Machine Learning in Drupal with TensorFlow.js

Drupal GovCon 2021

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Esteemed
Github: https://github.com/ricktorzynski/drupal-govcon-tensorflowjs

Introduction

My Development History

I've been a Drupal Developer for 12 years, working on government agency Drupal websites, healthcare Drupal websites, machine learning applications, and software engineering.

ECS

Senior Drupal Developer

TEKsystems
Own change

Drupal Developer at Florida Blue

NLP LOGIX
AI REALIZED

Senior Software Developer

Our Agenda

- ★ Intro to Machine Learning
- ★ What is Deep Learning?
- ★ What is TensorFlow.js?
- ★ Drupal and Machine Learning
- ★ Understanding the Component Module
- ★ Demo
- ★ Looking to the Future
- ★ Questions?

Intro to Machine Learning

"Just as electricity transformed almost everything 100 years ago, today I actually have a hard time thinking of any industry that I don't think AI will transform in the next several years."

Andrew Ng - Stanford Professor & Co-founder of Coursera

Intro to Machine Learning

Companies currently leveraging machine learning applications and devices

Nvidia

- GPUs
- Edge Devices
- Omniverse

Facebook

- Face Recognition
- Friend Recommender
- PyTorch

Tesla

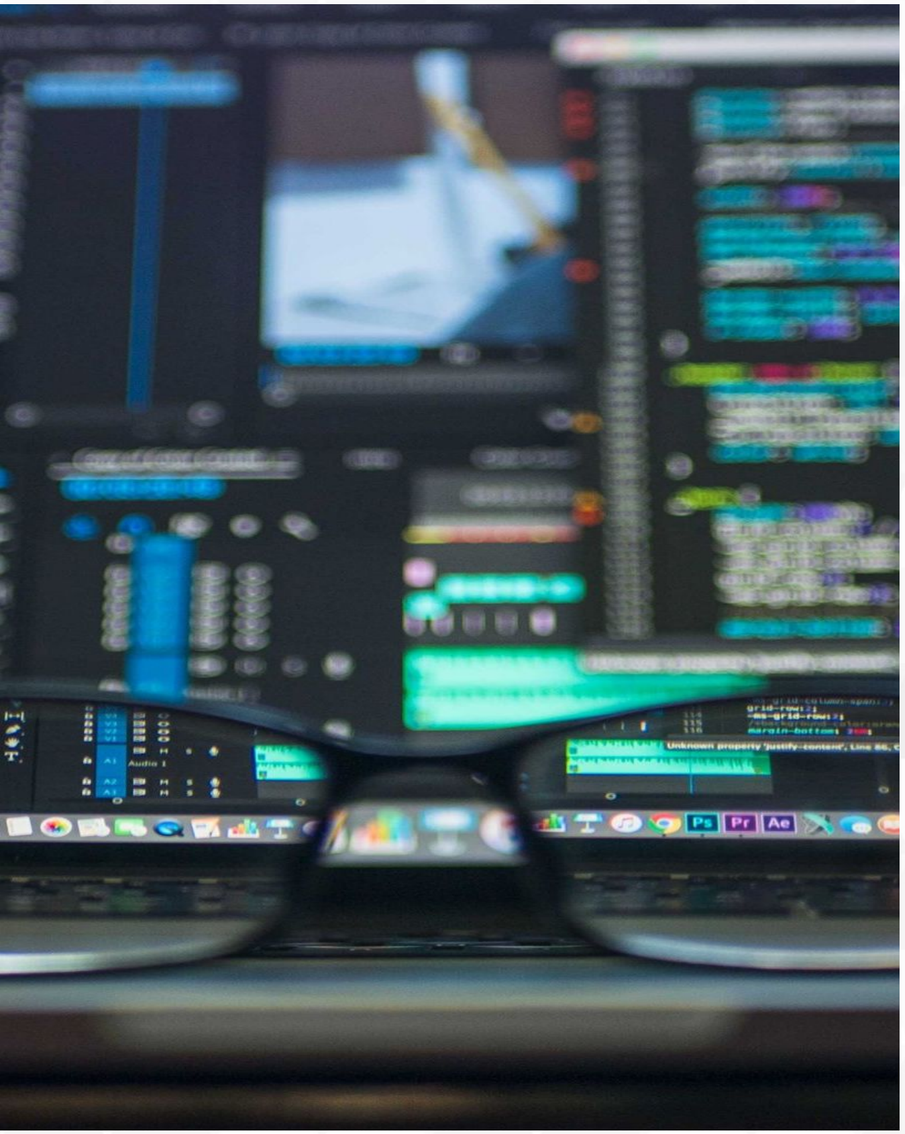
- Self Driving Cars
- Robots

LinkedIn

- Job Search
- Networking

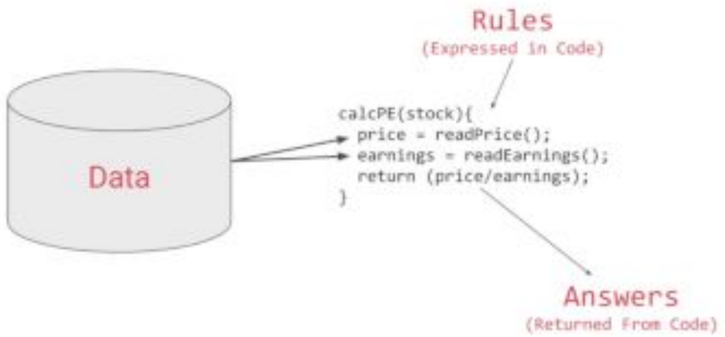
Others: Amazon, Banks (credit card fraud), Airports (facial recognition), Ebay, etc...

Intro to Machine Learning



"Machine learning focuses on applications that learn from experience and improve their decision-making or predictive accuracy over time." - IBM

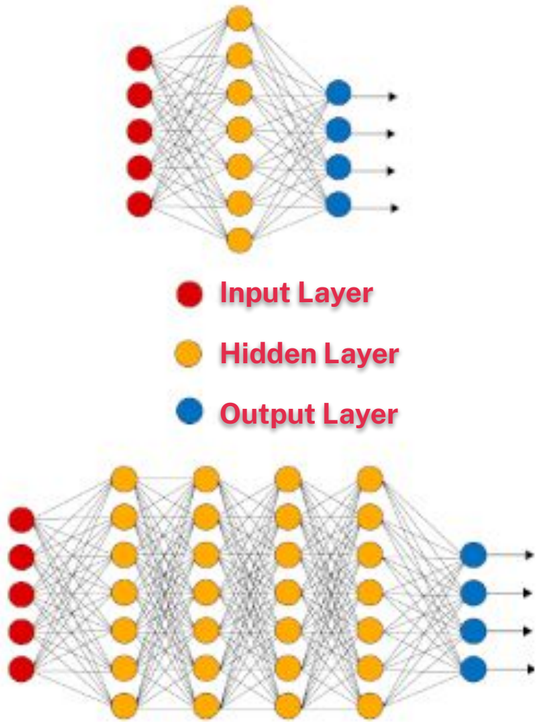
Intro to Machine Learning



- ★ **Types of Machine Learning**
  - **Supervised Learning - for a set of data, the outcome is known (linear regression, classification)**
  - **Unsupervised Learning - outcome unknown, but interested in how data clusters together into groups (PCA, Recommender)**
- ★ **Programming Paradigm**
  - **Traditional Programming**
    - **Rules + Data -> Answers**
  - **Machine Learning**
    - **Answers + Data -> Rules**

Diagram: Moroney, L. (2021). AI and Machine Learning for Coders: A Programmer's Guide to Artificial Intelligence. O'Reilly.

What is Deep Learning?

