Real-Time Emotion Recognition Detection in Education

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01 Introduction

Goal

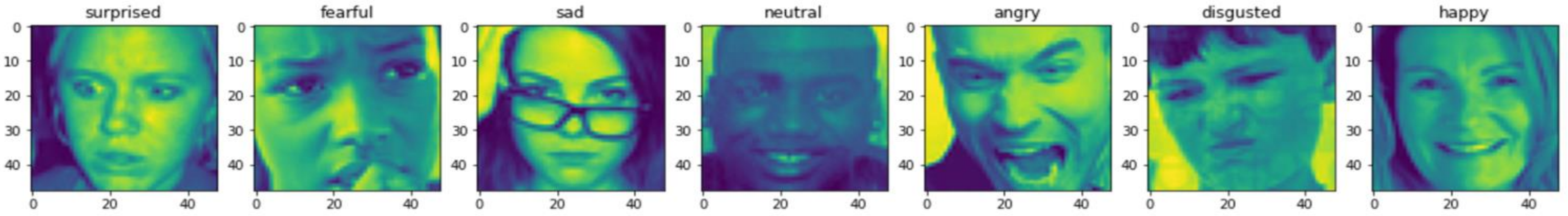
By using Real-Time Emotion Recognition detection to help schools and teachers understand students' emotion towards to the course.

> "Real-Time Emotion Detection"

Introduction

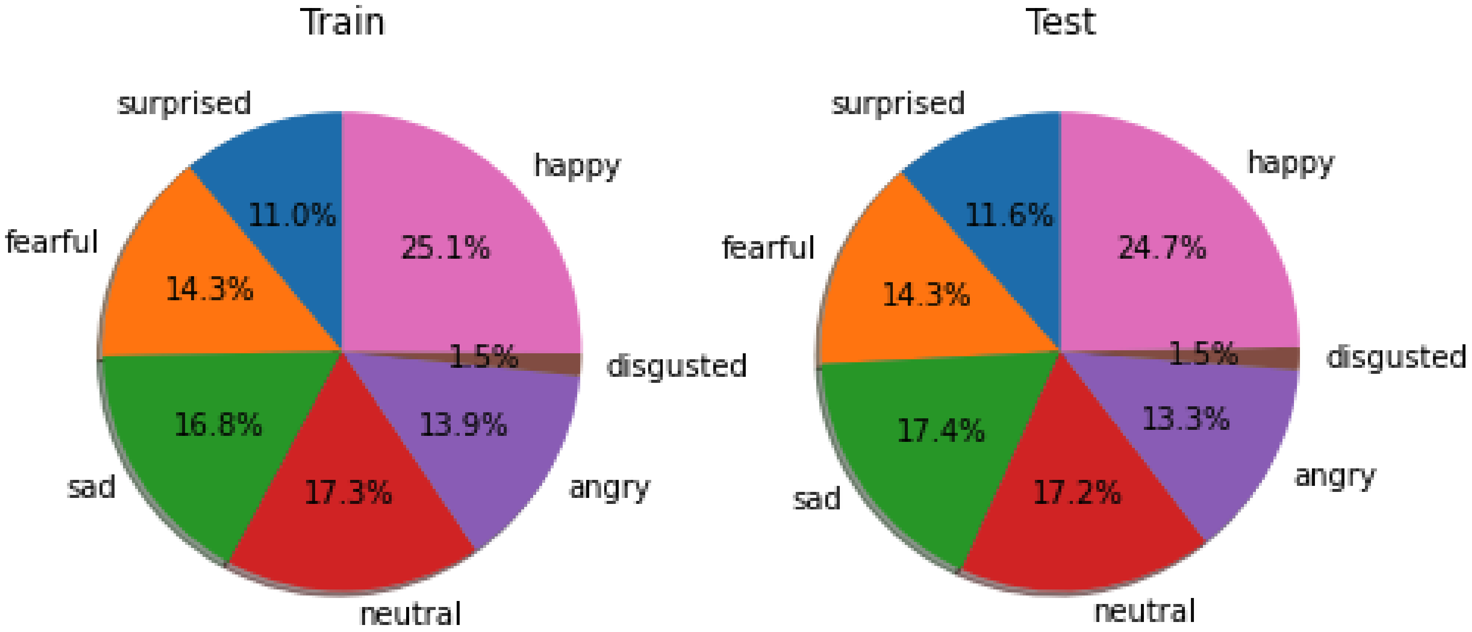
Emotion Detection Dataset - Kaggle

- The dataset contain 35,685 examples of 48x48 pixel gray scale images of faces.
- The dataset already divided into train and test dataset.
- Train dataset: 28709 Test dataset: 6976
- There are seven categories based on facial emotion images
- Happiness, Neutral, Sadness, Anger, Surprise, Disgust, Fear.

