APACHE:

BIG_DATA

EUROPE

@SoyGema

GEMA PARREÑO PIQUERAS

WHAT IS AN **ARTIFICIAL NEURON**?

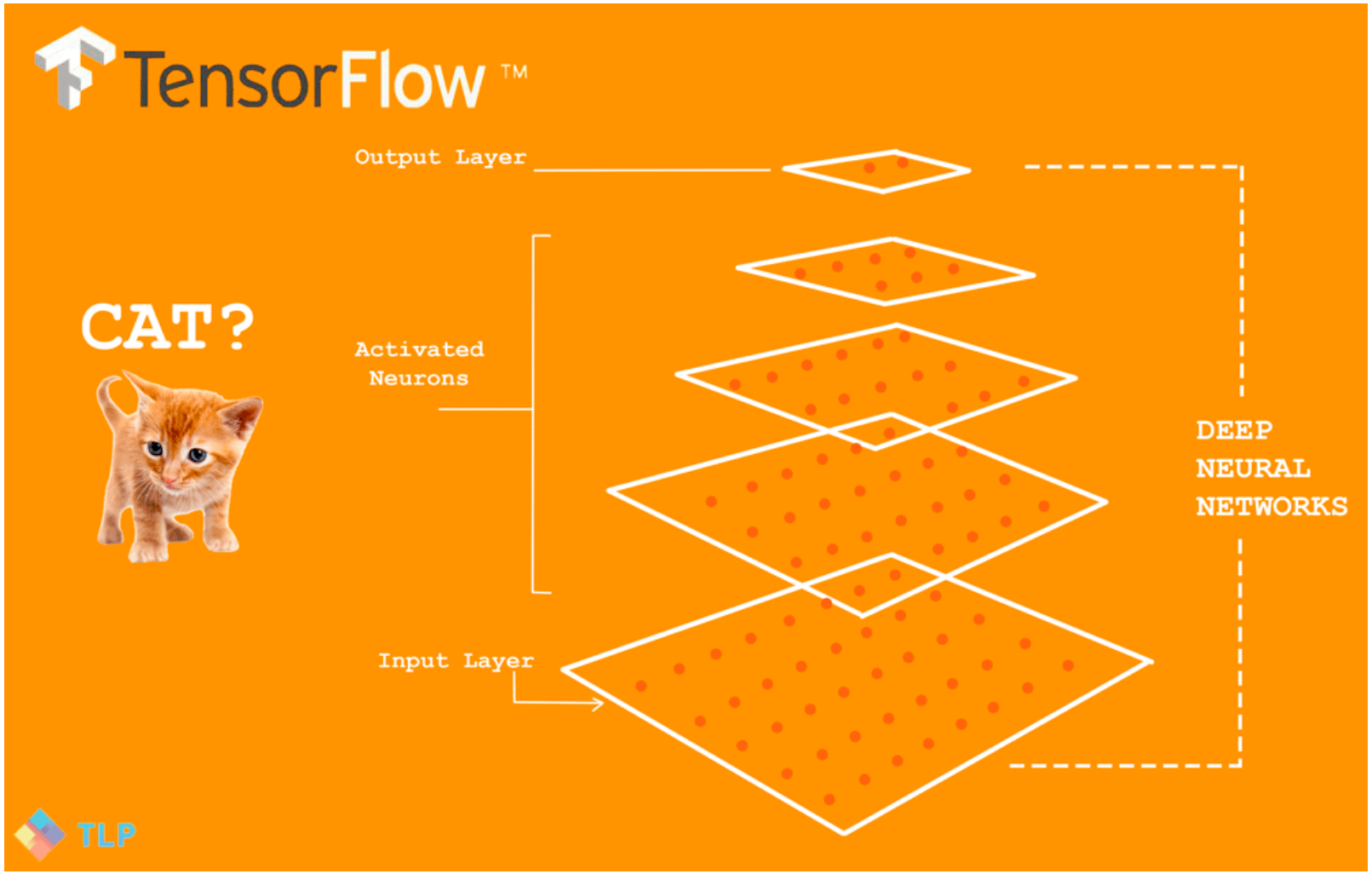


Image Recognition

Classification using Softmax Regressions and Convolutional Neural Networks

Languaje Understanding

Find in SoftMax Regression interesting semantic Relationships

What is Tensor Flow ?

Open Source Python artificial intelligence library using data flow graphs to build models

Helps to **create** a deep neural network architecture

Used in language understanding,image recognition, classification and prediction .

Advantajes about

1.Flexibility of representation. Create any type of data flow graph

2.Performs calculations both on CPU and GPU . Supports for parallel and asynchronous computations

1.Higly Scalable across many machines and huge datasets

3. Comes with many tools helping to build and visualize the data flow networks and neural nets

What is Tensor Flow used for ?

CLASSIFICATION

PERCEPTION

UNDERSTANDING

DISCOVERING

PREDICTION

CREATION

Difference in between **Machine Learning** and **Deep Learning**

CORE : Deep Learning
Can run on multiple CUPs and GPUs
USES : Perceptual and language understanding
NEURAL NETWORKS
MULTILAYERED - HMM

MULTILAYERED CONTEXTS

CORE : Machine Learning
Based on more logical inputs
USES : Perceptual and language understanding
REASONING
NAIVE BAYES

LOGICAL REASONING

CORE : Deep learning generally means building large scale neural networks with many layers

The Main **architecture** of TensorFlow

The Main **architecture** of TensorFlow

TENSORS

Structure of data

VARIABLES

Helps define the structure of the neural net model

GRAPHS

Graphic representation of the computational process

NEURAL NETS

Structure that is built to deal with complex problems

The Main **architecture** of TensorFlow

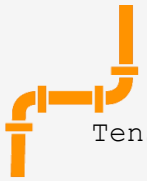
TENSOR

DATA

Tensors :multidimensional and dynamically sized data arrays
TF use a tensor data structure to represent all data

Comparing to matrix it has more dregrees of freedom regarding data selection and slicing.

