**Assignment 1**

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**1. Backpropagation in a Simple Neural Network**

a) Dataset

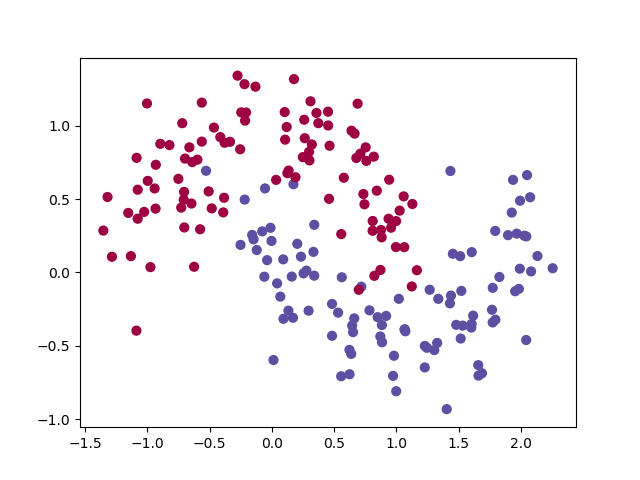


Fig 1. Distribution of Make-Moons dataset

b) Activation Function

1)

2) Derivatives of Tanh, Sigmoid, and ReLU

Mathematically, the derivative of ReLU(z=0) is undefined, but it is necessary to define the value for computational reasons. Therefore, the derivative of ReLU(z=0) is defined to be 0 in my code.

3)