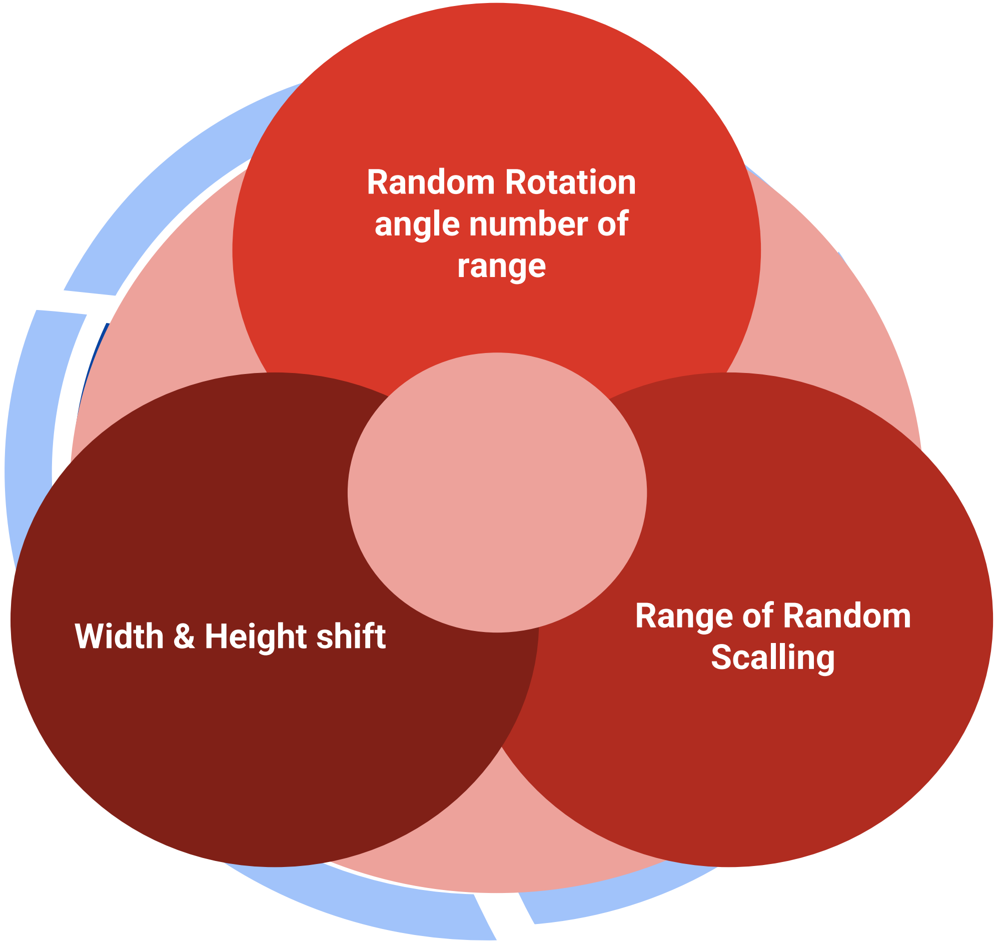


02 Processs / EDA

Distribution of Seven Categories



Preparation for next step

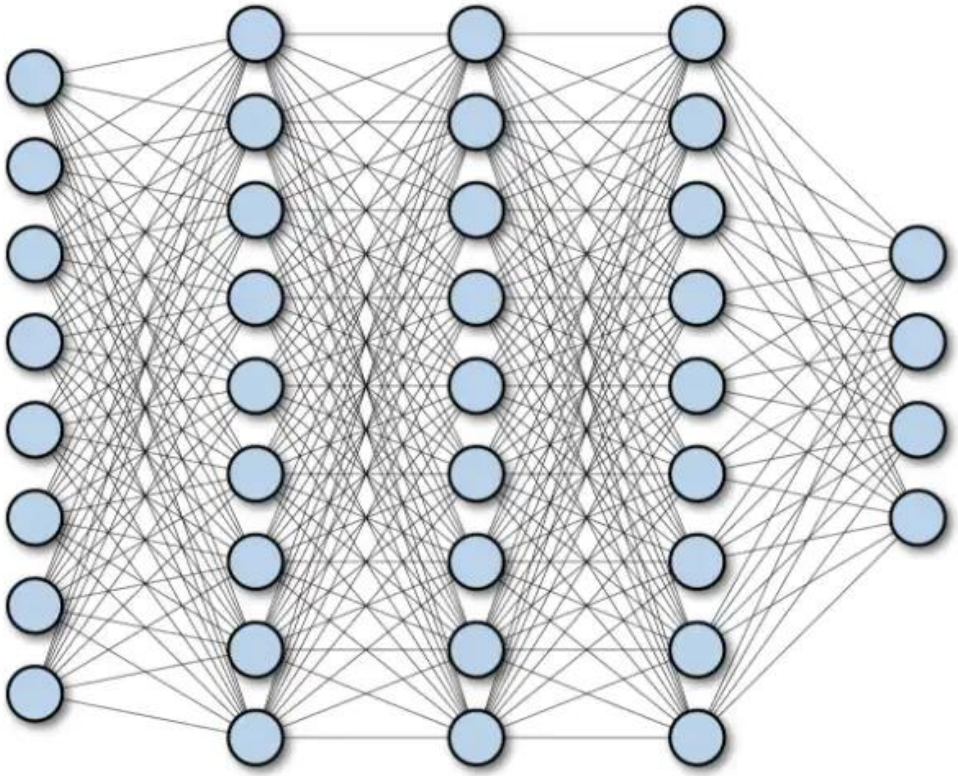


03

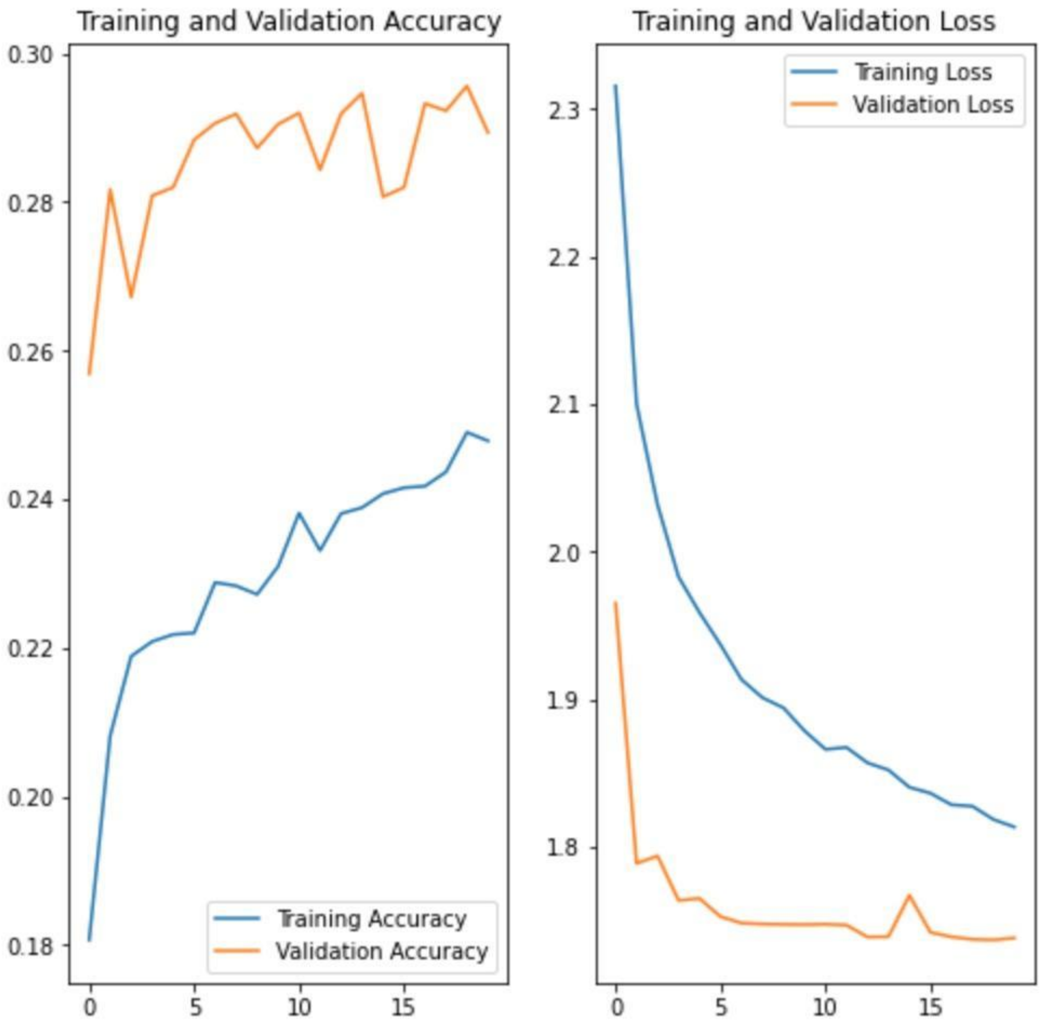
Fitting Model & Performance Tuning

Fully Connected(dense) Networks

A fully connected neural network consists of a series of fully connected layers that connect every neuron in one layer to every neuron in the other layer.