tf.Tensor class



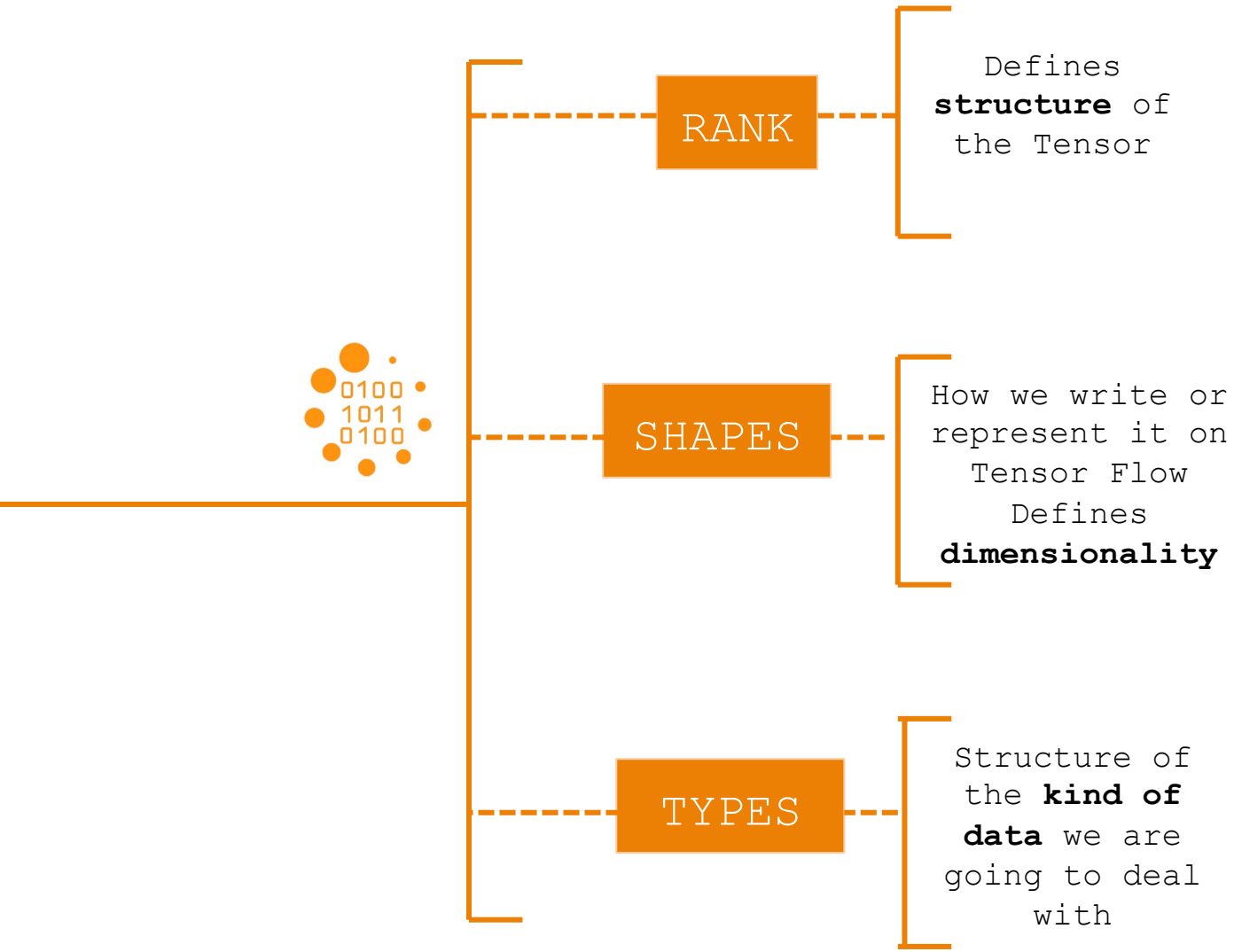
ARCHITECTURE TIP

Tensor is a structure in wich you can add levels of complexity

From Scalar to time!

TENSOR

The Main **architecture** of TensorFlow



The Main **architecture** of TensorFlow **TENSOR**

TENSOR TRANSFORMATIONS

SHAPING

Operations that you can use to determine the shape of a tensor and change the shape of a tensor

tf.reshape(input, name=None)

Reshape a tensor

SLICING & JOINING

Operations to slice or extract parts of a tensor, or join multiple tensors together

Tf.slice(input_, begin, size, name=None)

Extracts a slice of a tensor

The Main **architecture** of TensorFlow

VARIABLES

TRAIN

When you train a model, you use variables to **hold and update parameters .**
Variables contains tensors

