Training Neural Networks

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What is our project about?

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Objective: Mathematical understanding of artificial neural networks, how to tune the parameters to improve the performance of each neural network.

Method: Train 3 types of Neural Networks:

- Feed-Forward Neural Networks
- Convolution Neural Networks
- Recurrent Neural Networks

Background

1943

Warren McCulloch proposed how neurons may work by creating a simple neural network using electrical circuits.

1950s:

Advancement within computers enabled simulation of neural networks.

1960s:

Frank Rosenblatt introduces the first practical implementation of neural networks that used supervised learning algorithms.

1980s:

David Rumelhart, Geoffrey Hinton, and Ronald Williams maximized the efficiency of the backpropagation learning algorithm.

1980s to present:

Continuous expansion and evolution of the field of neural networks

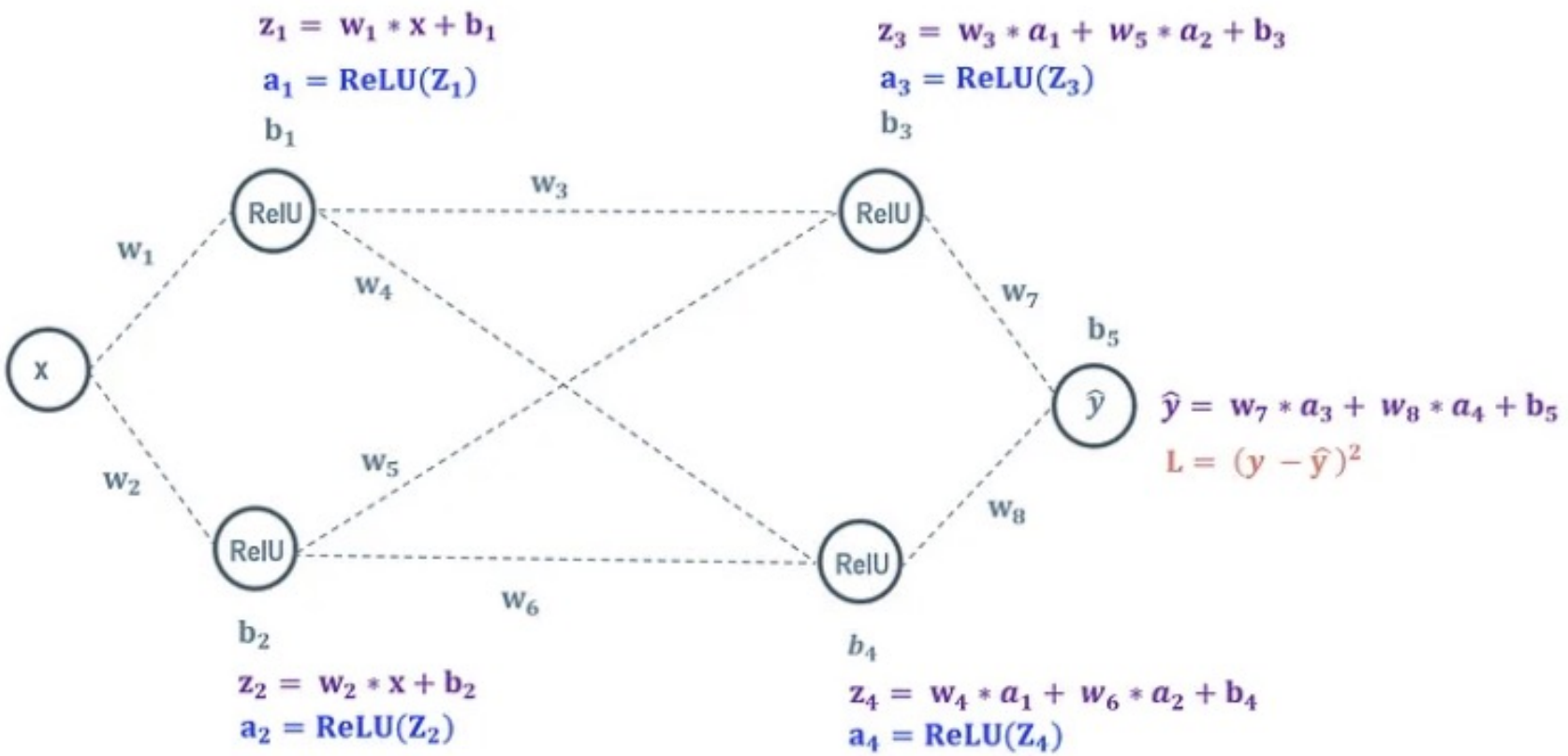
2012:

AlexNet, a convolutional neural network architecture wins the ILSVRC competition for the first time.

