Title: PyTorch

URL: https://en.wikipedia.org/wiki/PyTorch

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Categories: Category:Deep learning software, Category:Facebook software, Category:Free science software, Category:Free software programmed in C, Category:Free software programmed in Python, Category:Open-source artificial intelligence, Category:Python (programming language) scientific libraries, Category:Software using the BSD license

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Bayes net

Conditional random field

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RANSAC

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Local outlier factor

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Recurrent neural network LSTM GRU ESN reservoir computing

LSTM

GRU

ESN

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Diffusion model

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U-Net

LeNet

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Neural radiance field

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List of datasets for machine-learning research List of datasets in computer vision and image processing

List of datasets in computer vision and image processing

Outline of machine learning

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PyTorch is an open-source machine learning library based on the Torch library, [4] [5] [6] used for applications such as computer vision , deep learning research [7] and natural language processing , [7] originally developed by Meta AI and now part of the Linux Foundation umbrella. [8] [9] [10] [11] It is one of the most popular deep learning frameworks, alongside others such as TensorFlow , [12] offering free and open-source software released under the modified BSD license . Although the Python interface is more polished and the primary focus of development, PyTorch also has a C++ interface. [13]

PyTorch utilises tensors as a intrinsic datatype, very similar to NumPy . Model training is handled by an automatic differentiation system, Autograd, which constructs a directed acyclic graph of a forward pass of a model for a given input, for which automatic differentiation utilising the chain rule , computes model-wide gradients. [14] PyTorch is capable of transparent leveraging of SIMD units, such as GPGPUs .

A number of commercial deep learning architectures are built on top of PyTorch, including Tesla Autopilot , [15] Uber 's Pyro, [16] Hugging Face 's Transformers, [17] [18] and Catalyst. [19] [20]

History

In 2001, Torch was written and released under a GPL license . It was a machine-learning library written in C++, supporting methods including neural networks, support vector machines (SVM), hidden Markov models , etc. [21] [22] [23] It was improved to Torch7 in 2012. [24] Development on Torch ceased in 2018 and was subsumed by the PyTorch project. [25]

Meta (formerly known as Facebook) operates both PyTorch and Convolutional Architecture for Fast Feature Embedding (Caffe2), but models defined by the two frameworks were mutually incompatible. The Open Neural Network Exchange (ONNX) project was created by Meta and Microsoft in September 2017 for converting models between frameworks. Caffe2 was merged into PyTorch at the end of March 2018. [26] In September 2022, Meta announced that PyTorch would be governed by the independent PyTorch Foundation, a newly created subsidiary of the Linux Foundation . [27]

PyTorch 2.0 was released on 15 March 2023, introducing TorchDynamo , a Python-level compiler that makes code run up to 2x faster, along with significant improvements in training and inference performance across major cloud platforms . [28] [29]

PyTorch tensors

PyTorch defines a class called Tensor (torch.Tensor) to store and operate on homogeneous multidimensional rectangular arrays of numbers. PyTorch Tensors are similar to NumPy Arrays, but can also be operated on by a CUDA -capable NVIDIA GPU . PyTorch has also been developing support for other GPU platforms, for example, AMD's ROCm [30] and Apple's Metal Framework. [31]

PyTorch supports various sub-types of Tensors. [32]

Note that the term "tensor" here does not carry the same meaning as tensor in mathematics or physics. The meaning of the word in machine learning is only superficially related to its original meaning as a certain kind of object in linear algebra . Tensors in PyTorch are simply multi-dimensional arrays.

PyTorch neural networks

PyTorch defines a module called nn (torch.nn) to describe neural networks and to support training. This module offers a comprehensive collection of building blocks for neural networks, including various layers and activation functions, enabling the construction of complex models. Networks are built by inheriting from the torch.nn module and defining the sequence of operations in the forward() function.

Example

The following program shows the low-level functionality of the library with a simple example.

The following code-block defines a neural network with linear layers using the nn module.

See also

Free and open-source software portal

Comparison of deep learning software

Differentiable programming

DeepSpeed

References

External links

Official website

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Comparison

Apache MXNet

Apache SINGA

Caffe

Deeplearning4j

DeepSpeed

Dlib

Keras

Microsoft Cognitive Toolkit

ML.NET

OpenNN

PyTorch

TensorFlow

Theano

Torch

ONNX

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Apple Core ML

IBM Watson

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Information geometry

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Inductive bias

IPU

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