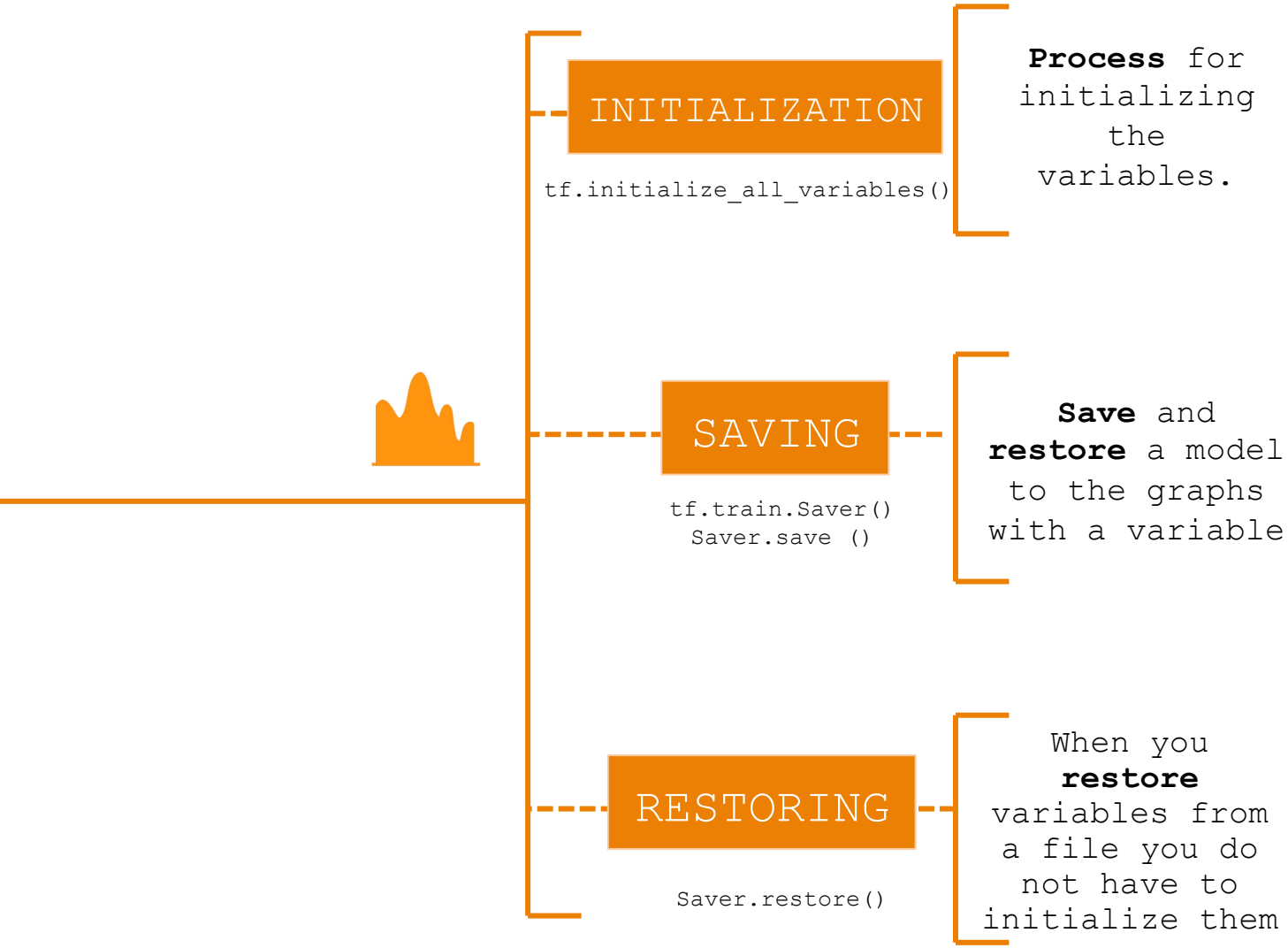
ARCHITECTURE TIP
During the training phase, you might discover a variable useful value.
Weights and biases are variables

Can be shaped and restored.
It has an specific class

tf.Variable class

The Main **architecture** of TensorFlow

VARIABLES



The Main **architecture** of TensorFlow

GRAPHS

KNOWLEDGE REPRESENTATION

Launch de graph starting a session.A session object encapsulates th enviroment in wich Operation objects are exexuted, and Tensor objects are evaluated

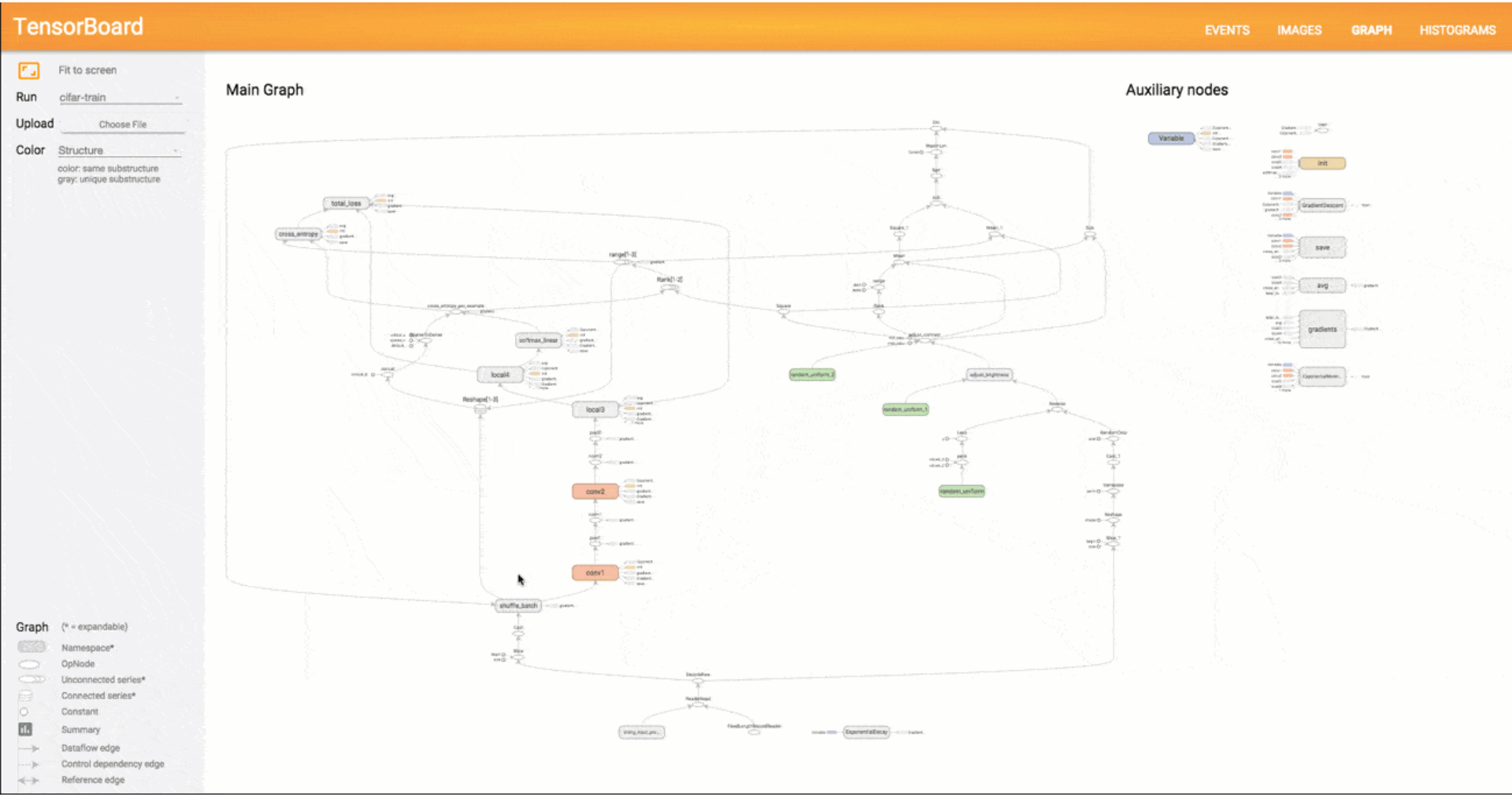
ARCHITECTURE TIP

Graphs are visual construction of the Neural Network : considered knowledge representation