Applications

Forward-Feed Neural Networks (FNNs):	Convolutional Neural Networks (CNNs):	Recurrent Neural Networks (RNNs):
Fraud detection	Image classification	Prediction problems
Medical diagnosis	Object detection and recognition	Language modeling
Handwriting recognition	Facial recognition	Text generation
	Video analysis	Speech recognition and translation
		Forecasting

FNN Model & Architecture



Roy, R. (2022, November 17). Neural Networks: Forward pass and Backpropagation. Medium. https://towardsdatascience.com/neural-networks-forward-pass-and-backpropagation-be3b75a1cfcc

Findings for FNN Model

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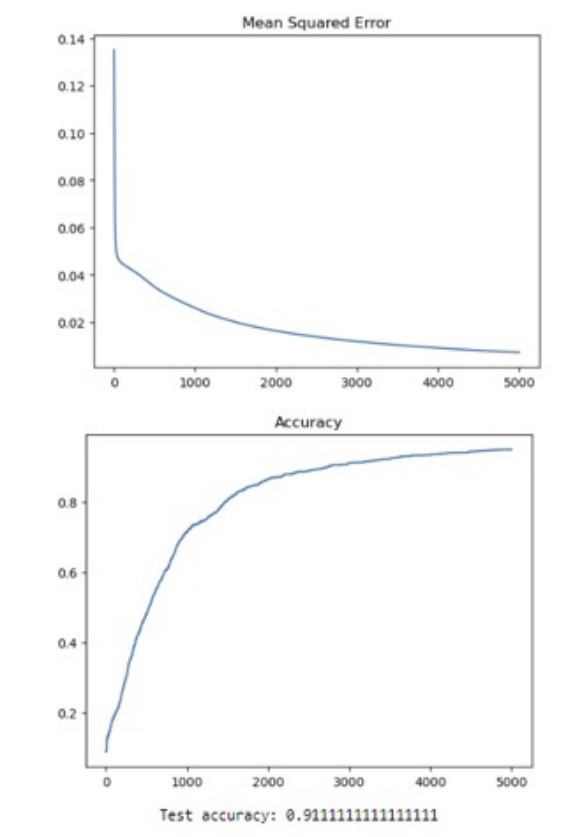
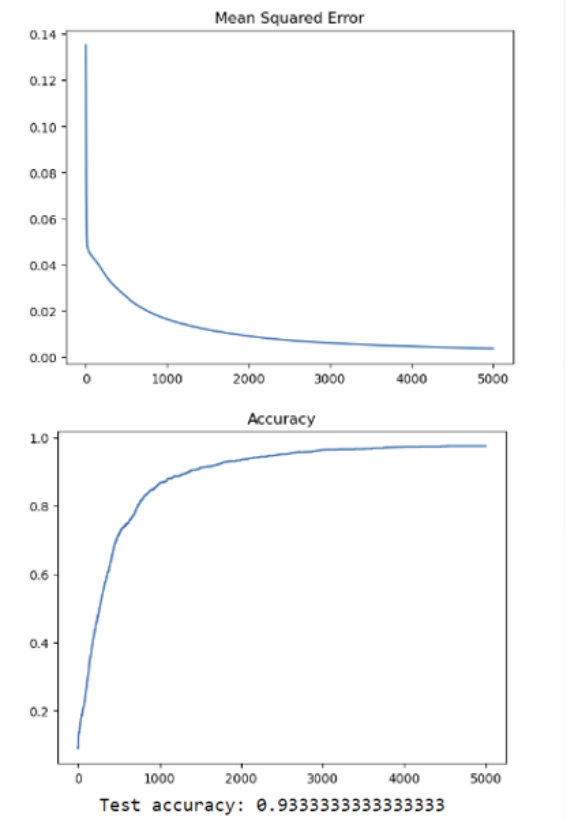
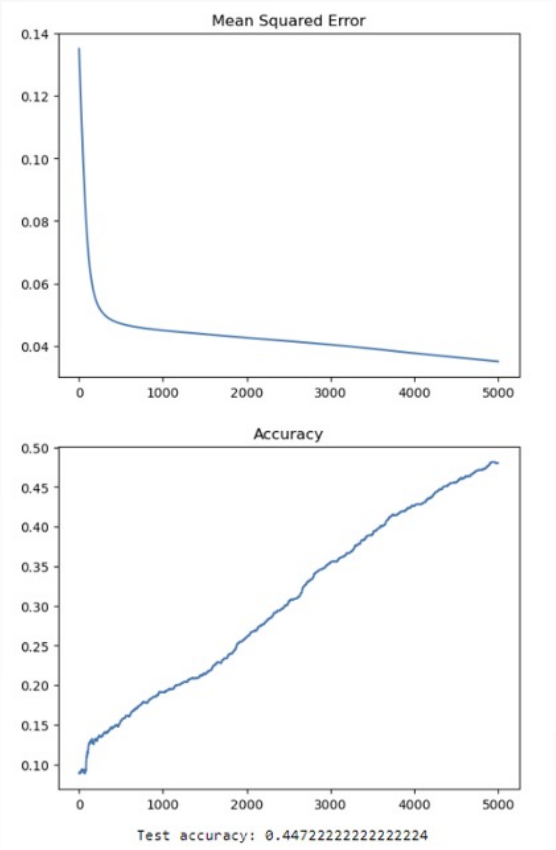
Learning Rate: 0.1
Iterations: 5000



