



## 09: TensorFlow

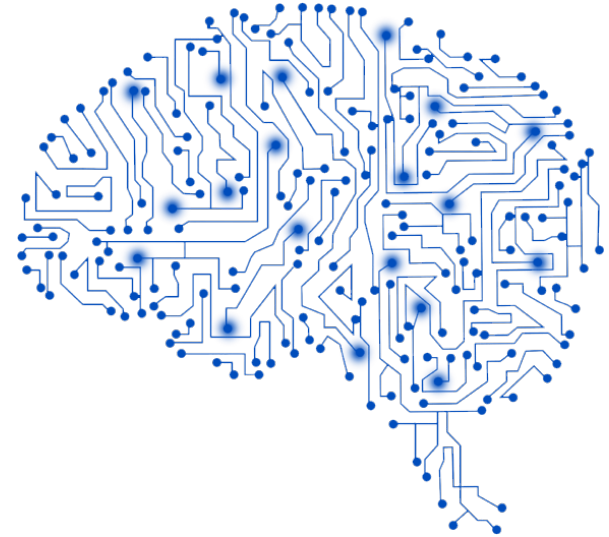
<https://github.com/matthiascoenig/itbtechtalks>

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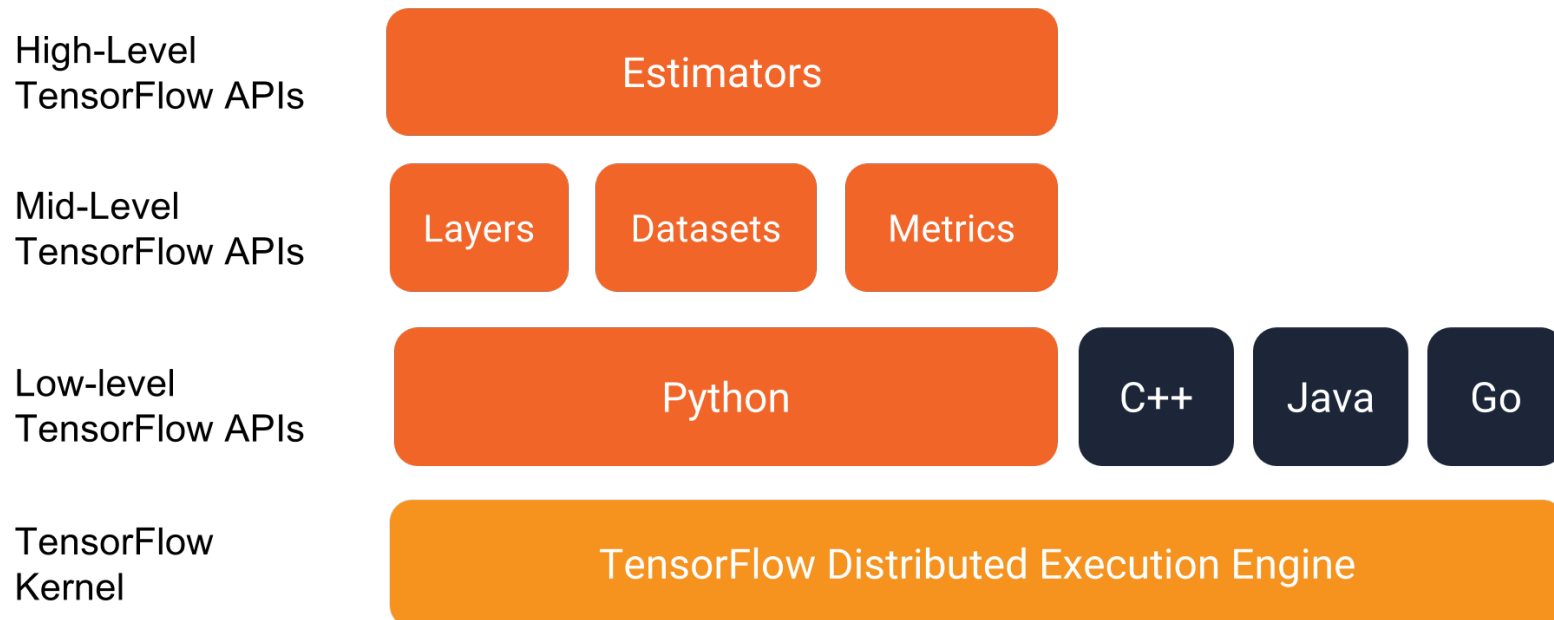
# Supervised machine learning

- **features** are input variables describing your data  $\{x_1, \dots, x_N\}$
- **label** is the true thing we are predicting ( $y$ )
- **example** is a particular instance of data  $\{x_1, \dots, x_N\}$ 
  - **labeled example** has  $(\{x_1, \dots, x_N\}, y)$ 
    - used to train the model
  - **unlabeled example** has  $(\{x_1, \dots, x_N\}, ?)$ 
    - used for making predictions
- **model** maps examples to predicted labels  $y'$ 
  - defined by **internal parameters** which **are learned**
  - **regression** model predicts continuous values
  - **classification** model predicts discrete values





- computational framework for **building machine learning models**
- variety of toolkits allow to construct models at preferred level of abstraction
- Main components:
  - a **graph protocol buffer**
  - a **runtime that executes the (distributed) graph**
- TensorFlow can run the graph on multiple hardware platforms, including CPU, GPU, and TPU.



