Aula 17 – Redes Neurais Convolucionais

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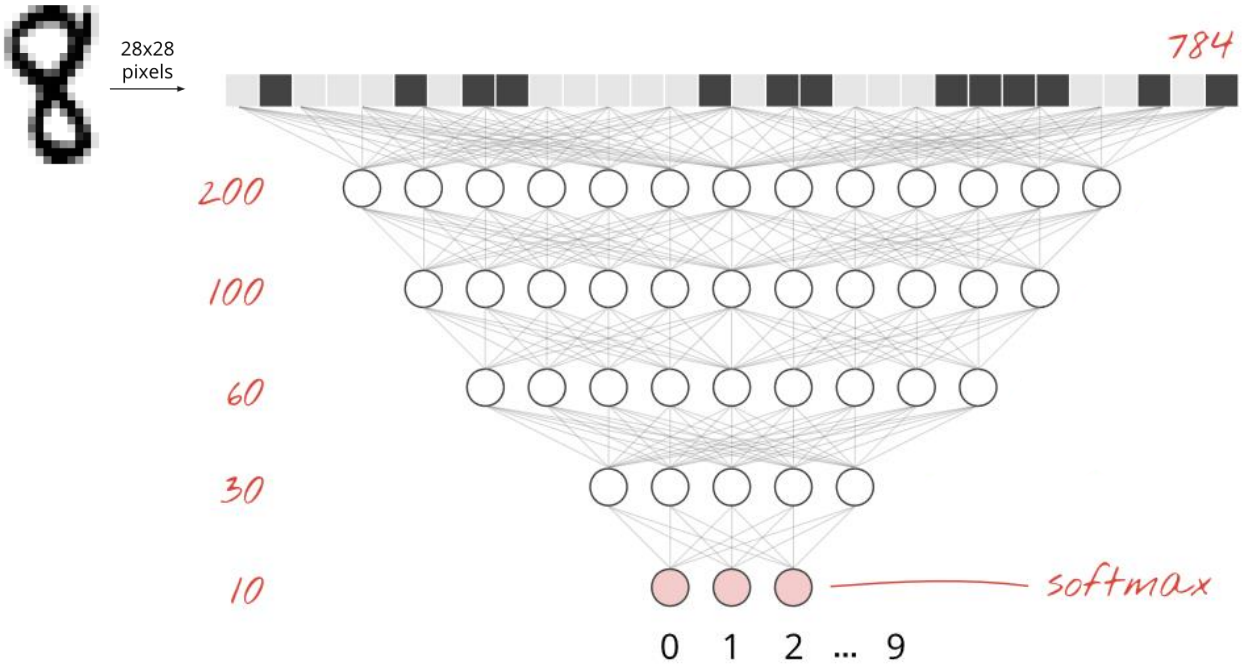
Roteiro

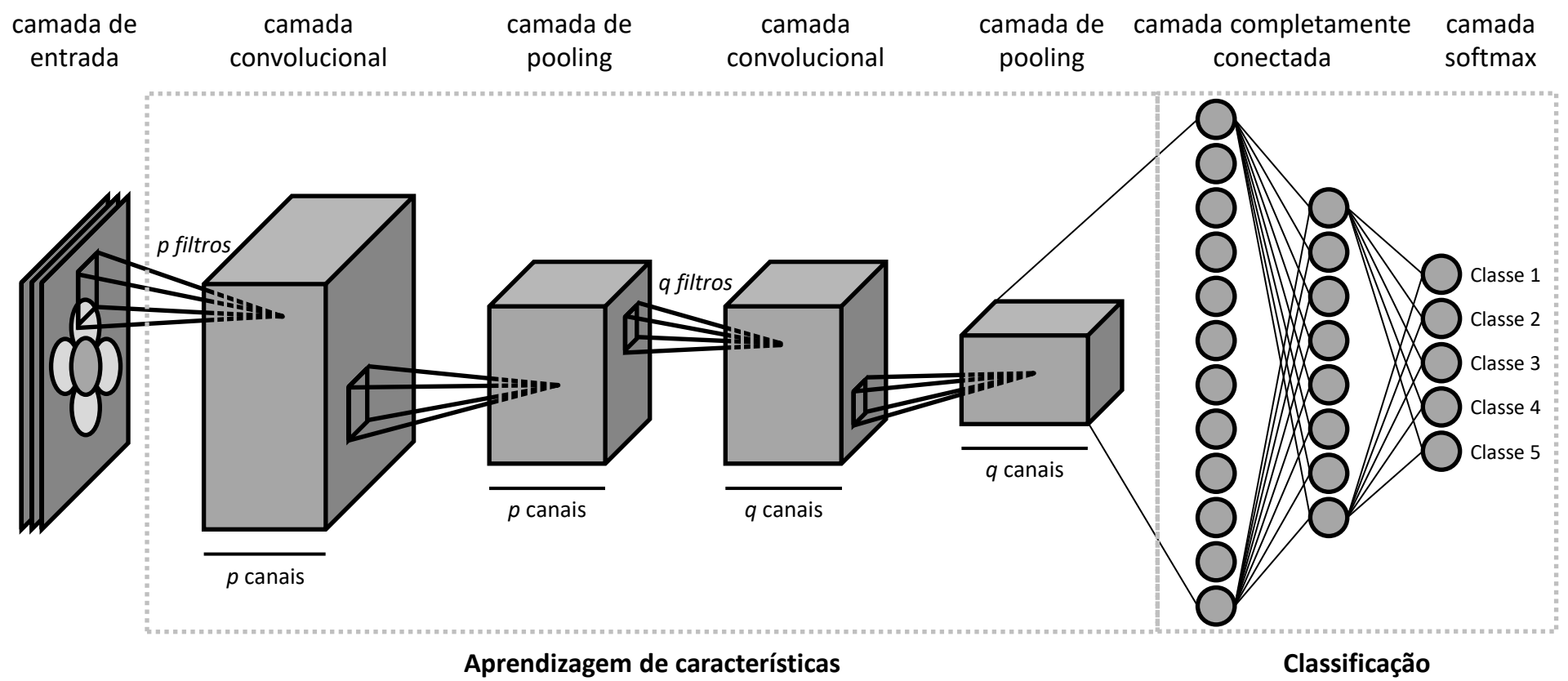
- Perceptron de multiplas camadas (MLP)
- Redes Neurais Convolucionais (CNNs)
- Camada convolucional
- Camada de pooling
- Modelos
- Bibliotecas e ambientes de desenvolvimento
- Conjuntos de imagens

