Image Classification with Convolutional Neural Networks

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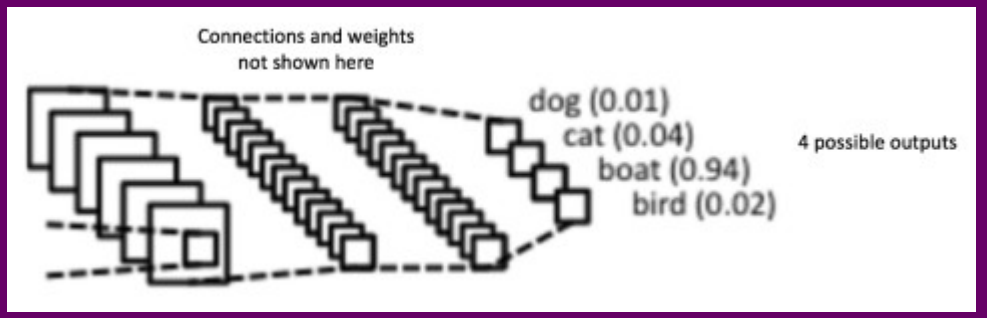
What is it?

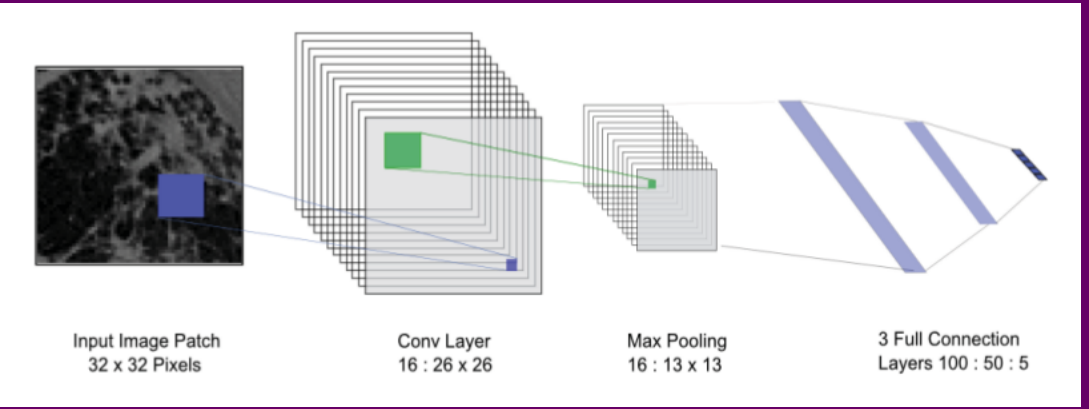
- Technique to classify images in to pre-determined groups
- Compares a kernel to each part of the image to find a convolved feature
- Multiple layers of neurons
- Final result is some number [0,1] at the end neurons



https://ujwlkarn.files.wordpress.com/2016/08/screen-shot-2016-08-06-at-12-34-02-am.png?w=484&h=152

Why bother?

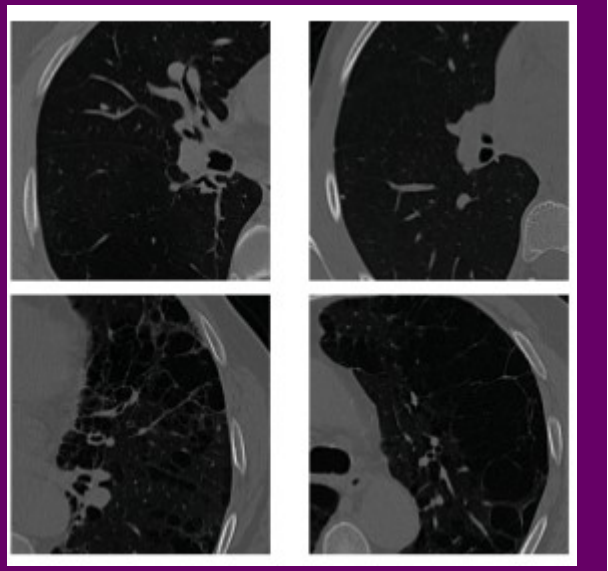
- Difficult problem to solve as involves use of non-direct comparisons
- No easy way to ask “is there an <x> in this picture?”
- Many practical uses in medicine, engineering



“Medical Image Classification with Convolutional Neural Network” – Qing Li, Weidong Cai, Xioagang Wang et. al. c.2014

Approach 1

- “Medical Image Classification with Convolutional Neural Network”
- Uses a CNN to classify whether an image of a lung is normal or has one of several disorders
- Only a single convolutional layer – more interested in texture than image features
- Works well in domain but very specific. Can’t easily be applied to other domains without lots of training.

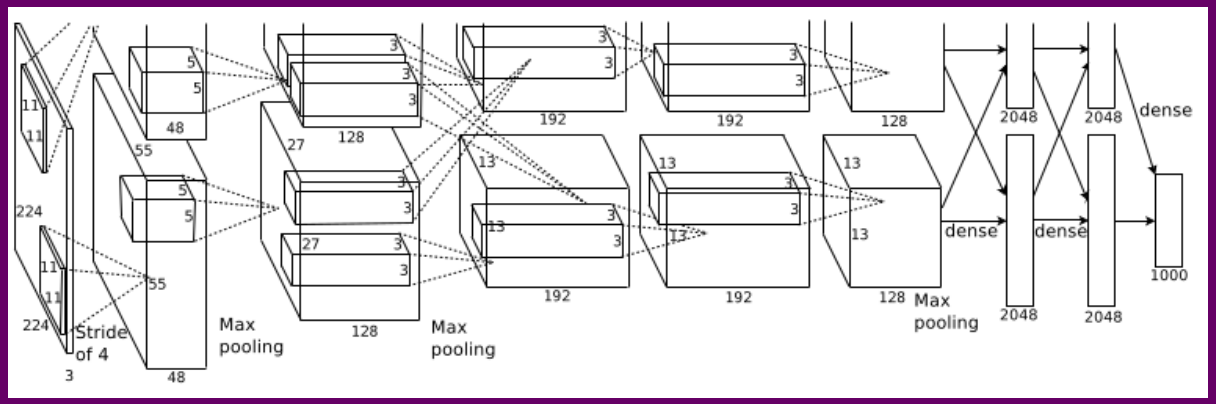


“Medical Image Classification with Convolutional Neural Network” – Qing Li, Weidong Cai, Xioagang Wang et. al. c.2014

First two are normal, second two have emphysema

Approach 2

- “ImageNet Classification with Deep Convolutional Neural Networks”
- Uses newly developed techniques to improve accuracy against massive data sets (15 million images, 22,000 categories!)
- Need to mitigate against “overfitting” - model fits too closely to training set, misses general trend
- Trains on multiple GPUs, allowing for parallelisation



“ImageNet Classification with Deep Convolutional Neural Networks” - Alex Krizhevsky, Ilya Sutskever, Geoffrey E. Hinton c. 2017

Conclusion

- Important but difficult problem to solve
- Lots of new techniques being developed – ReLU, dropout
- Success rates constantly improving, almost at human level (0.3% error) on small data sets

References

“ImageNet Classification with Deep Convolutional Neural Networks” - Alex Krizhevsky, Ilya Sutskever, Geoffrey E. Hinton c. 2017

“Medical Image Classification with Convolutional Neural Network” – Qing Li, Weidong Cai, Xioagang Wang et. al. c.2014

“An Intuitive Explanation of Convolutional Neural Networks” - https://ujjwalkarn.me/2016/08/11/intuitive-explanation-convnets/