# Iris classification problem

- classify Iris flowers based on the **length and width** measurements of their **sepals and petals**
- Iris genus entails about 300 species, but we will classify only: *Iris setosa*, *Iris versicolor*, *Iris virginica*



Figure 1. *Iris setosa* (by [Radomil](#), CC BY-SA 3.0), *Iris versicolor*, (by [Dlanglois](#), CC BY-SA 3.0), and *Iris virginica* (by [Frank Mayfield](#), CC BY-SA 2.0).

# Neuronal network

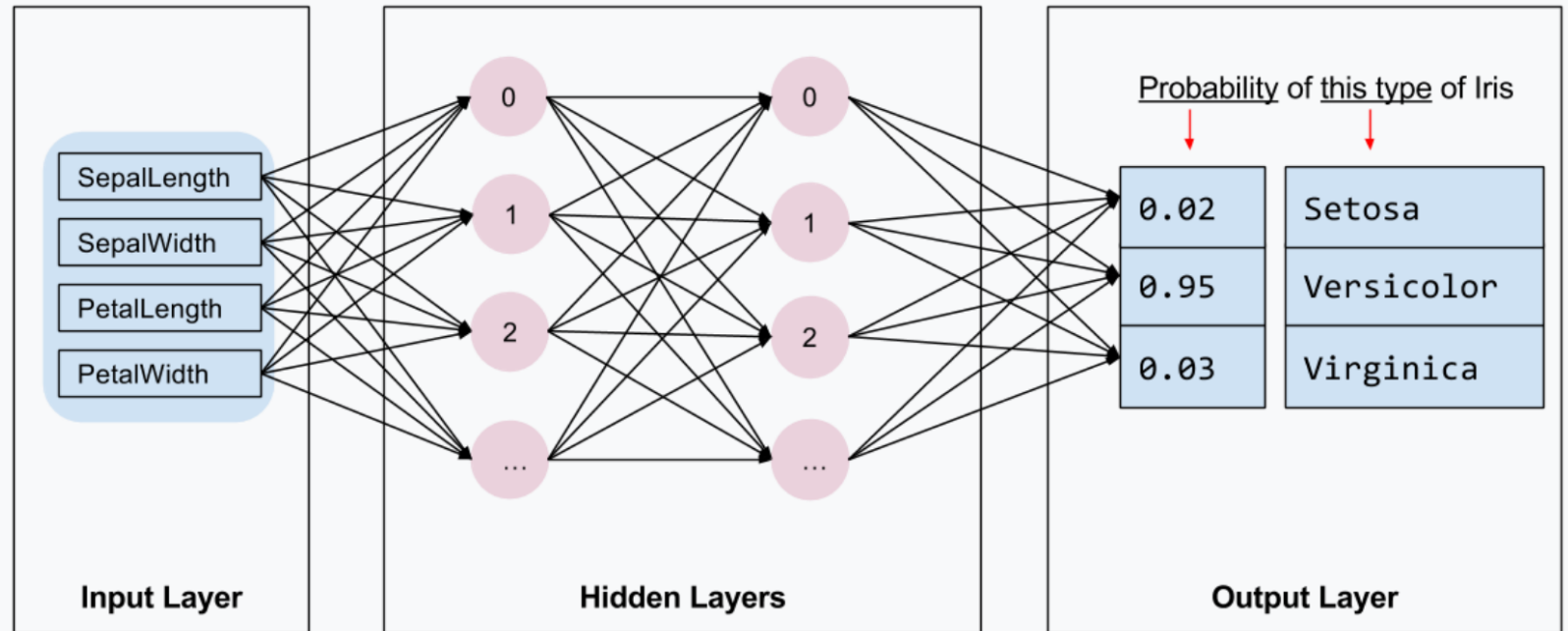
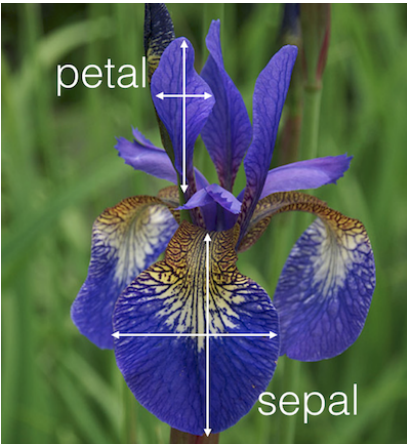


Figure 2. A neural network with features, hidden layers, and predictions.

- set of nodes, analogous to neurons, organized in layers  $\sigma(\mathbf{w} \mathbf{x} + \mathbf{b})$
- set of weights ( $\mathbf{w}$ ) representing the connections between nodes
- set of biases ( $\mathbf{b}$ ), one for each node
- (nonlinear) activation function ( $\sigma$ ) that transforms output of each node

<https://developers.google.com/machine-learning/crash-course/introduction-to-neural-networks/playground-exercises>  
[https://www.tensorflow.org/get\\_started/get\\_started\\_for\\_beginners](https://www.tensorflow.org/get_started/get_started_for_beginners)