Convolutional Neural Networks and Computer Vision

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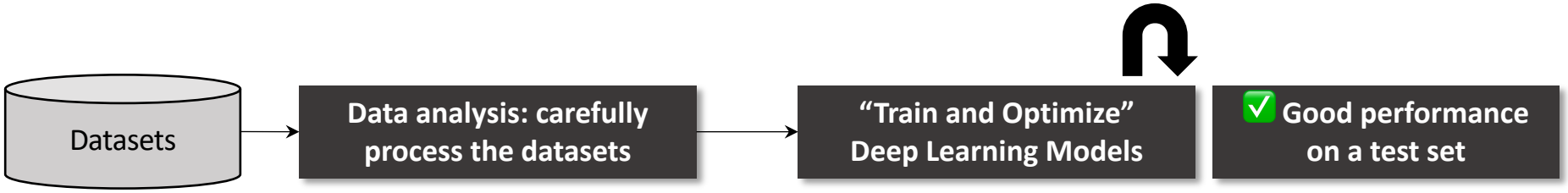
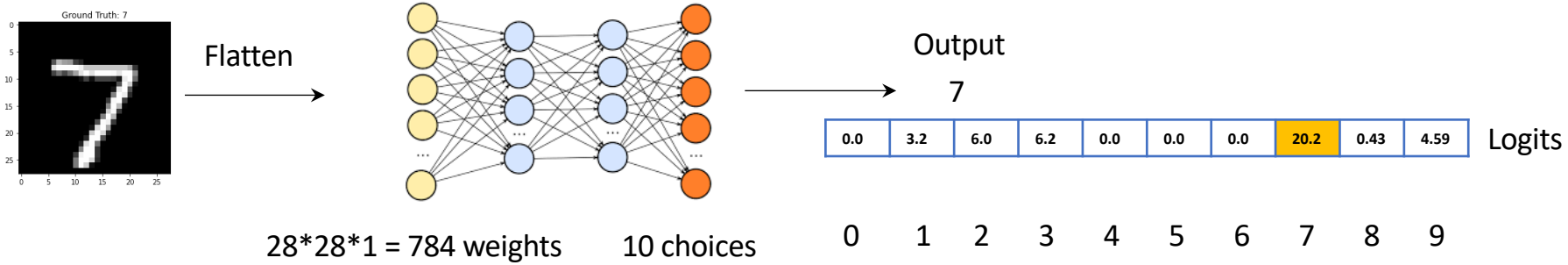
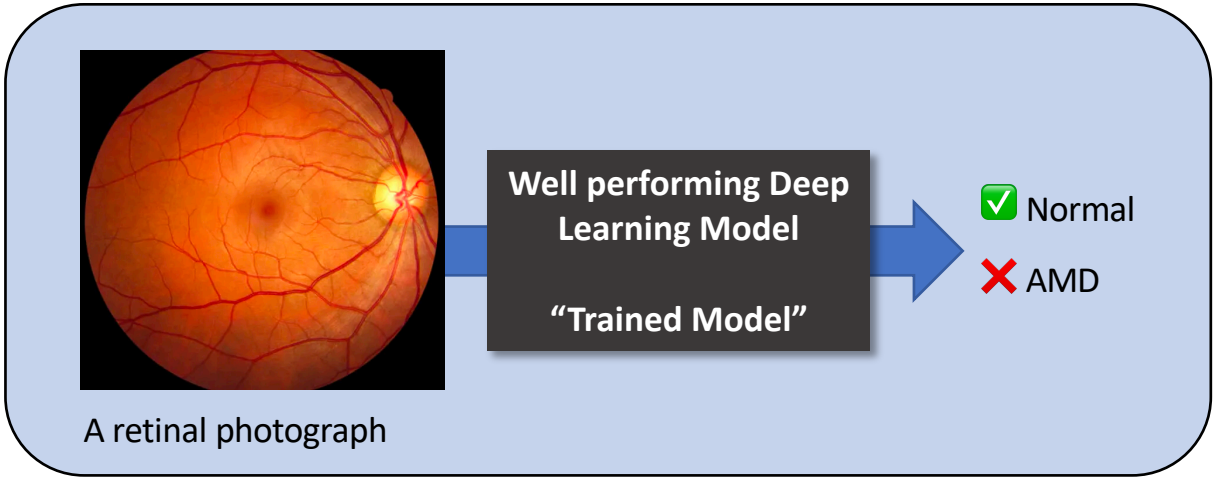
Generic Deep Learning Pipeline



Deep Neural Networks (Fully Connected, Multilayer Perceptrons)

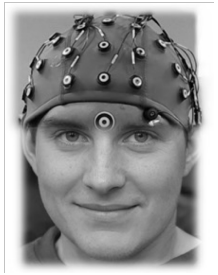


Large images is a problem!