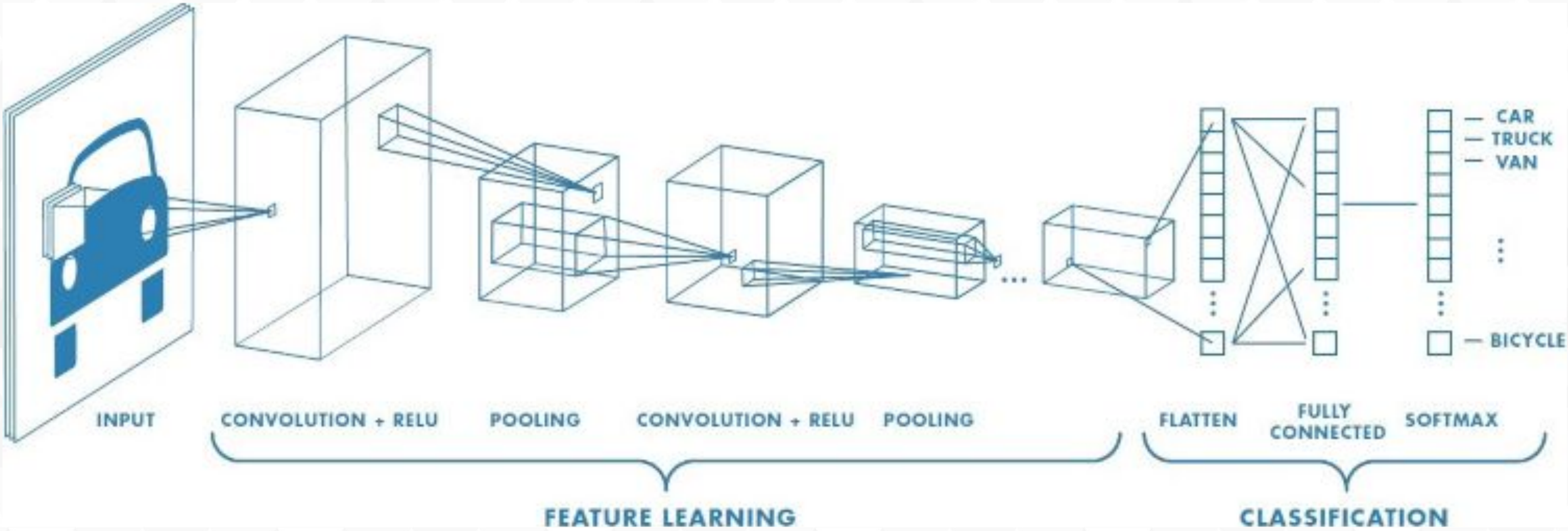


“A subfield of machine learning concerned with algorithms inspired by the structure and function of the brain called artificial neural networks.”

- **Input Layer** - Images, text, audio, video, numbers, etc. Must be quantifiable.
- **Hidden Layers** - Filters for feature extraction
- **Output Layer** - Classification, prediction
- **Activation function** - takes in the output signal from the previous cell and converts it into some form that can be taken as input to the next cell.
  - Sigmoid, ReLU and Softmax

