

Overview Deep Learning:

First -> Big Picture

Next time -> Focus on Convnets

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Typical Processing Pipeline Before Deep Learning

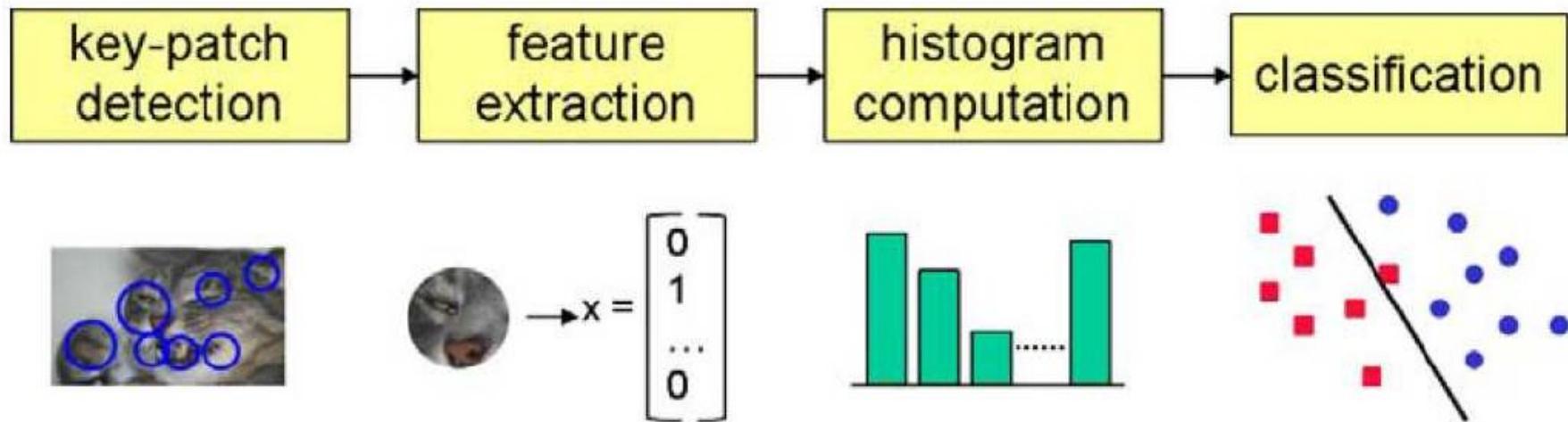
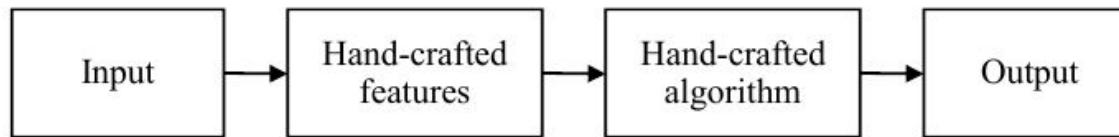
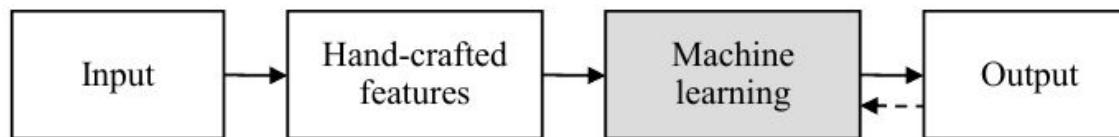


Figure 6.6: Computer Vision: Algorithms and Applications 2nd Edition Richard Szeliski, (2021)

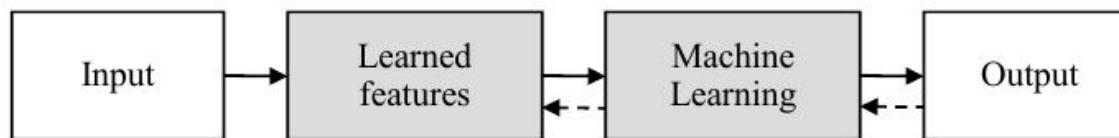
In the Exercise, Followed Traditional Vision Pipeline