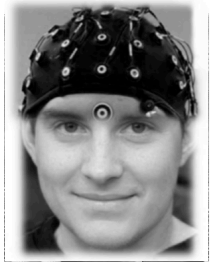
What about 512x512 images?
A single 512x512 color image can have 512*512*3 = 786432 weights !
We will need several more FC layers. Hence DNNs are not scalable to larger images.

Traditional Image Processing



0.0625	0.125	0.0625
0.125	0.25	0.125
0.0625	0.125	0.0625

blur



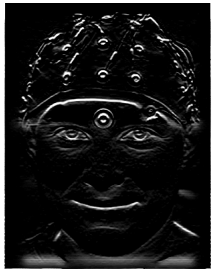
Blur

0	0	0
50	50	50
255	255	255

Horizontal

-1	-2	-1
0	0	0
1	2	1

bottom sobel



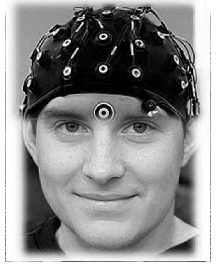
Bottom Sobel

0	50	255
0	50	255
0	50	255

Vertical

0	-1	0
-1	5	-1
0	-1	0

sharpen



Sharpen

https://setosa.io/ev/image-kernels/

Traditional Image Processing

Object detection using traditional image processing techniques.

We usually have a source image, and we are trying to see if the source is in the target.

What are some of the issues that might pop up?

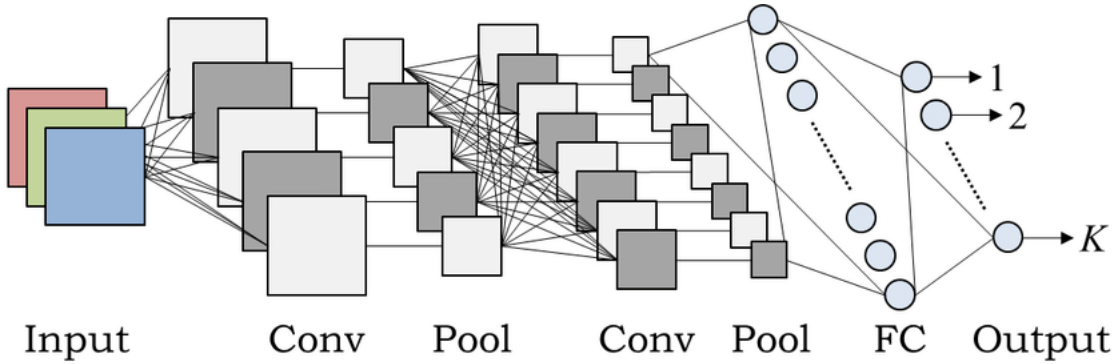
- Scaling
- Rotation
- Textures?
- Colors?
- Day or night?

- Hand crafting these features require subject matter experts.
- Small changes in the input image could drastically change the predictions.
- We might have to develop 100's of kernels (filters) to achieve it (what happens if it snows next?).

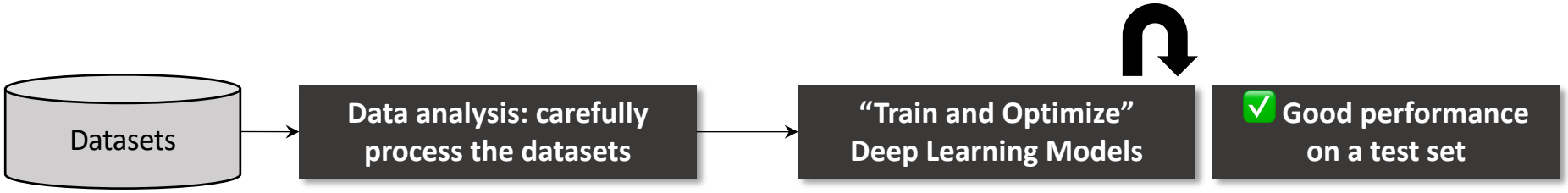
Using Convolution Operation to Learn Kernels

- Instead of hand-featured kernels, can we learn to optimize the weights in these kernels using an optimization algorithm?
- What if it could help with the classic invariance issues that we mentioned?
- Convolutional Neural Networks (CNNs) are designed specifically for this.

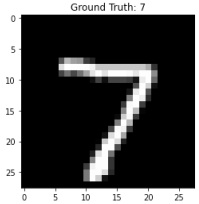
- Scaling
- Rotation
- Textures?
- Colors?
- Day or night?

