11/2022

EE 482 – Introduction to Artificial Intelligence

Course Project

Appling transfer learning to SqueezeNet on COVID-10 chest XRAY dataset

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Introduction

In this project, we will apply transfer learning to the SqueezeNet network on the COVID-10 chest XRAY dataset. The aim of this project is to determine the accuracy of the SqueezeNet network on the COVID-10 chest XRAY dataset. We will use the SqueezeNet network provided by Google, then we will compare the accuracy that we found from squeezeNet with ResNet50 & ResNet18 by using two kinds of optimization algorithms which are Stochastic Gradient Descent with Momentum (SGDM) & Adam.

What is SqueezNet?

SqueezeNet is a deep learning model that is designed to be small and efficient. It uses a technique called "deep compression" which reduces the size of the model while still preserving its accuracy. This makes it ideal for use on mobile devices and other applications where limited resources are available.

What is ResNet50?

ResNet50 is a deep neural network architecture used for object recognition and detection. The ResNet50 model is a 50-layer deep neural network that can achieve a top-5 error rate of 3.8% on the ImageNet dataset.

What is ResNet18?

A ResNet18 is a deep neural network that has been designed to recognize objects in photos. It is made up of 18 layers, each of which is designed to learn how to recognize a particular type of object.

COVID-19 Radiography Database

We take the 2nd update of COVID-19 Radiography Database, this database had 3616 COVID-19 positive cases along with 10,192 Normal, 6012 Lung Opacity (Non-COVID lung infection), and 1345 Viral Pneumonia images and corresponding lung masks.

Table 1: COVID-19 Radiography Database

Labels	COVID	Normal	Lung Opacity	Viral Pneumonia
Number of images	3616	10,192	6012	1345
Total	**21,165**			

Training phase

In this phase we applied transfer learning to SqueezeNet & ResNet50 & ResNet18 within the same database, also within the same Training options but little differences such batch size because each network had different number of hidden layers which may cause a problem with the GPU memory. Also, we applied the transfer learning with two kinds of optimization algorithms which are Stochastic Gradient Descent with Momentum (SGDM) & Adam.

Training options

Table 2: Training Options

Training Option	SqueezeNet	ResNet50	ResNet18
Optimization Algorithm	SGDM & Adam	SGDM & Adam	SGDM & Adam
Mini Batch Size	300	70	200
Max Epochs	30	30 for SGDM 10 for Adam	30
Initial Learning Rate	0.00001	0.00001	0.00001
Validation Frequency	100	100	100
Verbose	False	False	False
Shuffle	Every-epoch	Every-epoch	Every-epoch
Validation Data	30%	30%	30%