When you run a session it is considered a representation

tf.Graph class

How to best construct a Graph in Tensor Flow ?



Example of of a data flow graph with multiple nodes (data operations). Notice how the execution of nodes is asynchronous. This allows incredible scalability across many machines


Online Resources for TensorFlow

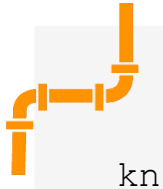

Tips & Tricks for Designing Neural Nets

TIPS & TRICKS FOR DESIGNING NEURAL NETS

ARCHITECTURE TIP
Seize the data . The selection of training data has alredy proven to be key in the learning process

ARCHITECTURE TIP
In the Neural Net, how we structure data will define the tensorflow model construction.

ARCHITECTURE TIP
Think about the learning as a **multilayered process by design**



ARCHITECTURE TIP
In the Neural Net, knowledge hierarchy is key. Think about learning from bottom-top of top-bottom aproach

Courses

Tutorials

The
BRAIN

Social

Books

https://medium.com/
@gema.parreno.piqueras/

DESIGN THE LEARNING PROCESS in the net Input / output and activation function

TENSOR FLOW PLAYGROUND

Iterations 000,599 | Learning rate 0.1 | Activation ReLU | Regularization L2 | Regularization rate 0.001 | Problem type Classification

DATA

Which dataset do you want to use?

Ratio of training to test data: 50%

Noise: 0

Batch size: 10

REGENERATE

INPUT

Which properties do you want to feed in?

6 HIDDEN LAYERS

8 neurons | 8 neurons | 8 neurons | 8 neurons | 8 neurons | 8 neurons

X_1 X_2 X_1^2 X_2^2 X_1X_2 $\sin(X_1)$ $\sin(X_2)$

*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.*

OUTPUT

Test loss 0.005

Training loss 0.012

Colors shows data, neuron and weight values.

-1 0 1

Show test data | Discretize output

CREATE YOUR OWN CLASSIFIER in the net
Input / output and activation function

TENSOR FLOW FOR POETS

Did you find a mistake? Please file a bug.

TensorFlow For Poets

47 min remainir

1. Introduction

TensorFlow is a an open source library for numerical computation, specializing in machine learning applications. In this codelab, you will learn how to install and run TensorFlow on a single machine, and will train a simple classifier to classify images of flowers.

What are we going to be building?

In this lab, we will be using transfer learning, which means we are starting with a model that has been already trained on another problem. We will then be retraining it on a similar problem. Deep learning from scratch can take days, but transfer learning can be done in short order.

We are going to use the Inception v3 network. Inception v3 is a trained for the ImageNet Large Visual Recognition Challenge using the data from 2012, and it can differentiate between 1,000 different classes, like Dalmatian or dishwasher. We will use this same network, but retrain it to tell apart a small number of classes based on our own examples.

What you will learn

- How to install and run TensorFlow Docker images
- How to use Bazel and Python to train an image classifier
- How to classify images with your trained classifier

What you need

- A basic understanding of Unix commands
- A fast computer running OS X or Linux
- A fair amount of time

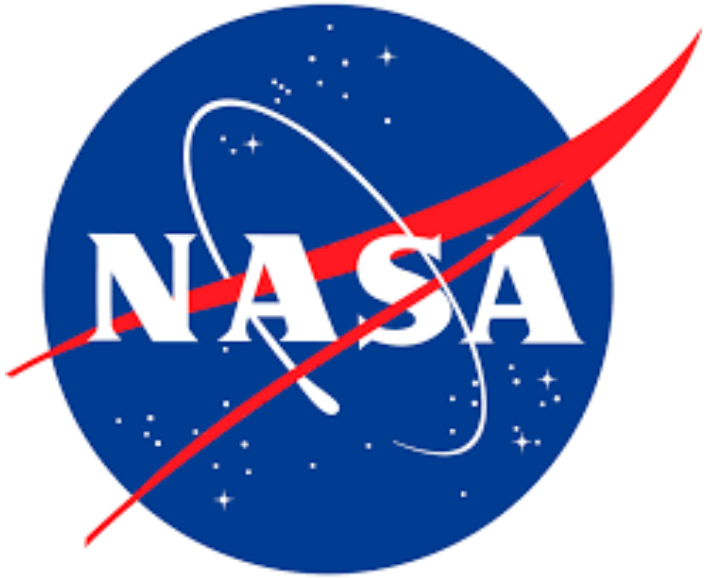
This codelab does not cover Windows. Adventuresome folks have had some success getting the Docker image working on Windows, but it's not currently easy or recommended. Running natively on Windows is not possible because Bazel does not support Windows at this time.

Note: This codelab has quiet periods of downloading and training. During those times, it might be a fun idea to play

Integration in products

NO SILVER BULLETS

Without product expertise …



Nasa Apps Challenge 2016

Near Earth Objects Machine Learning

For this challenge, we invite you to become "virtual contributors" to the Asteroid Grand Challenge and develop a hypothetical method, con...

