Deep Learning Computation

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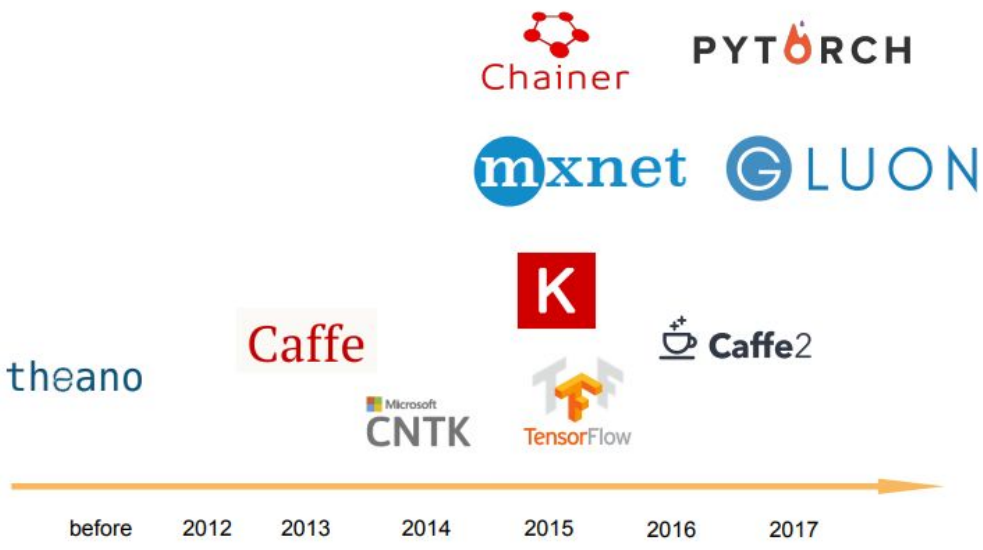
Outline

- DL Frameworks
- Tensorflow vs PyTorch
- PyTorch DL Tutorial
- Tensorflow DL Tutorial
- Homeworks

DL Frameworks



	Languages	Tutorials and training materials	CNN modeling capability	RNN modeling capability	Architecture: easy-to-use and modular front end	Speed	Multiple GPU support	Keras compatible
Theano	Python, C++	++	++	++	+	++	+	+
Tensor-Flow	Python	+++	+++	++	+++	++	++	+
Torch	Lua, Python (new)	+	+++	++	++	+++	++	
Caffe	C++	+	++		+	+	+	
MXNet	R, Python, Julia, Scala	++	++	+	++	++	+++	
Neon	Python	+	++	+	+	++	+	
CNTK	C++	+	+	+++	+	++	+	

Tensorflow vs PyTorch

Tensorflow

Implement Adam

```
# m_t = beta1 * m + (1 - beta1) * g_t
m = self.get_slot(var, "m")
m_scaled_g_values = grad.values * (1 - beta1_t)
m_t = state_ops.assign(m, m * beta1_t,
                       use_locking=self._use_locking)
m_t = state_ops.scatter_add(m_t, grad.indices, m_scaled_g_values,
                            use_locking=self._use_locking)
```

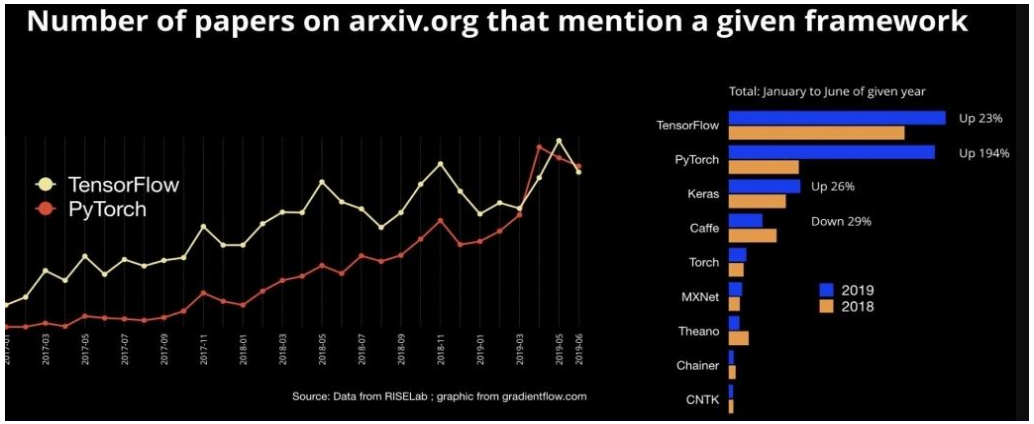
- A domain specific language (DSL) for Python
- A rich set of operators
- Rich features
- Codes are not very easy to read

