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Deep Learning & Accelerated Calculation with Debian

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Debian Deep Learning Team

Deep Learning

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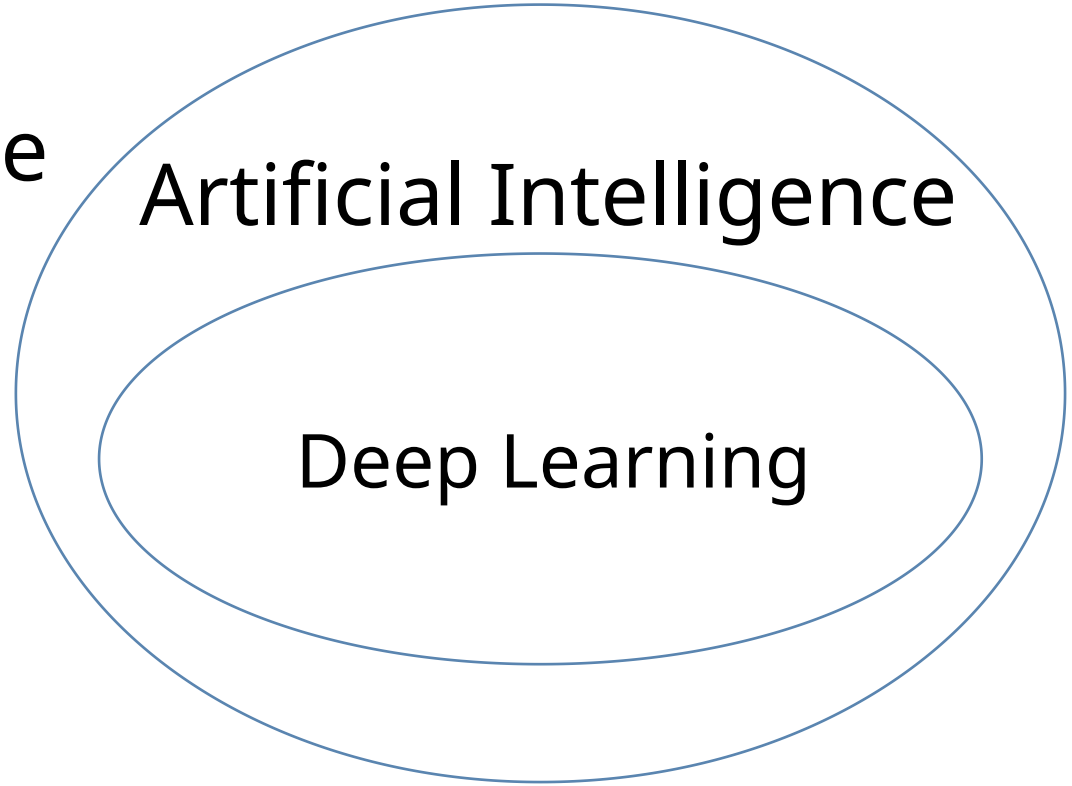
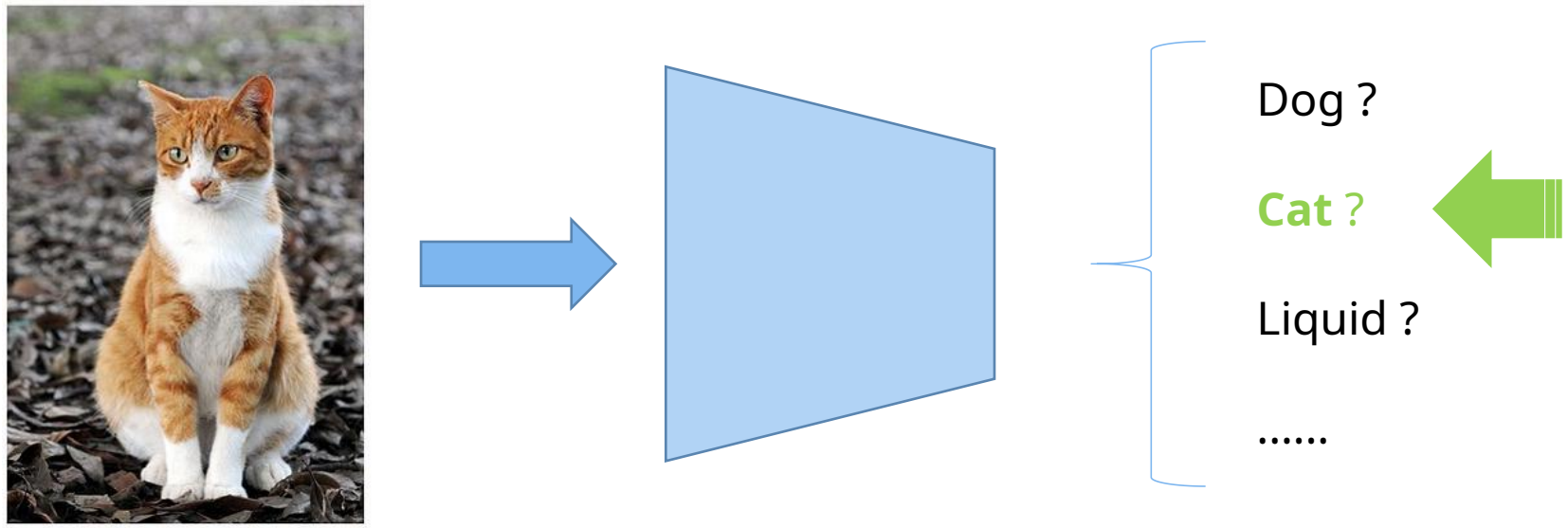
- Trend of Artificial Intelligence
  - AlphaGo, Automobile, etc.
- Deep Learning is a key part of the state-of-the-art AI.



