Introduction to Machine Learning & TensorFlow

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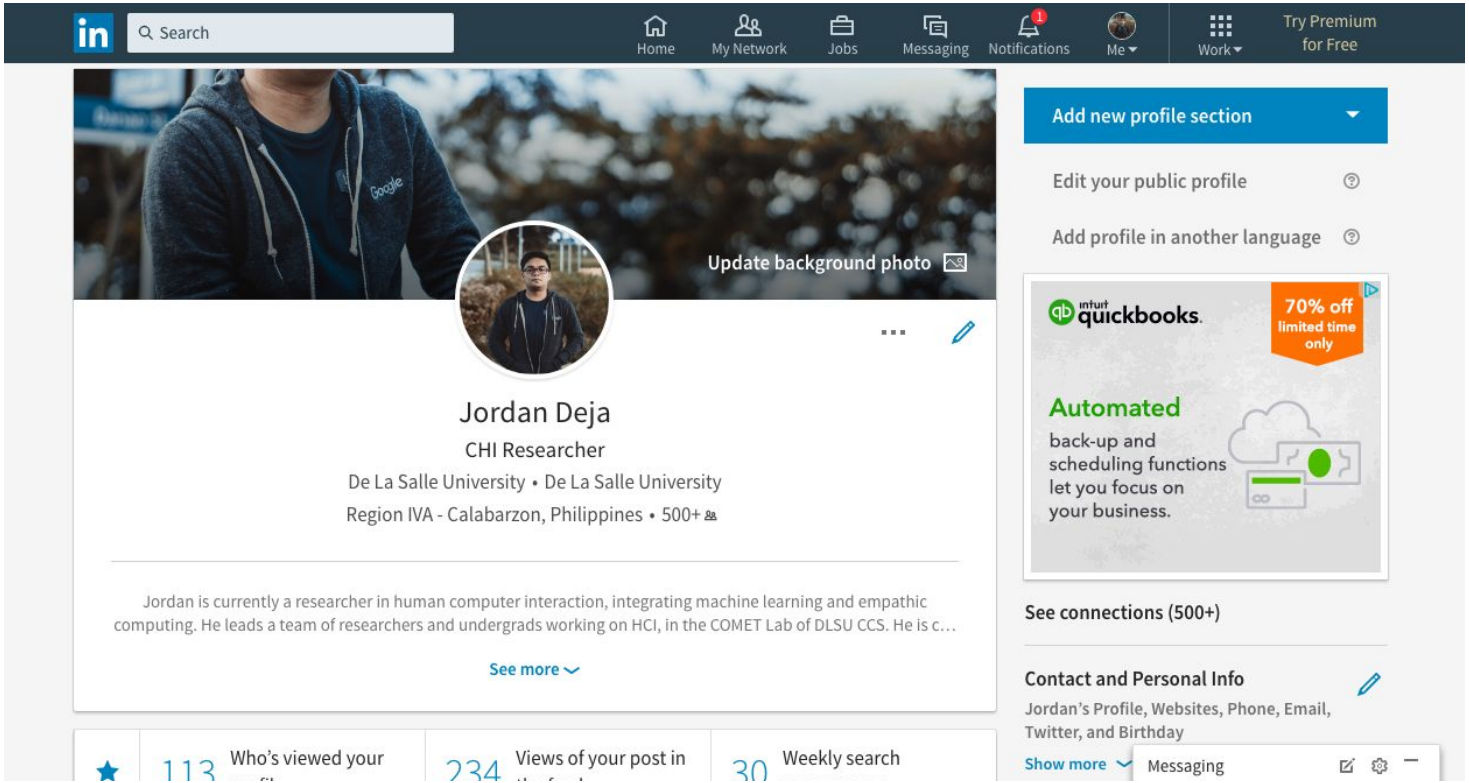
CENTER FOR
COMPLEXITY &
EMERGING
TECHNOLOGIES

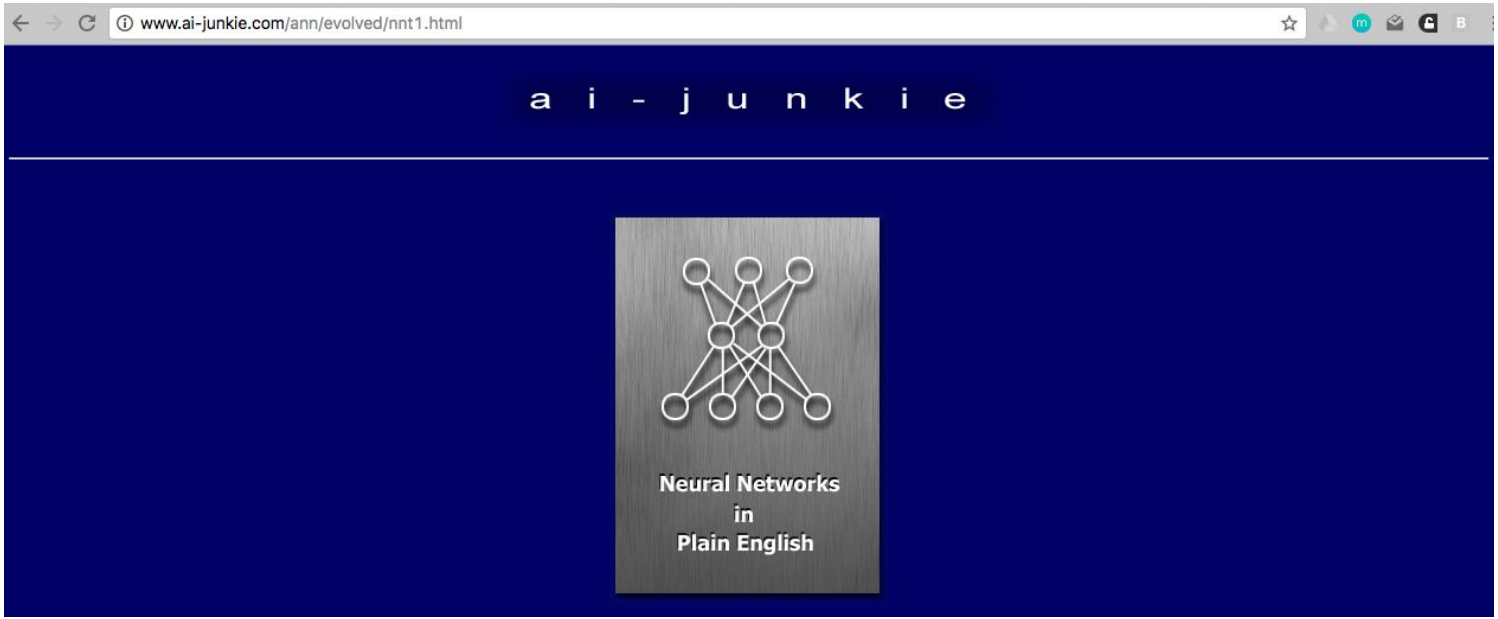
I’m on twitter!