Fully Connected(dense) networks



Training accuracy: 0.2479

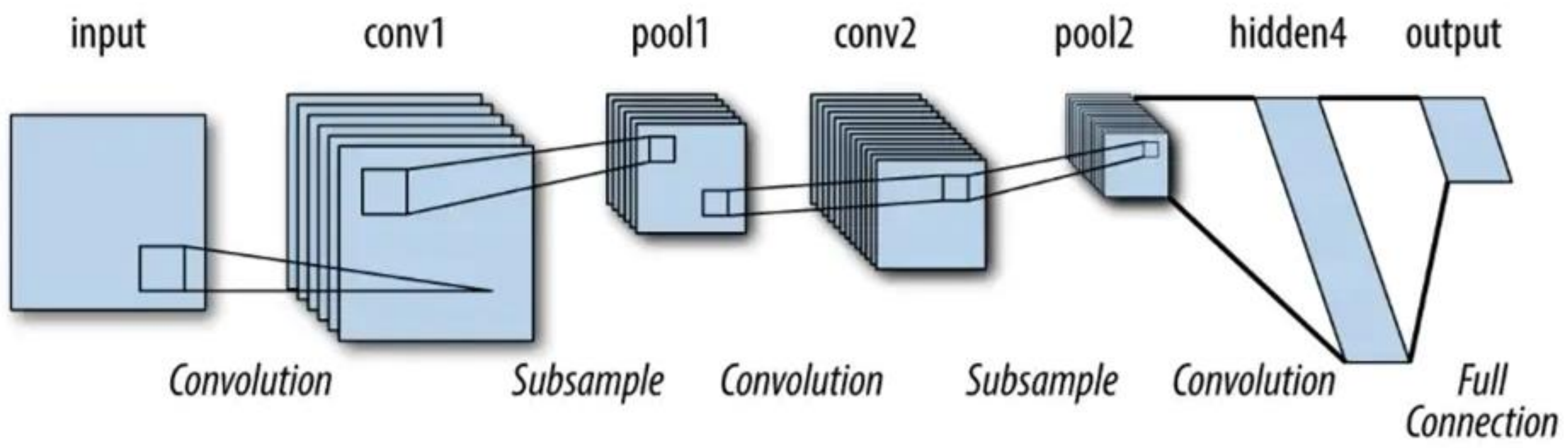
Validation accuracy: 0.2894

Training loss: 1.8134

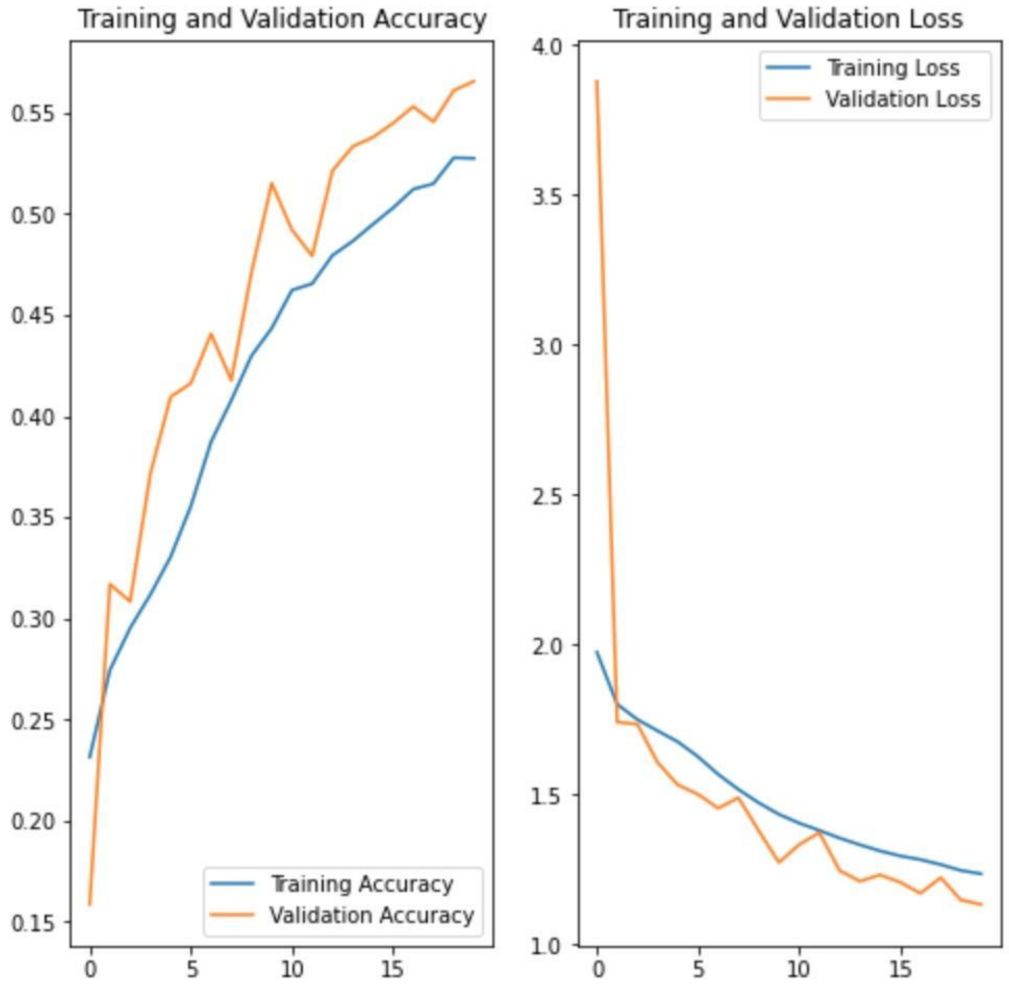
Validation loss: 1.7382

Convolutional Neural Networks

CNN architectures make the explicit assumption that the inputs are images, which allows encoding certain properties into the model architecture.
A simple CNN is a sequence of layers, and every layer of a CNN transforms one volume of activations to another through a differentiable function. Three main types of layers are used to build CNN architecture: Convolutional Layer, Pooling Layer, and Fully-Connected Layer.



