AI Face Mask Detector Phase 1 Report

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Abstract

This is the project report of AI Face Mask Detector. Alexander Fulleringer works as the Training Specialist, Jun Huang works as the Evaluation Specialist, and Cheng Chen works as Data Specialist. We use a dataset of 5,000 pictures with 1000 pictures in every class as required. Our task is to build a convolutional neural network that can correctly classify images, and evaluate its learning metrics. Beyond accuracy, we look at precision, recall, and the f-measure.

Our full sources files are in our github repo:youyinnn/ai_face_mask_detector

Dataset

For the dataset of our model, we collect 2,390 images for five different *types* of people with or without masks. Since we need a balanced dataset on each *type*, we apply five image transformation strategies for data augmentation after we preprocessed all the images. Table 1 shows the overall information of our dataset.

Table 1
Size and Source of Each Type in the Dataset

	Type	Size before Augmentation	Size after Augmentation	Source
0	Cloth Mask	418	1,000	Intelligence (2020)
1	No Face Mask	1,006	1,000	Intelligence (2020)
2	Surgical Mask	411	1,000	Intelligence (2020)
3	N95 Mask	387	1,000	Image Search Engine
4	Mask Worn Incorrectly	168	1,000	Image Search Engine
		2,390	5,000	**Total**

Data Collection

For data type "Cloth Mask", "No Face Mask" and "Surgical Mask", data are collected from the public dataset (Intelligence, 2020, Face Mask Detection). For data type "N95 Mask" and "Mask Worn Incorrectly", data are collected manually from several image search engines such as *Google*, *Bing*, *Yahoo* etc. If we consider 400 images for each type of the data, then the previous four types have balanced size, but the data of "Mask Worn Incorrectly" has half size of the others. For that, we consider not using any techniques to generate synthetic data as we think it might mislead the model performance. We randomly apply multiple augmentation strategies to obtain a dataset with a balanced size for each type.

Data Preprocessing

To input the data right away to the net for training and testing, we crop the data into a 1:1 resolution ratio and make the human face locate at the center of the image as much as possible. And then we resize all the data into 256×256 resolution.

CNN Architecture

Title1

Title2

Item	Quantity
Widgets	42
Gadgets	13

Table 2

An example table.

Evaluation

Original Version

- Precision:
- Accuracy:Class 1: , Class 2: , Class 3: , Class 4: , Class 5: .
- Recall:Class 1: , Class 2: , Class 3: , Class 4: , Class 5: .
- F-Measure:Class 1: , Class 2: , Class 3: , Class 4: , Class 5: .

Confusion Matrix

Version 1(Removing/Adding pooling layers)

- Precision:
- Accuracy:Class 1: , Class 2: , Class 3: , Class 4: , Class 5: .
- Recall:Class 1: , Class 2: , Class 3: , Class 4: , Class 5: .
- F-Measure:Class 1: , Class 2: , Class 3: , Class 4: , Class 5: .

Confusion Matrix

Version 2(Change convolutional layers' number)

- Precision:
- Accuracy:Class 1: , Class 2: , Class 3: , Class 4: , Class 5: .
- Recall:Class 1: , Class 2: , Class 3: , Class 4: , Class 5: .
- F-Measure:Class 1: , Class 2: , Class 3: , Class 4: , Class 5: .

Confusion Matrix

Statement

According to the three results above, we can see that xxxx has the biggest impact. We can see

In the second phase. We decide to do more normalization on our dataset, and then use other training/test-split methods like other types of k-fold to make the improvements.

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References

Intelligence, W. (2020). *Face mask detection dataset.* Retrieved 2022-06-01, from https://www.kaggle.com/datasets/wobotintelligence/face-mask-detection-dataset