..and on facebook

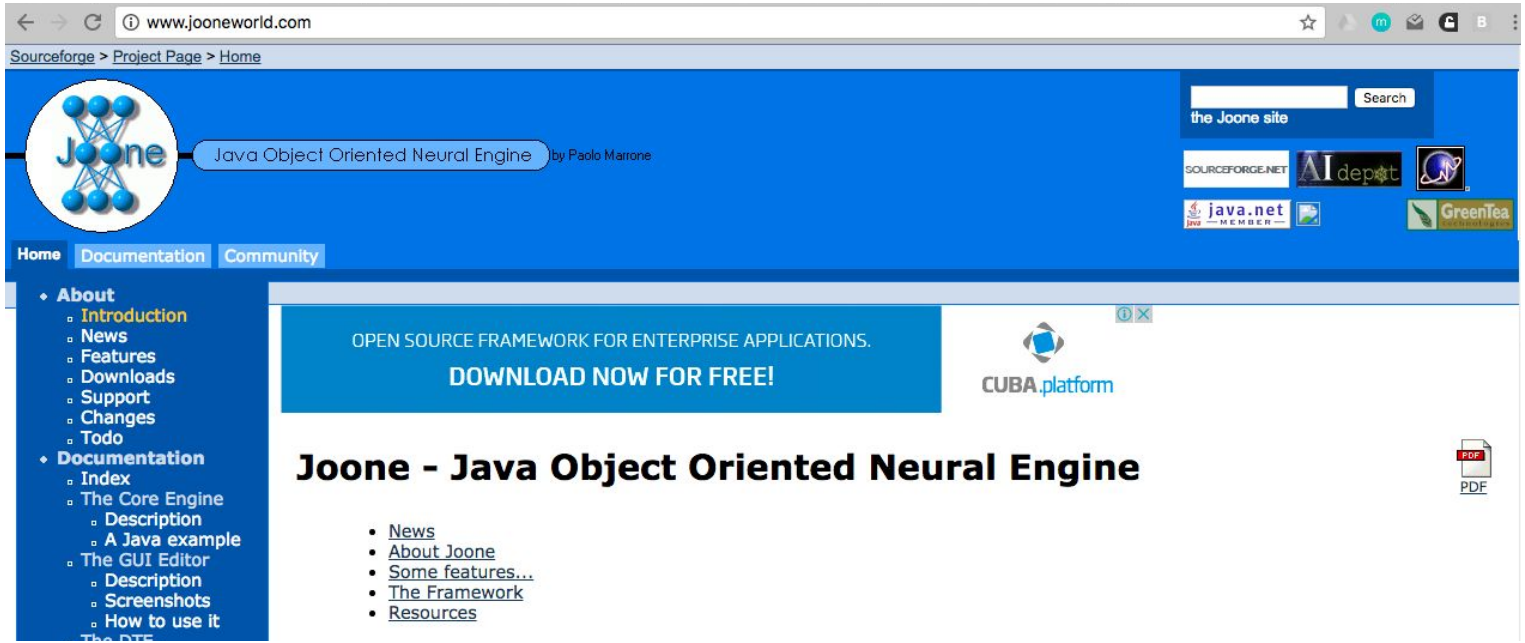
...also LinkedIn



my AI journey began in 2007

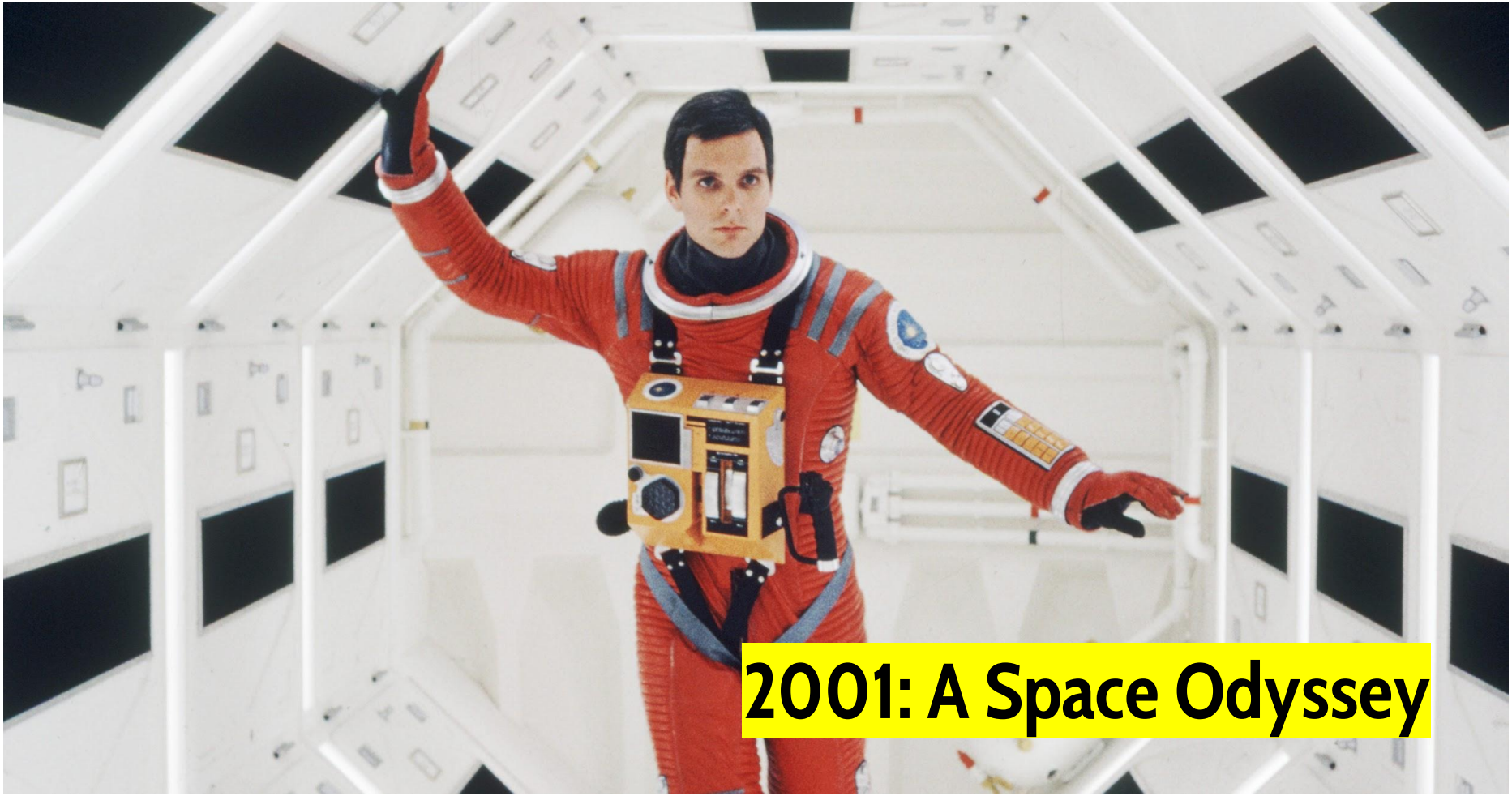


there was JOONE in 2008



the AI hype

There’s so much movement in the field of AI, the real world is having difficulty in adjusting.


2001: A Space Odyssey

Artificial Intelligence

Refers to the discipline involving the study and the development of intelligent, sentient machines.

- Marvin Minsky

Machine Learning

A subfield of Computer Science & AI that gives the computers the ability to learn without being explicitly programmed

- Arthur Samuel

formally...

A computer program is said to learn from an experience E with respect to some task T and some performance measure P , If its performance on T as measured by P , improves by some experience E.

- Tom Mitchell

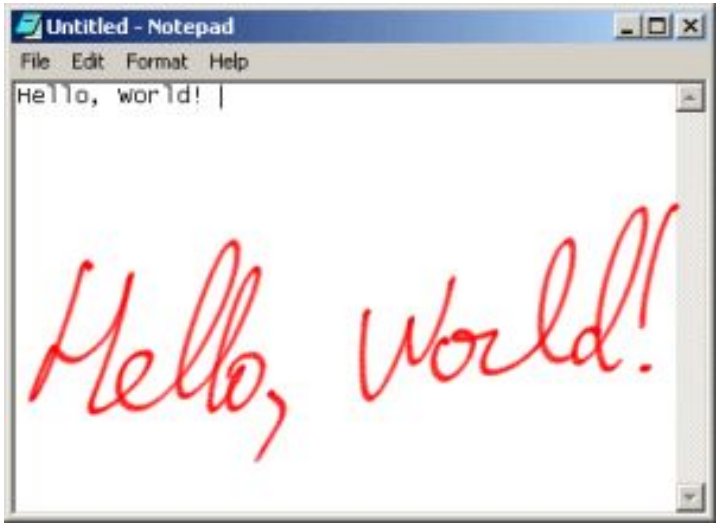
Learning to play checkers

Task: playing checkers
Performance measure: percent of games won against opponents
Experience: playing practice games against itself

photo from cnews.com