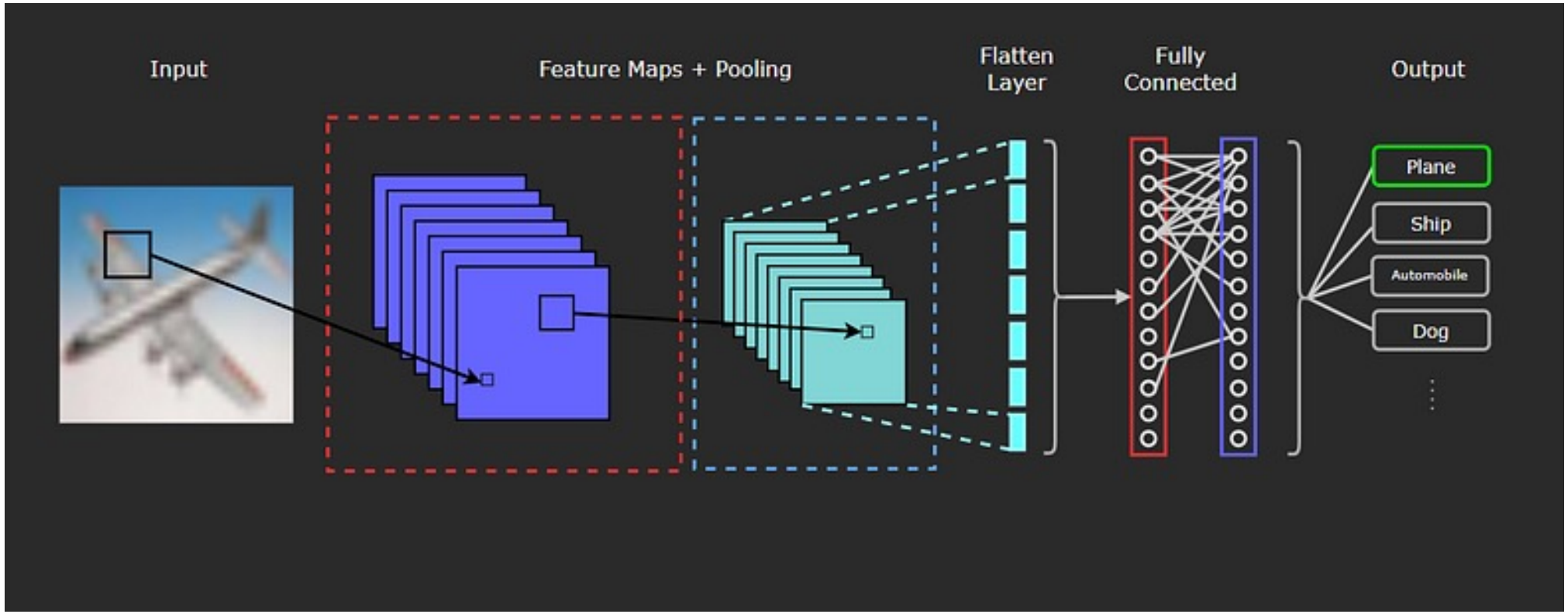
Learning Rate: 0.2
Iterations: 5000



Learning Rate: 0.01
Iterations: 5000



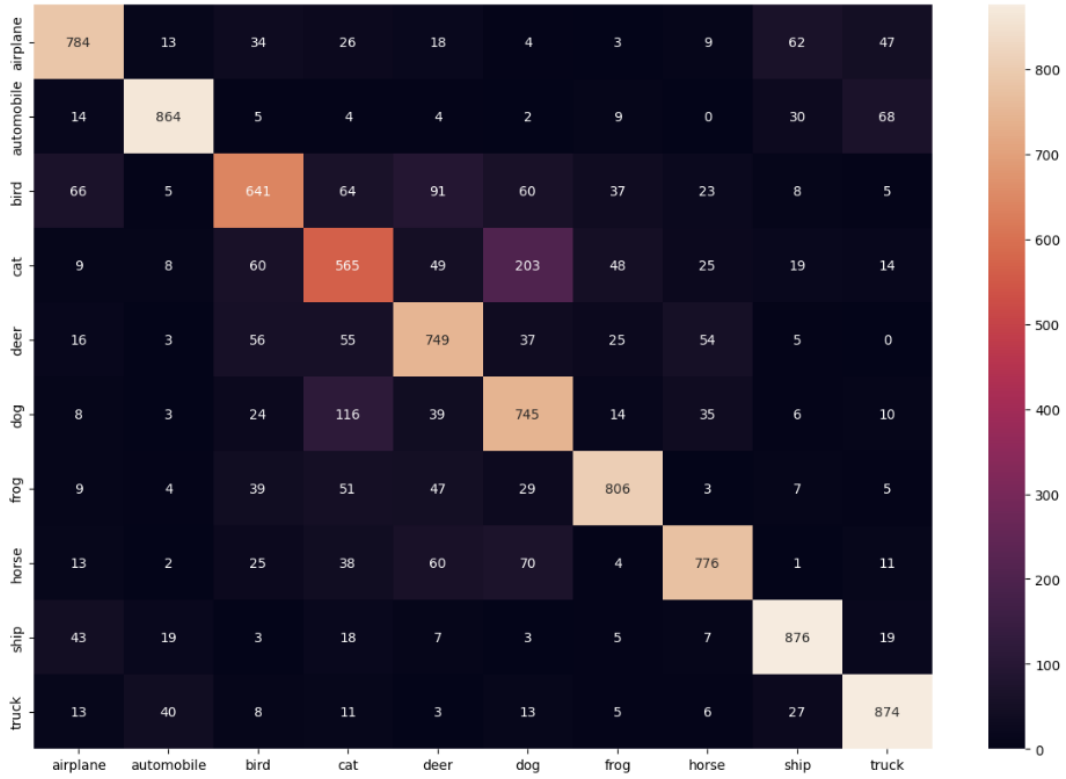
CNN Model & Architecture



Kamali, K. (2023, January 24). *Deep Learning (Part 3) - Convolutional neural networks (CNN)* [Text]. Galaxy Training Network. https://training.galaxyproject.org/training-material/topics/statistics/tutorials/CNN/tutorial.html