Advanced

2016 AWARDS & RECOGNITIONS

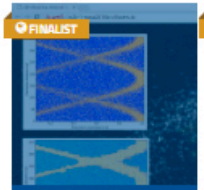
The Space Apps universe produced 1,287 projects this year. Challenge owners, NASA experts and local hosts nominated 128 projects for People's Choice for 2016. Congratulations to our star solvers on their out-of-this-world work!

Global Awards | Global Finalists | People's Choice

EXPLORE THE 2016 GLOBAL FINALIST NOMINEES

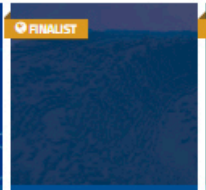
Global nominees represent local winners nominated as the strongest solutions across every challenge category. NASA experts and Challenge Owners narrowed the field from 322 project to 25 Finalists. NASA executives will select the Global Award winners. We'll reveal the champion of each category during the week of May 23rd.

BEST USE OF DATA



Asterion - CYA — Ukraine

Deep Asteroid — Spain

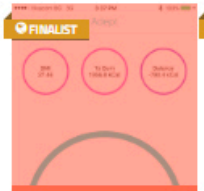


MarCraft — Guatemala

Scintilla — USA

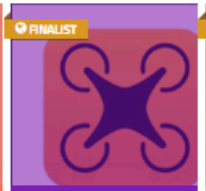
eoNetTambora — Germany

BEST USE OF HARDWARE



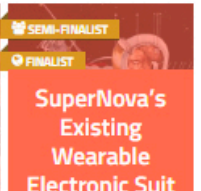
Adept — Bulgaria

Canaria — England



GeoDrone — Argentina

Mars UPV — Spain



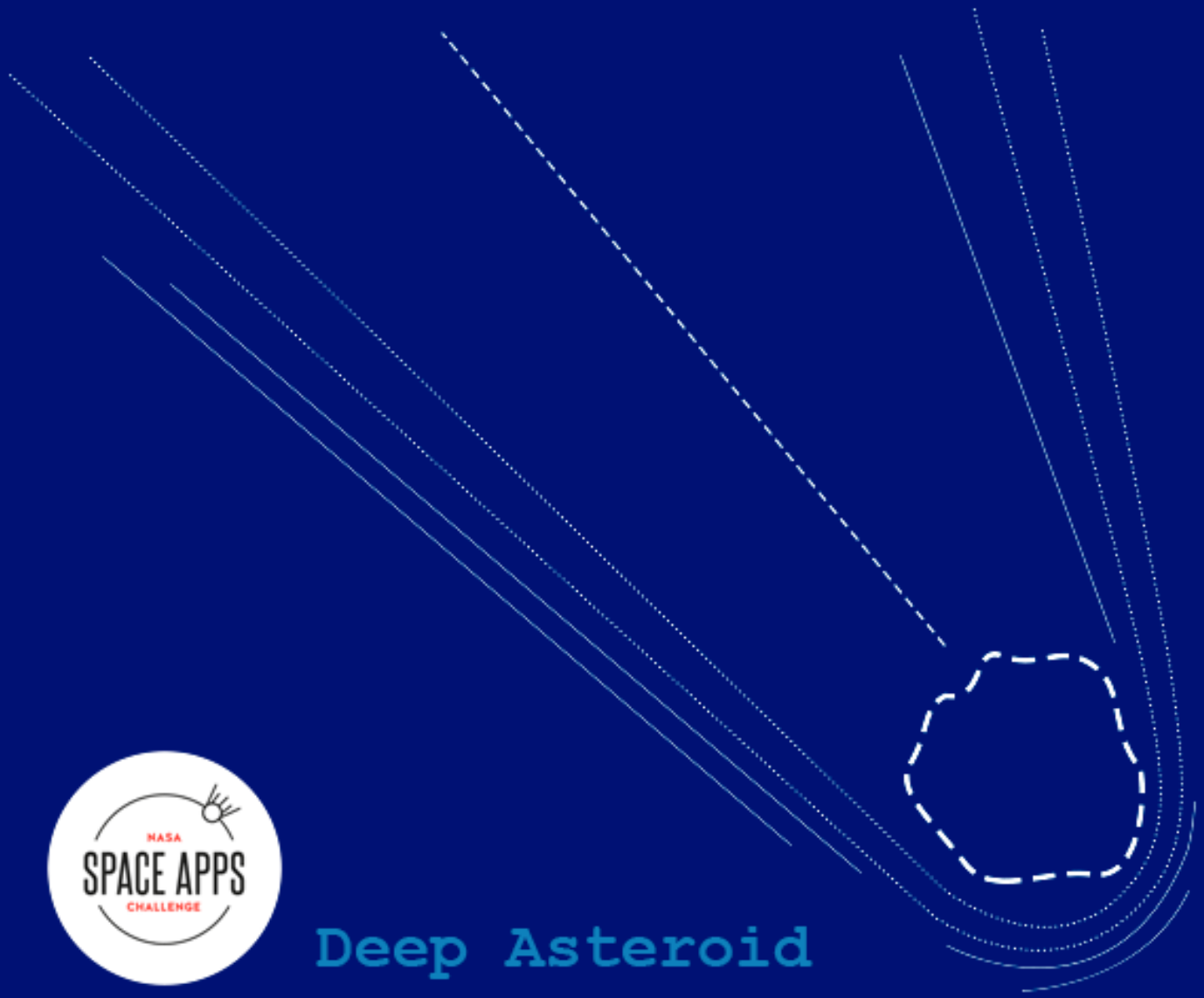
SuperNova's Existing Wearable Electronic Suit (EWES) — France

BEST MISSION CONCEPT

Solar System

We're Out There.