Handwriting recognition

Task: recognizing and classifying handwritten words within images
Performance measure: percent of words correctly classified
Experience: database of handwritten words with given classifications



"A computer program is said to learn from experience E with respect to some task T and some performance measure P, if its performance on T, as measured by P, improves with experience E."

Pop quiz!

Suppose your email program watches which emails you do or do not mark as spam, and based on that learns how to better filter spam. What is the task T in this setting?

T A. Classifying emails as spam or not spam.

E B. Watching you label emails as spam or not spam.

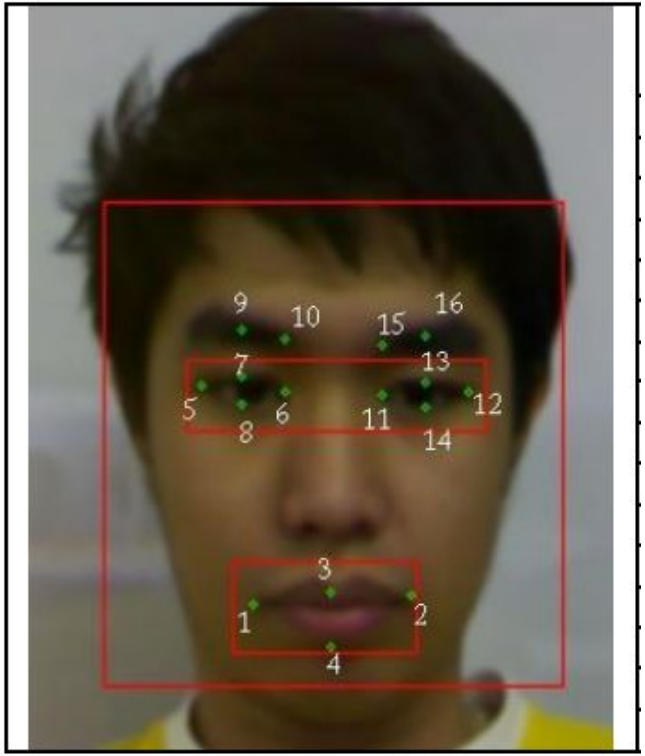
P C. The number (or fraction) of emails correctly classified as spam/not spam.

D. None of the above—this is not a machine learning problem.

Facial recognition

How do we teach a computer if a face is sad or happy?

Facial action points, regions of interest, manhattan distance = emotion



“Learning is experience..