(a) Traditional vision pipeline

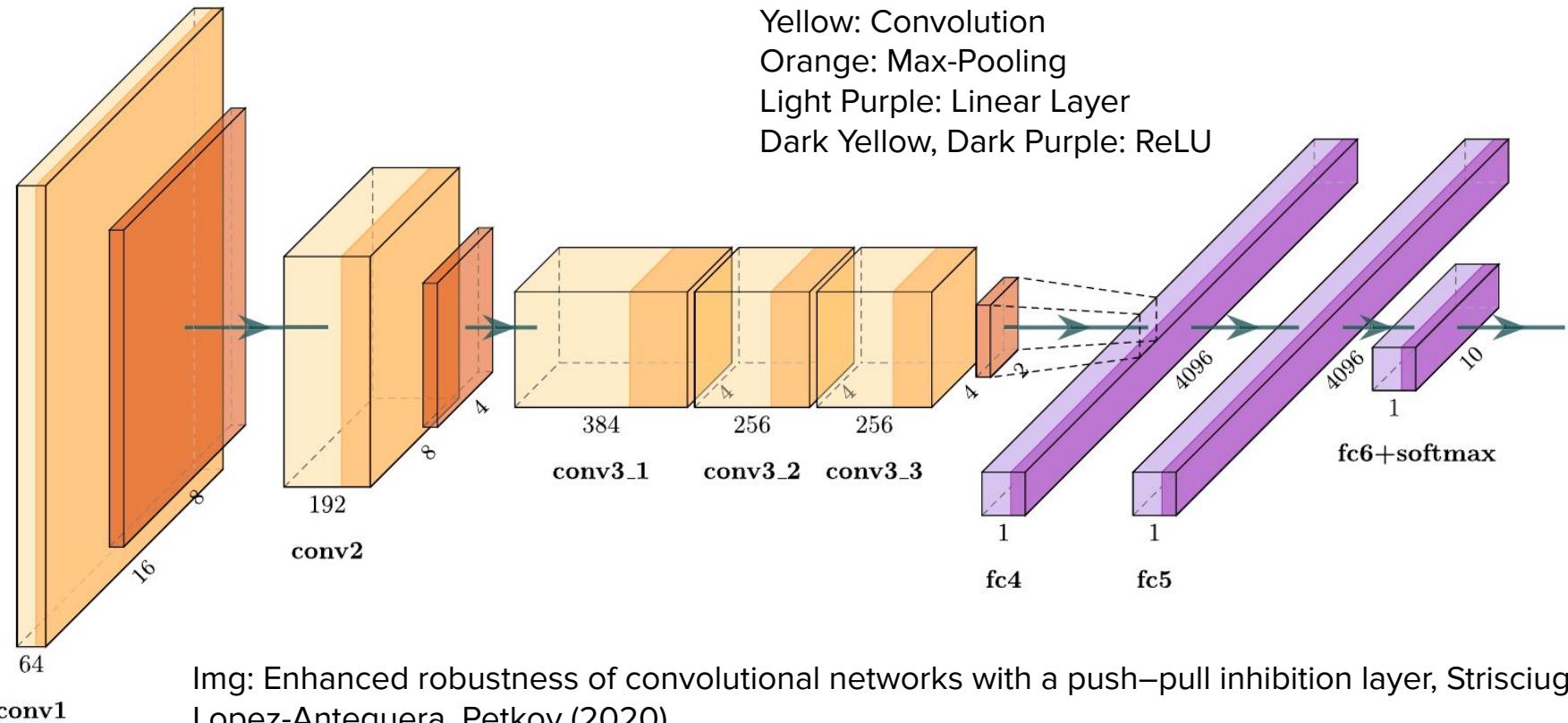


(b) Classic machine learning pipeline

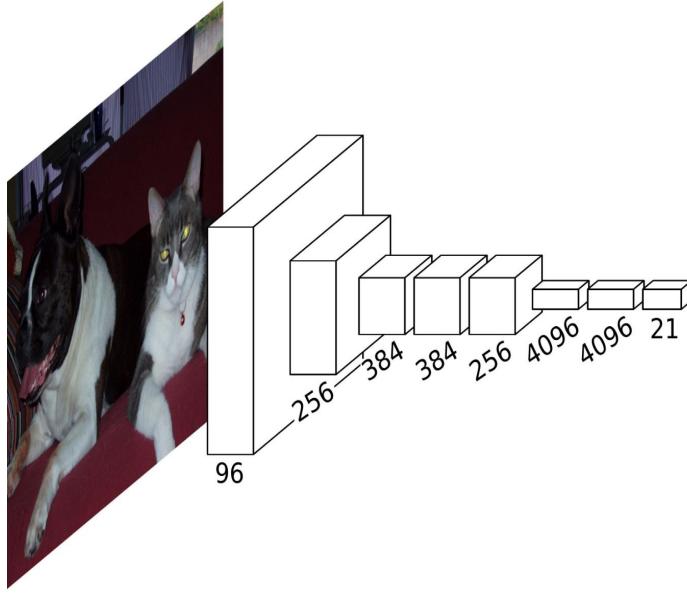


(c) Deep learning pipeline

Alexnet Architecture



Very Simple Feed-Forward Structure



0	0	0	0	0	0	0	...
0	156	155	156	158	158	158	...
0	153	154	157	159	159	159	...
0	149	151	155	158	159	159	...
0	146	146	149	153	158	158	...
0	145	143	143	148	158	158	...
...

Input Channel #1 (Red)

0	0	0	0	0	0	0	...
0	167	166	167	169	169	169	...
0	164	165	168	170	170	170	...
0	160	162	166	169	170	170	...