Neural Networks

- Deep Learning is basically about (Deep) Neural Networks
- The most typical application is classification.



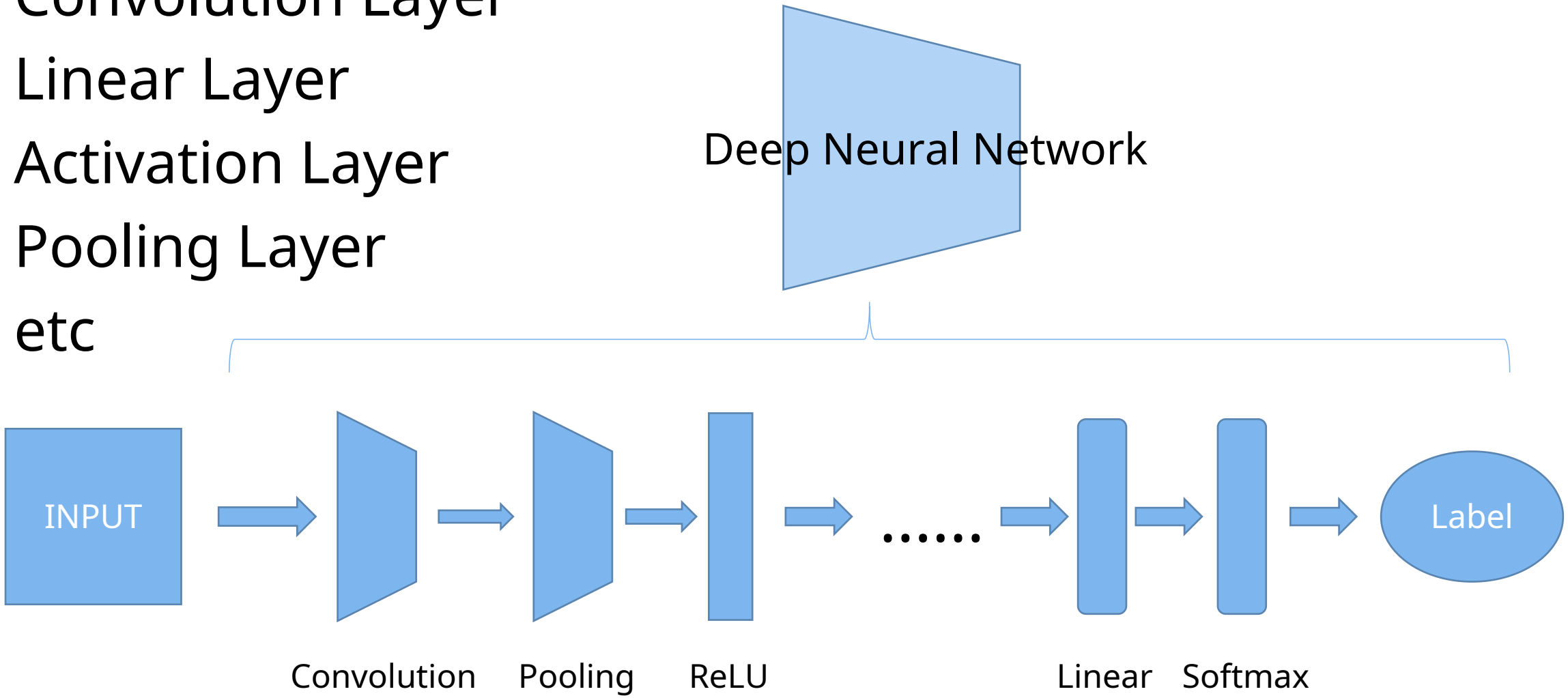
Input Image

Deep Neural Network

* The cat image comes from wikipedia, CC-licensed.

Closer look to Neural Net

- Convolution Layer
- Linear Layer
- Activation Layer
- Pooling Layer
- etc



Performance Bottleneck

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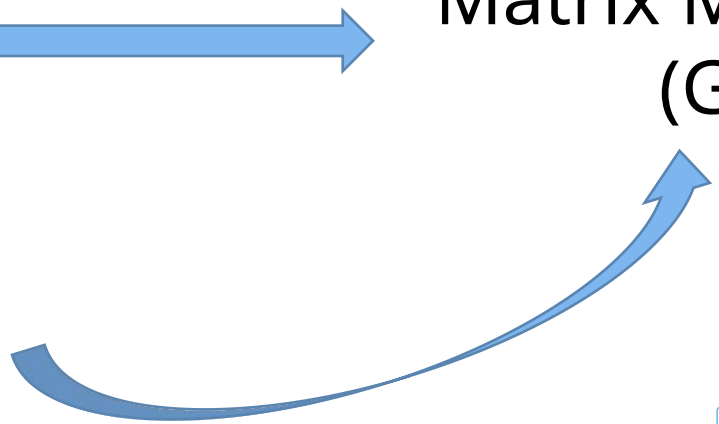
- Linear Layer
- Convolution Layer
  (Linear Operation)



Matrix Multiplication
(GEMM)

Acceleration?

- Parallelization
- Optimizing Cache Access
- **Hardware Acceleration**

- SIMD (CPU), e.g. AVX2
- OpenCL (GPU)
- Nvidia/CUDA (GPU)
- AMD/ROCm (GPU)
- Intel/SYCL (GPU)
- FPGA, etc.

Hardware Acceleration

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- SIMD (CPU), e.g. AVX2 ..... FLOPS upper bound
- OpenCL (GPU) ..... Programming?, Support?
- Nvidia/CUDA (GPU) ..... Mature but PROPRIETARY
- AMD/ROCm (GPU) ..... Open Source, developing
- Intel/SYCL (GPU) ..... Open Source, developing
- FPGA, etc. ..... Oops, unfamiliar :-(