OutThere



NASA SPACE APPS CHALLENGE

Deep Asteroid

Deep Asteroid

Classification & Predictive model using 'TensorFlow'

1 WHO WE ARE

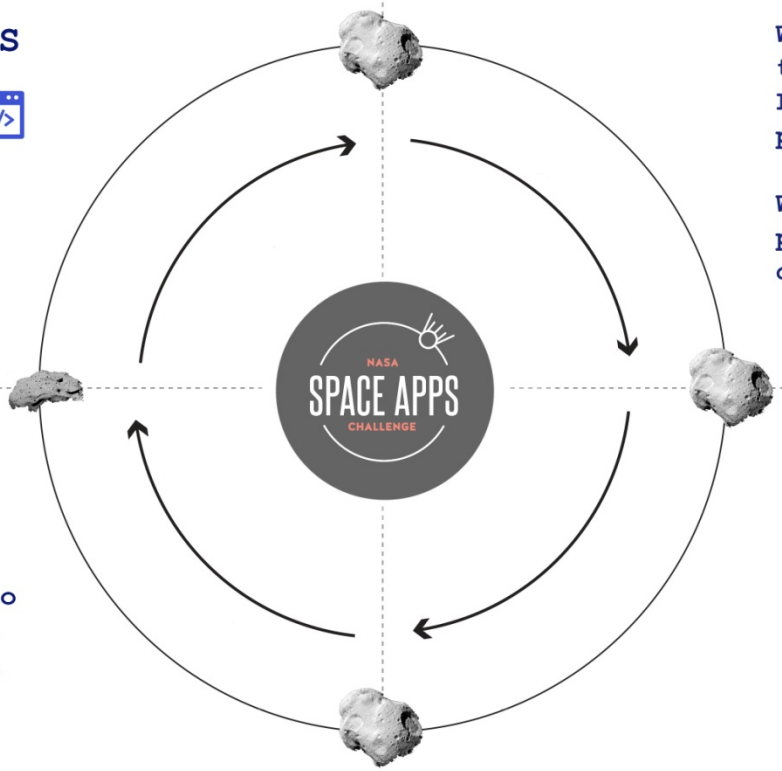
6 TECHNOLOGY GEEKS

4 Sofware developers

1 journalist

1 designer

Near Earth Objects
Machine Learning



2 WHY DO WE DO IT?

We are passionate about the potencial of Machine Learning for solving problems.

We believe in the power of producing knowledge through data!

4 HOW CAN WE DO IT?

We are creating a system to classify and predict NEO's using 'Deep Learning' with 'TensorFlow', an open-source tool.

TensorFlow

3 WHAT ARE WE CREATING?

We are designing a system for orbit classification and object clustering of astroids.

Deep Asteroid

Classification&Predictive model using TensorFlow

PROBLEM

Measuring the odds of possible collision of NEO´s with Earth.

Predict the possible impact of a potential Hazardous Asteroid

Gathering the correct amount of data and different **data sets** for training the **net**.

Designing the architecture for the machine learning model.

NASA SPACE APPS CHALLENGE

SOLUTION

Orbits and composition data about asteroids

Neural Net using images and raw data to predict. Orbit Classification data including Visual data and numerical data associated to visual patterns -orbit and composition-

PHA: Potentially Hazardous Asteroid, brighter than H=22 with a MOID less than 0.05 AU

MOID: Minimum Orbit Intersection Distance, or how close the object and the Earth can come if the timing is just right (or wrong).

Orbit Training Sets

-> List of Aten Minor Planets
-> List of Apollo Minor Planets
-> List of Amor Minor Planets
-> Light Curve Database
-> Wide-field Infrared Survey Explorer
-> Focusing on ATEN and APOLLO Datasets

New Image Dataset

Create a new model of photo caption for NEO´s, using ISS for imge capturing

Deep Asteroid

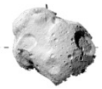
Classification&Predictive model using TensorFlow

WHY DEEP LEARNING?

DEEP LEARNING
is a method- multilayered computational process- that teaches machines to deal with complex problems

MACHINE VISION
is the technology and methods used to provide imaging-based automatic inspection and analysis for such applications as automatic inspection, process control

NEURAL NETS
Artificial Neural Networks are systems that help with predictions



WHY TensorFlow™ ?

MULTIPLE TOOLS Comes with many tools helping to build and visualize the data flow networks

FLEXIBLE We can run the vairables whenever we want

HIGLY SCALABLE across many machines and huge datasets

AUTODIFFERENCIATION
TensorFlow can automatically compute derivatives for you. It is very convenient if you love gradient-based machine learning algorithms

MULTIPLE USE
Used in language understanding,image recognition, classification.

