

Face Mask Detection Using Deep Learning

Using Deep Learning Techniques

Ahood Faisal Al shahrani

Dr. Yasser Abdel Hamid

AI901 – Artificial Intelligence Thesis

Midocean University

Second Semester – 2026

Chapter 1

Introduction

The spread of the COVID-19 pandemic created a global health challenge and required many preventive measures to reduce infection rates. One of the most effective safety measures recommended by health organizations was wearing face masks in public places. Monitoring whether people are wearing masks in crowded environments such as airports, hospitals, schools, and shopping centers can be difficult when done manually.

With the development of artificial intelligence and computer vision technologies, automated systems can now help monitor safety measures. Deep learning techniques allow computers to analyze images and recognize patterns within visual data.

This project focuses on developing an intelligent system that can detect whether a person is wearing a face mask or not using deep learning. The system is trained using a dataset containing images of people wearing masks and people not wearing masks. The goal of the model is to classify images into two categories: with mask and without mask.

Chapter 2

Background and Related Work

Artificial Intelligence and Computer Vision

Artificial intelligence is a field of computer science that focuses on building systems capable of performing tasks that usually require human intelligence. Computer vision is a branch of artificial intelligence that enables machines to interpret and understand visual information such as images and videos.

Deep Learning

Deep learning is a subset of machine learning that uses neural networks with multiple layers to learn patterns from data. Deep learning has become widely used in image classification tasks due to its high accuracy and ability to automatically extract important features from images.

Convolutional Neural Networks

Convolutional Neural Networks (CNN) are one of the most effective deep learning architectures used for image recognition tasks. CNN models consist of several layers such as convolutional layers, pooling layers, and fully connected layers. These layers work together to extract features from images and perform classification.

Related Work

Many researchers have used deep learning models for face mask detection. Some studies used CNN models to classify images of masked and unmasked faces. Other research used real-time detection models such as YOLO to detect multiple faces in images and determine whether each person is wearing a mask.

Chapter 3

Proposed Approach

Dataset Description

The dataset used in this project consists of images of human faces divided into two categories: people wearing masks and people without masks. The dataset includes images captured under different lighting conditions, angles, and backgrounds.

Data Preprocessing

Before training the model, several preprocessing steps were performed. Images were resized to a fixed dimension to ensure consistent input to the neural network. Pixel values were normalized to improve training performance. The dataset was also divided into training and validation sets.

Model Architecture

The deep learning model used in this project is based on a Convolutional Neural Network. The model includes convolutional layers for feature extraction followed by pooling layers that reduce the spatial size of feature maps. After feature extraction, the features are passed to fully connected layers that perform the classification task.

Training the Model

The model was trained using the labeled dataset for several epochs. During training, the model adjusts its internal parameters to minimize classification errors. The Adam optimizer and binary cross-entropy loss function were used during

the training process.

Chapter 4

Experimental Results and Discussion

The trained model achieved good performance in classifying images of masked and unmasked faces. During training, the accuracy increased gradually while the loss decreased, indicating that the model successfully learned meaningful patterns from the dataset.

Training and validation graphs were used to evaluate the learning performance of the model. These graphs help analyze whether the model is improving during training and whether overfitting occurs.

Chapter 5

Conclusion and Future Work

This project presented a deep learning approach for detecting face masks using image classification. A convolutional neural network model was trained on a dataset containing masked and unmasked face images.

The results showed that the model can effectively classify images and detect whether individuals are wearing masks. This system can potentially be used in public monitoring systems to improve safety in crowded environments.

Future work may include using larger datasets, improving model accuracy, and implementing real-time face mask detection using live camera systems.