c) Build the Neural Network

d) Backward Pass – Backpropagation

1) Derive the gradients

dL/dW2, dL/db2, dL/dW1, dL/db1

**2. Training a Simple Deep Convolutional Network on MNIST**

a) The final test accuracy : 0.9856

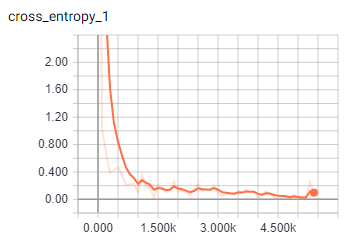


Fig. cross\_entropy curve

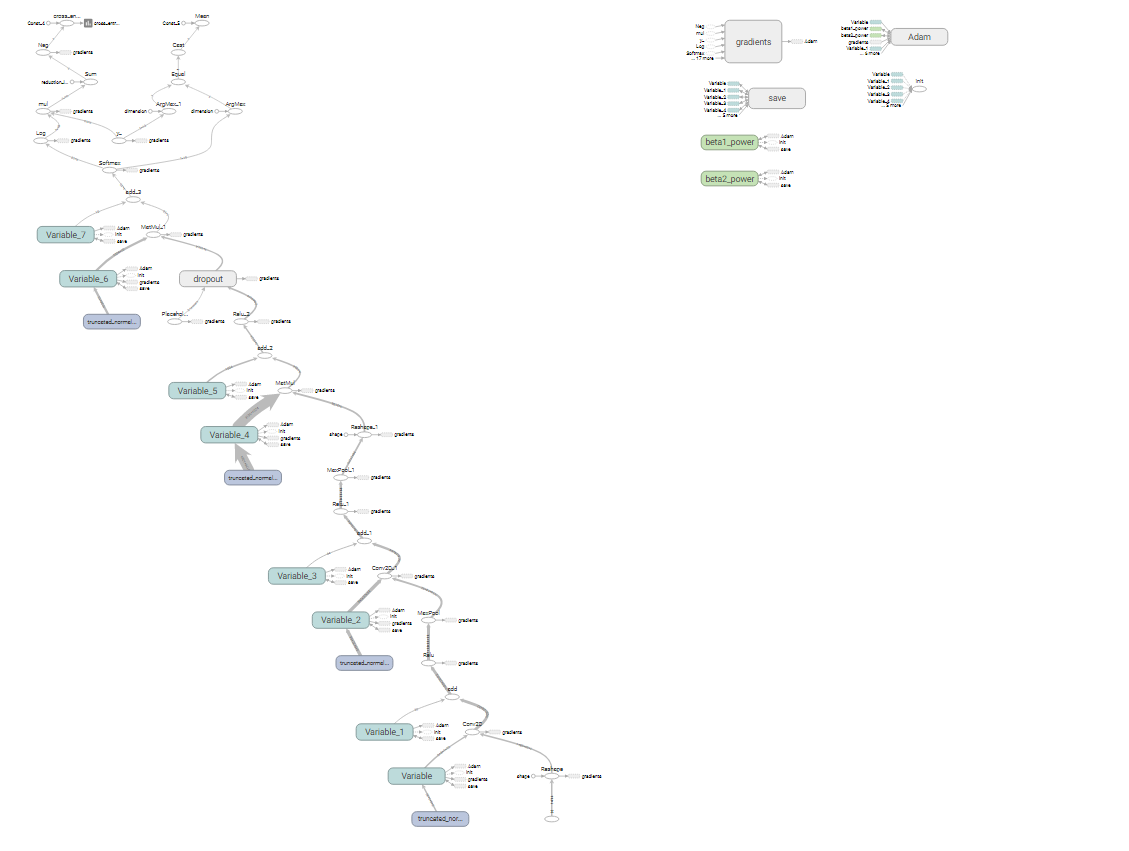


Fig. Curve

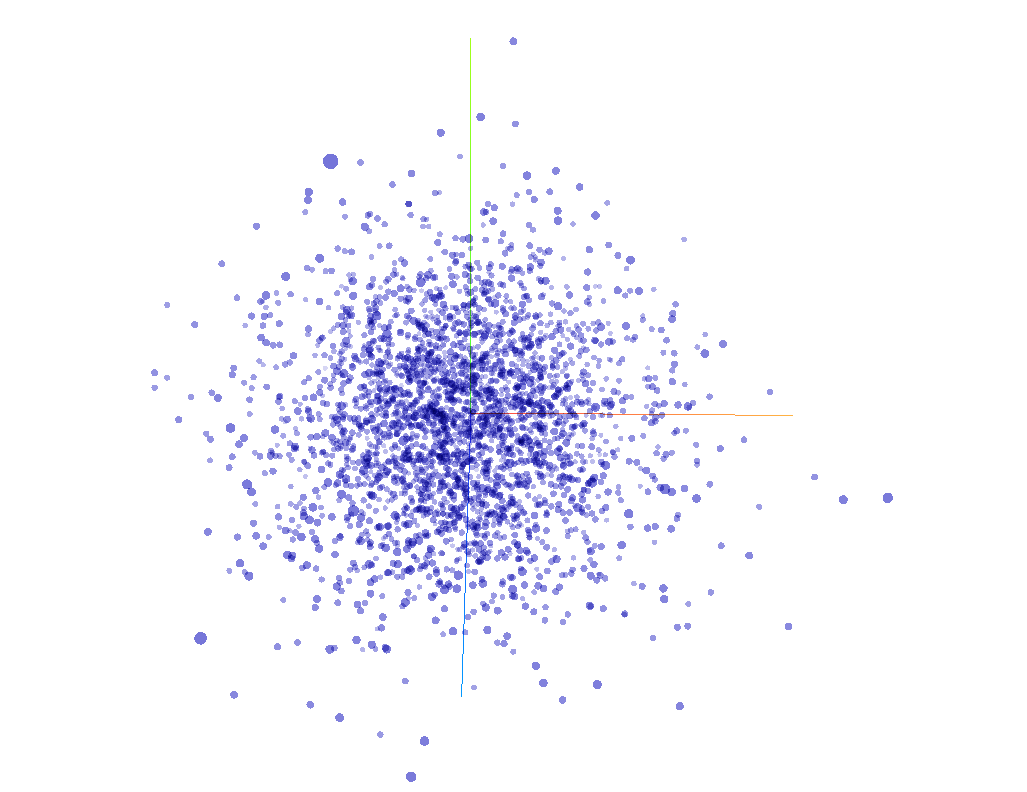


Fig. Distribution

For the latest version of TensorFlow, some functions given in the dcn\_mnist.py are outdated, so needed to be replaced as shown below.

* tf.initialize\_all\_variables() 🡪 tf.global\_variables\_initializer()
* tf.scalar\_summary() 🡪 tf.summary.scalar()
* tf.merge\_all\_summaries 🡪 tf.summary\_merge\_all()
* tf.train.SummaryWriter() 🡪 tf.summary.FileWriter()