...everything else is just information

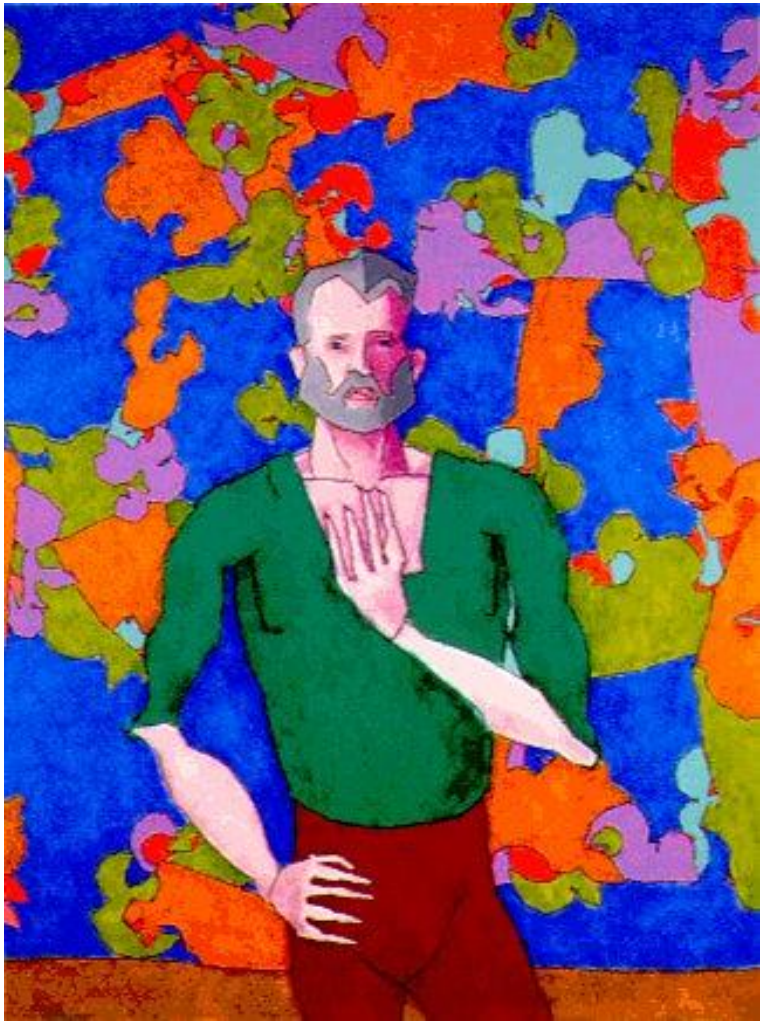
- Albert Einstein

ALVINN (1994)

Autonomous Land Vehicle in Neural Network (ALVINN) travelled from the US West Coast to the East Coast, totally unmanned. The trip took 6days.

AARON (1998)

AARON was a computer that was trained to paint in the style of the different artists from the Renaissance



https://www.autodraw.com/

AutoDraw

Fast drawing for everyone.

Start Drawing | Fast How-To*

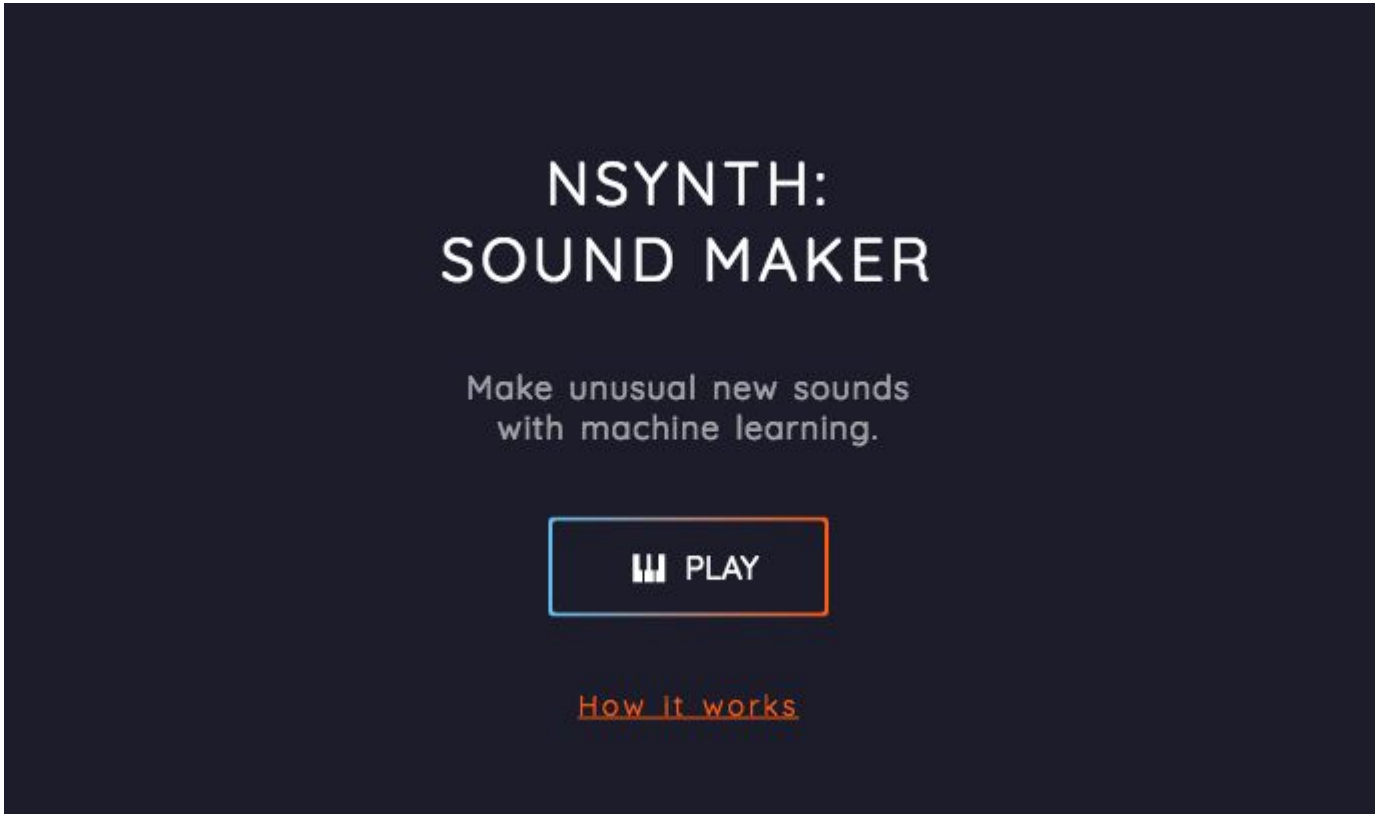
https://quickdraw.withgoogle.com/

Can a neural network learn to recognize doodling?

Help teach it by adding your drawings to the world's largest doodling data set, shared publicly to help with machine learning research.

Let's Draw!