PACKAGED Covered by a single API making the execution very streamlined

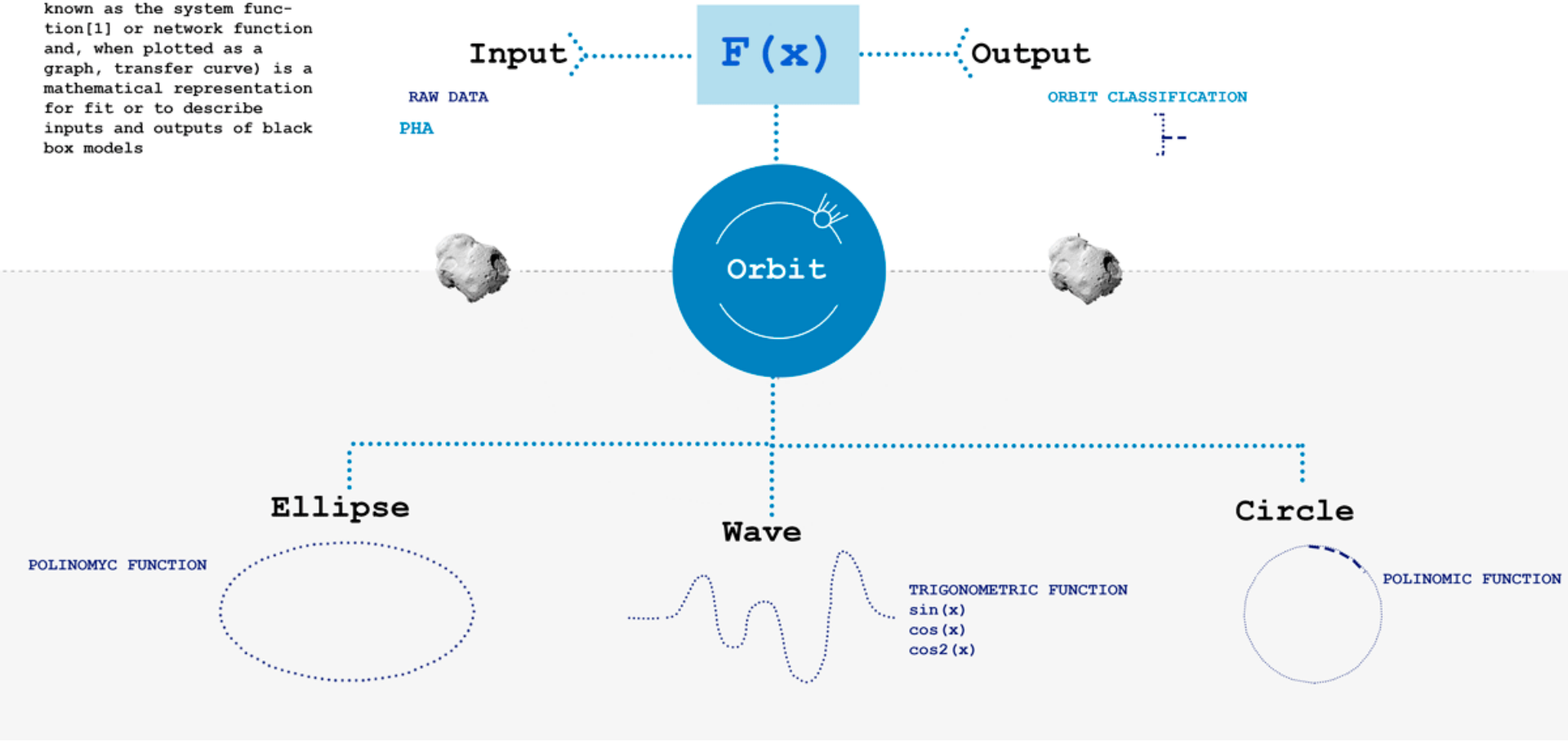
Deep Asteroid

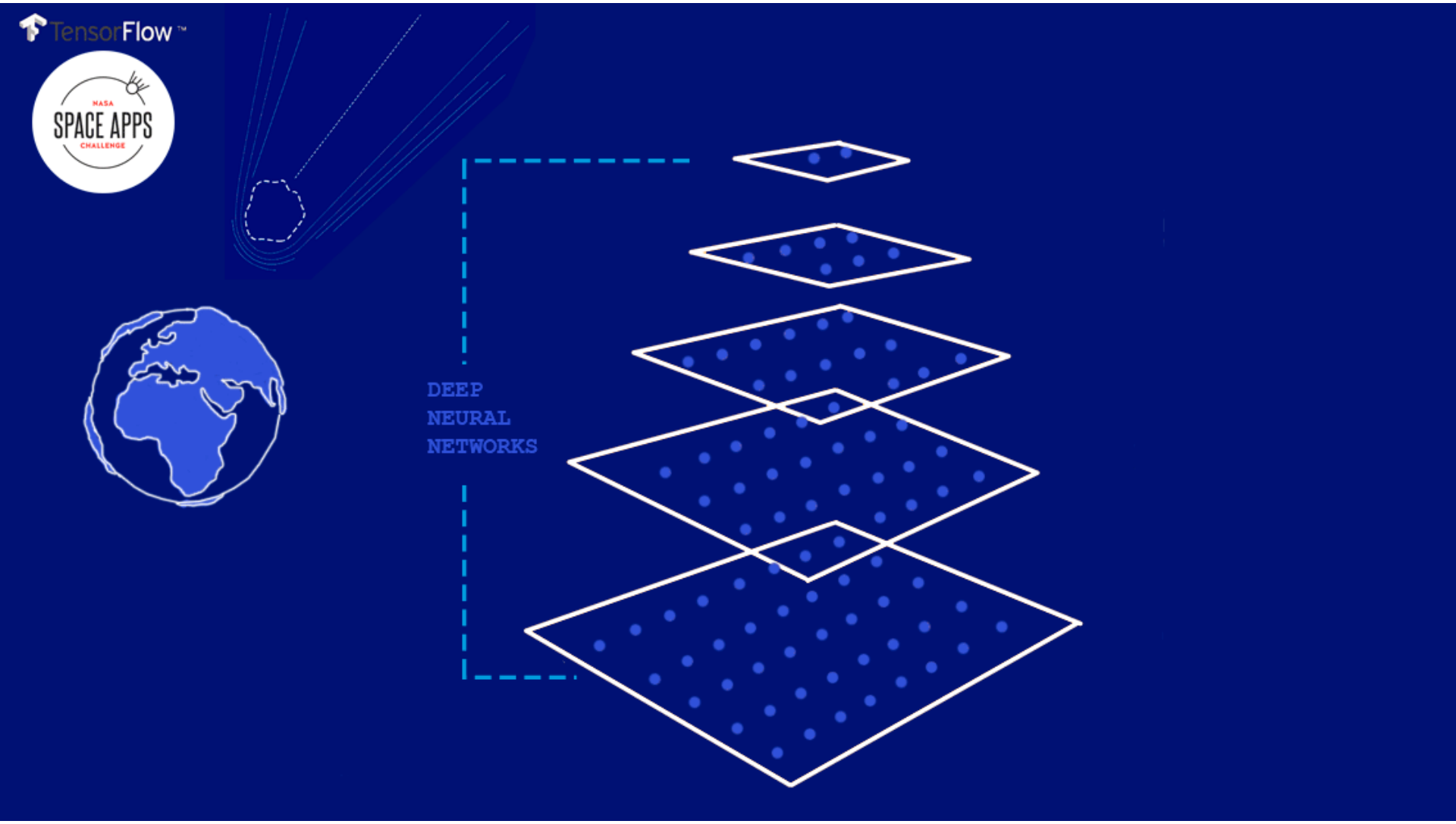
Classification&Predictive model using TensorFlow

F(x)

Transfer function (also known as the system function[1] or network function and, when plotted as a graph, transfer curve) is a mathematical representation for fit or to describe inputs and outputs of black box models

ARTIFICIAL NEURON FOR ORBIT CLASSIFICATION




TensorFlow ™
NASA
SPACE APPS
CHALLENGE
DEEP
NEURAL
NETWORKS

NEURAL NET

Neo´s neural Net design

EXECUTION OF NEO RECOGNIZING PROTOCOL

Execution of the protocol described in "Hazards Due to Comets and Asteroids" Tree decision data pruning process that allows raw data to transform into knowledge

EVALUATION

Execution a Softmax regression with the spectral and physical data about the asteroid, gathering info about the potencial harm the NEO could do.

