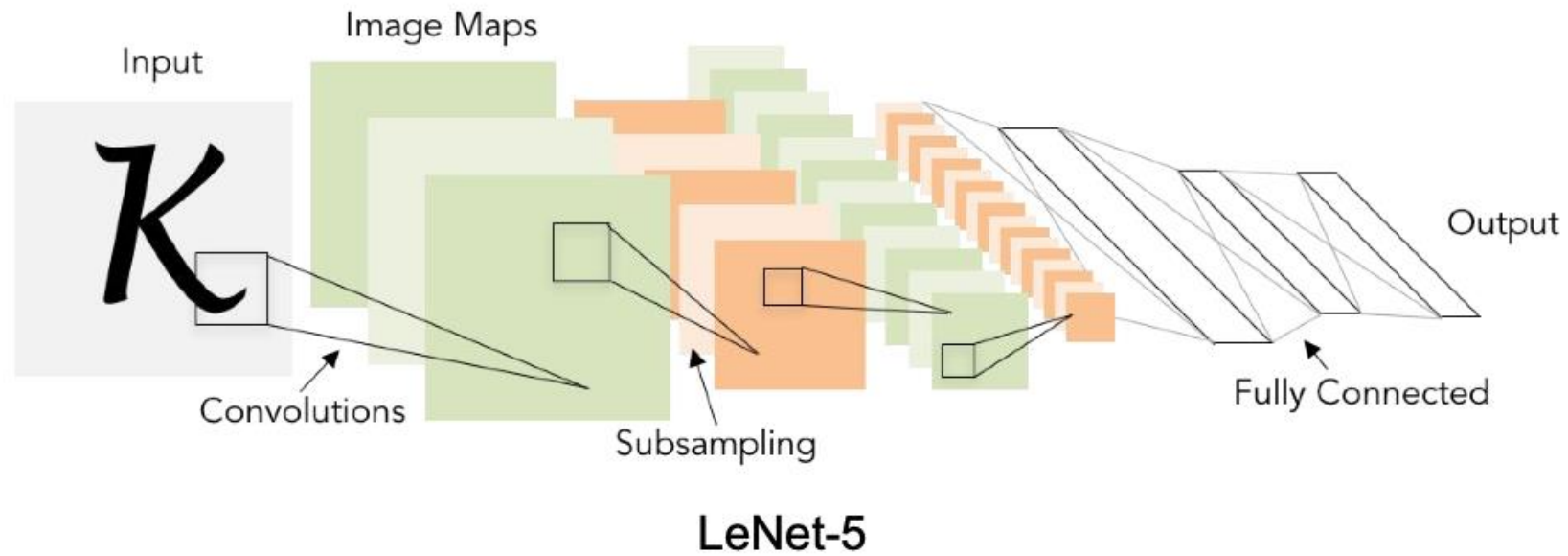# CNN의 역사

A bit of history:
Gradient-based learning applied to document recognition
[LeCun, Bottou, Bengio, Haffner 1998]