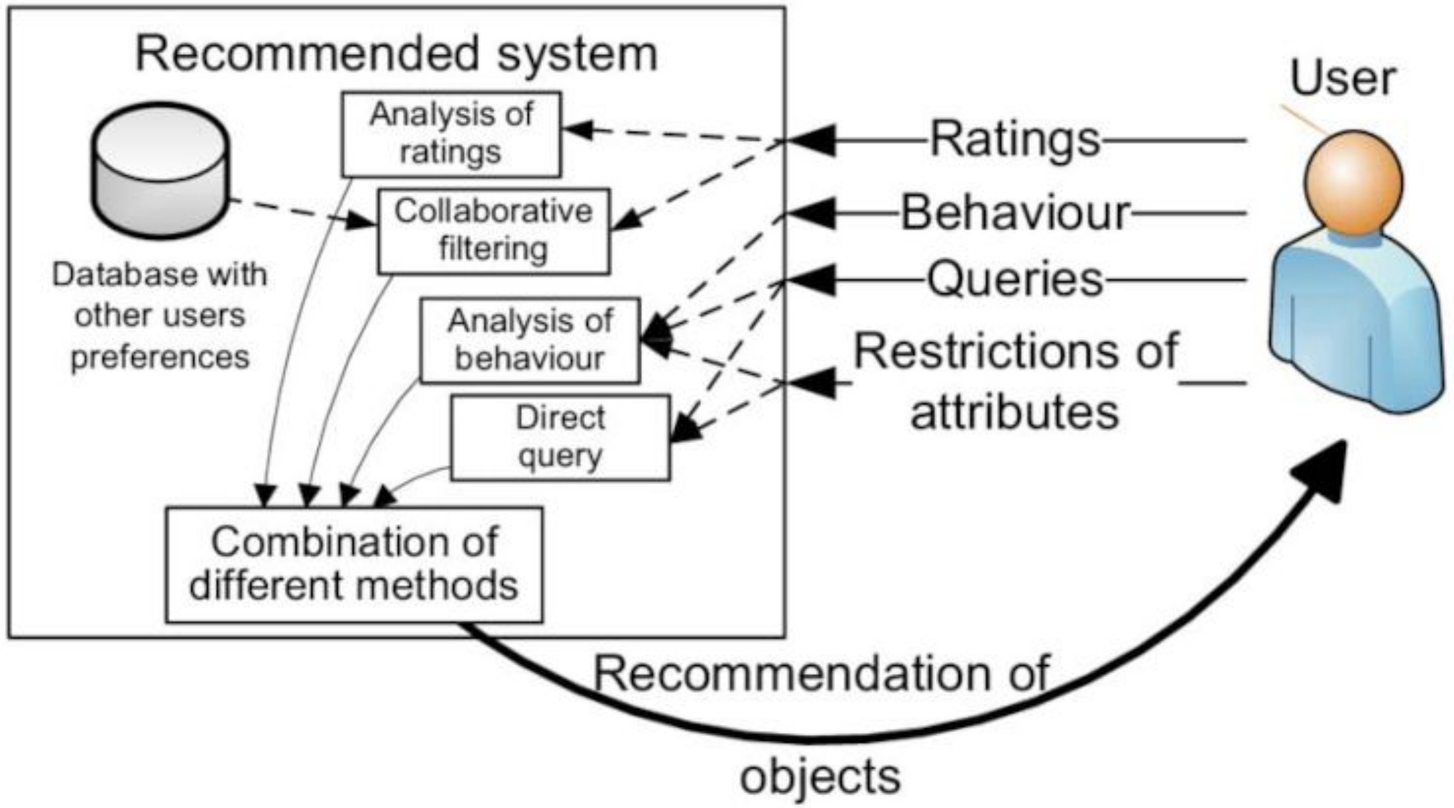
What is Deep Learning?

