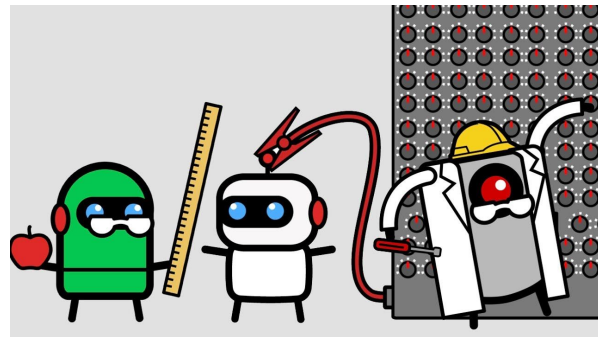
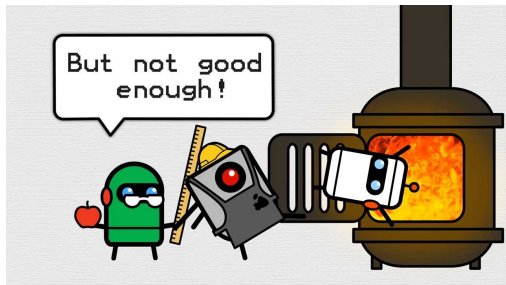


TensorFlow



What is Machine Learning?

- Based on some amount of data, variables are adjusted in tiny ways to put data into categories
- Basically, you create a network that uses coefficients to guess at what category something belongs
- Based on a “loss function”, which is being minimized, the computer makes educated adjustments based on back propagation to change the coefficients to make a better system
- Test. Adjust. Repeat. ([How Machines Learn](#))





So...What's TensorFlow

- It's an incredibly fast moving open source piece of software developed by Google
 - (It's literally had 5 revisions since June of 2018 with v2.0 in Alpha now)
- An accessible, yet deep way to do machine learning
- Has Python, C++, Javascript Versions
 - (There's a Swift version in development also with a Machine Learning Intermediate Representation because the LLVM and Swift guy is at Google Brain now)
- Runs on GPUs, has compilation for TPUs, it's everywhere and it's questionably great





Great, how do I get started?

- Python is the most well supported and the most well documented
- It's pretty easy to install and there's some great tutorials by Google help you get started
 - [Install](#)
 - [Tensorflow Tutorials](#)
 - [Version 1.13 Documentation](#)




Demo and Tutorials



General Idea

- Build a Graph that acts on Tensors
- Load in Data
- Run the Graph on the Data in a session

TensorFlow
is not
“Pythonic”

A series of vertical bars of varying heights and shades of teal, creating a decorative border at the bottom of the slide.



Why is there a Graph?

- This is where Tensorflow breaks the Python Model of programs
- Tensorflow executes a Graph that is full of nodes that act on Tensors
- This graph carries the data through the program, and create the necessary structures to measure and change the system as necessary
- Every action must be included in the graph
- There are ways to reshape the vectors and some control flow/data structures to organize the graph



What's a Tensor?

- Most of Machine Learning right now is based on linear algebra
- A Tensor basically a multidimensional array that you can perform operations on
- Each tensor has a shape, and this becomes important later
- Each node in the graph acts on these tensors, so the shapes of the tensors must line up in such a way that the operations are correct



Placeholders and Variables

- Variables are what change throughout a program
 - Can specify initial values, or just let the system decide them
- Placeholders are data that you pass to a program
 - These are set in a dictionary when you run the “session”



Running the Graph

- From here, you initialize the variables as needed with a very fancy function: `tf.global_variables_initializer()`
- Initialize a session: `tf.Session()` as session:
- Then you give the result of this to a session to run with: `session.run(init)`
- Then run this as many times as you like until you get a result you like



TensorBoard



Can I *Understand* the Network

- You can try
- Tensorboard is an external program that reads logs written during execution, where you can look at the structure of the graph and the values over time
- With certain options, the metadata is written out to file and can be viewed