Perceptron de multiplas camadas (MLP)

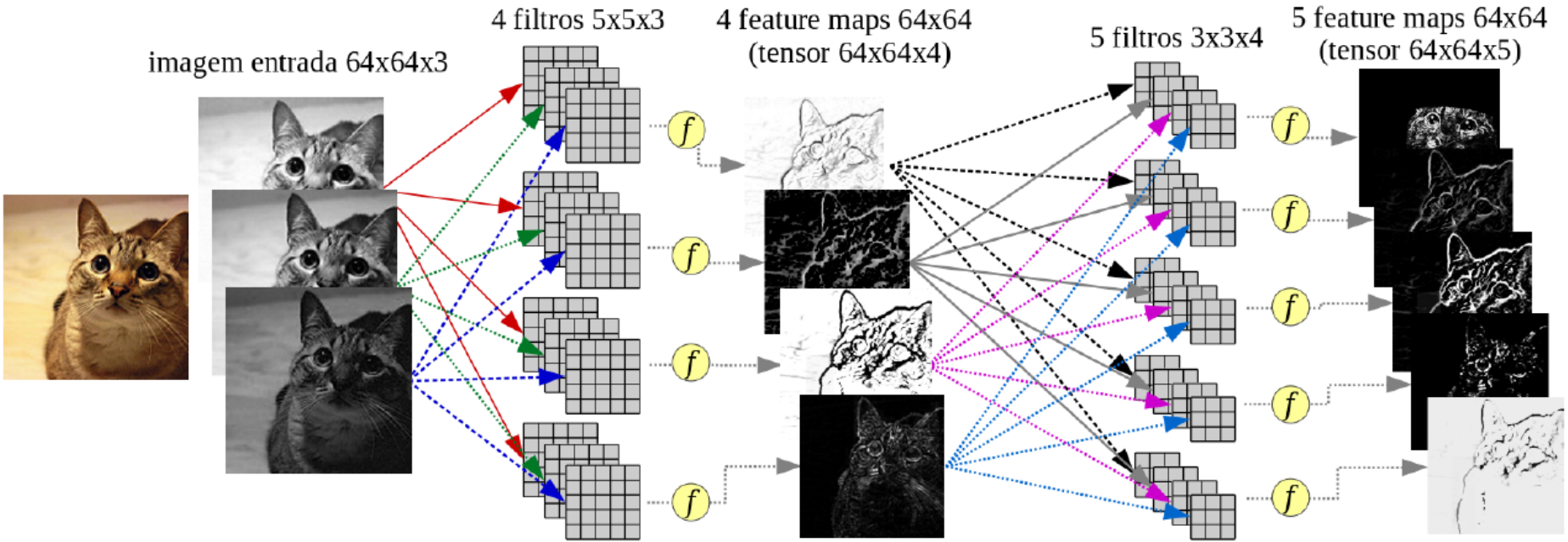


Learn TensorFlow and deep learning, without a Ph.D.

