Department of Electrical and Computer Engineering

NORTH SOUTH UNIVERSITY
Bashundhara, Dhaka - 1216

Spring 2023 | CSE499

Title: Early Fusion of CNN + BoVW Features for Facial Emotion Recognition on FER2013 without additional training data

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

Bachelor of Science in Computer Science and Engineering

Submitted by:

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Under the supervision of

Dr. Shazzad Hosain

Spring 2023

CSE499B:

Undergraduate Thesis Paper

Submitted to the Undergraduate Faculty of North South University,

in partial fulfillment

of the requirements for the degree of

Bachelors Of Science

in

Computer Science and Engineering

Letter of Transmittal

June 2023

To

Dr. Rajesh Palit

Chairman
Department of Electrical and Computer Engineering, North South University

Subject: Submission of Capstone Project on: "Early Fusion of CNN + BoVW Features for Facial Emotion Recognition on FER2013, without additional training data"

Dear Sir,

We would like to submit our Capstone Project: "*Early Fusion of CNN + BoVW Features for Facial Emotion Recognition on FER2013, without additional training data*" as a part of our BSc program. While working on this project we have learned a lot about a wide array of topics in the field of machine learning/deep learning. And it has helped us immensely in advancing our skillset as BSc CSE students.

We would be extremely grateful if you would accept our report that outlines our motivation, method, and our work regarding our Capstone Project.

Sincerely yours,

....

Nashrah Haque, 1931857042 Minhazul Abedin Toshin, 1931672042

....

Md. Rifat Bin Yusuf, 1912217042 Labib Rahman, 1931740042

Approval

Nashrah Haque(ID#1931857042), Minhazul Abedin Toshin(ID#1931672042), Md. Rifat Bin Yusuf(ID#1912217042) and Labib Rahman(ID#1931740042), from the Department of Electrical and Computer Engineering has worked on The Senior Design Report entitled "**Early Fusion of CNN + BoVW Features for Facial Emotion Recognition on FER2013 without additional training data**" under the supervision of Dr. Shazzad Hosain in partial fulfillment for the degree of Bachelors of Science in Engineering and has been accepted as satisfactory.

SUPERVISOR'S SIGNATURE

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Dr. Shazzad Hosain

Professor

Department of Electrical and Computer Engineering

North South University, Dhaka, Bangladesh

CHAIRMAN'S SIGNATURE

…….

Dr. Rajesh Palit

Professor and Chairman

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.

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Abstract

Early Fusion of CNN + BoVW Features for Facial Emotion Recognition on FER2013 without additional training data

Facial emotion recognition is an important research area with various applications such as human-computer interaction, psychology and social robotics. Consequently, there has been active research in the field using the approach of Convolutional Neural Networks (CNNs), for feature extraction and inference. In our paper, we explored the use of Bag of Visual Words(BoVW) and CNNs on the FER2013 dataset without any additional training data. To combine the features from both methods, we concatenated the feature vectors obtained from BoVW and CNN. Subsequently, we employed a Support Vector Machine (SVM) classifier to train and classify the concatenated feature vectors. The evaluation of our approach on the FER2013 dataset yielded an accuracy of 62%. Although this accuracy level indicates room for improvement, it demonstrates the potential of utilizing both BoVW and CNN in facial emotion recognition tasks. Overall, this study showcases the effectiveness of combining the BoVW approach with CNN for facial emotion recognition. The results obtained serve as a foundation for further investigations and advancements in this field.