



TensorFlow Basics



Deep Learning

- This section will expand on what we've learned and explore the TensorFlow's Framework approach to Neural Networks
- You'll see lots of parallels with our own simple implementation!



Deep Learning

- TensorFlow Basics
 - TF Basic Syntax
 - TF Graphs
 - TF Variables
 - TF Placeholders
- TensorFlow Neural Network



Deep Learning

- TensorFlow Regression Code Along
- TensorFlow Classification Code Along
- Regression Exercise
 - Solution
- Classification Exercise
 - Solution



Let's get started!



TensorFlow Basic Syntax



TensorFlow Graphs



Deep Learning

- Graphs are sets of connected nodes (vertices).
- The connections are referred to as edges.
- In TensorFlow each node is an operation with possible inputs that can supply some output.



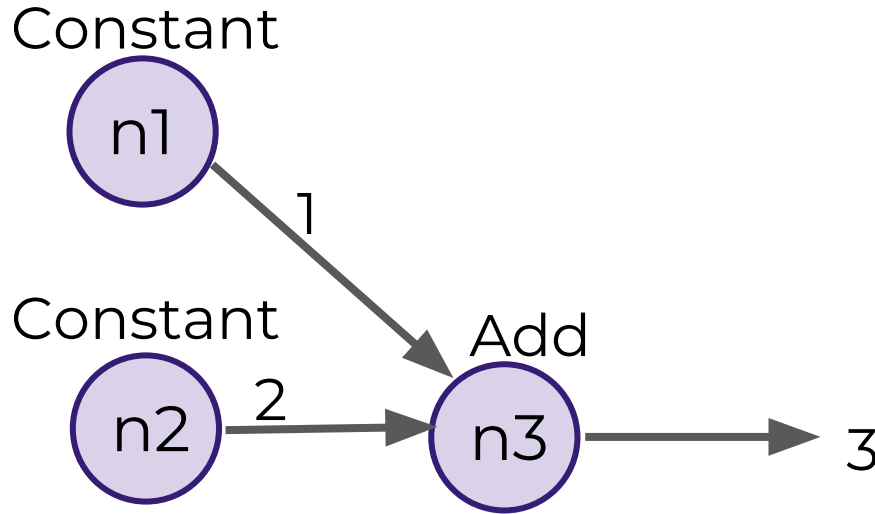
Deep Learning

- In general, with TensorFlow we will construct a graph and then execute it.
- Let's start showing some simple examples in Python!
- We'll also discuss how TensorFlow uses a default graph.



Deep Learning

- We'll start by building out this graph:





Variables and Placeholders



Deep Learning

- There are two main types of tensor objects in a Graph:
 - Variables
 - Placeholders



Deep Learning

- During the optimization process TensorFlow tunes the parameters of the model.
- Variables can hold the values of weights and biases throughout the session.
- Variables need to be initialized.



Deep Learning

- Placeholders are initially empty and are used to feed in the actual training examples.
- However they do need a declared expected data type (`tf.float32`) with an optional shape argument.



Deep Learning

- Let's see some examples of each.
- Once we understand how they work we'll be ready to build our first model with TensorFlow!



First TF Neural Network



Deep Learning

- We've learned about Sessions, Graphs, Variables, and Placeholders.
- With these building blocks we can create our first neuron!
- We'll create a neuron that performs a very simple linear fit to some 2-D data.