https://aiexperiments.withgoogle.com/sound-maker/view/

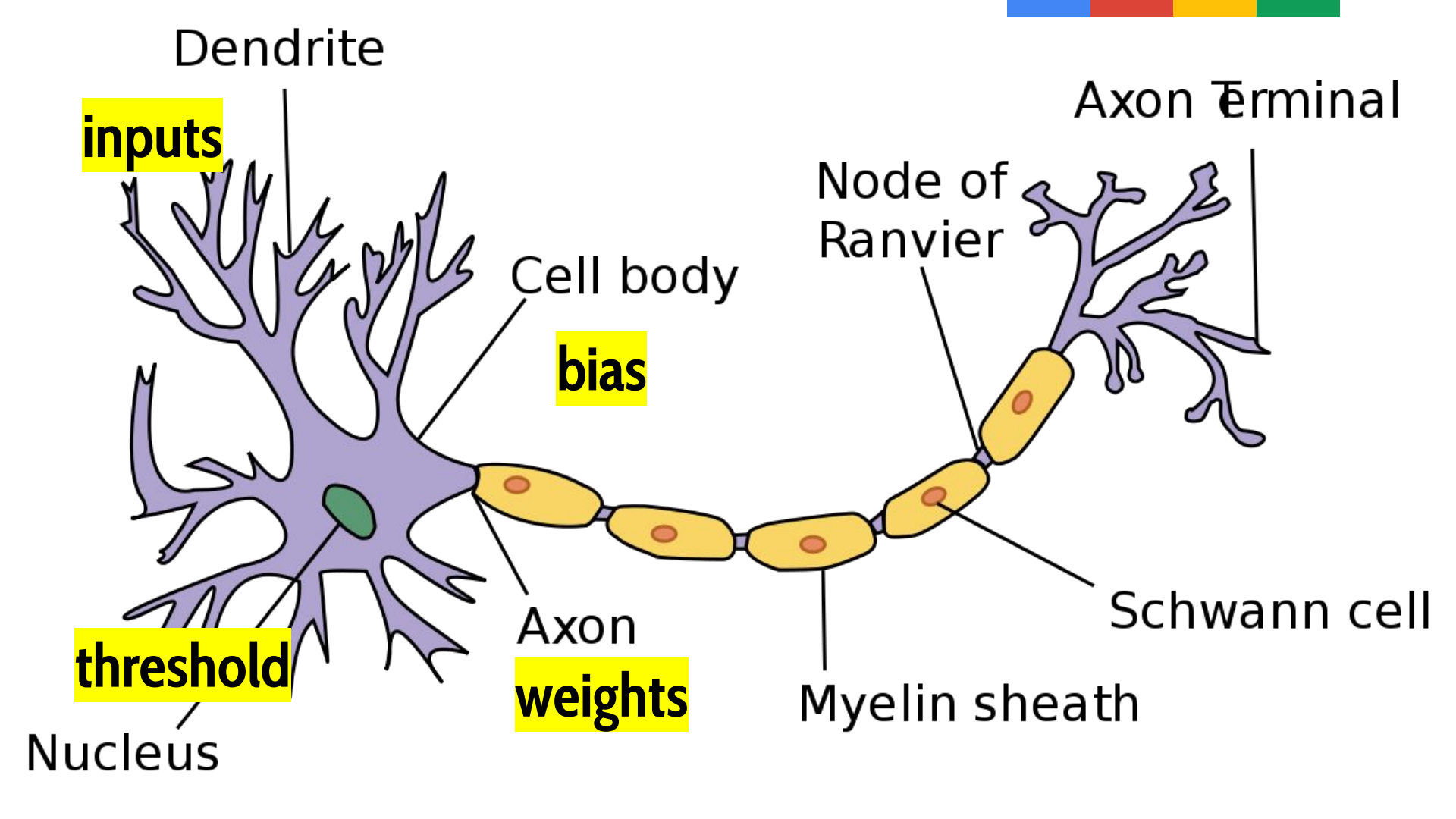


https://aiexperiments.withgoogle.com/ai-duet/view/

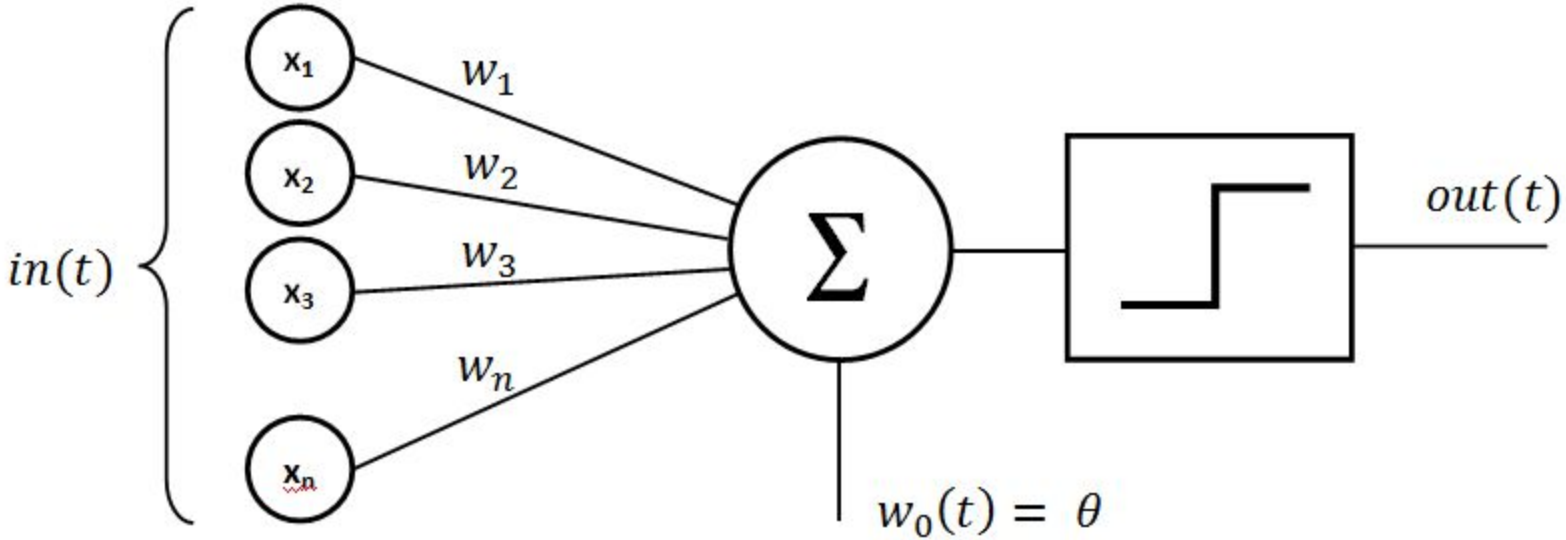
For more AI Experiments and source code

https://aiexperiments.withgoogle.com/

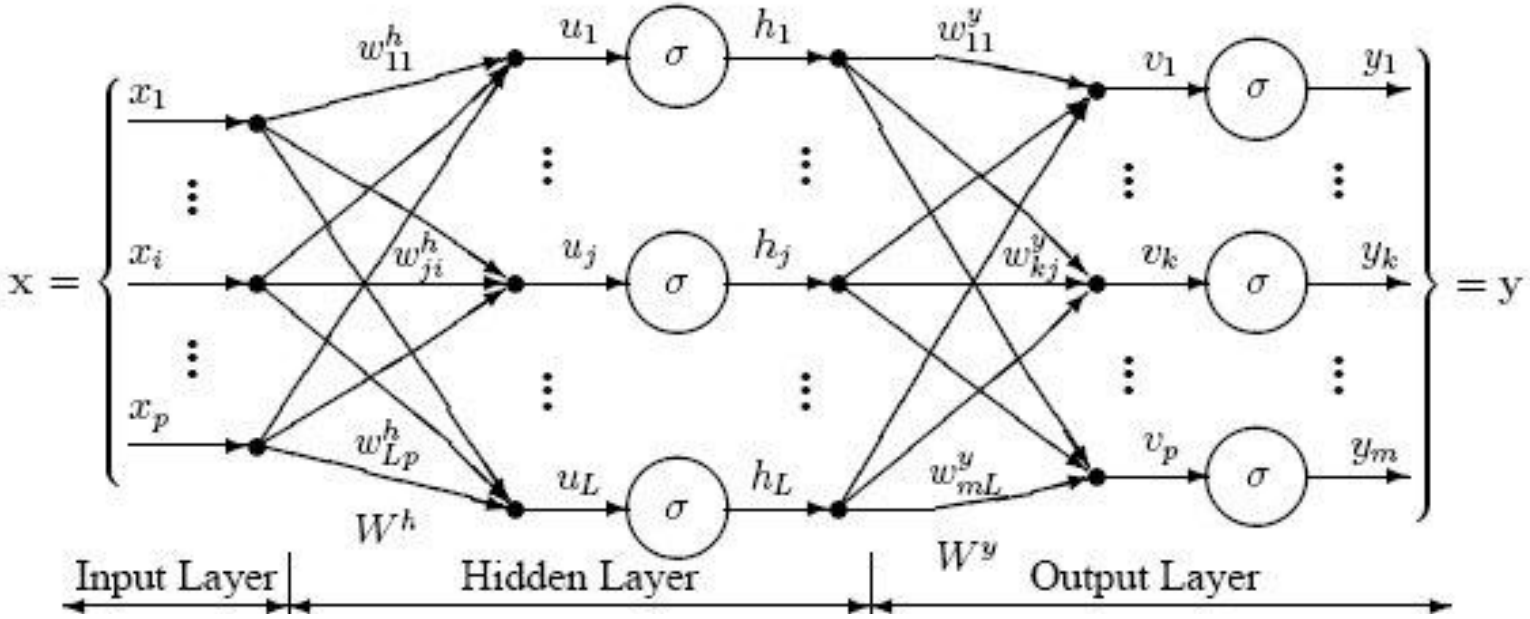
