Deep Learning for Business

Deep Learning Computing Systems & Software

Prof. Jong-Moon Chung

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Deep Learning Open Source Software

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Deep Learning Open Source Software

Software	Creator	Software License	Open Source	Platform	Written in	Interface	OpenMP Support	OpenCL Support
Tensor Flow 	Google Brain Team	Apache 2.0	Yes	Linux, Mac OS X, Windows	C++, Python	Python, C/C++, Java, Go	No	On roadmap
	TensorFlow enables scalable ML computation using data flow graphs							
CNTK 	Microsoft Research	MIT license	Yes	Windows, Linux (OS X via Docker on roadmap)	C++	Python, C++, Command line, BrainScript (.NET on roadmap)	Yes	No
	CNTK (Cognitive Toolkit) open source DL (Deep Learning) software toolkit							

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Software	Creator	Software License	Open Source	Platform	Written in	Interface	OpenMP Support	OpenCL Support
Keras 	François Chollet	MIT license	Yes	Linux, Mac OS X, Windows	Python	Python	Only if using Theano as backend	Under development
	Keras is a Python based DL (Deep Learning) library to support CNN and RNN programming to run on TensorFlow or Theano							
Caffe Caffe	Berkeley Vision and Learning Center	BSD license	Yes	Linux, Mac OS X, Windows	C++	Python, MATLAB	Yes	Under development
	Caffe is a fast open framework for DL (Deep Learning) program development							

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Theano	Université de Montréal	BSD license	Yes	Cross-platform	Python	Python	Yes	Under development
	Theano is a Python library that enables efficient programming (define, optimize, and evaluate) of mathematical expressions involving multi-dimensional arrays (can be processed on GPUs) and can perform efficient symbolic differentiation							

Deep Learning Software References

- Comparison of deep learning software [Online]. Available: https://en.m.wikipedia.org/wiki/Comparison_of_deep_learning_software
- Wikipedia, www.wikipedia.org

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Google TensorFlow

Google TensorFlow

TensorFlow

- Open source ML (Machine Learning) software library
- Developed by the Google Brain Team

- Programmed in Python or C++
- Computation deployment to multiple TPUs, CPUs, GPUs is possible

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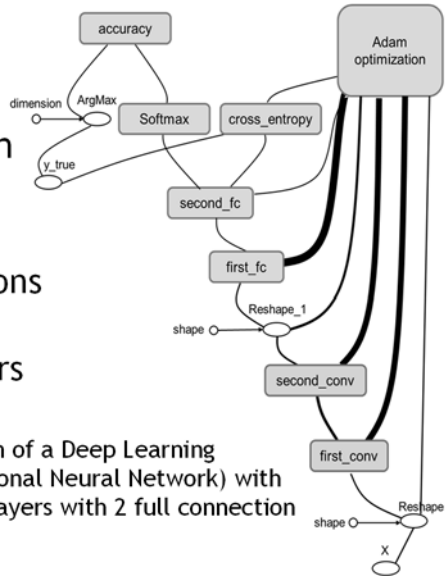
Google TensorFlow

TensorFlow

- Data flow graph based numerical computation
  - Nodes represent mathematical operations
  - Edges represent tensors

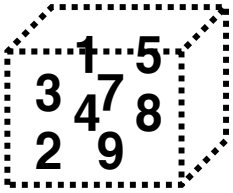


Data flow graph of a Deep Learning CNN (Convolutional Neural Network) with 2 Convolution layers with 2 full connection

Google TensorFlow

Tensor *definition*

- Geometric vector
  - Describes geometric relations
- Organized multidimensional array of data values



- Used in *Physics* and *Engineering* in modeling
  - Elasticity, fluid mechanics, general relativity, etc.

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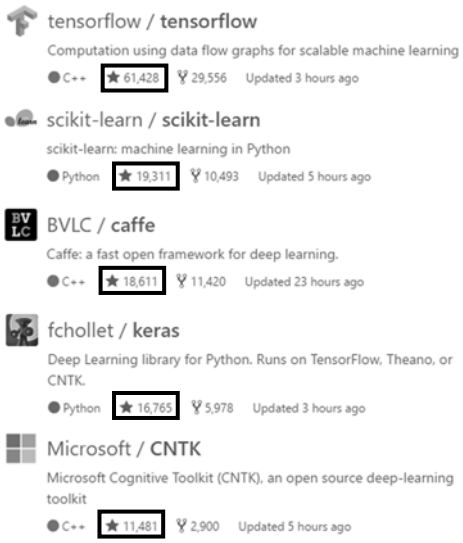
Google TensorFlow

TensorFlow is the most popular machine learning language in **GitHub**

Tensorflow has earned the most stars in GitHub (June 2017)

Reference :
https://github.com/showcases/machine-learning?s=stars



Google TensorFlow

TensorFlow v0.5.0

- Released in November 9, 2015
- Initial release of Tensorflow

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Google TensorFlow

TensorFlow v0.6.0

- Released in December 2015
- Improvements to GPU performance and memory usage
- Performance improvements due to using 32-bit indices and faster shuffling kernels
- Support for Python 3.3+

Google TensorFlow

TensorFlow v0.7.0

- Released in February 2016
- Support for Nvidia CUDA (7.0 or higher) and cuDNN (R2 or higher)
  - CUDA: Compute Unified Device Architecture
  - cuDNN: CUDA Deep Neural Network library
- Support for contrib/ directory
  - Enables processing of unsupported or experimental features, and higher level layers modules
- Support for MetaGraphDef
  - Enables easier saving of graphs with metadata

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Google TensorFlow

TensorFlow v0.8.0

- Released in April 2016
- Support for TensorBoard displays of metadata stats
- Improved linear optimizer
  - Added in contrib/linear_optimizer
- Support for adding a network file system

Google TensorFlow

TensorFlow v0.9.0

- Released in June 2016
- Support for Python 3.5 and iOS
- Support for GPU on Mac OS processing
- Support for makefile
  - For better cross-platform build, C API only

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Google TensorFlow

TensorFlow v0.10.0

- Released in July 2016
- Graph-construction C API added
- Support for C++ shape inference added
- Support for makefile build for iOS added

Google TensorFlow

TensorFlow v0.11.0

- Released in October 2016
- Support for HDFS added
  - HDFS: Hadoop Distributed File System
- Support for Fused LSTM via cuDNN 5
  - LSTM: Long Short-Term Memory (DL RNN)
  - Added in tensorflow/contrib/cudnn_rnn
- Support for cuDNN 5 added

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Google TensorFlow

TensorFlow v0.12.0

- Released in November 2016
- Support for Microsoft Windows
  (Python, C++, CUDA 8.0, cuDNN 5.1)
- New library for matrix-free (iterative) solvers
  for linear equations, linear least-squares,
  eigenvalues, and singular values added
  - Added in tensorflow/contrib/solvers
- Solver for ordinary differential equations added

Google TensorFlow

TensorFlow v1.0.0

- Released in January 2017
- Added new Python 3 docker images

TensorFlow v1.1.0

- Released in March, 2017
- Support of Java APIs for Windows
- TensorFlow Spectral module (tf.spectral) added
  - Includes 1D, 2D, and 3D real signal
    Fourier transform module

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TensorFlow v1.2.0

- Released in May 2017
- Support for Python 3.6 on Windows
- C library for Windows added
- Function to create dynamic TensorFlow clusters added

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Google TensorFlow

References

References

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- TensorFlow [Online]. Available: https://www.tensorflow.org/
- Tensorflow – GitHub [Online]. Available: https://github.com/tensorflow
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