

Deep Learning Tutorial

MNIST Dataset

Sep 2018

Core and Visual Computing Group

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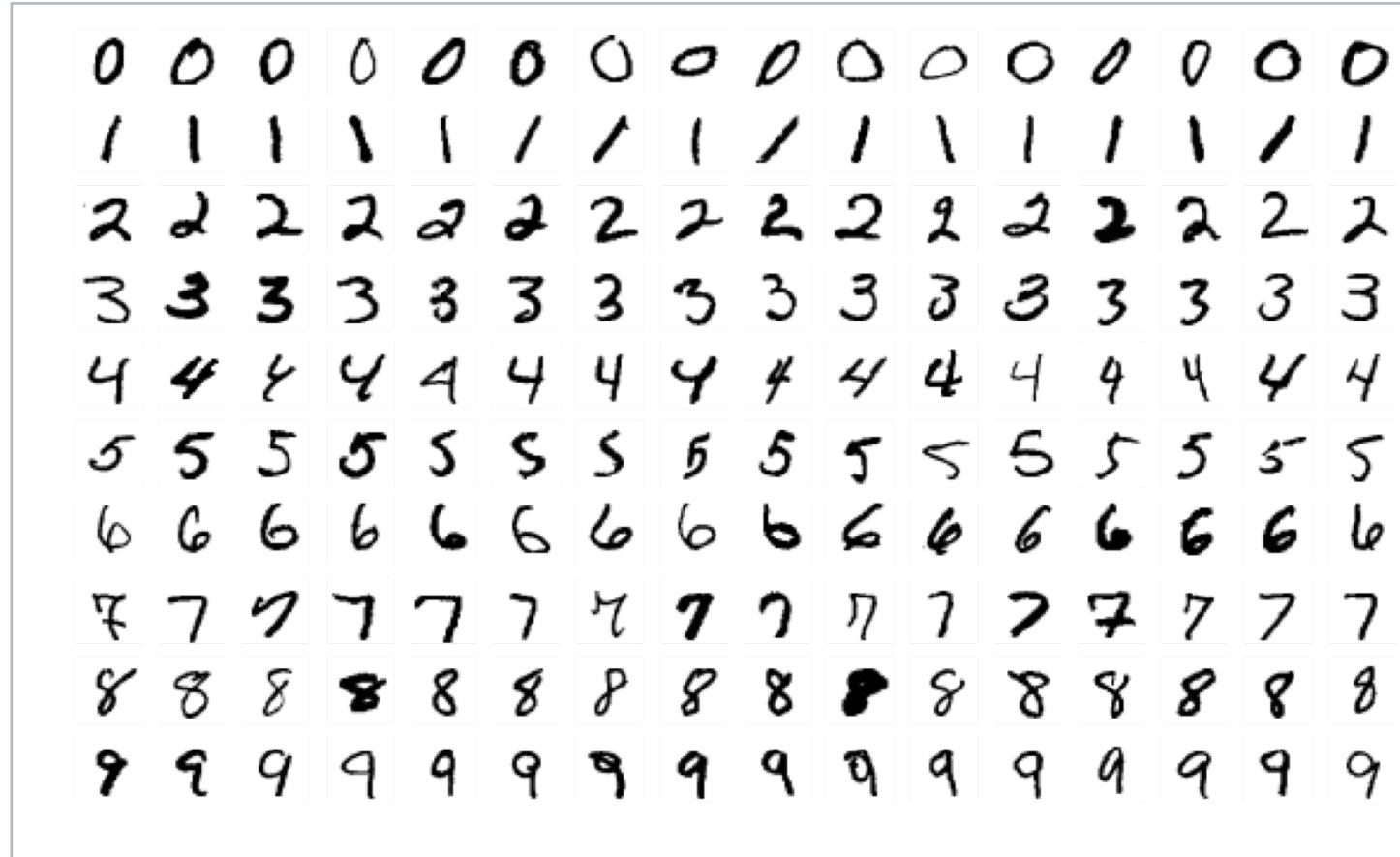
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Mixed National Institute of Standards and Technology (MNIST) Dataset

- MNIST Dataset contains:
 - Image files of handwritten digits
 - Files that are 28 x 28 pixels in dimension
 - 70k of images: 10k for testing, 60k for training
- MNIST Dataset is:
 - Commonly used for training
 - Available as a Keras dataset