Results

1. SqueezeNet

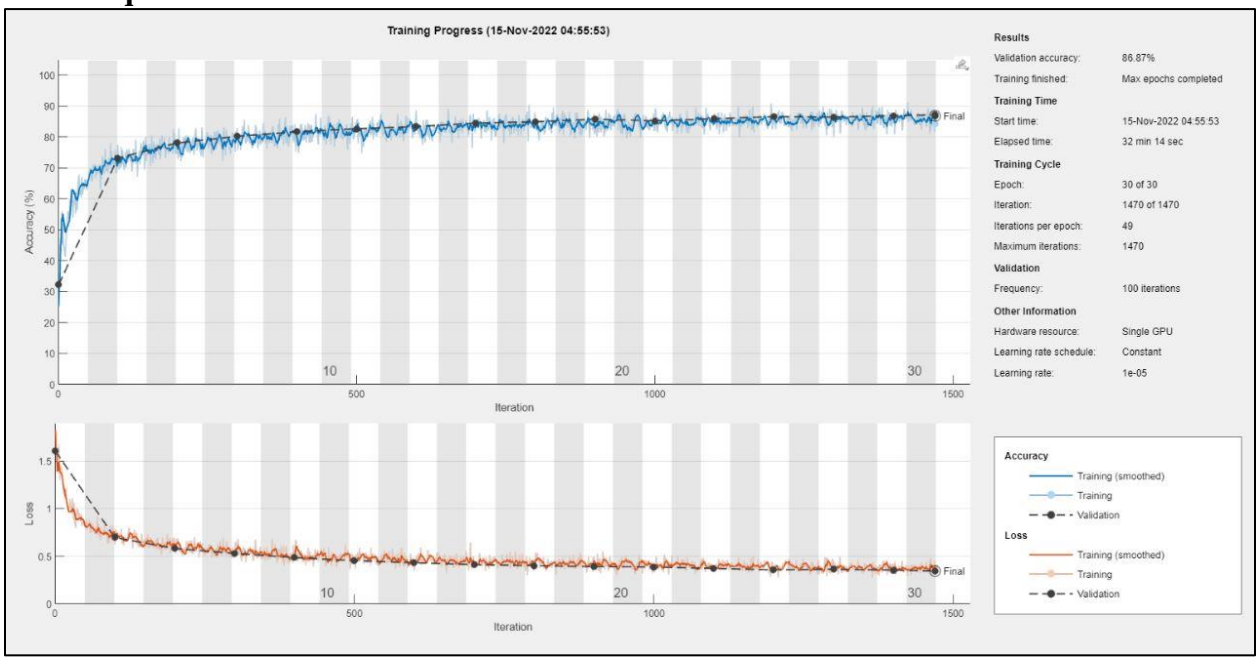

Figure 1:SqueezeNet with SGDM Optimization Algorithm, Epoch: 30

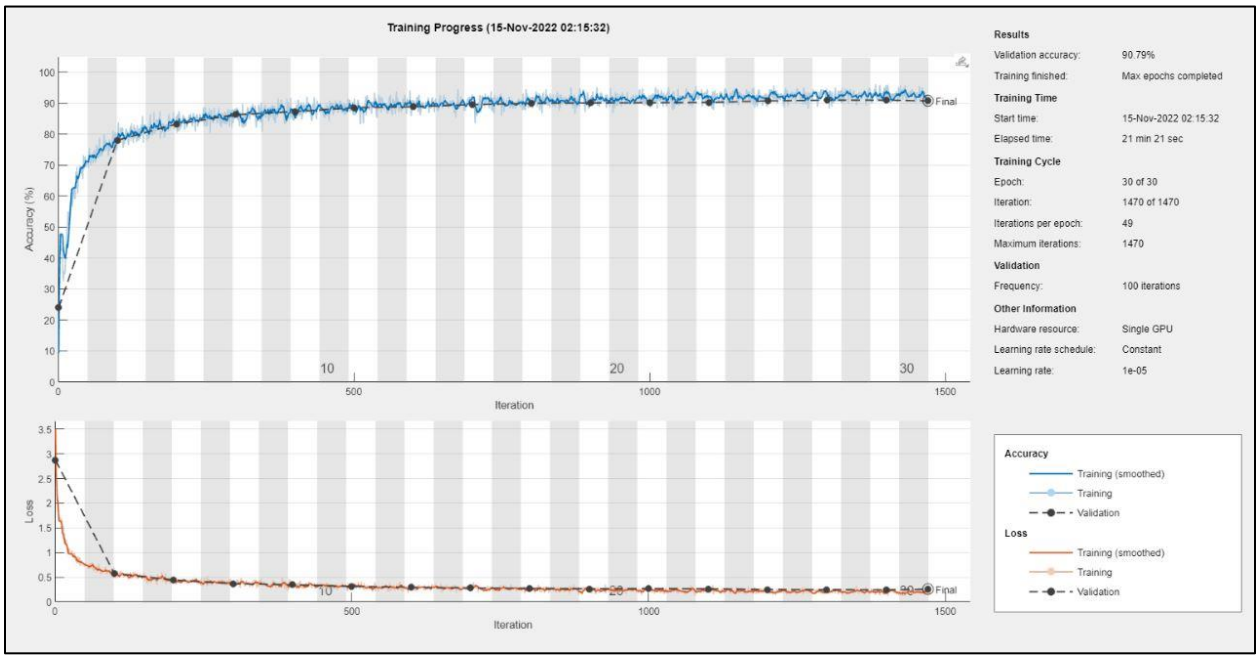

Figure 2: SqueezeNet with Adam Optimization Algorithm, Epoch: 30