Redes Neurais Convolucionais (CNNs)

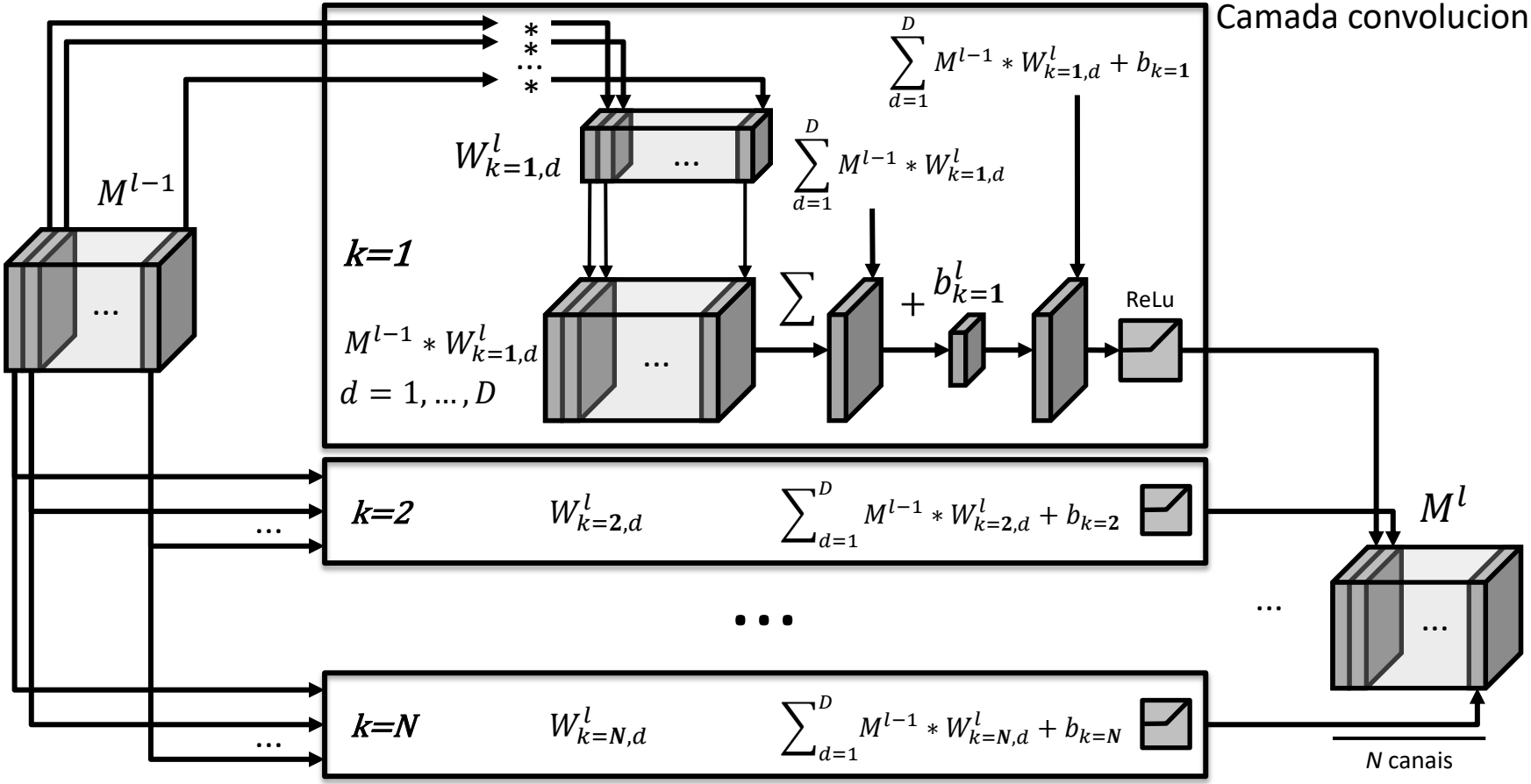


Redes Neurais Convolucionais (CNNs)