Pytorch

```
class Net(nn.Module):
    def __init__(self, input_size, hidden_size, num_classes):
        super(Net, self).__init__()
        self.fc1 = nn.Linear(input_size, hidden_size)
        self.relu = nn.ReLU()
        self.fc2 = nn.Linear(hidden_size, num_classes)

    def forward(self, x):
        out = self.fc1(x)
        out = self.relu(out)
        out = self.fc2(out)
        return out
```

- Torch tensors + chainer neural networks
- Easy to develop and debug
- Less convenient to deploy

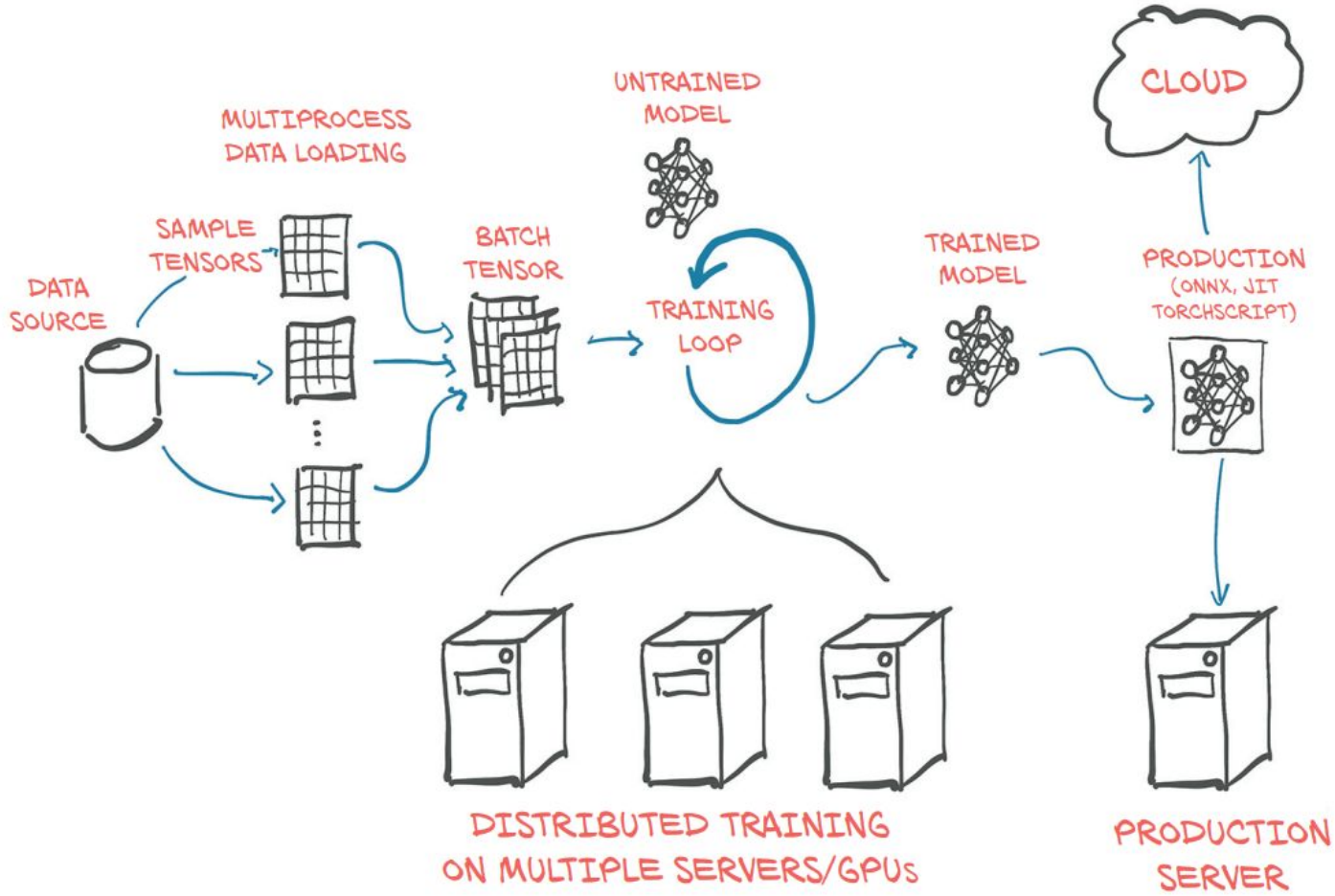


	Keras	TensorFlow	PyTorch
Level of API	high-level API[1]	Both high & low level APIs	Lower-level API[2]
Speed	Slow	High	High
Architecture	Simple, more readable and concise	Not very easy to use	Complex[3]
Debugging	No need to debug	Difficult to debugging	Good debugging capabilities
Dataset Compatibility	Slow & Small	Fast speed & large	Fast speed & large datasets
Popularity Rank	1	2	3
Uniqueness	Multiple back-end support	Object Detection Functionality	Flexibility & Short Training Duration
Created By	Not a library on its own	Created by Google	Created by Facebook[4]
Ease of use	User-friendly	Incomprehensive API	Integrated with Python language
Computational graphs used	Static graphs	Static graphs	Dynamic computation graphs[5]