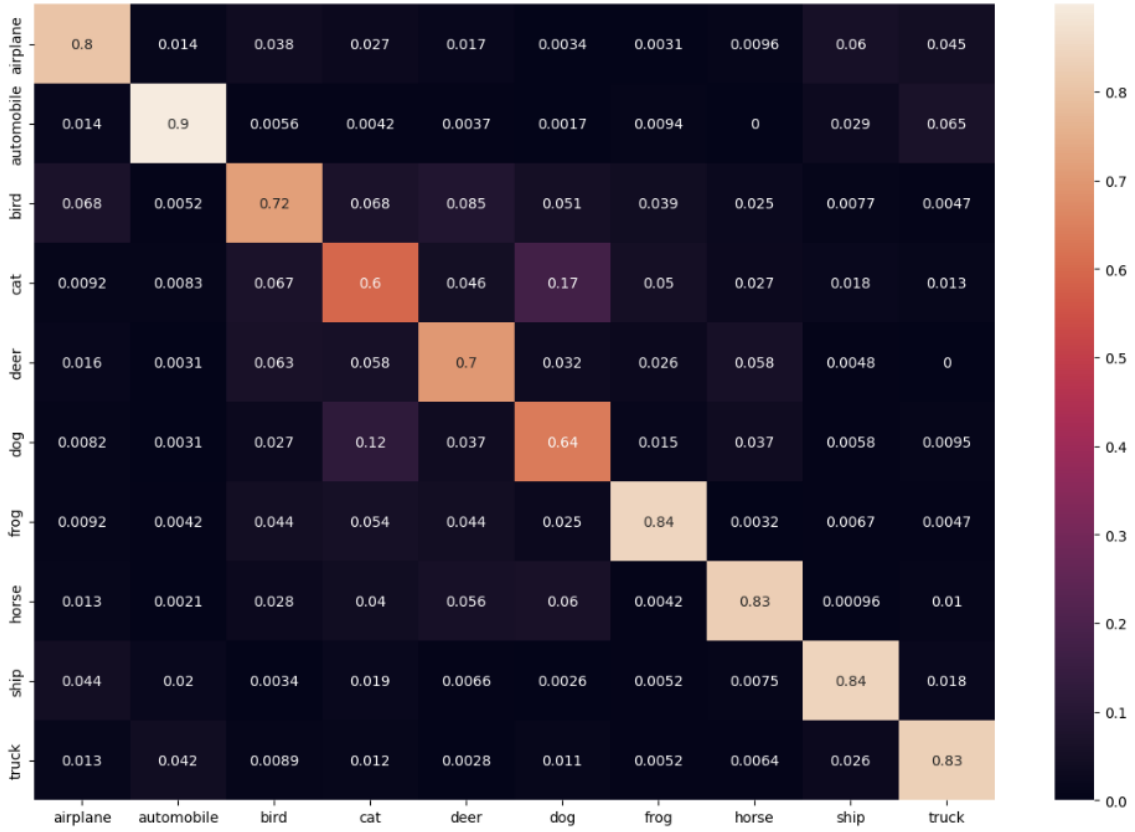
Findings for CNN Model

	ACCURACY
Airplane	0.882
Automobile	0.828
Bird	0.548
Cat	0.458
Deer	0.654
Dog	0.750
Frog	0.579
Horse	0.889
Ship	0.733
Truck	0.833
Avg Accuracy & Loss:	76.3% and 0.69 loss