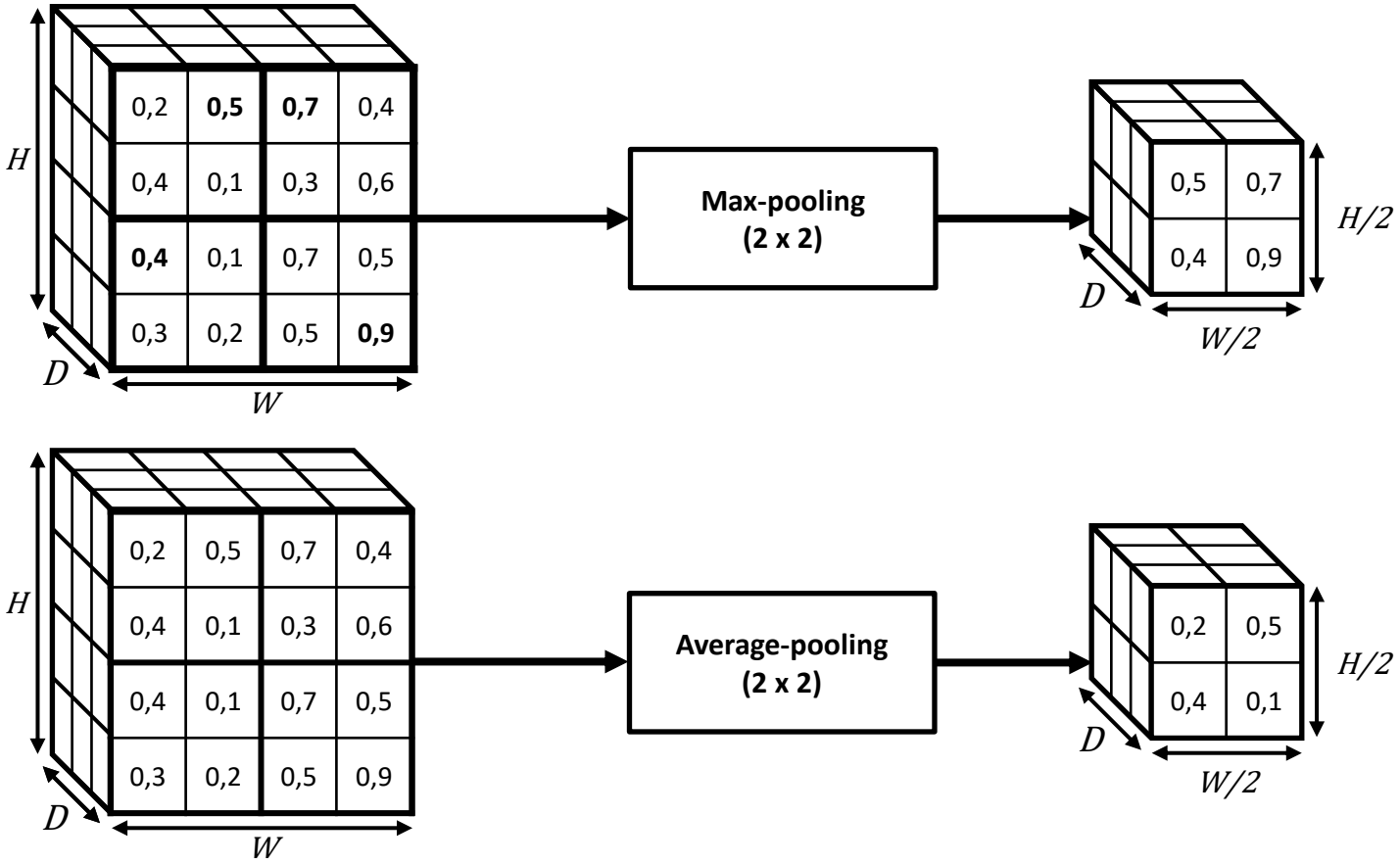


Moacir Ponti. http://conteudo.icmc.usp.br/pessoas/moacir/p17sibgrapi-tutorial/

Camada convolucional

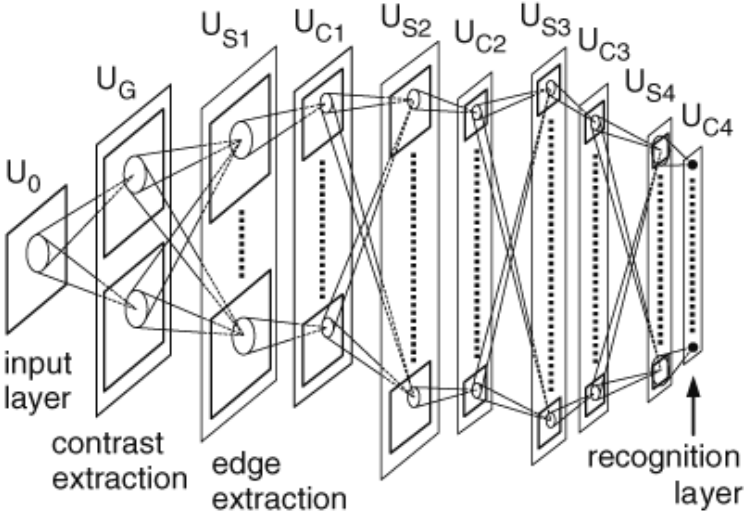