LeNet-5

First strong results

Acoustic Modeling using Deep Belief Networks
Abdel-rahman Mohamed, George Dahl, Geoffrey Hinton, 2010
**Context-Dependent Pre-trained Deep Neural Networks
for Large Vocabulary Speech Recognition**
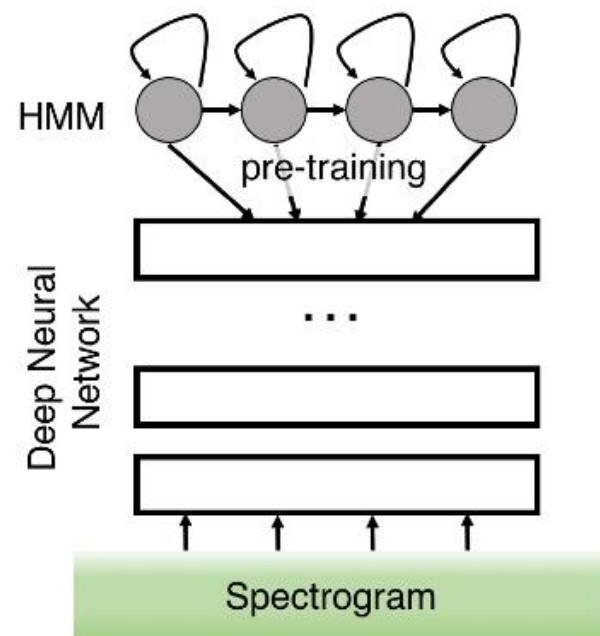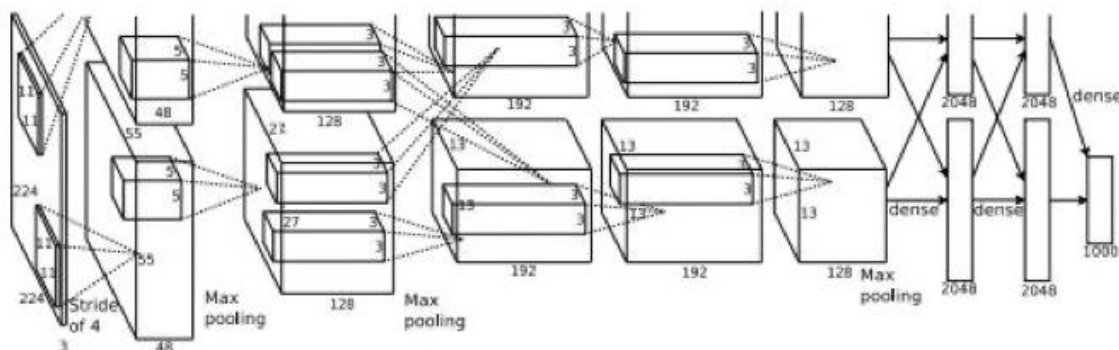George Dahl, Dong Yu, Li Deng, Alex Acero, 2012

**Imagenet classification with deep convolutional
neural networks**
Alex Krizhevsky, Ilya Sutskever, Geoffrey E Hinton, 2012

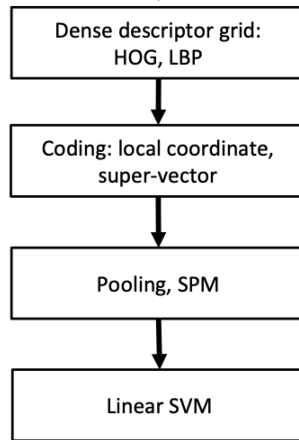Illustration of Dahl et al. 2012 by Lane McIntosh, copyright
CS231n 2017

Figures copyright Alex Krizhevsky, Ilya Sutskever, and Geoffrey Hinton, 2012. Reproduced with permission.

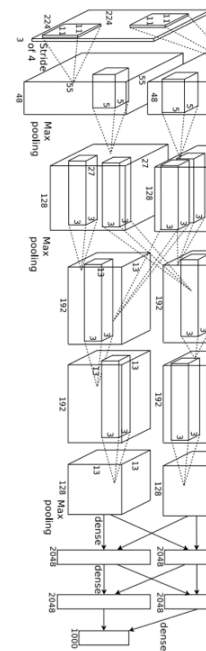# IMAGENET Large Scale Visual Recognition Challenge

Year 2010

NEC-UIUC

Dense descriptor grid:
HOG, LBP

Coding: local coordinate,
super-vector

Pooling, SPM

Linear SVM

[Lin CVPR 2011]

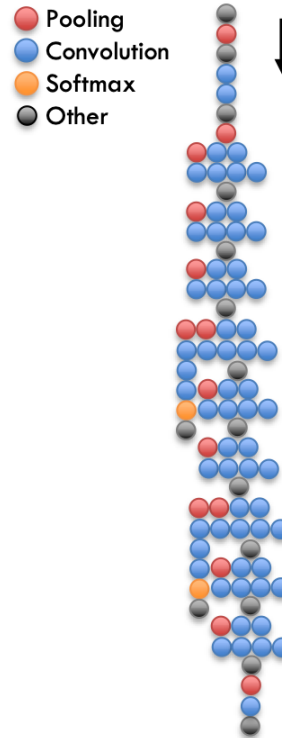Lion image by Swissfrog is licensed under CC BY 3.0

Year 2012

SuperVision

[Krizhevsky NIPS 2012]

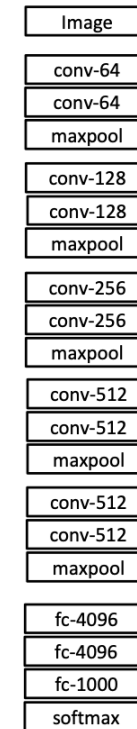Figure copyright Alex Krizhevsky, Ilya Sutskever, and Geoffrey Hinton, 2012. Reproduced with permission.