2. ResNet50

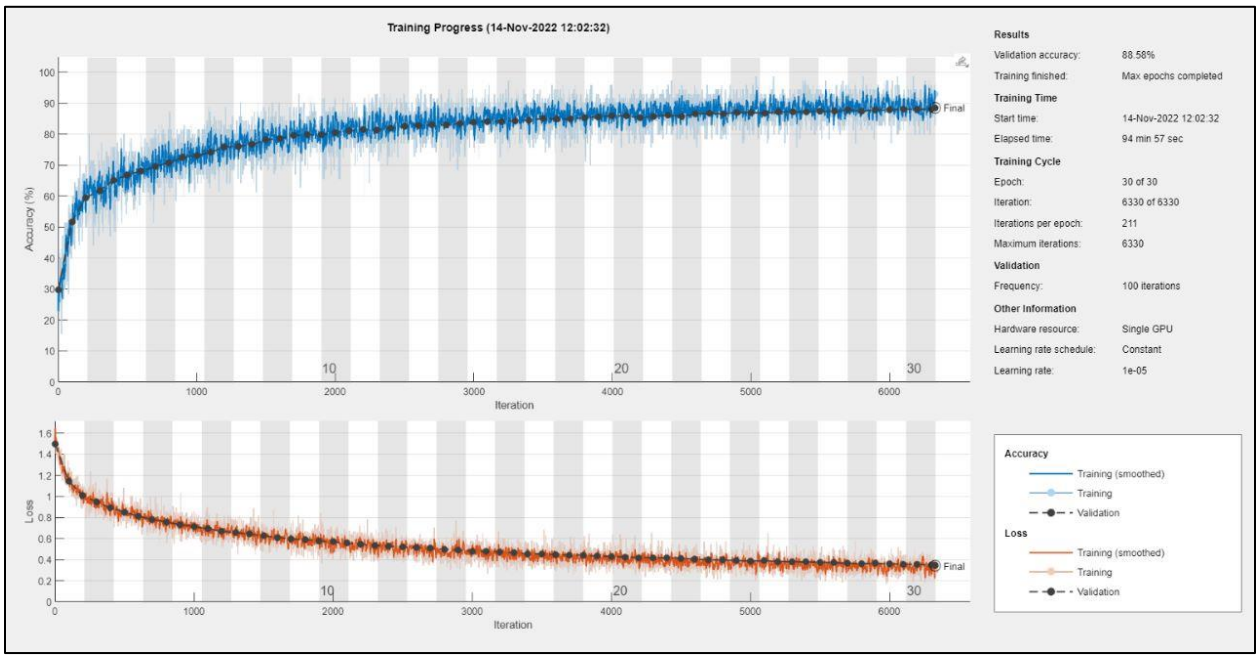

Figure 3: ResNet50 with SGDM Optimization Algorithm, Epoch: 30

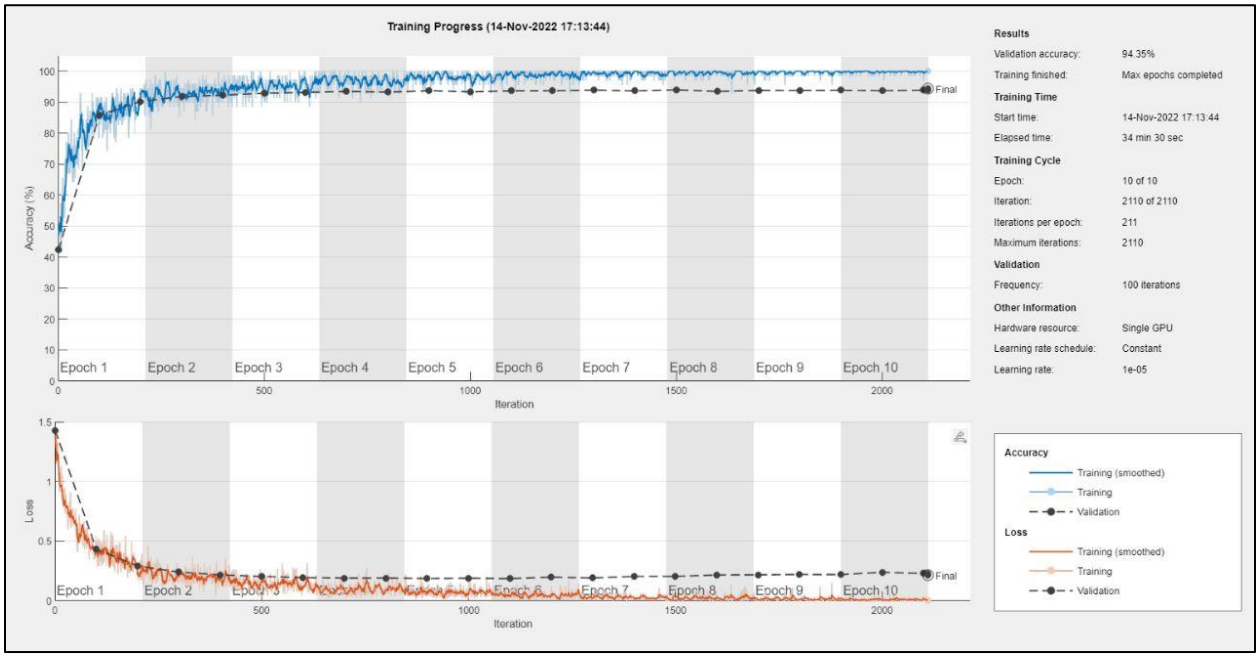

Figure 4: ResNet50 with Adam Optimization Algorithm, Epoch: 10