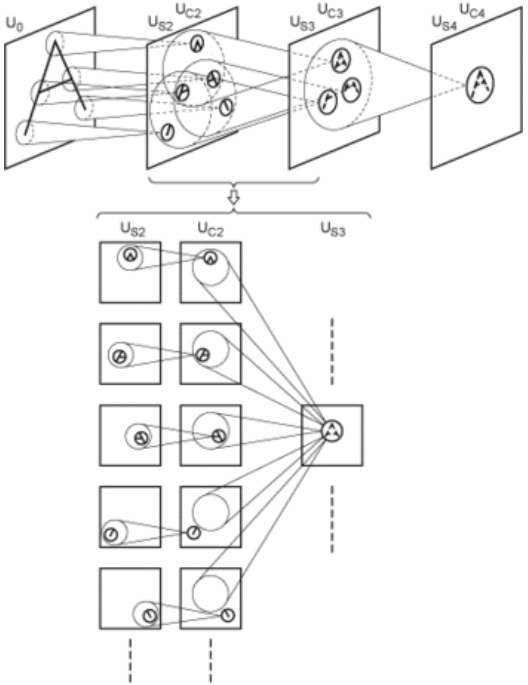
Camada de pooling



MODELOS

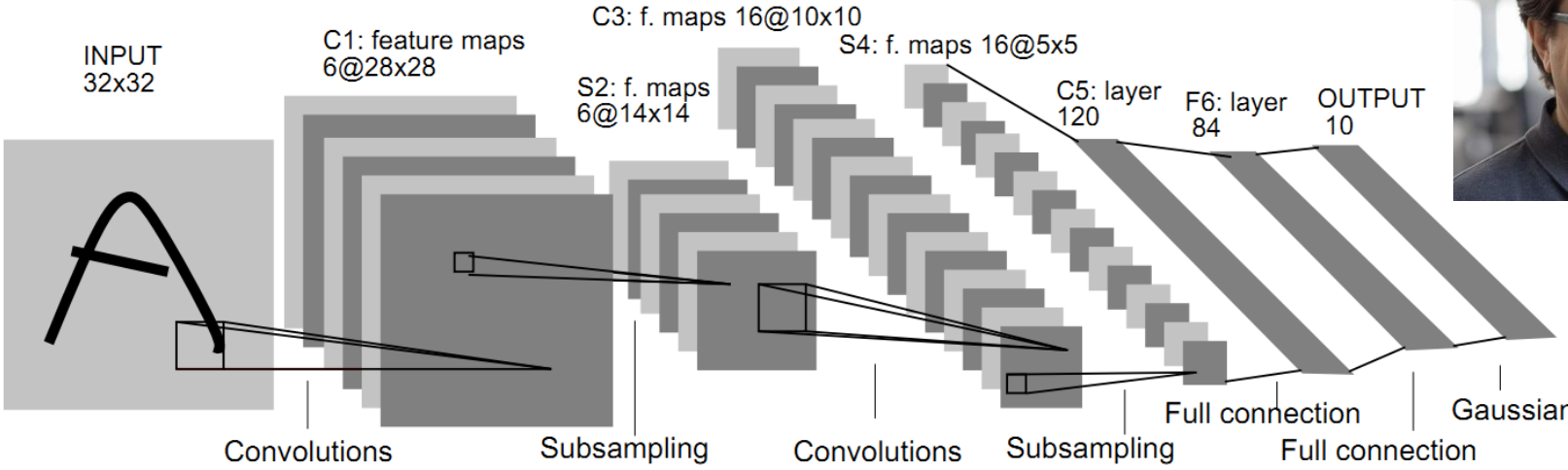
Neocognitron (1980)





Kunihiko Fukushima

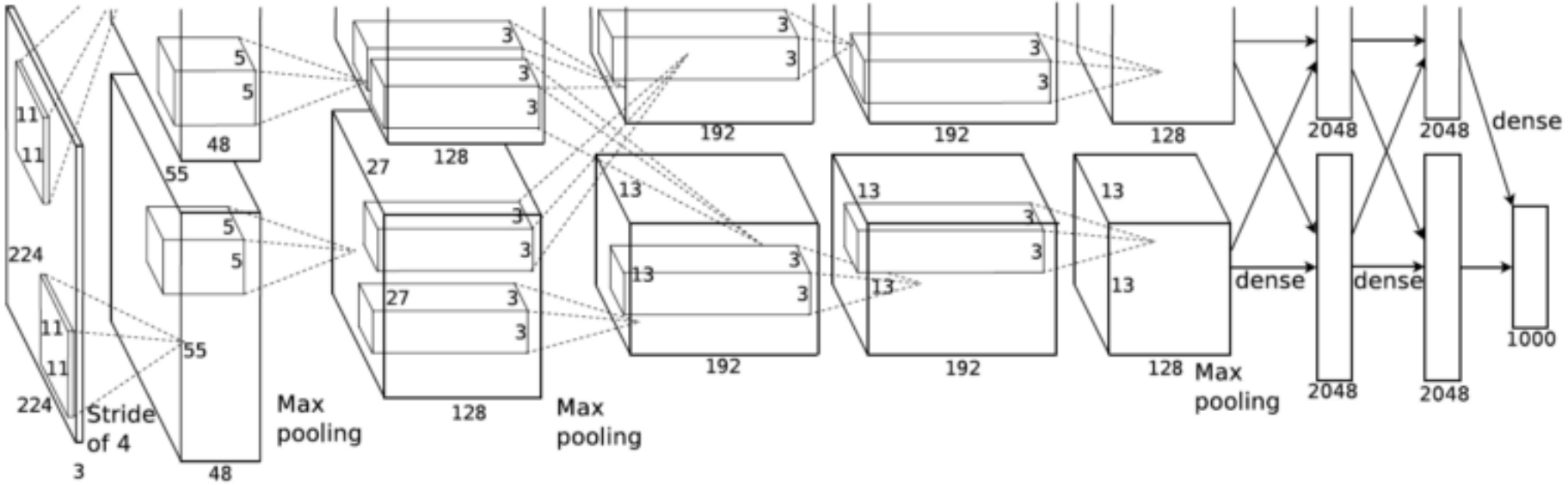
LeNet-5 (1998)