Year 2014

GoogLeNet   VGG

- ● Pooling
- ● Convolution
- ● Softmax
- ● Other

Image

conv-64
conv-64
maxpool

conv-128
conv-128
maxpool

conv-256
conv-256
maxpool

conv-512
conv-512
maxpool

conv-512
conv-512
maxpool

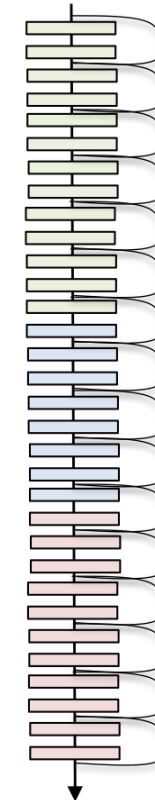fc-4096
fc-4096
fc-1000
softmax

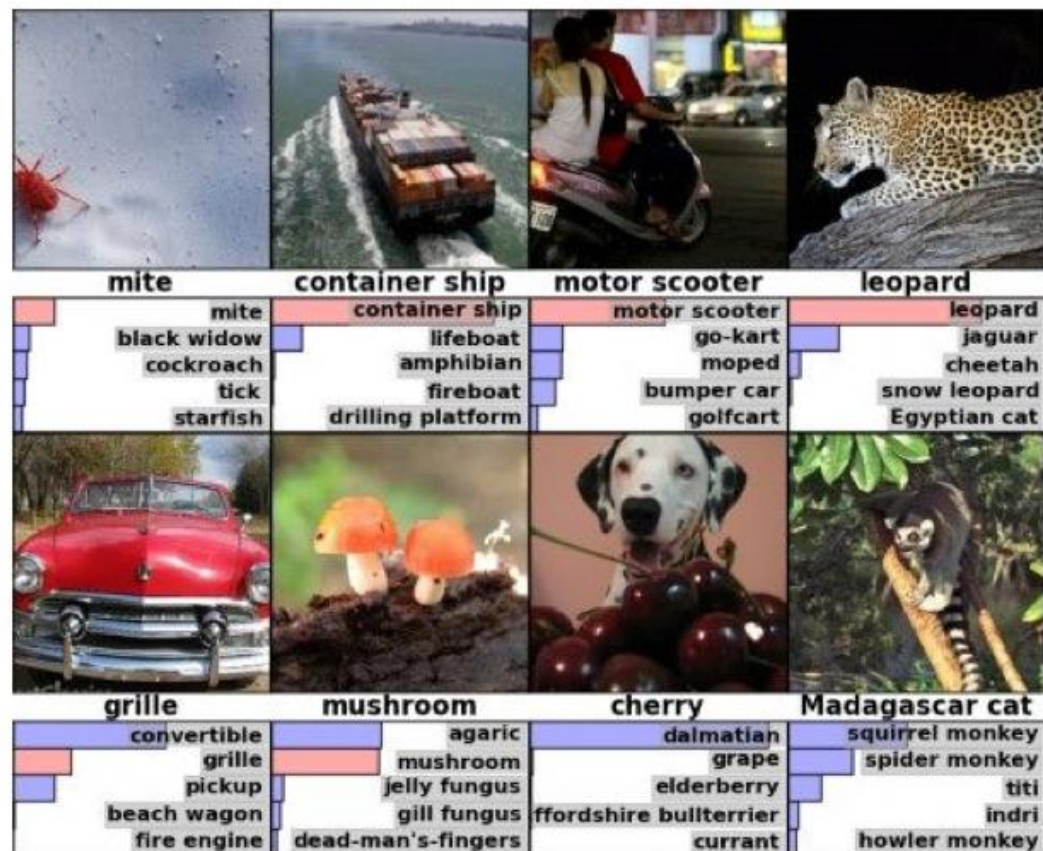[Szegedy arxiv 2014]   [Simonyan arxiv 2014]

