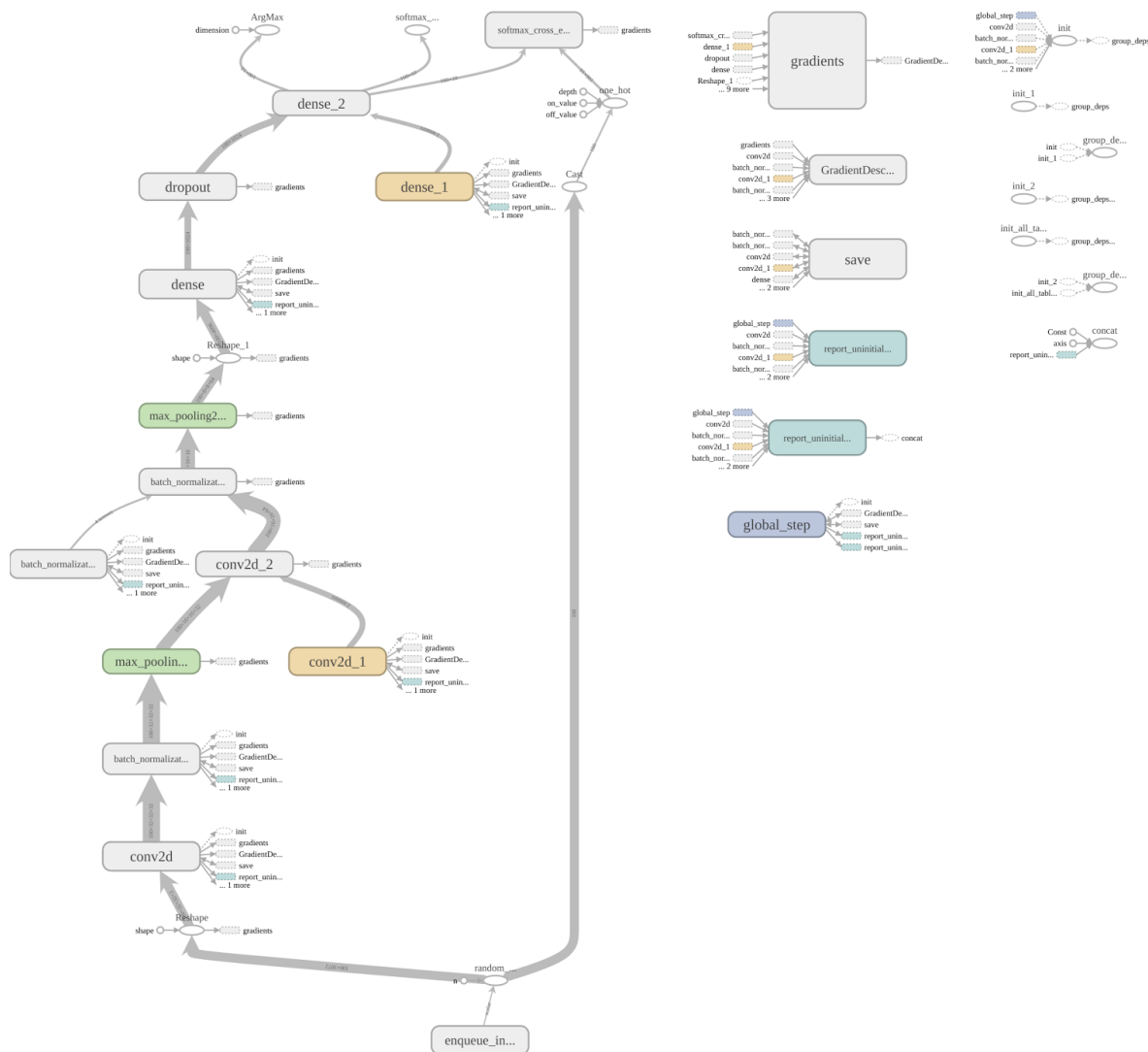# Homework 2

QUESTION 1:

Architecture:

The architecture consists of two convolutional layers with 32 and 64 filters respectively. Each convolutional layer is followed by batch normalization and max pooling. This is then followed by a dense layer. We perform dropout after the dense layer with a dropout rate of 0.4.