Convolutional Neural Networks



Training accuracy: 0.5274

Validation accuracy: 0.5655

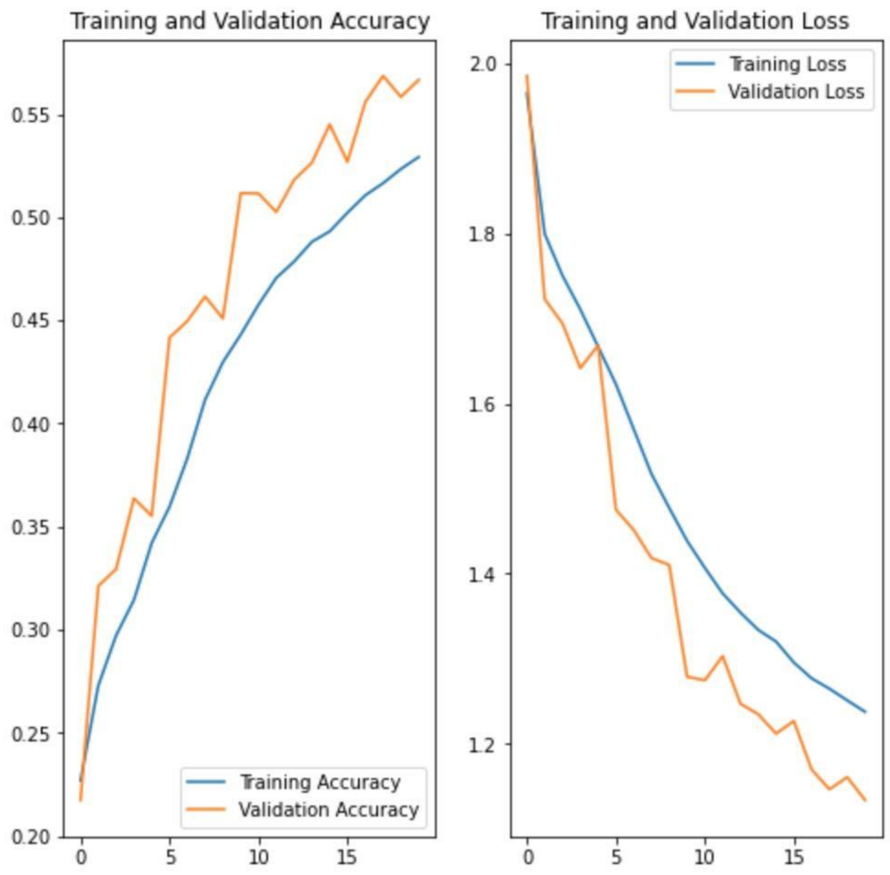
Training loss: 1.2370

Validation loss: 1.1351

Test accuracy:0.5655
Test loss:1.1351

Convolutional Neural Networks

Try various network architectures——L1



Training accuracy: 0.5292

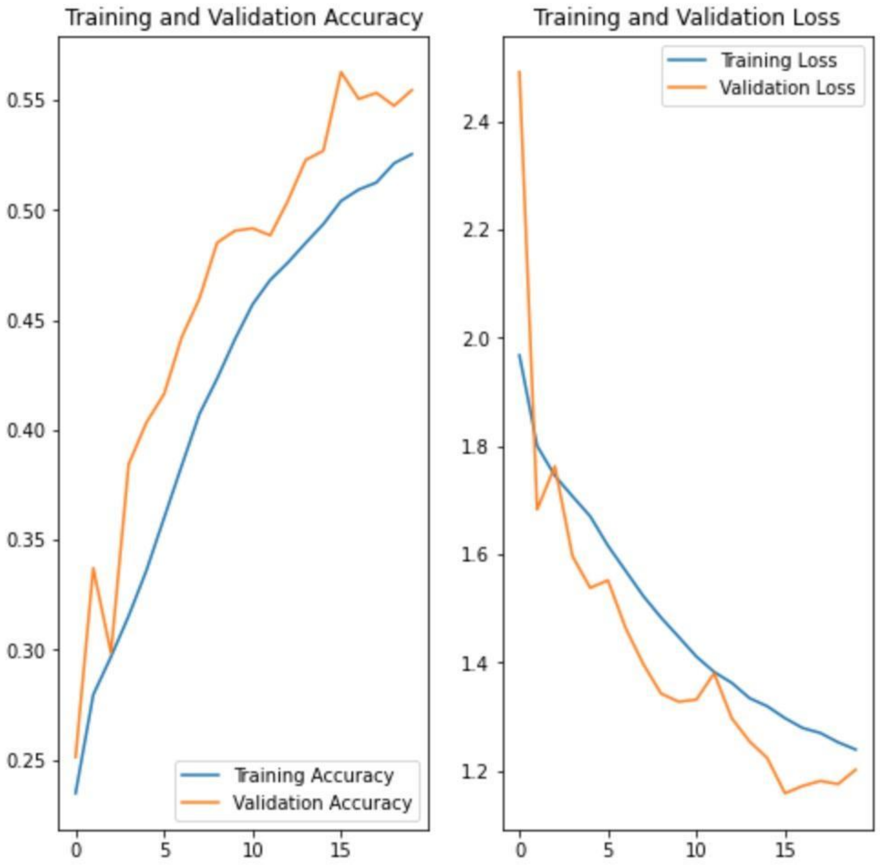
Validation accuracy: 0.5666

Training loss: 1.2376

Validation loss: 1.1337

Convolutional Neural Networks

Try various network architectures——L2



Training accuracy: 0.5254

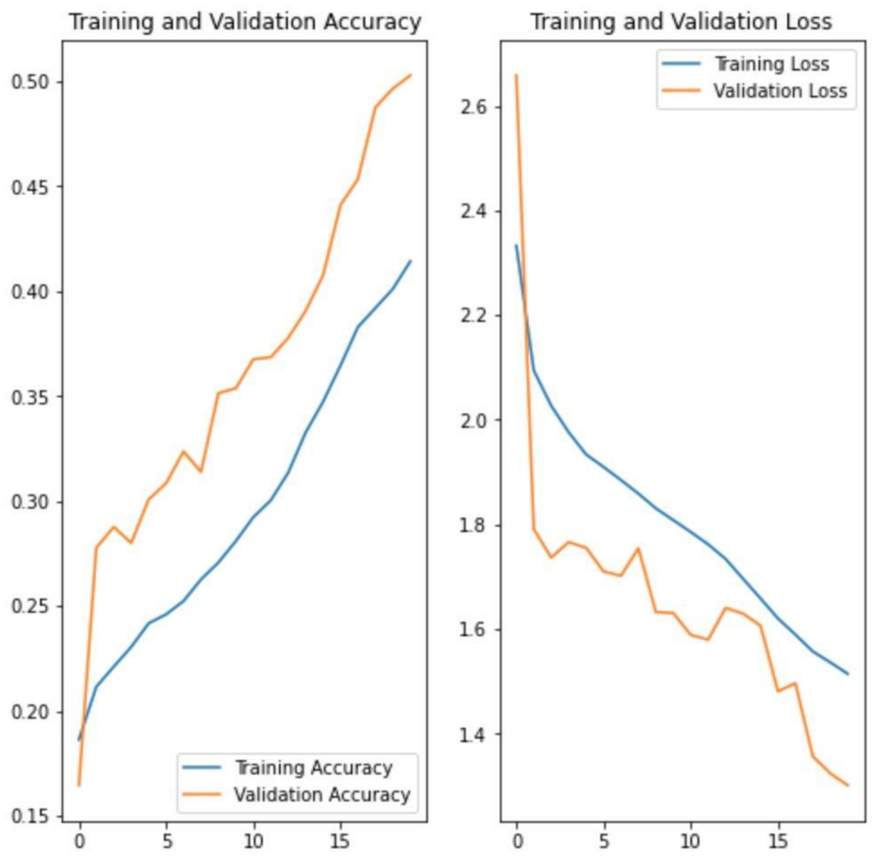
Validation accuracy: 0.5545

Training loss: 1.2387

Validation loss: 1.2014