Year 2015

MSRA

[He ICCV 2015]

Fast-forward to today: ConvNets are everywhere
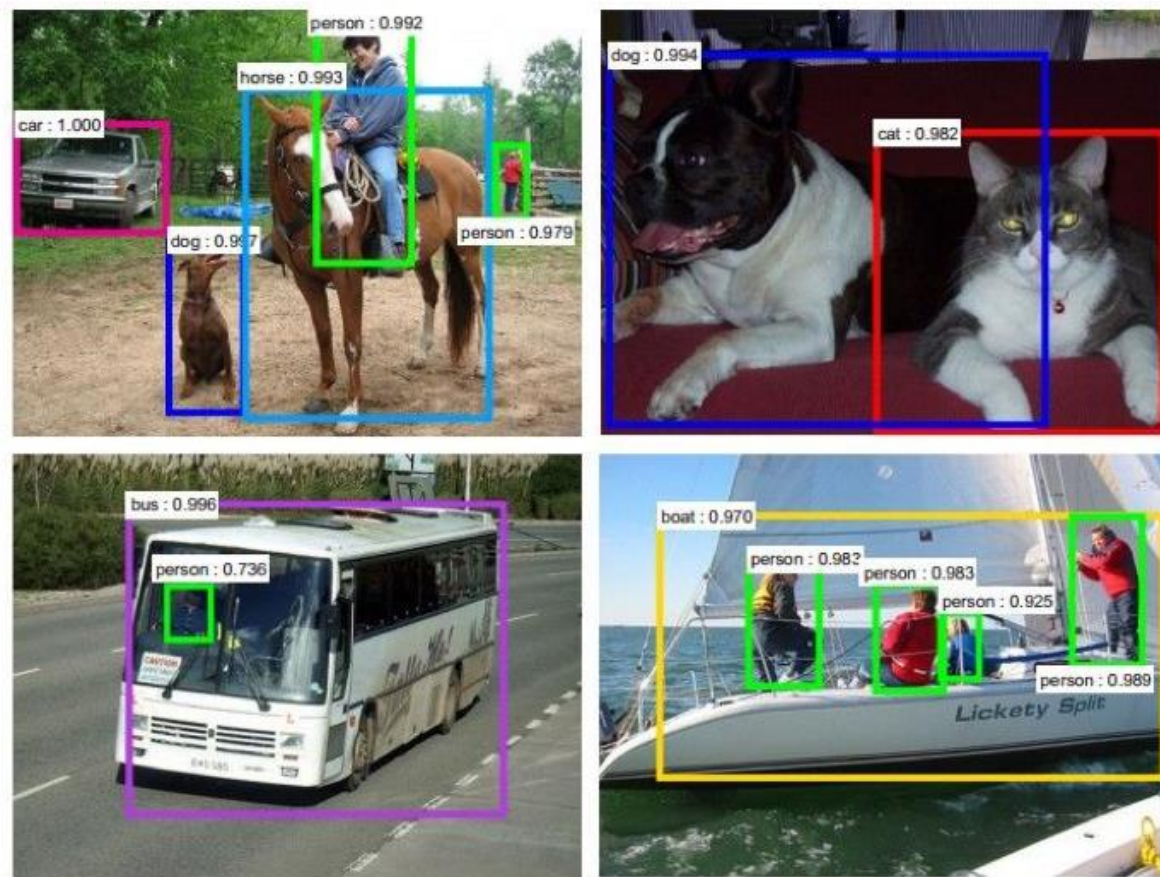
Classification