Convolutional Neural Network

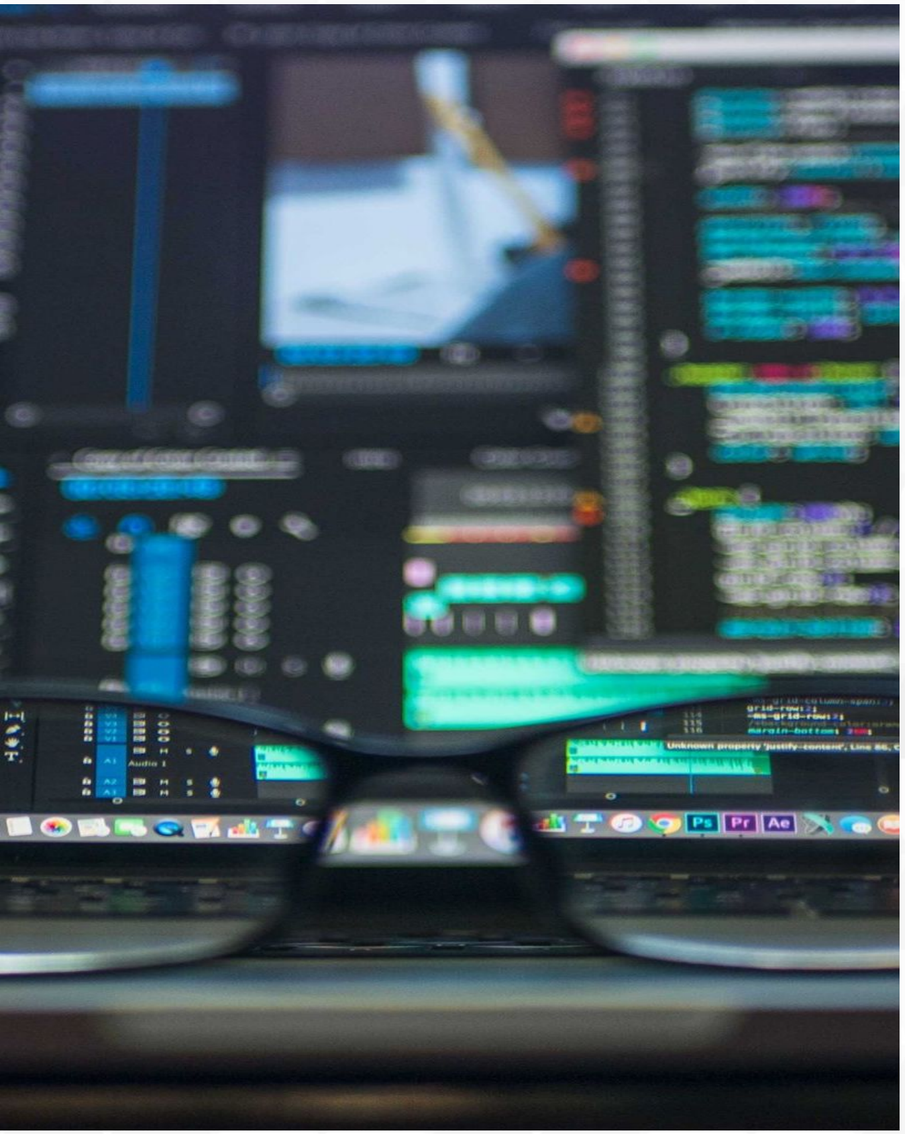


What is Deep Learning?

Recommendation Engine using Machine Learning



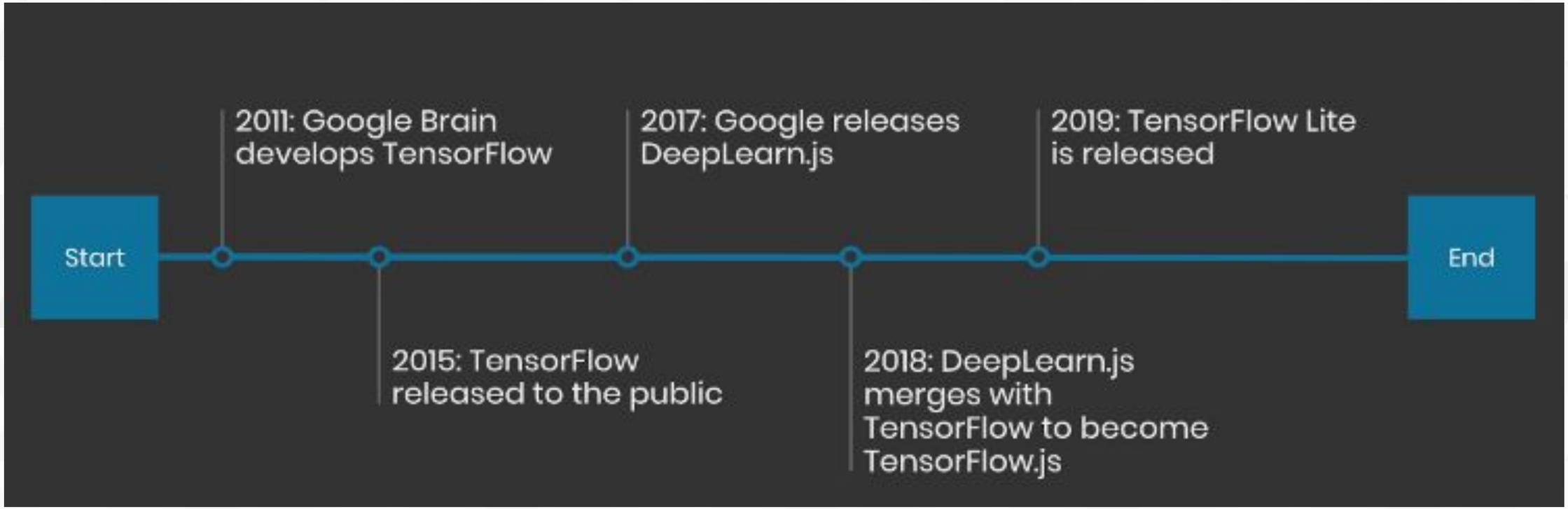
What is TensorFlow.js?