Convolutional Neural Networks

Try various network architectures——add dropouts



Training accuracy: 0.4141

Validation accuracy: 0.5026

Training loss: 1.5146

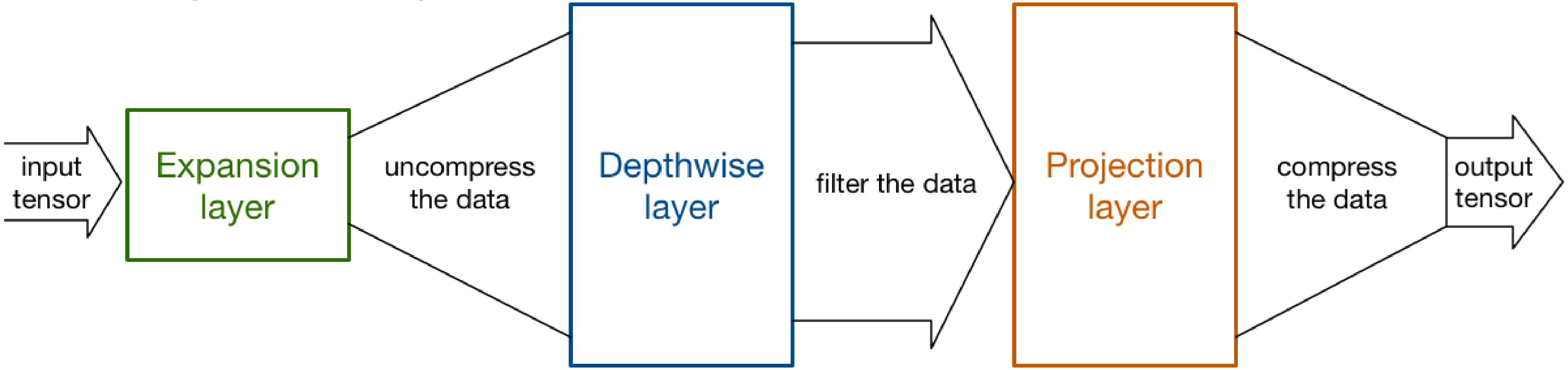
Validation loss: 1.3016

04 Transfer Learning

MobileNetV2

MobileNetV2 is a convolutional neural network (CNN) designed for efficient on-device mobile and embedded vision applications.

The MobileNetV2 architecture is based on an inverted residual structure where the input and output of the residual block are thin bottleneck layers opposite to traditional residual models which use expanded representations in the input. MobileNetV2 uses lightweight depthwise convolutions to filter features in the intermediate expansion layer.