AI Systems were patterned like how the complex system of the brain works


Dendrite
inputs
Axon Terminal
Node of Ranvier
Cell body
bias
threshold
Axon
weights
Schwann cell
Myelin sheath
Nucleus

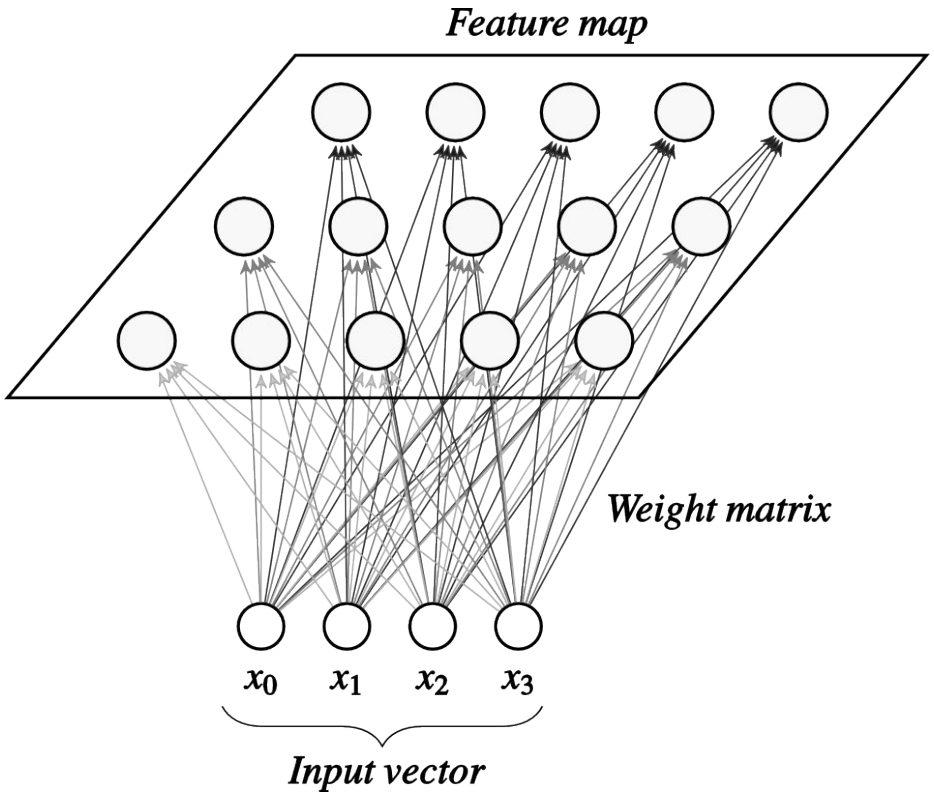
The Perceptron



A MultiLayer Perceptron



Self-Organizing Maps (SOM)



T or F?