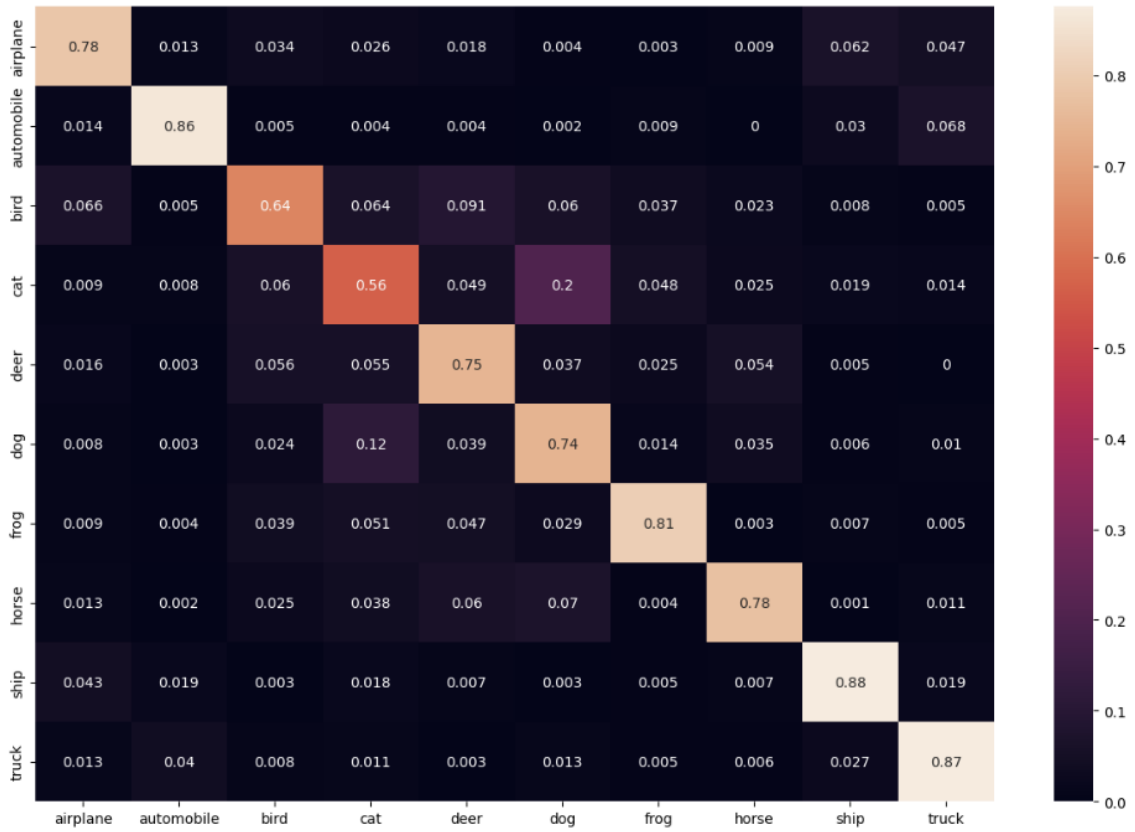


Confusion Matrix

Findings for CNN Model

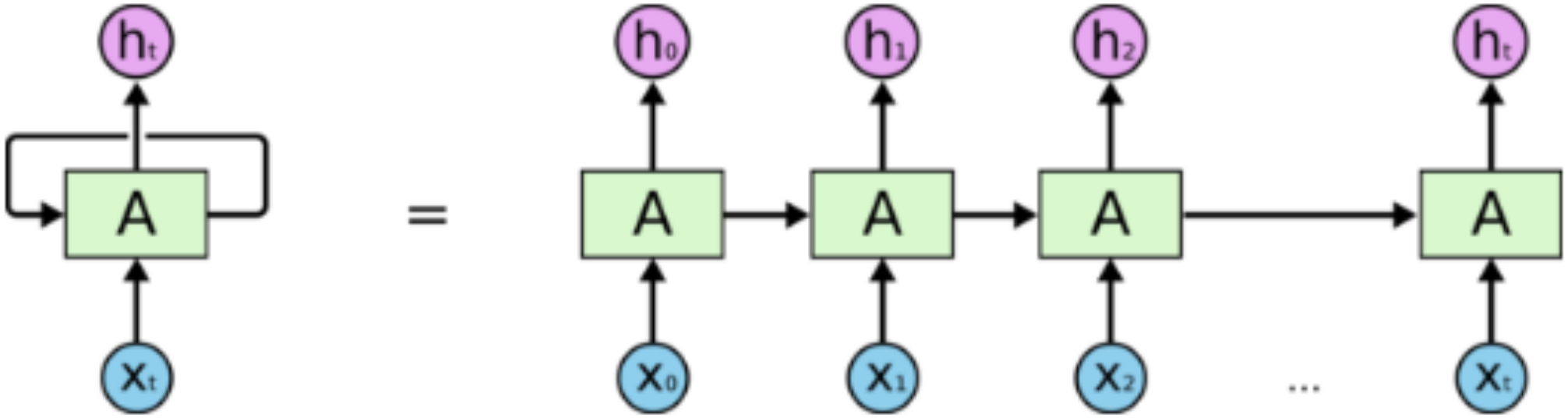


Precision: The fraction of