MNIST Dataset Sample

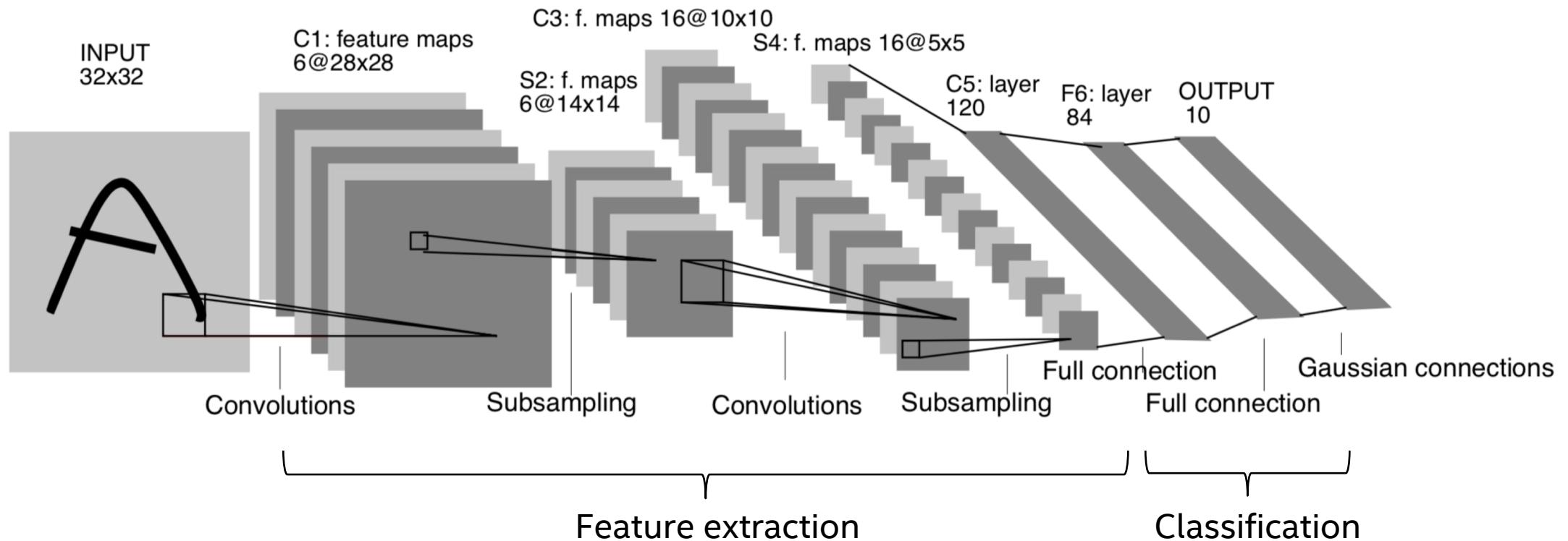


SOURCE: By Josef Steppan - Own work, CC BY-SA 4.0,
<https://commons.wikimedia.org/w/index.php?curid=64810040>

Convolutional Neural Network (CNN or ConvNet)

- Feed-forward Artificial Neural Network
- Two major components:
 - Feature detection layers
 - Classification layers
- CNN example – LeNet:
 - LeNet-5, Yann LeCun et al. 1998
 - 7-level CNN

LeNet-5



SOURCE: Gradient Based Learning Applied to Document Recognition - <http://yann.lecun.com/exdb/publis/psgz/lecun-98.ps.gz>

Image Kernels



input image

$$\begin{aligned} & (\begin{array}{ccc} 206 & + & 206 & + & 247 \\ \times 0 & & \times -1 & & \times 0 \\ + & 243 & + & 160 & + & 137 \\ \times -1 & & \times 5 & & \times -1 \\ + & 192 & + & 154 & + & 75 \\ \times 0 & & \times -1 & & \times 0 \end{array}) \\ & = 60 \end{aligned}$$

kernel:

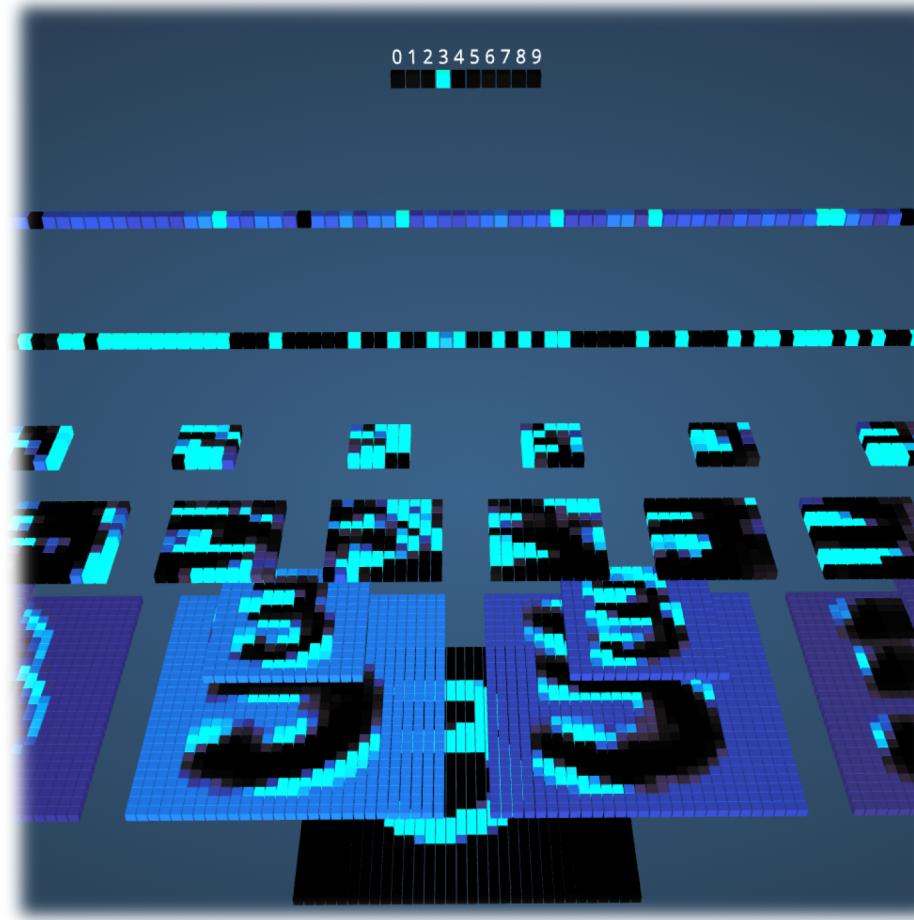
sharpen



output image

SOURCE: <http://setosa.io/ev/image-kernels/>

3D Interactive Demo



SOURCE: <http://scs.ryerson.ca/~aharley/vis/conv/>