Packages in Debian

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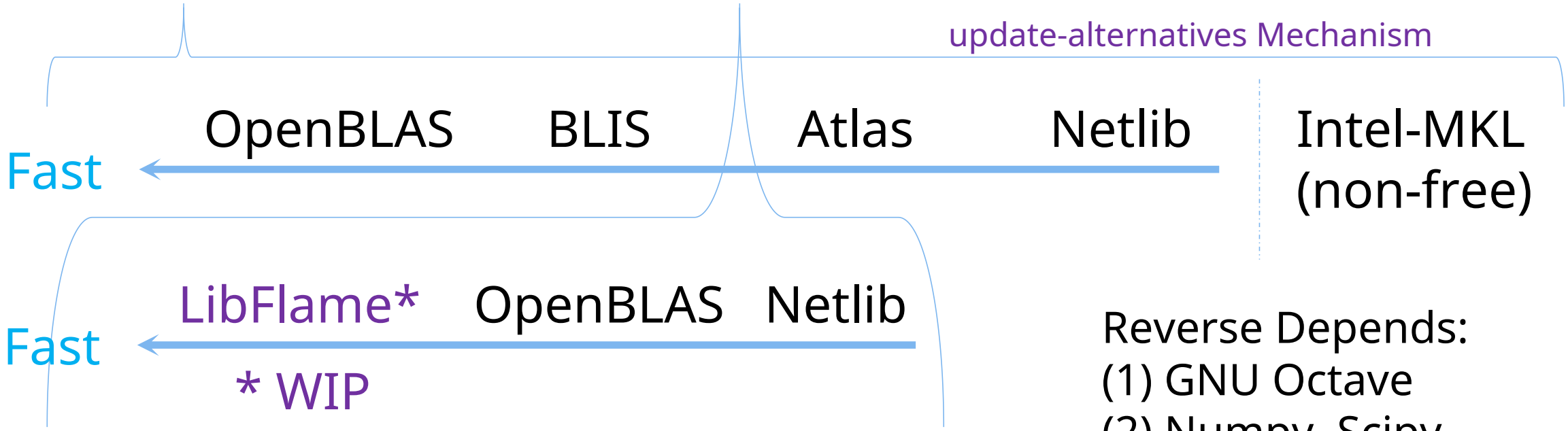
- Performance Libraries
  - e.g. math libraries incl. BLAS/LAPACK. (SIMD)
- Deep Learning Frameworks
  - e.g. TensorFlow, PyTorch, Caffe, etc
- AMD ROCm (AMD GPUs)
  - FOSS counterpart to Nvidia/CUDA
- Intel SYCL (Intel GPUs)
  - OpenCL, LLVM, Not-yet-upstreamed

Following:
Status
Summary

BLAS/LAPACK

- Numerical Linear Algebra / Fundamental Math libs
- **`libblas.so.3`** + **`liblapack.so.3`**



Reverse Depends:
(1) GNU Octave
(2) Numpy, Scipy
(3) ...

Deep Learning Frameworks

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- **TensorFlow**
  - Bazel (Build System, Java): Heavy Development
    - https://salsa.debian.org/bazel-team
  - Preliminary Packaging
    - https://salsa.debian.org/science-team/tensorflow
- **PyTorch**
  - https://salsa.debian.org/deeplearning-team/pytorch
  - Deps libs queued in NEW. PyTorch also in NEW.
  - No CUDA version planned. ROCm version is planned.
- **Caffe**
  - Already Available. Educational Code Base.

AMD/ROCm

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- Firmware (OK, non-free :-(
- KMod: amdkfd (already present in kernel, usable)

- HIP Compiler
- ROCm libraries (e.g. MIOpen)

WIP; Still being packaged.

https://salsa.debian.org/rocm-team

Other Related Issues

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- Better leverage the SIMD instructions?
  - SIMDebian (bumping ISA baseline in dpkg's buildflags)
  - Project status: Stalled.

- Deep Learning & Software Freedom?
  - ML-Policy (Machine Learning Policy)
  - Sorts out the issues between ML & software freedom
  - https://salsa.debian.org/deeplearning-team/ml-policy

Thanks!

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References:

- https://people.debian.org/~lumin/debian-dl.html