MobileNetV2

Training accuracy: 0.7068

Validation accuracy: 0.4646

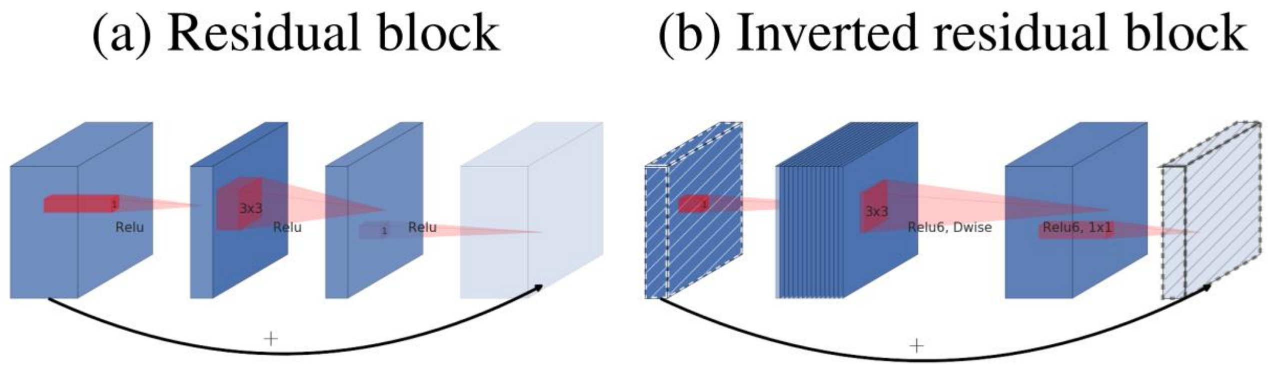
Training loss: 0.7896

Validation loss: 1.8871

Resnet50

ResNet50 is a 50-layer deep CNN, with a large number of parameters, that has achieved very good performance on a variety of image classification and object detection tasks.

One of the key features of ResNet50 is the use of residual connections. This helps to alleviate the problem of vanishing gradients, which can occur in very deep networks, and allows ResNet50 to learn more effectively.