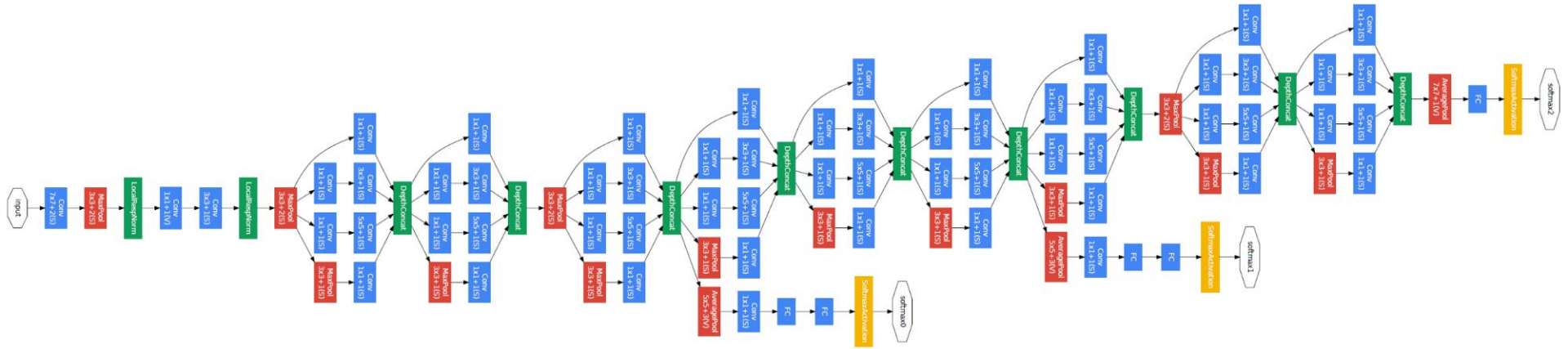
Yann LeCun

Fig. 2. Architecture of LeNet-5, a Convolutional Neural Network, here for digits recognition. Each plane is a feature map, i.e. a set of units whose weights are constrained to be identical.

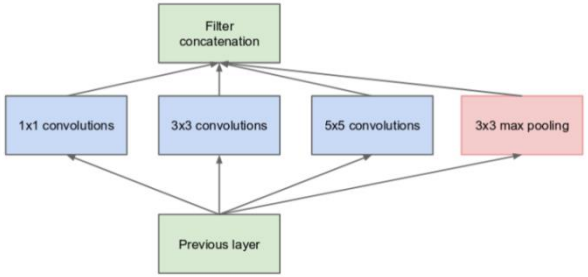
AlexNet (2012)



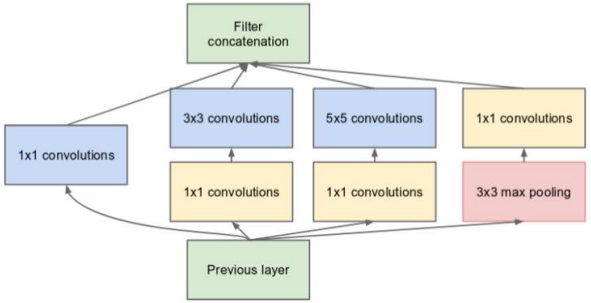
Inception (GoogLeNet) (2014)