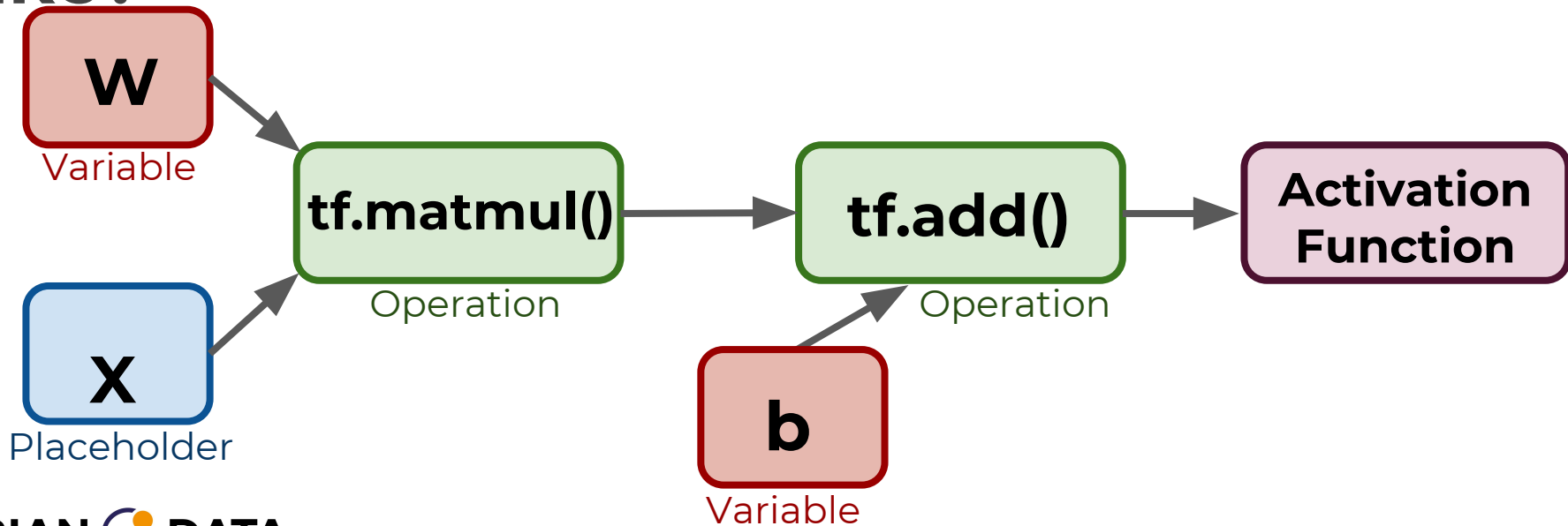
Deep Learning

- Our steps are:
 - Build a Graph
 - Initiate the Session
 - Feed Data In and get Output
- We'll use the basics we've learned so far to accomplish this task!



Deep Learning

What does the graph of $wx+b=z$ look like?





Deep Learning

- Afterwards you can add in the cost function in order to train your network to optimize the parameters!
- Let's go build this neural network!



TensorFlow Regression



Deep Learning

- Let's code along with a more realistic regression example and introduce `tf.estimator`!



TensorFlow Estimator API



Deep Learning

- Let's now explore the Estimator API from TensorFlow!
- There are lots of other higher level APIs (Keras, Layers, etc), we cover those later on in the Miscellaneous Section.



Deep Learning

- The `tf.estimator` API has several model types to choose from.
- Let's quickly show you the options!



Deep Learning

- Here are the Estimator Types
 - `tf.estimator.LinearClassifier`:
Constructs a linear classification model.
 - `tf.estimator.LinearRegressor`:
Constructs a linear regression model.



Deep Learning

- Here are the Estimator Types
 - `tf.estimator.DNNClassifier`:
Construct a neural network classification model.
 - `tf.estimator.DNNRegressor`:
Construct a neural network regression model.



Deep Learning

- Here are the Estimator Types
 - `Tf.estimator`.

`DNNLinearCombinedClassifier`:

Construct a neural network and linear combined classification model.



Deep Learning

- Here are the Estimator Types

- Tf.estimator.

DNNLinearCombinedRegressor:

Construct a neural network and
linear combined regression model.



Deep Learning

- In general, to use the Estimator API we do the following:
 - Define a list of feature columns
 - Create the Estimator Model
 - Create a Data Input Function
 - Call train, evaluate, and predict methods on the estimator object.



Deep Learning

- Let's go ahead and show a simple example of using this Estimator API.



TensorFlow Classification



Deep Learning

- Pima Indians Diabetes Dataset
- Tf.estimator API
- Categorical and Continuous Features
- LinearClassifier and DNNClassifier
- Let's get started!



TF Regression Exercise



Deep Learning

- Time to test your new skills!
- You will create a model to predict housing prices using the `tf.estimator` API.
- Let's review the exercise notebook.
- Optional - skip to the solutions and treat the exercise as a code-along lecture.



TF Regression Exercise Solution



TF Classification Exercise



TF Classification Exercise Solution