Development Lifecycle

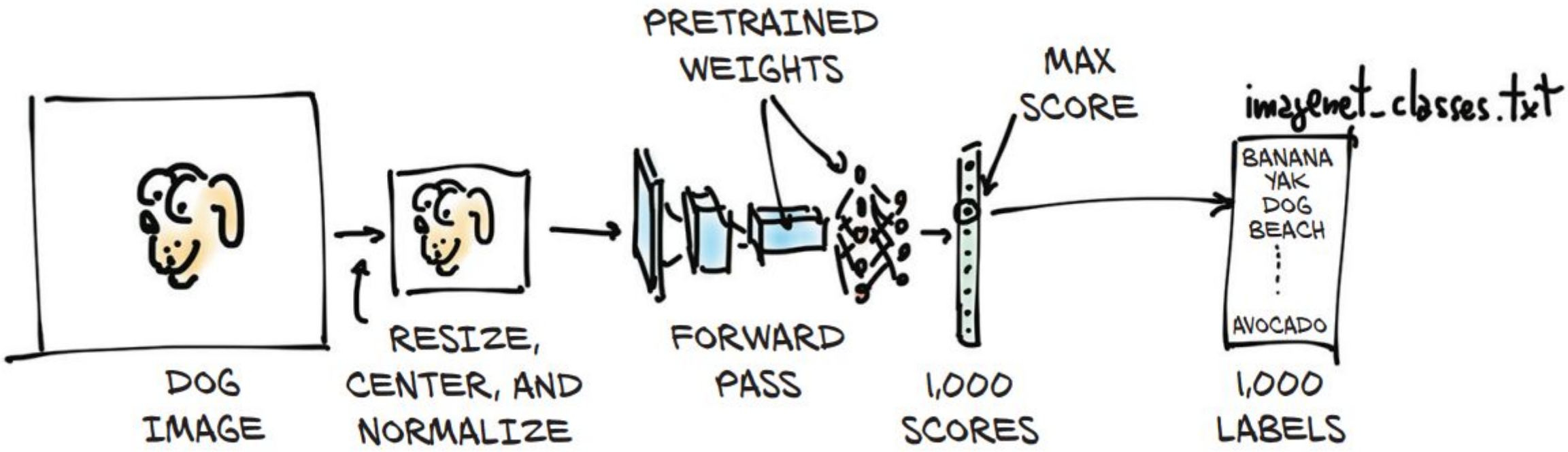
Free eBooks

- https://pytorch.org/assets/deep-learning/Deep-Learning-with-PyTorch.pdf



Development Lifecycle

https://pytorch.org/assets/deep-learning/Deep-Learning-with-PyTorch.pdf



Its About Tensor Processing

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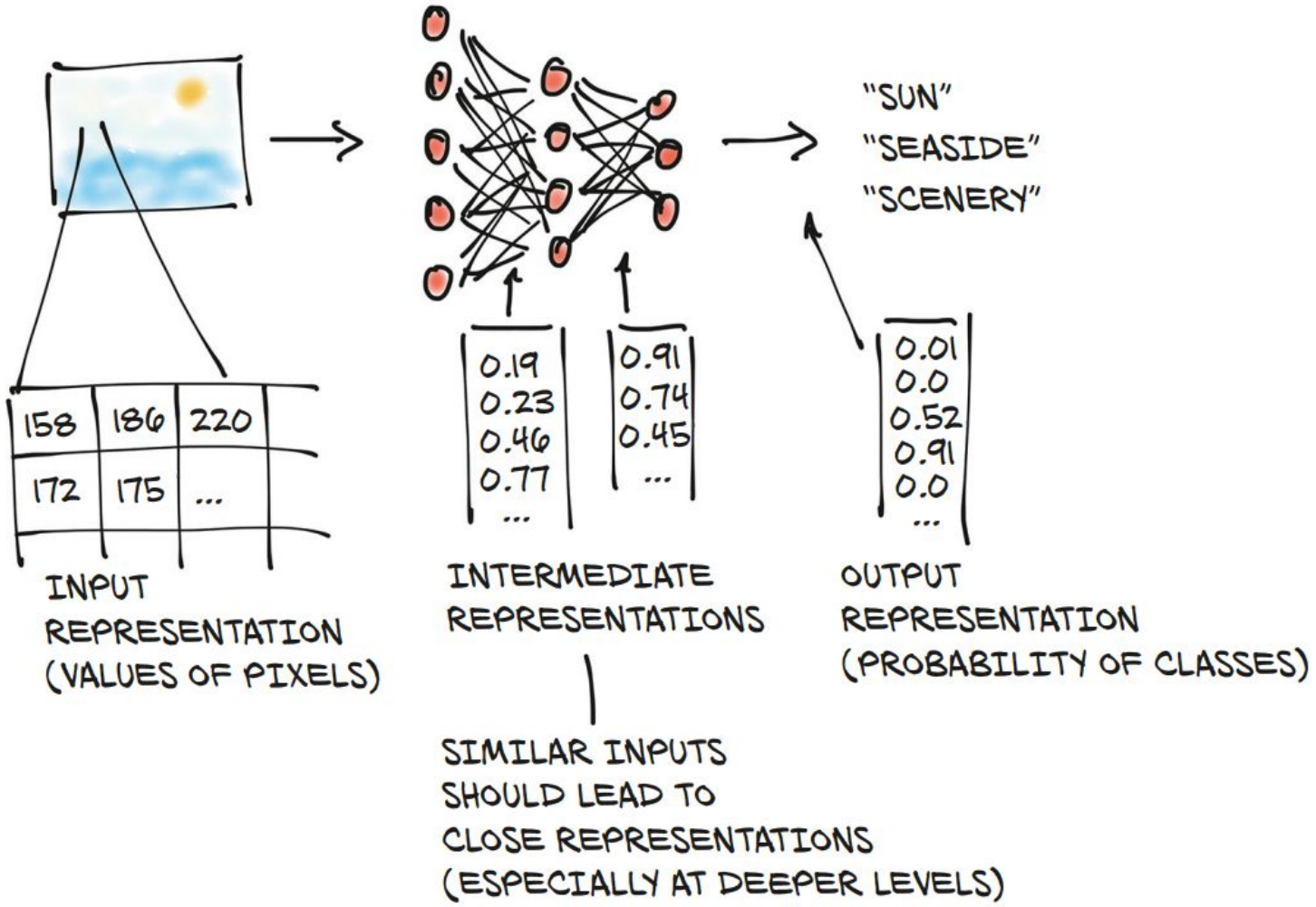
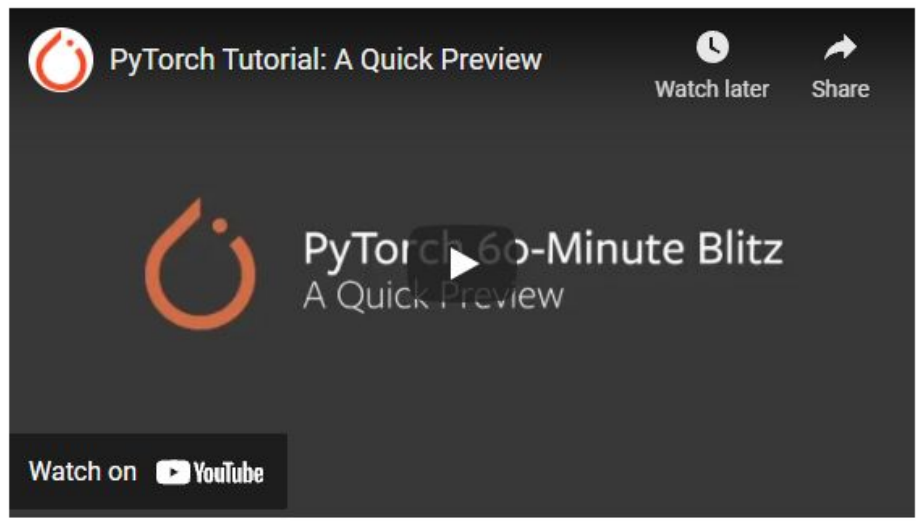


DEEP LEARNING WITH PYTORCH: A 60 MINUTE BLITZ

Author: Soumith Chintala



What is PyTorch?

PyTorch is a Python-based scientific computing package serving two broad purposes:

- A replacement for NumPy to use the power of GPUs and other accelerators.
- An automatic differentiation library that is useful to implement neural networks.

Home Work

- PyTorch Tutorial
- How to Visualize Training with TensorBoard