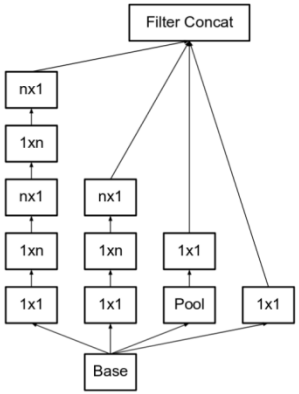
Módulos Inception

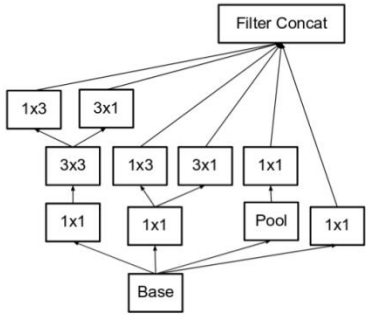


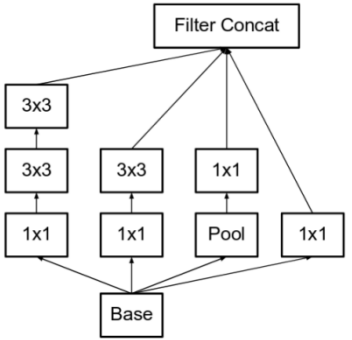
(a) Inception module, naïve version



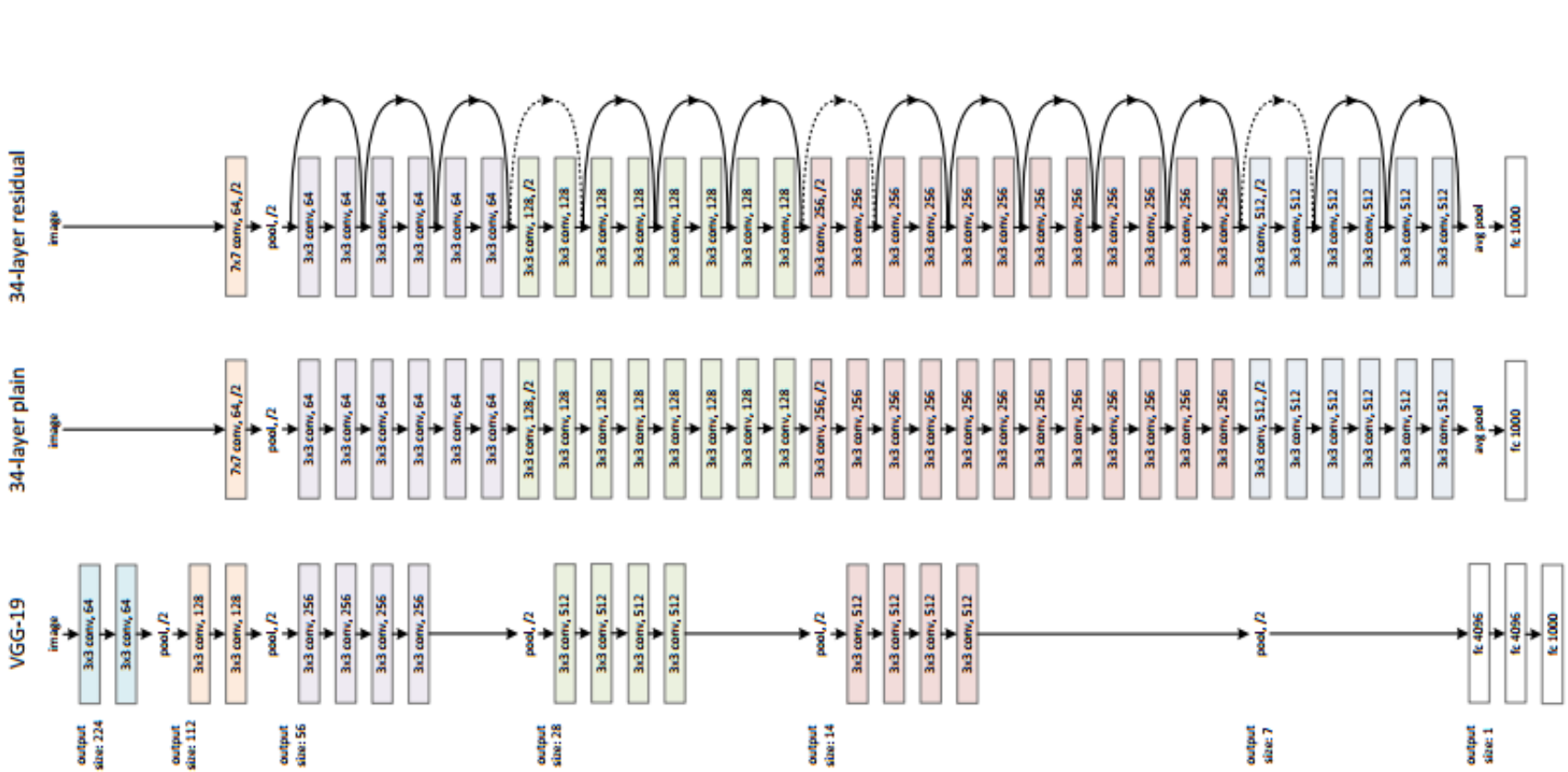
(b) Inception module with dimension reductions







VGG (2014) e ResNet (2015)



BIBLIOTECAS E AMBIENTES DE DESENVOLVIMENTO

Bibliotecas e ambientes de desenvolvimento

- O treinamento de CNNs possui alto custo computacional.
  - Recomenda-se que sejam treinados usando GPUs.
  - O Google Colab fornece acesso à GPUs (com algumas restrições).

Bibliotecas e ambientes de desenvolvimento

- Principais bibliotecas para Deep Learning e Redes Neurais Convolucionais
  - PyTorch
    - https://pytorch.org/
  - Tensorflow
    - https://www.tensorflow.org/

Bibliotecas e ambientes de desenvolvimento

- **Anaconda Distribution:**
  - Distribuição Python com suporte às principais bibliotecas
  - https://www.anaconda.com/products/distribution
- **Google Colab:**
  - Ambiente de execução em nuvem com GPUs.
  - https://colab.research.google.com