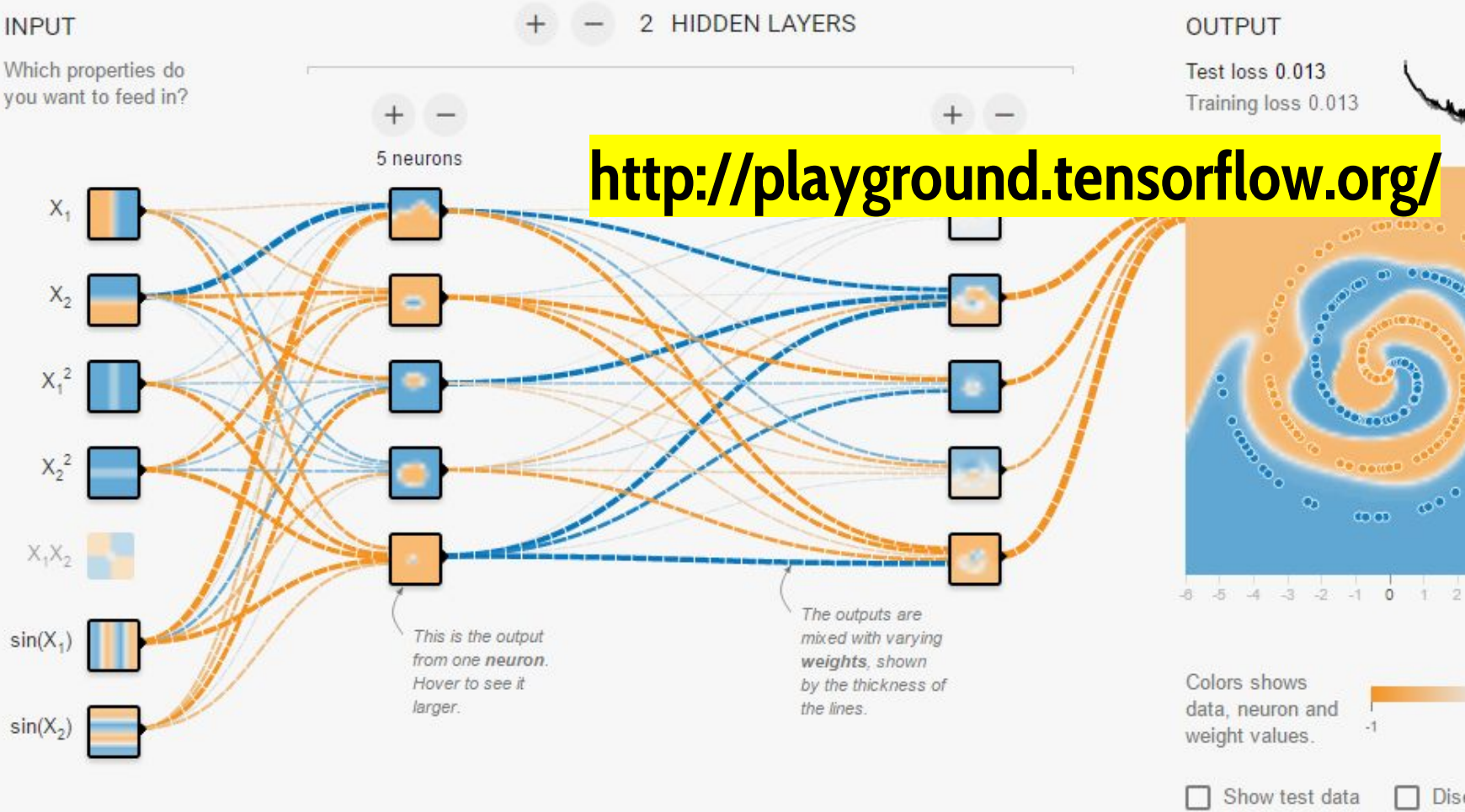
TensorFlow

An open-source software library for Machine Intelligence. Supports various machine learning algorithms used by Google in its products.

TF was create to build complex Neural Networks but is general enough to build a wide variety of ML algorithm or computation systems

TensorFlow?

- **Tensor** : N-dimensional array
  - 1-dimension: vector | 2-dimension: matrix
- **Flow** : Computation based on data flow graphs
- **TensorFlow** : Tensors flow through the graph
  - Edges represent the Tensors
  - Nodes represent the processing


INPUT
Which properties do you want to feed in?
2 HIDDEN LAYERS
5 neurons
OUTPUT
Test loss 0.013
Training loss 0.013
http://playground.tensorflow.org/
X1
X2
X1²
X2²
X1X2
sin(X1)
sin(X2)
This is the output from one neuron. Hover to see it larger.
The outputs are mixed with varying weights, shown by the thickness of the lines.
-6 -5 -4 -3 -2 -1 0 1 2
Colors shows data, neuron and weight values.
-1
Show test data

Planes dont flap their wings to fly,
but birds dont take off from trees
either...

A car can run faster than a cheetah
but it can never climb a tree..

Hi!

Feel free to connect :)

fb.com/just.keep.hustlin

linkedin.com/in/justhustlin

How to install

Supports Mac OS, Linux, and Windows.

Visit **https://www.tensorflow.org/install/**

Required knowledge

Sprinkle with **Python**. Add a cup of **Arrays**. And a pinch of **Machine Learning**

Tensors

The central unit of data in TensorFlow. A **tensor** consists of a set of primitive values shaped into an array of any number of dimensions.

```
3 # a rank 0 tensor; this is a scalar with shape []
[1. ,2., 3.] # a rank 1 tensor; this is a vector with shape [3]
[[1., 2., 3.], [4., 5., 6.]] # a rank 2 tensor; a matrix with shape [2, 3]
```

Computational Graph

TensorFlow Core programs has two discrete sections:

1. Building the computational graph.
2. Running the computational graph.

Low-level API

[Researchers]

High-level API

[Developers]

Basic Coding

Importing TensorFlow

- The canonical import statement for TensorFlow programs is as follows:

```
import tensorflow as tf
```

Constant

- A type of tensor. **Constants** takes no inputs, and outputs a value it stores internally.

```
node1 = tf.constant(3.0, tf.float32)
```

Placeholder

- A graph can be parameterized to accept external inputs, known as **placeholders**. A **placeholder** is a promise to provide a value later.

```
a = tf.placeholder(tf.float32)
```

Variable

- **Variables** allow us to add trainable parameters to a graph. They are constructed with a type and initial value.

```
W = tf.Variable([.3], tf.float32)
```

Updating a Variable

- **Variables** allow us to add trainable parameters to a graph. They are constructed with a type and initial value.

```
tf.assign(var,[1])
```

Arithmetic Operators

- TensorFlow provides several operations that you can use to add basic arithmetic operators to your graph.

```
tf.add(var1,var2)

tf.subtract(var1,var2)
```

Session Object

- To actually evaluate the nodes, we must run the computational graph within a session. A session encapsulates the control and state of the TensorFlow runtime.

```
sess = tf.Session()
```

Initialising all Variables

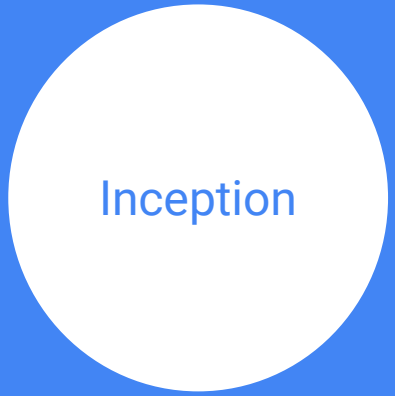
- To initialize all the variables in a TensorFlow program, you must explicitly call a special operation as follow:

```
init = tf.global_variables_initializer()
sess.run(init)
```