Resnet50

Training accuracy: 0.6740

Validation accuracy: 0.6236

Training loss: 0.8741

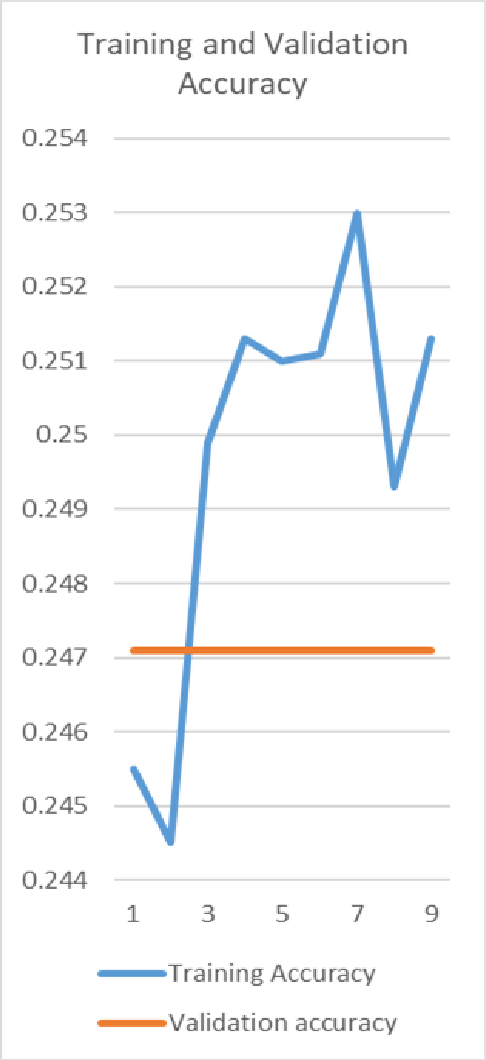
Validation loss: 1.0200

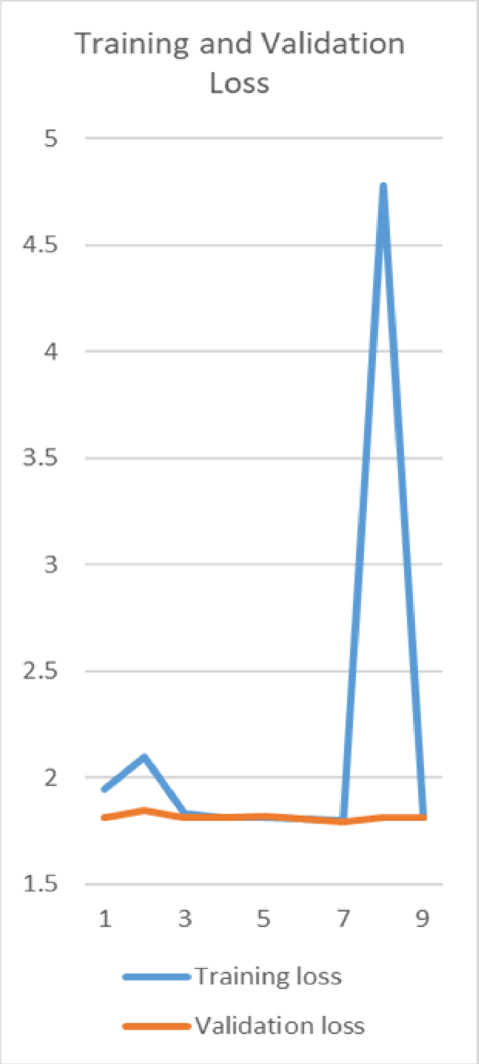
VGG16

VGG16 is a 16-layer CNN that has been trained on the ImageNet dataset, which contains over 1.2 million images and 1000 classes.

VGG16 consists of 13 convolutional layers and 3 fully-connected layers, which allows it to learn rich and complex features from the input images. It also uses a simple and uniform architecture, with all convolutional layers having a kernel size of 3x3 and a stride of 1, which helps to reduce the number of model parameters and improve the network's ability to generalize.

VGG16





Training accuracy: 0.2513

Validation accuracy: 0.2471

Training loss: 1.8101

Validation loss: 1.8133

05 Conclusion

Summary

	CNN	CNN with L1	CNN with L2	CNN with Dropout	MobileNetV2	Resnet50	VGG16
Training Accuracy	0.5274	0.5292	0.5254	0.4141	0.7068	0.6740	0.2513
Validation Accuracy	0.5655	0.5666	0.5545	0.5026	0.4646	0.6236	0.2471

Issues

1. Large dataset —> AutoDL
2. Most of images are white poeple
3. How to improve accuracy

    Add more hidden layers or units

    Preprocess the data

    Use a larger training dataset

    Fine-tune the model's hyperparameters

Application

Online Learning


THANK YOU

Reference:

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