior Design Project titled “**Enhancing Images for Color Vision Deficiency (CVD) using Deep Learning**” under the supervision of Dr. Mohammad Ashrafuzzaman Khan partial fulfillment of the requirement for the degree of Bachelors of Science in Engineering and has been accepted as satisfactory.

Supervisor’s Signature

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Dr. Mohammad Ashrafuzzaman Khan

Associate Professor

Department of Electrical and Computer Engineering

North South University

Dhaka, Bangladesh.

Chairman’s Signature

.....

Dr. Rajesh Palit

Professor

Department of Electrical and Computer Engineering

North South University

Dhaka, Bangladesh.

DECLARATION

This is to certify that the project titled "**Enhancing Images for Color Vision Deficiency (CVD) using Deep Learning**" is entirely our own work. We have not submitted any part of this work to any other institution, in whole or in part, for the award of any other degree or diploma. All project-related information will be kept confidential and will not be shared without the express permission of the project supervisor. All relevant previous works cited in this report have been duly acknowledged and cited. We have adhered to the plagiarism policy outlined by the supervisor.

Students' names & Signatures

Taneem Ahmed

Siddhartha Sankar Saha

Mahbub Morshed Rifat

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

Enhancing Images for Color Vision Deficiency (CVD) Using Deep Learning

In a stunning world full of colors, color vision deficiency is the most common difficulty every human being faces. This problem still has no treatment. The subject of this research is to expose artificial intelligence methods as profound studies that aim at material, tangible visualization through images of color blindness in humanity, hence becoming a hope that technology will eventually fill the gap in color perception. The two AI models are the basis for creating and utilizing the project.

The first model is Daltonization, which simulates the perception of color by different kinds of CVD and hence can create image transformations that specifically cater to one's eye problems. Secondly, A CNN-based Autoencoder model trains on various images taken under normal vision color conditions and color vision deficiency (CVD) conditions. Therefore, the aim is to create an autoencoder that will convert any image into a better-colored one that is clearly visible to individuals suffering from CVDs.

The triumph of this task is determined by how well it performs in terms of two criteria. Quantitative measurements allow for an analysis of the degree to which the latest picture reproduces original images through methods like SSIM (Structural similarity index). User testing and feedback obtained by people suffering from CVD constitute quality appraisals for verifying the acceptability of changes made to their visual perception.

We ensure that data collection and utilization are done per strict ethical principles to avoid violating privacy rights or obtaining participants' permission. The primary objective of using converted images is to adhere to and also maintain established accessibility standards for people with Color Vision Deficiency (CVD), therefore rendering them more manageable.

The project focuses on user feedback and iterative design methods aimed at guaranteeing that the produced tools are intuitive and user-friendly for persons with low vision (CVD). These AI models work well on web browsers, mobile devices, or picture-editing tools. This project looks not only at