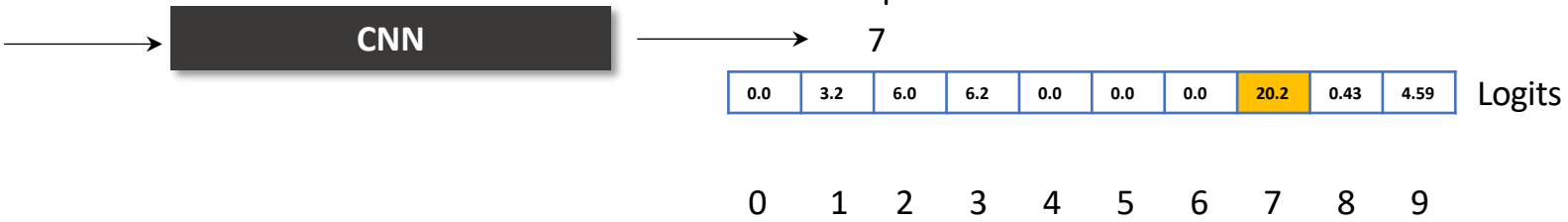


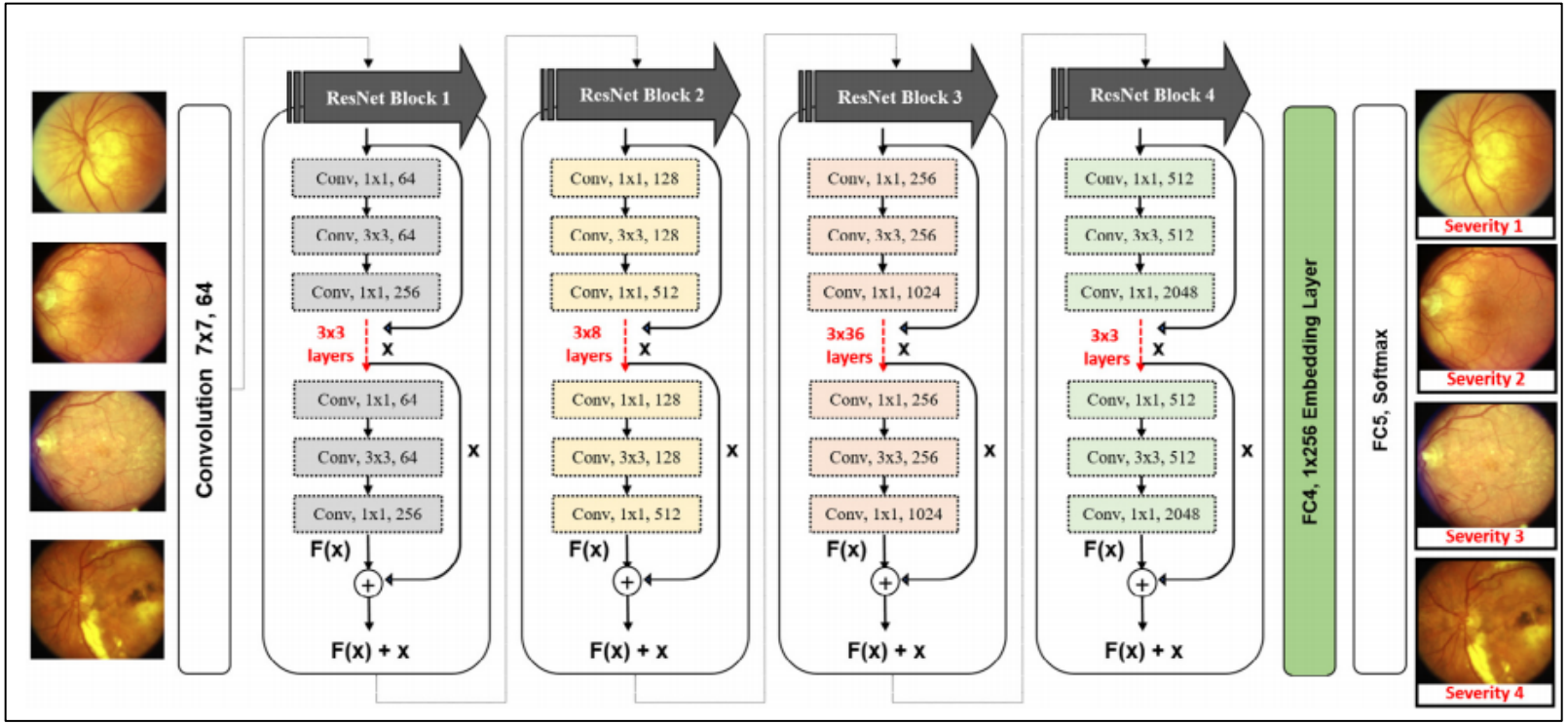
Generic Deep Learning Pipeline



CNNs







Das, Arun, et al. "Distributed machine learning cloud teleophthalmology IoT for predicting AMD disease progression." *Future Generation Computer Systems* 93 (2019): 486-498.