Retrieval

Figures copyright Alex Krizhevsky, Ilya Sutskever, and Geoffrey Hinton, 2012. Reproduced with permission.
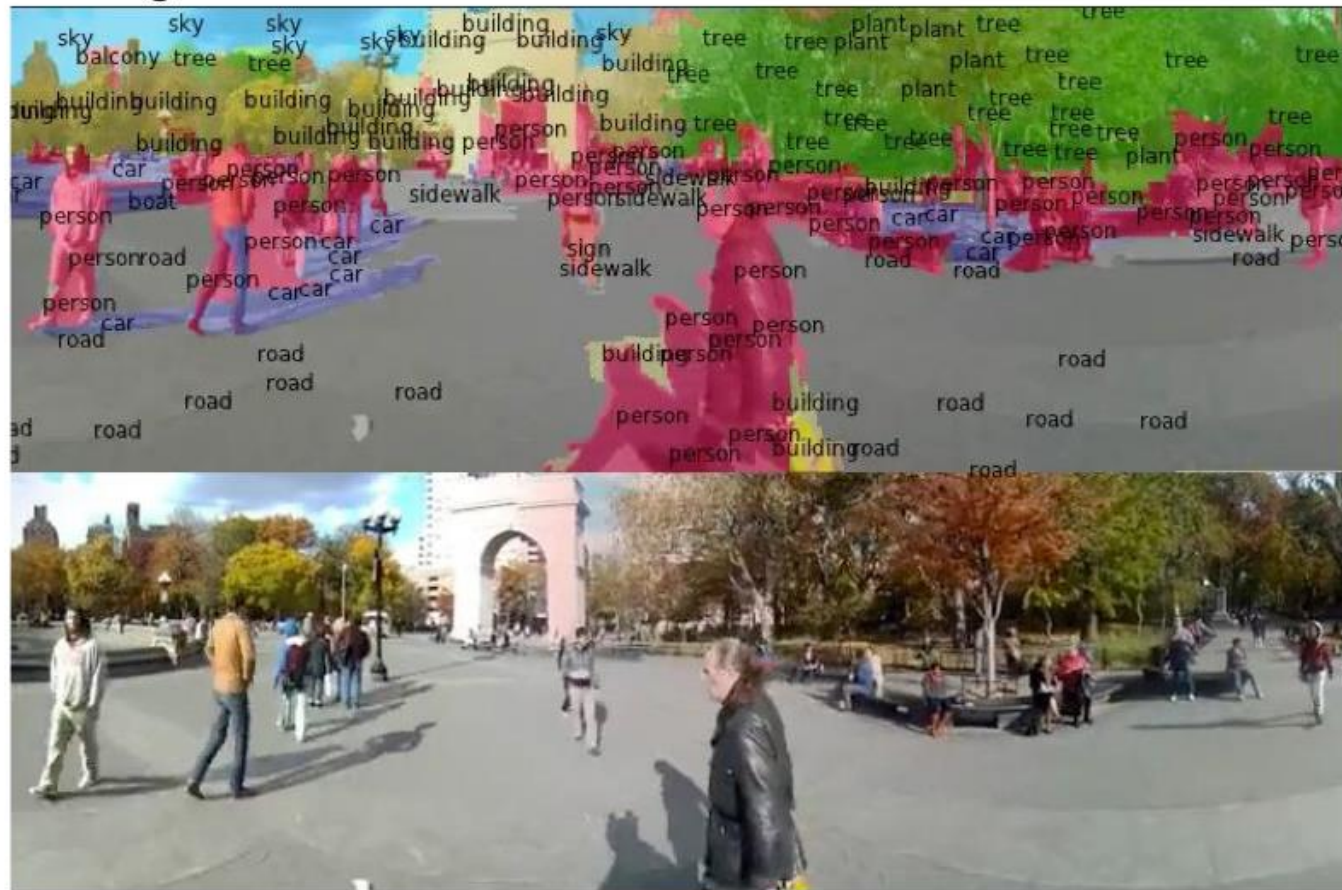
Fast-forward to today: ConvNets are everywhere

Detection

Segmentation

Figures copyright Shaoqing Ren, Kaiming He, Ross Girschick, Jian Sun, 2015. Reproduced with permission.