identified positive cases correctly predicted



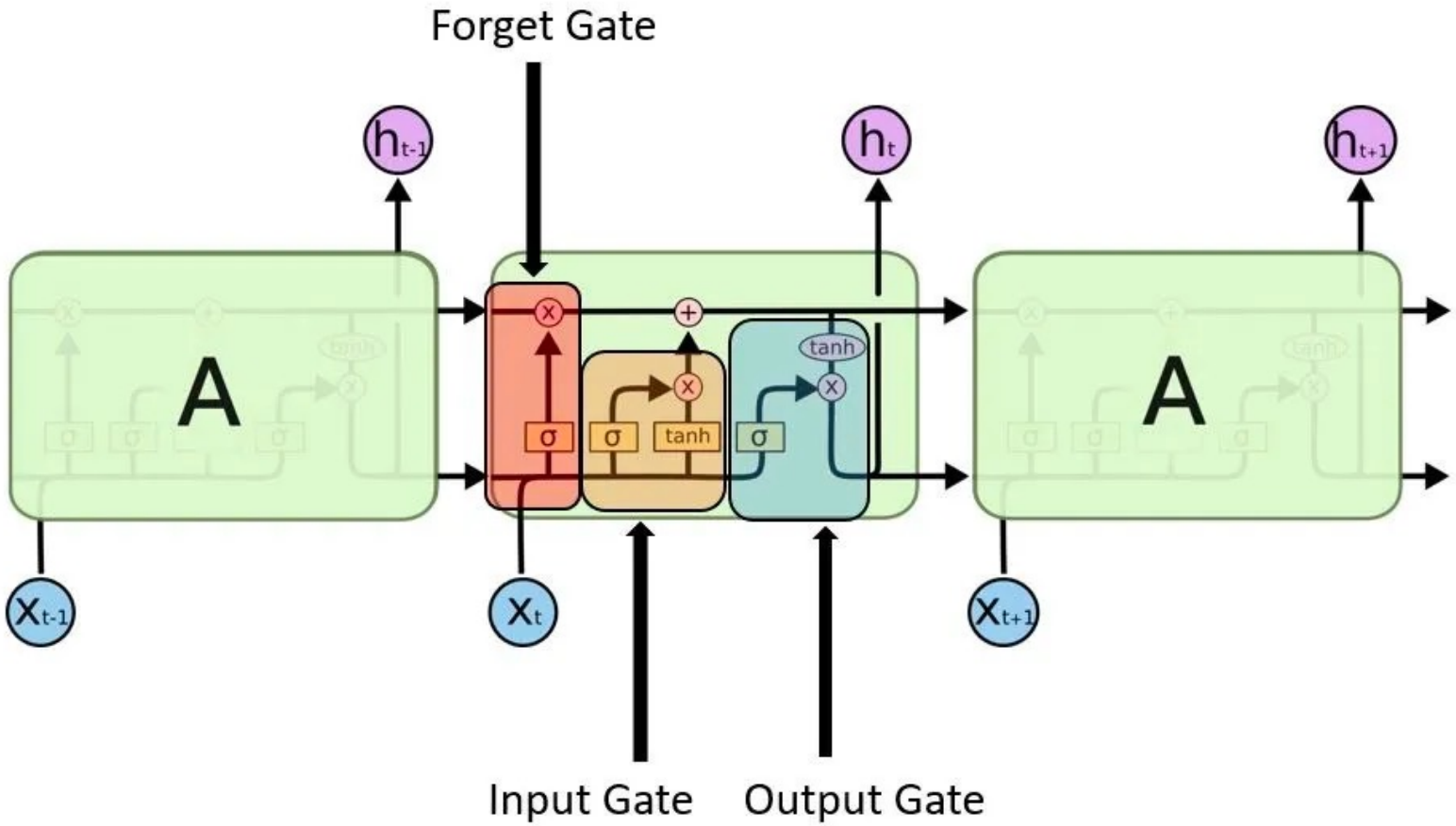
Recall: The fraction of actual positive cases that are correctly predicted