Let’s build a simple model

Models

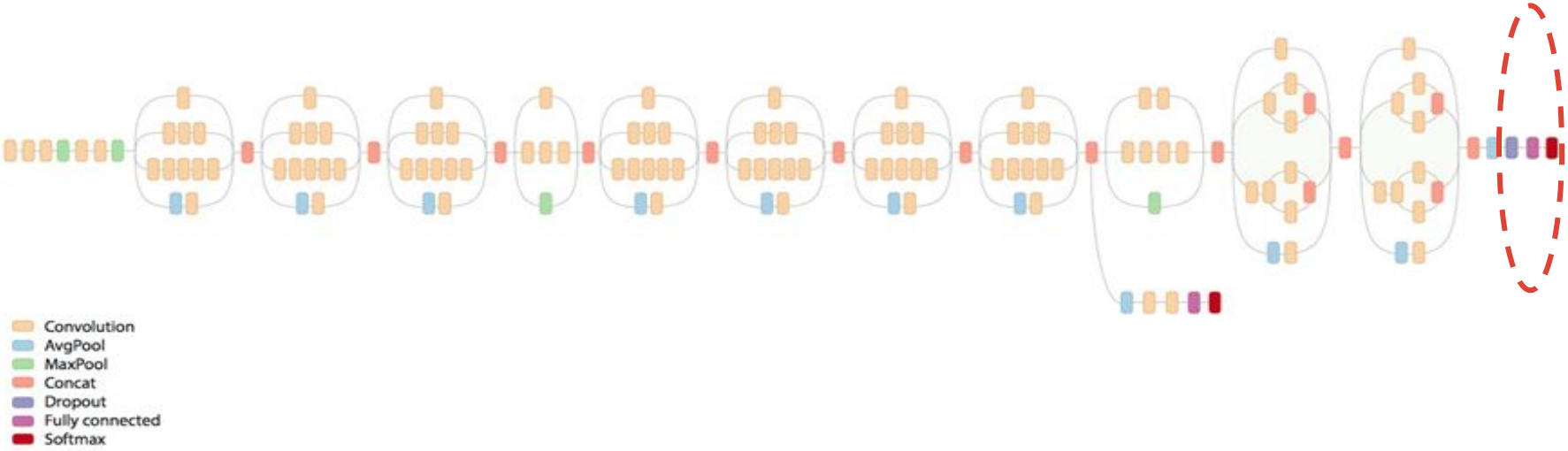
https://github.com/tensorflow/models

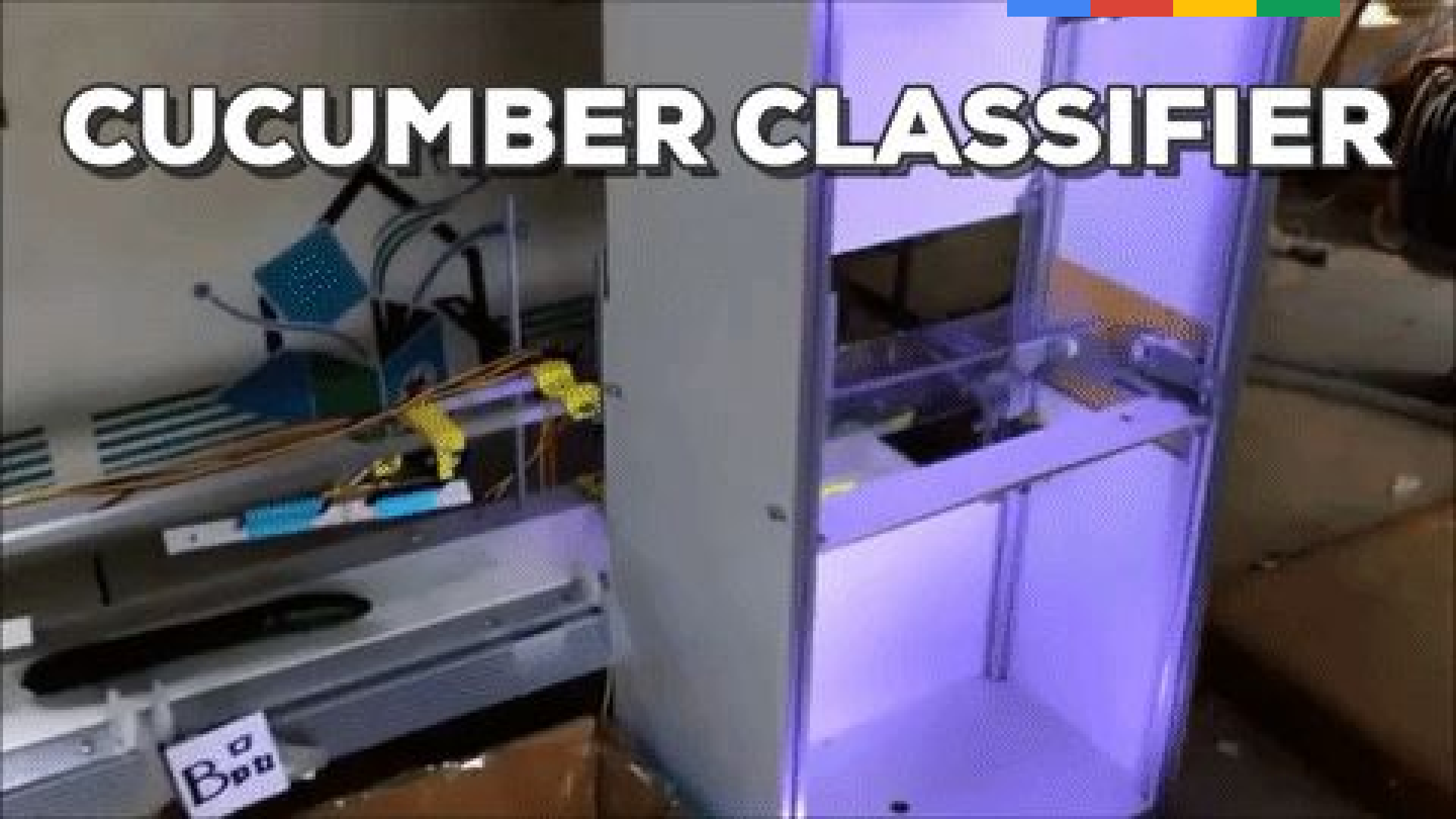


Codelabs

https://codelabs.developers.google.com/codelabs/tensorflow-for-poets/

Inception Model




CUCUMBER CLASSIFIER

Join the TensorFlow Philippine Community

https://www.facebook.com/groups/TensorFlowPH/

Join our Machine Learning Meetups (MLM)

facebook.com/groups/ph.mlm

Learn more about TensorFlow

https://www.tensorflow.org

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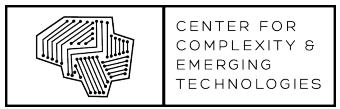
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