Machine Learning

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Sources for Slides

- I have extensively used the machine learning materials that have been prepared by Google.

  `https://developers.google.com/machine-learning/crash-course/`

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Outline

First Steps with Keras/TensorFlow

Toolkit

Keras

Under construction ...

TensorFlow

- TensorFlow is a computational framework for building machine learning models.
- TensorFlow provides a variety of different toolkits that allow you to construct models at your preferred level of abstraction.
- You can use lower-level APIs to build models by defining a series of mathematical operations.
- Alternatively, you can use higher-level APIs (like `tf.estimator`) to specify predefined architectures, such as linear regressors or neural networks.
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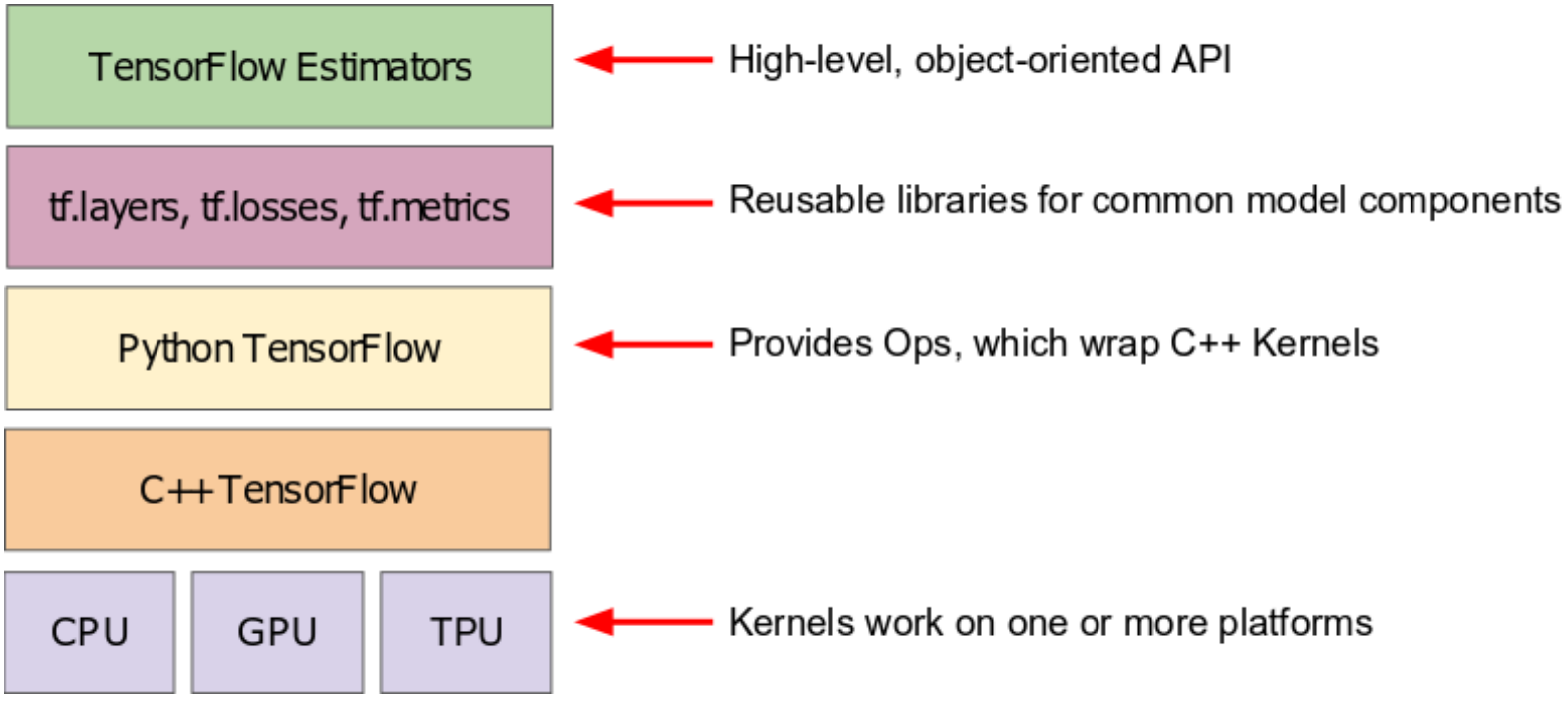
TensorFlow

- The following figure shows the current hierarchy of TensorFlow toolkits:



TensorFlow

- The following table summarizes the purposes of the different layers:

Toolkit(s)	Description
Estimator `tf.estimator`	High-level, OOP API
`tf.layers/tf.losses/ tf.metrics`	Libraries for common model components
TensorFlow	Lower-level APIs

TensorFlow

- TensorFlow consists of the following two components:
  - a graph protocol buffer used to specify the computation as a distributed graph
  - a runtime that executes the distributed graph
- These two components are analogous to
  - Python code and
  - the Python interpreter.
- The Python interpreter is implemented on multiple hardware platforms to run Python code.
- Analogously, TensorFlow is implemented on multiple hardware platforms, including CPU, GPU, and TPU (Tensor Processing Unit), to run the graph.

`https://en.wikipedia.org/wiki/Tensor_processing_unit`

TensorFlow

- In TensorFlow, the computation is specified as a distributed graph.
- Nodes in the graph represent operations.
- Edges are directed and represent passing the result of an operation (a tensor) as an operand to another operation.
- Tensors are the primary data structure in TensorFlow programs. They are N-dimensional (where N could be very large) data structures, most commonly scalars, vectors, or matrices.
- TensorBoard is used to visualize a computational graph.

TensorFlow

- Which API(s) should you use? You should use the highest level of abstraction that solves the problem.
- The higher levels of abstraction are easier to use, but are also (by design) less flexible.
- We recommend you start with the highest-level API first and get everything working.
- If you need additional flexibility for some special modeling concerns, move one level lower.
- Note that each level is built using the APIs in lower levels, so dropping down the hierarchy should be reasonably straightforward.

Key Terms

- estimators
- graph
- tensor