RNN Architecture

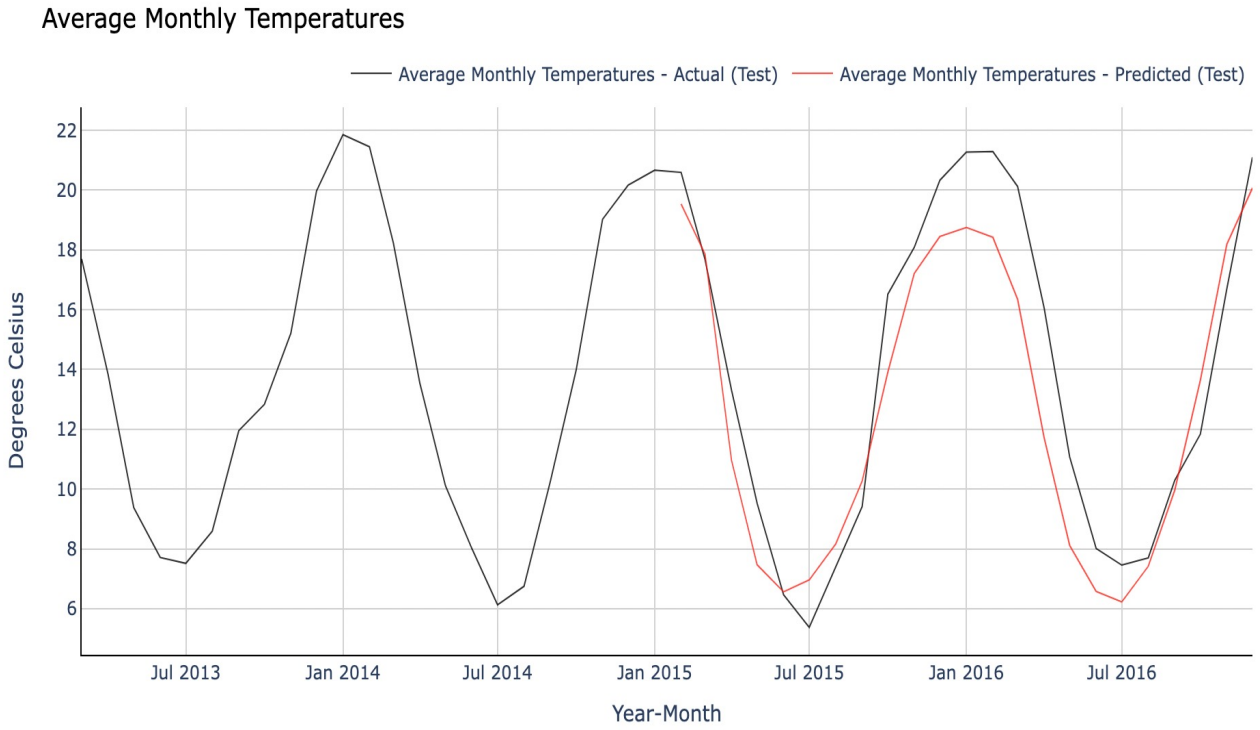


An unrolled recurrent neural network.

LSTM (Long Short Term Memory)

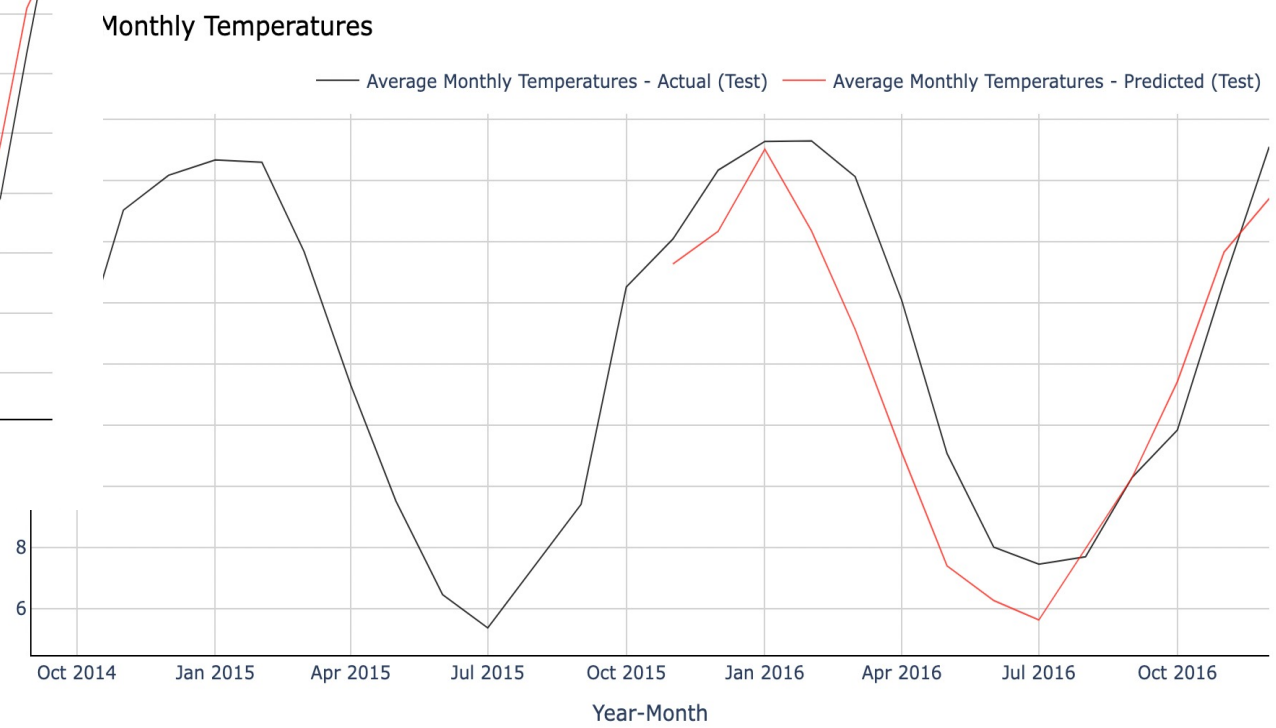


Findings for RNN Model



22 timestep + 1000 epoch

Canberra



18 timestep + 2000 epoch

Future Work

Continue evaluating the mathematical concepts of our neural networks and determining how to best tune the hyperparameters of our model

Thank you!

References

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