0	156	156	159	163	168	168	...
0	155	153	153	158	168	168	...
0	154	152	152	157	167	167	...
...

Input Channel #2 (Green)

0	0	0	0	0	0	0	...
0	163	162	163	165	165	165	...
0	160	161	164	166	166	166	...
0	156	158	162	165	166	166	...
0	155	155	158	162	167	167	...
0	154	152	152	157	167	167	...
...

Input Channel #3 (Blue)

-1	-1	1
0	1	-1
0	1	1

Kernel Channel #1



308

1	0	0
1	-1	-1
1	0	-1

Kernel Channel #2



-498

0	1	1
0	1	0
1	-1	1

Kernel Channel #3



164

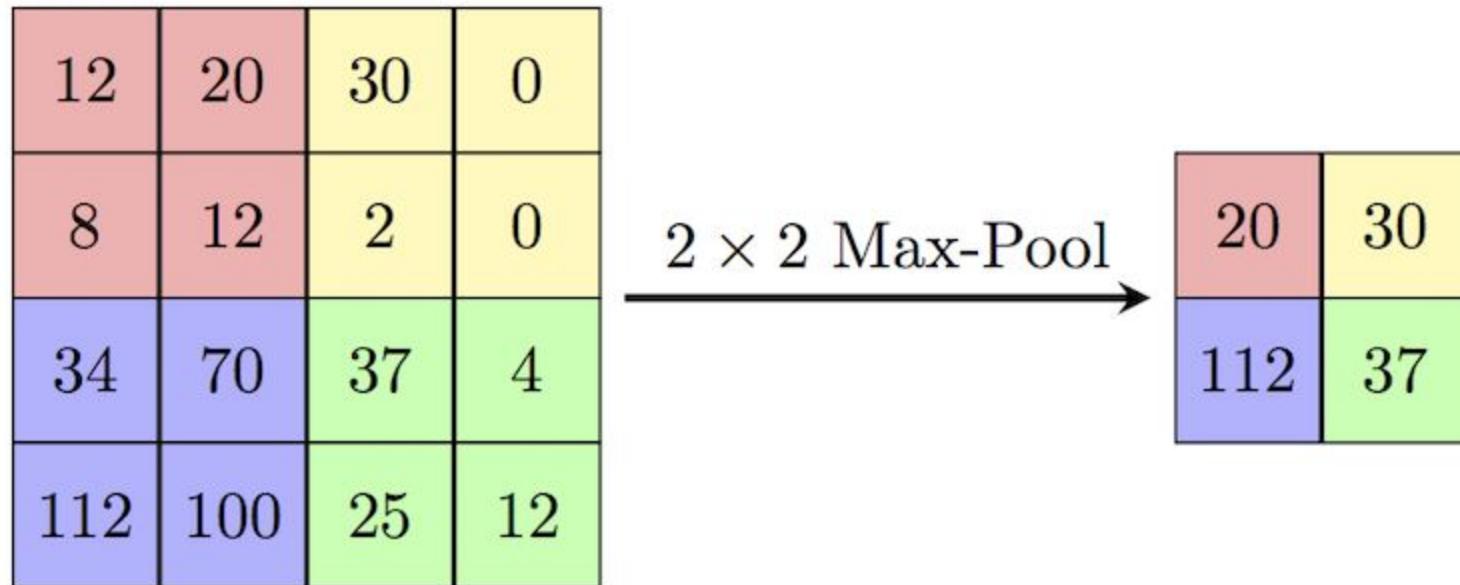
Output

-25				...
				...
				...
				...
				...