Part 1 Training Accuracy: **99.95%**

Part 1 Validation Accuracy: **72.74%**

QUESTION 2:

Architecture:
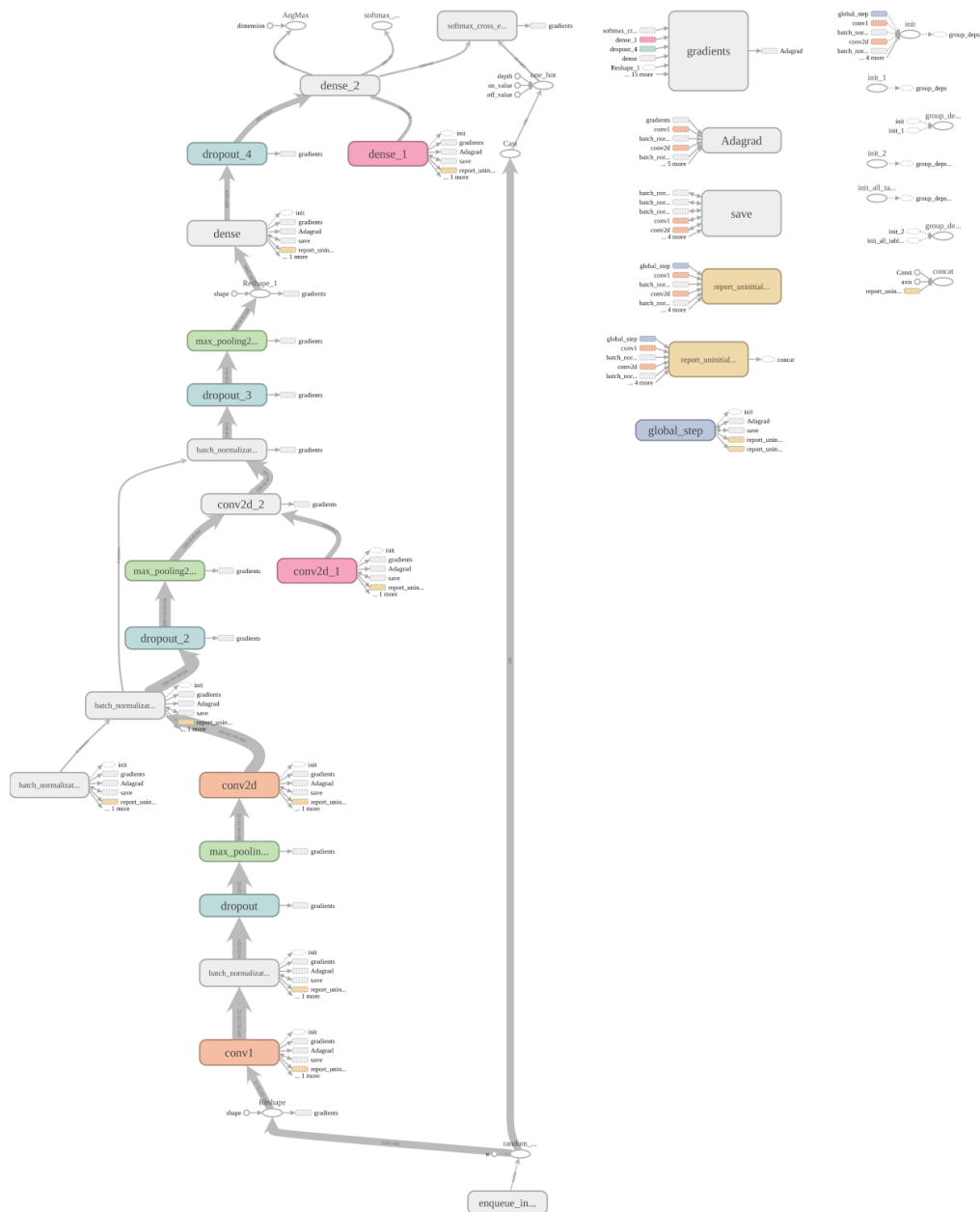
Steps:

1. **Different Optimizers**

   - ADAGrad Optimizer
   - ADAM Optimizer
   - RMSPROP Optimizer

   Best result:
   ADAGradOptimizer

2. **Dropouts**

   - We tried different configurations of

   Best result:
   Dropouts on all layers

LAYERS	DROPOUTS
Layer 1	0.2
Layer 2	0.3
Layer 3	0.4
Layer 4	0.3

3. **Different Layers**

- 5 Layer Network with [64,64,512,32] filters each layer respectively with a dense layer (1024 units)
- 5 Layer Network with [64,64,32,32] filters each layer respectively with a dense layer(1024 units)
- 4 Layer Network with [32,64,128] filters each layer respectively with a dense layer(1024 units)
- 4 Layer Network with [32,64,64] filters each layer respectively with a dense layer(1024 units)

Best Result:
4 Layer Network with [32,64,128] filters each layer respectively with a dense layer(1024 units)

While trying these experiments, our validation accuracy varied between 72%-78.08%.

Final Architecture:

-Training size: We did not use data augmentation. We used the original data which is 45K (5K validation data)
- Train Time: 16 minutes on a GPU
-4-layer network: [32,64,128] filters with 3 convolutional layers, with a final dense layer with 1024 units.
-Each of the convolutional layers were followed by batch normalization, max pooling and dropout (dropout rates: 0.2, 0.3, 0.4 respectively).

Validation accuracy improvement with each optimization:

-Adagrad Optimizer (vs Gradient Descent Optimizer in part 1): ***~2%***
-Change in layer architecture (from 2 Convolutional layers [32,64] to 3 Convolutional layers [32, 64, 128]): ***~2%***
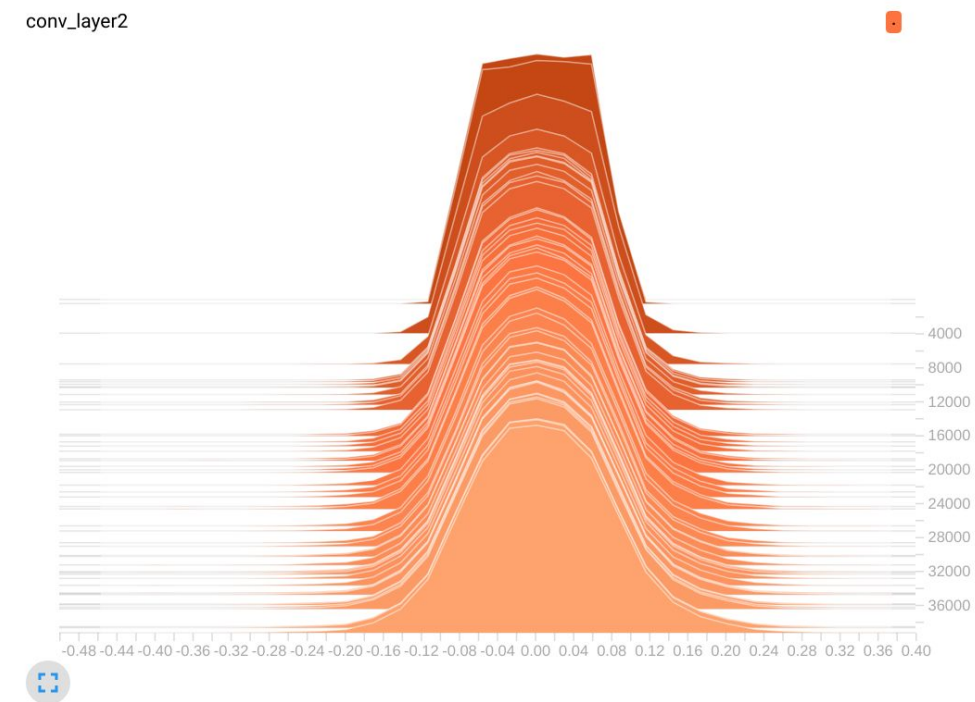-Adding dropout after each layer with dropout rates 0.2, 0.3 and 0.4: ***~2%***

Part 2 - Best Training Accuracy: ***99.17%***
Part 2 - Best Validation Accuracy: ***78.44%***