- ★ **Language most used for ML: Python**
  - **High level language very similar to PHP - Pip/Composer**
  - **Dependencies: Numpy, Scipy, Scikit-learn, Pandas, Matplotlib, Keras, TensorFlow, PyTorch**
  - **Jupyter Notebooks/Google Collab: interactive in-browser editor**
  - **Integrated Development Environments - Visual Studio Code, PyCharm, Atom**
- ★ **Other Languages used**
  - **R, Java, C++, Julia and JavaScript**

What is TensorFlow.js?

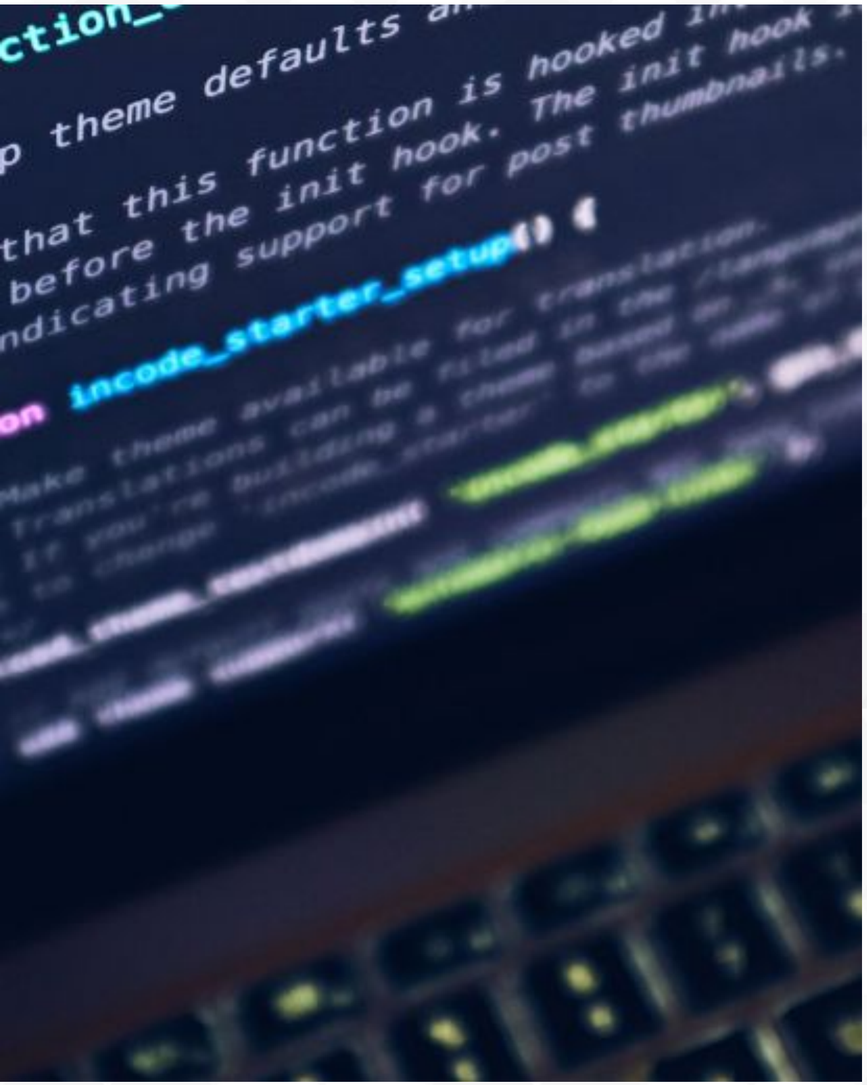
Brief History of TensorFlow.js



Drupal and Machine Learning

- ★ 3 Machine Learning modules:
  - Machine Learning Libraries
  - Drupal Compute
  - Recommender API
- ★ Drupal 7 only
- ★ Allows use of Python or Java code using Drupal queue
- ★ Proprietary Machine Learning functionality
  - Acquia - Personalization