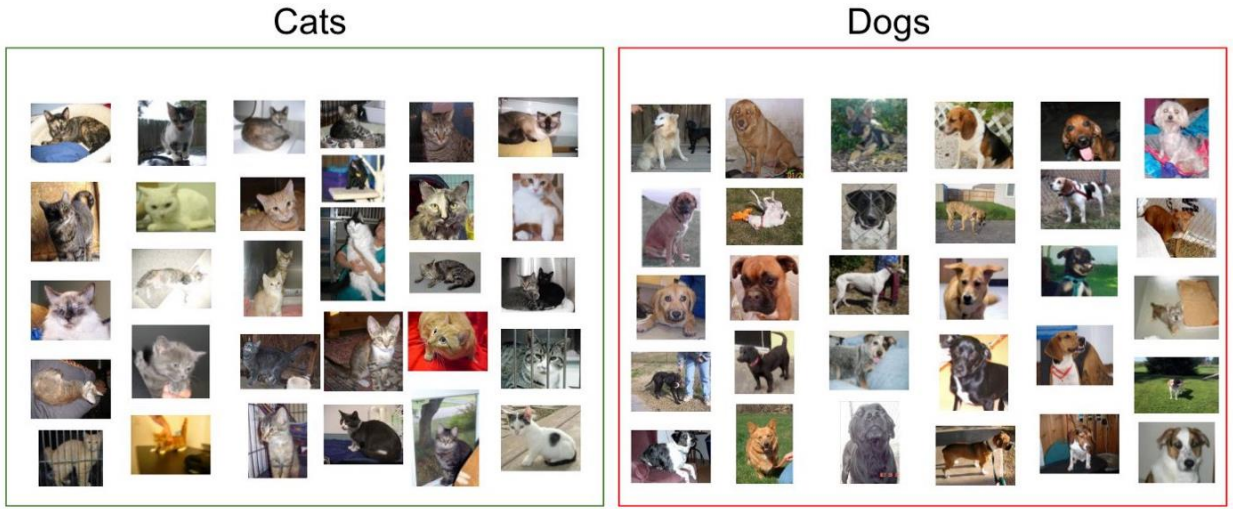
CONJUNTOS DE IMAGENS

Conjuntos de imagens

- MNIST
  - http://yann.lecun.com/exdb/mnist/
  - 60,000 training images
  - 10,000 testing images
  - 28 x 28 pixels
  - Níveis de cinza

Conjuntos de imagens

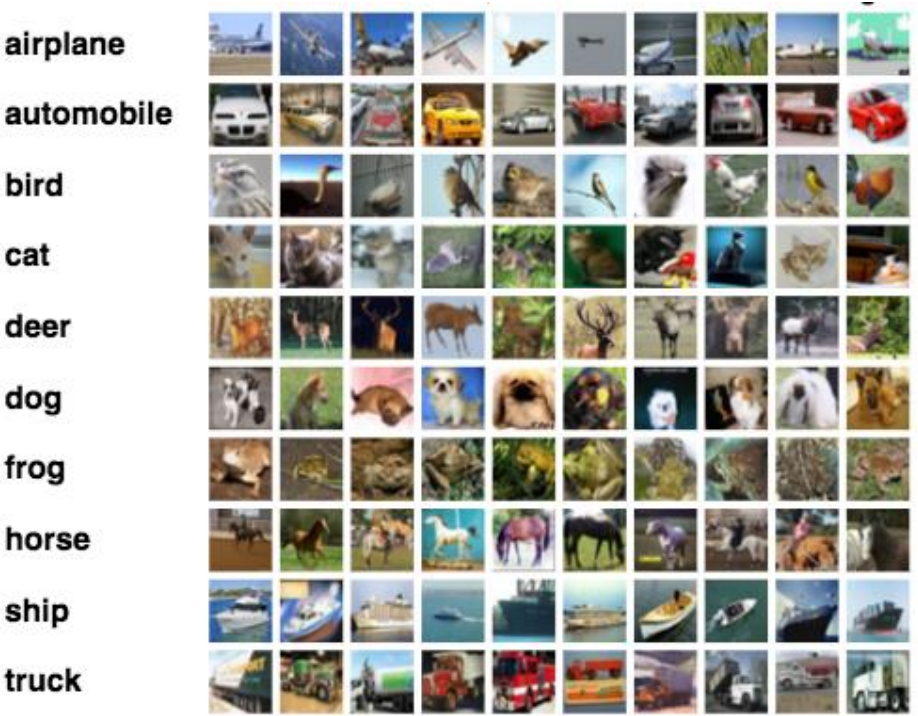
- Cats vs. Dogs
  - https://www.kaggle.com/c/dogs-vs-cats
  - 25,000 images de treinamento
  - 12,500 imagens de teste
  - 2 classes
  - Diversos tamanhos
  - RGB



Sample of cats & dogs images from Kaggle Dataset

Conjuntos de imagens

- CIFAR10
  - https://www.cs.toronto.edu/~kriz/cifar.html
  - 50,000 training images
  - 10,000 testing images
  - 10 classes
  - 32 x 32 pixels
  - RGB



Conjuntos de imagens

- ImageNet
  - https://www.image-net.org/
  - ~1,000,000 imagens
  - 1,000 classes
  - RGB

Bibliografia

- Prof. Moacir Ponti (ICMC-USP). **Material para o minicurso *Deep Learning***
  - https://github.com/maponti/deeplearning_intro_datascience
- Learn TensorFlow and deep learning, without a Ph.D.
  - https://cloud.google.com/blog/products/gcp/learn-tensorflow-and-deep-learning-without-a-phd
- CS231n: Convolutional Neural Networks for Visual Recognition
  - http://cs231n.github.io/
- Goodfellow, Bengio e Courville. Deep Learning. MIT Press, 2016
  - https://www.deeplearningbook.org/
- The MathWorks, Inc. What is a Convolutional Neural Network? 3 things you need to know.
  - https://www.mathworks.com/discovery/convolutional-neural-network-matlab.html

Bibliografia

- Rodrigues, L. F.; Naldi M. C., **Mari, J. F.** *Comparing convolutional neural networks and preprocessing techniques for HEp-2 cell classification in immunofluorescence images.* **Computers in Biology and Medicine**, 2019.
  - https://doi.org/10.1016/j.compbiomed.2019.103542

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FIM DA DISCIPLINA!