Convolution Layer 1
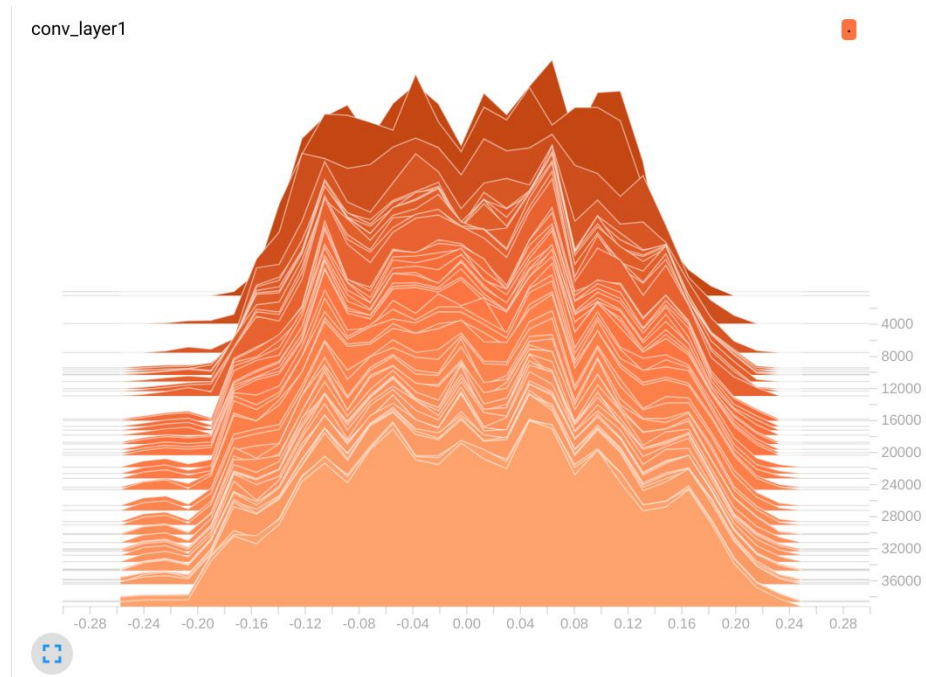
conv_layer1

Convolutional Layer 2

conv_layer2

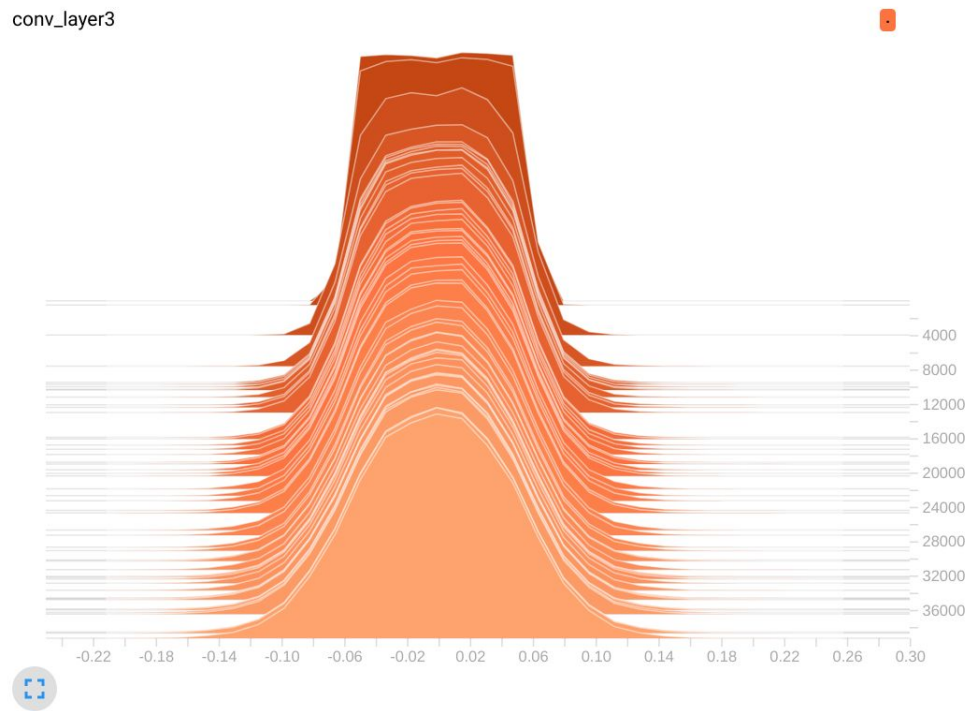## Convolutional Layer 3

conv_layer3

Last Fully Connected Layer

dense_layer1