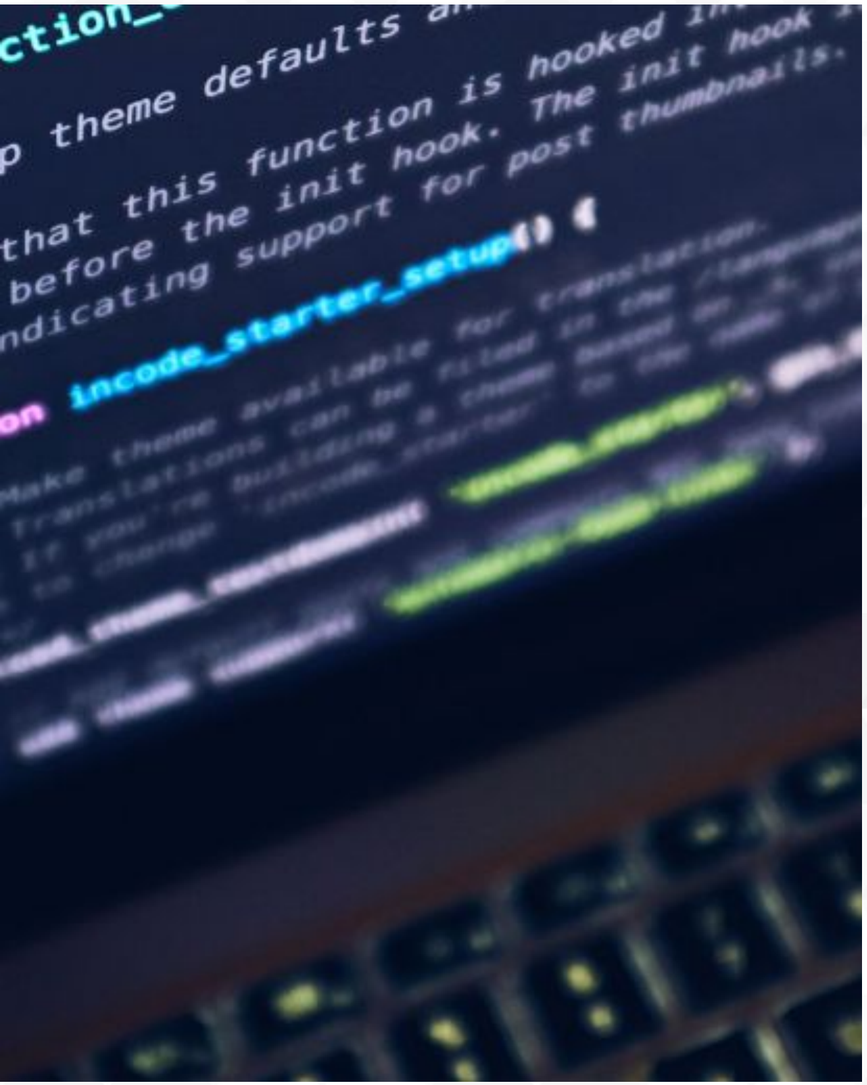
Drupal and Machine Learning



An alternative: Component Module + TensorFlow.js

- ★ Component Module
  - Use JavaScript within a block
  - JavaScript configuration in block config
  - Drupal setup to work with JavaScript
- ★ TensorFlow.js
  - Fully developed JavaScript library
  - Uses WebGL to access GPU for processing
  - TensorFlow Datasets - Collection of datasets
  - TensorFlow Hub - Collection of pre-trained models
  - Models developed in Python can be converted to TensorFlow.js models

Understanding the Component Module



Directory Structure

/web/modules/custom/tensorflow
.../tensorflow/tensorflow.info.yml
.../tensorflow/components
.../tensorflow/components/comp_linear_reg/comp_linear_reg.component.yml
.../tensorflow/components/comp_linear_reg/index.html
.../tensorflow/components/comp_linear_reg/tf_linear_reg.js

Creating Custom Component Module

- ★ Create tensorflow.info.yml file
- ★ Create comp_linear_reg.component.yml
- ★ Create tf_linear_reg.js
- ★ Create index.html

Adding Component Block to Page

- ★ Add TensorFlow.js Linear Regression Block to Content Region
- ★ Configure Block
- ★ Clear Cache

DEMO TIME!

Looking to the Future

- ★ Work on TensorFlow.js Module
- ★ AI Chatbot for Drupal
- ★ Recommender for Drupal Commerce
- ★ Job Recommender

QUESTIONS?

Thank You!

- ★ For all who attended my talk
- ★ Drupal GovCon Organizers and Volunteers
- ★ Matt Ellis Pritchard of Esteemed
- ★ My Colleagues at Esteemed
- ★ And Most of All I Thank God