[Faster R-CNN: Ren, He, Girshick, Sun 2015]

Figures copyright Clement Farabet, 2012. Reproduced with permission.
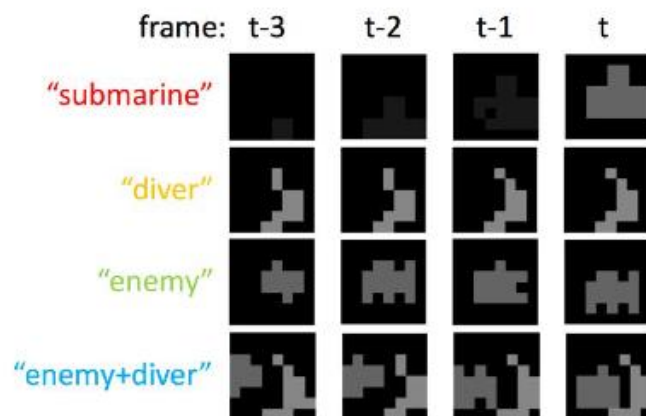
[Farabet et al., 2012]

Fast-forward to today: ConvNets are everywhere

Images are examples of pose estimation, not actually from Toshev & Szegedy 2014. Copyright Lane McIntosh.
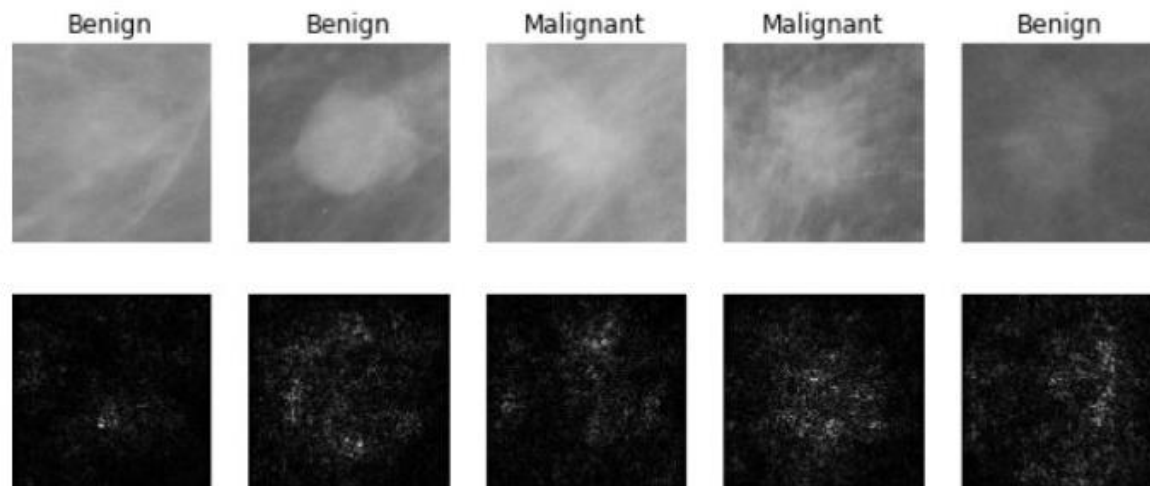
[Toshev, Szegedy 2014]

[Guo et al. 2014]

Figures copyright Xiaoxiao Guo, Satinder Singh, Honglak Lee, Richard Lewis, and Xiaoshi Wang, 2014. Reproduced with permission.

Fast-forward to today: ConvNets are everywhere

Benign Benign Malignant Malignant Benign

[Levy et al. 2016]

Figure copyright Levy et al. 2016.
Reproduced with permission.

[Dieleman et al. 2014]

From left to right: public domain by NASA, usage permitted by ESA/Hubble, public domain by NASA, and public domain.

[Sermanet et al. 2011]
[Ciresan et al.]

Photos by Lane McIntosh.
Copyright CS231n 2017.

No errors

A white teddy bear sitting in the grass

Minor errors

A man in a baseball uniform throwing a ball

Somewhat related

A woman is holding a cat in her hand

Image Captioning

[Vinyals et al., 2015]
[Karpathy and Fei-Fei, 2015]

A man riding a wave on top of a surfboard

A cat sitting on a suitcase on the floor

A woman standing on a beach holding a surfboard

All images are CC0 Public domain:
https://pixabay.com/en/luggage-antique-cat-1643010/
https://pixabay.com/en/teddy-plush-bears-cute-teddy-bear-1623436/
https://pixabay.com/en/surf-wave-summer-sport-litoral-1668716/
https://pixabay.com/en/woman-female-model-portrait-adult-983967/
https://pixabay.com/en/handstand-lake-meditation-496008/
https://pixabay.com/en/baseball-player-shortstop-infield-1045263/

Captions generated by Justin Johnson using Neuraltalk2