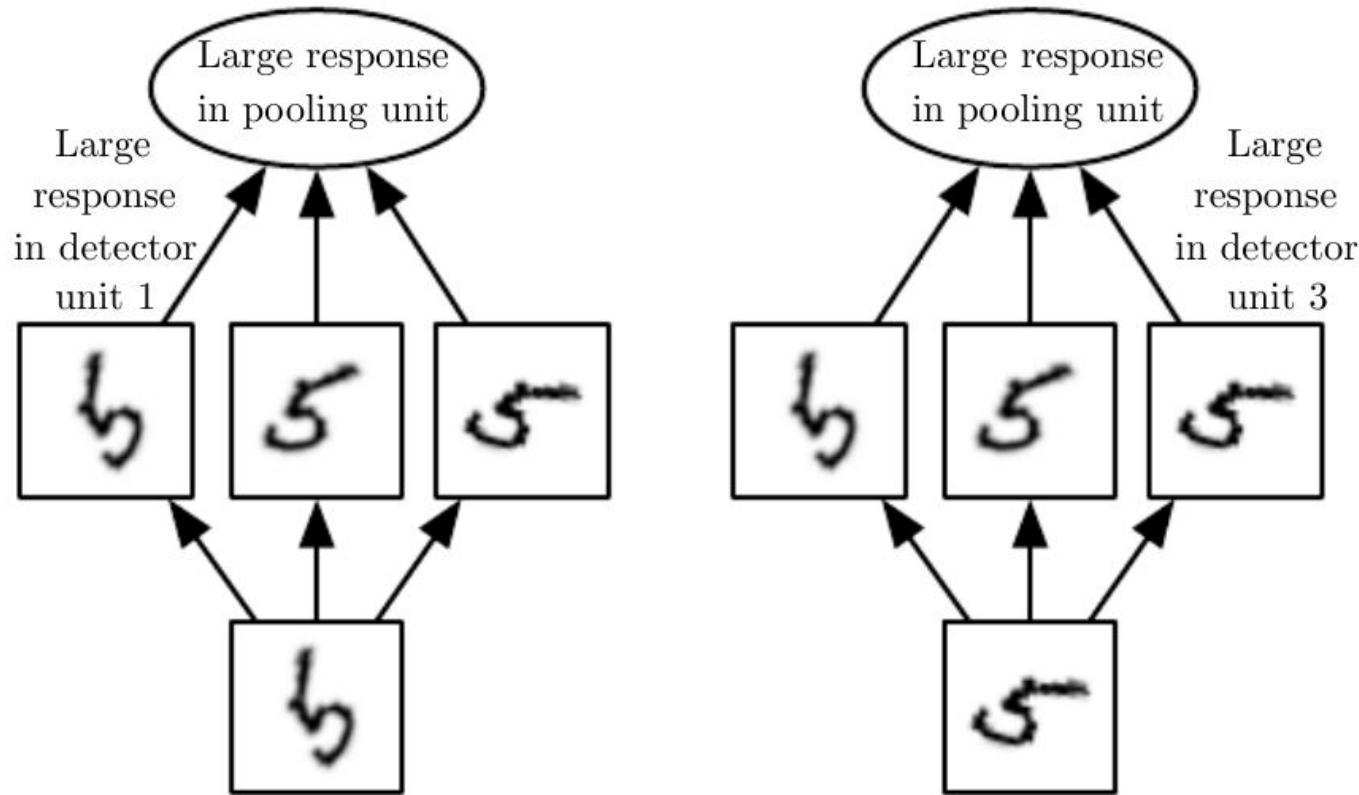
Bias = 1

Max Pooling

Average Pooling Similar



Max Pooling for Rotation Invariance



Top-5 Error 10.8% lower than runner up in 2012

- Alexnet wins ImageNet Challenge in 2012 with large impact
- Top-5 error rate of 15.3%
- Used ReLUs instead of tanh activation functions for faster training
- Learned complex kernel



ImageNet

- 14 million classified images
- 1 million with bounding boxes
- 20k classes
- Built based on WordNet
- Biased in many ways:
 - Lots of Dogs and Cats
 - Problematic labels



ImageNet 2012 Classification Results

- Most probable result after final Softmax Layer
- Pay attention to runner-ups!



ImageNet 2012 Classification Results

- Most probable result after final Softmax Layer
- Pay attention to runner-ups!
- Networks learn something essential about data structure.