A **B** **C** **D**

DATASETS

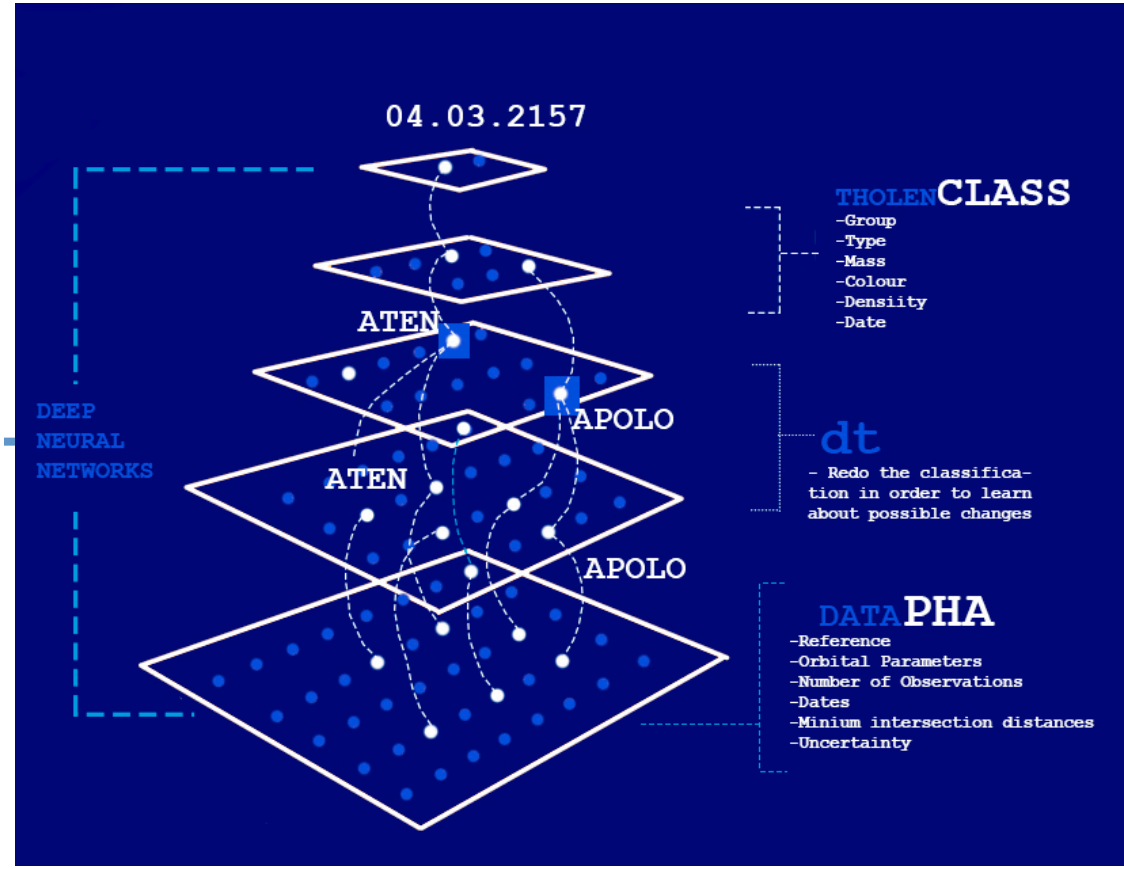
Extract into a CSV the actionable data for training process. Select a balanced dataset for training, including known matched NEO´s.

1st LAYER

Feed the neural net with training data. Create a tensor and including a transfer function that matches the known orbit of the NEO and do classification into the 4 main groups.

Neo´s neural Net design

NEURAL NET

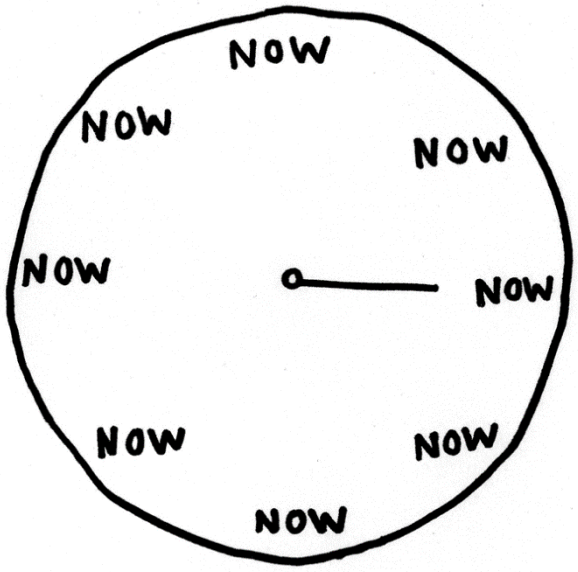


E

Retrain the Neural Network. Sometimes the observation of NEO´s might drive into changes. The software allow us to prune false positives

2nd LAYER

If we **re-train** a neural net over time, are we teaching it to change ?



Top 25 project among all projects worldwide

Global Finalist

Deep Asteroid made it to the Global Award Finals (Top 25)

Opportunity to have a high level of abstraction in design, and learn about how the observation of NEO´s can influence into their classification

Variables can be trained about the uncertainty of the change in orbit classification, offering an advantage against other classification approaches

One of the main key concepts about this is about how time can change classification and how we train a neural net to visualize it.

Thank **you!**

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