3. ResNet18

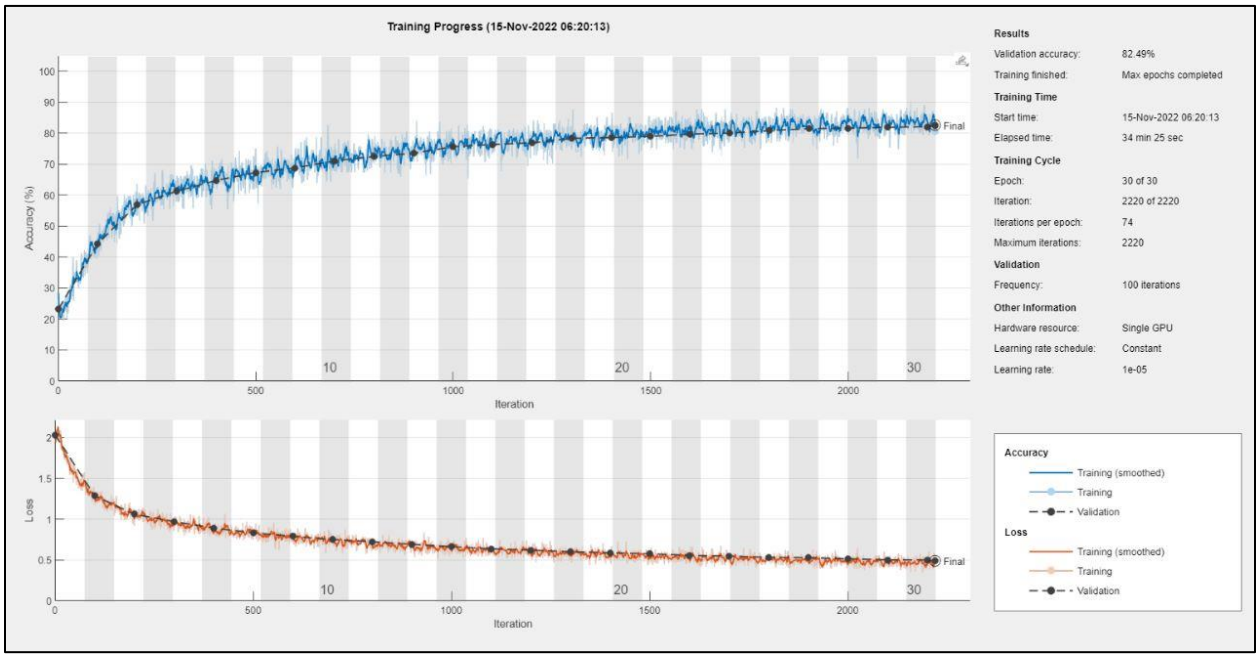

Figure 5: ResNet18 with SGDM Optimization Algorithm, Epoch: 30

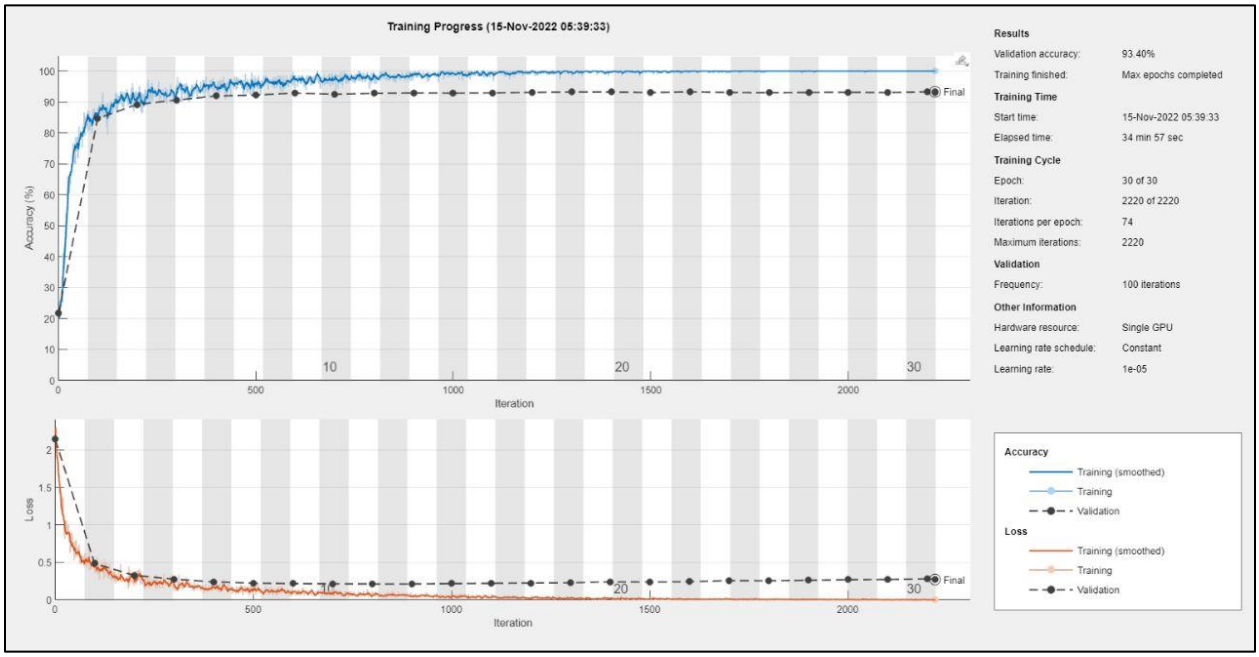

Figure 6: ResNet18 with Adam Optimization Algorithm, Epoch: 30

Table 3: Accuracy Results

Deep Neural Network	**SqueezeNet**		**ResNet50**		**ResNet18**	
Optimization Algorithm	**SGDM**	**Adam**	**SGDM**	**Adam**	**SGDM**	**Adam**
Accuracy	86.87%	90.79%	88.58%	94.35%	82.49%	93.40%