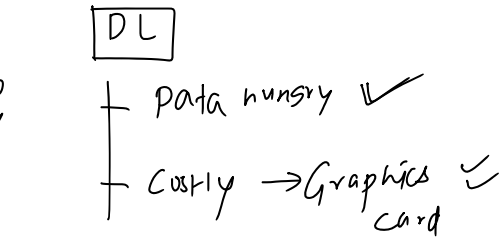
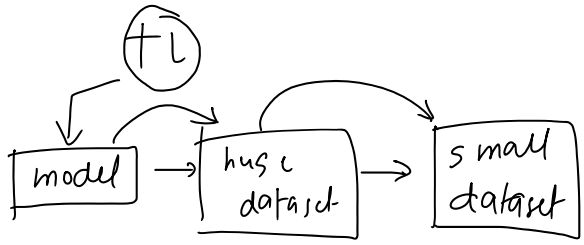
What is Transfer Learning

31 January 2025 11:12

Transfer learning is a machine learning technique where a model trained on one task is reused (partially or fully) for a different but related task. Instead of training a model from scratch, which can be computationally expensive and require large datasets, transfer learning leverages knowledge from a pre-trained model to improve learning efficiency and performance.



How Transfer Learning Works



1. Pretraining on a Large Dataset
   - A model is first trained on a large dataset (e.g., ImageNet for images, GPT for text).
   - The model learns general features, such as edges and shapes in images or syntax and semantics in text.
2. Fine-Tuning for a New Task
   - The pre-trained model is then adapted to a new, often smaller, dataset.
   - Some layers may be frozen (not updated), while others are fine-tuned for the specific task.

Why does Transfer Learning work?

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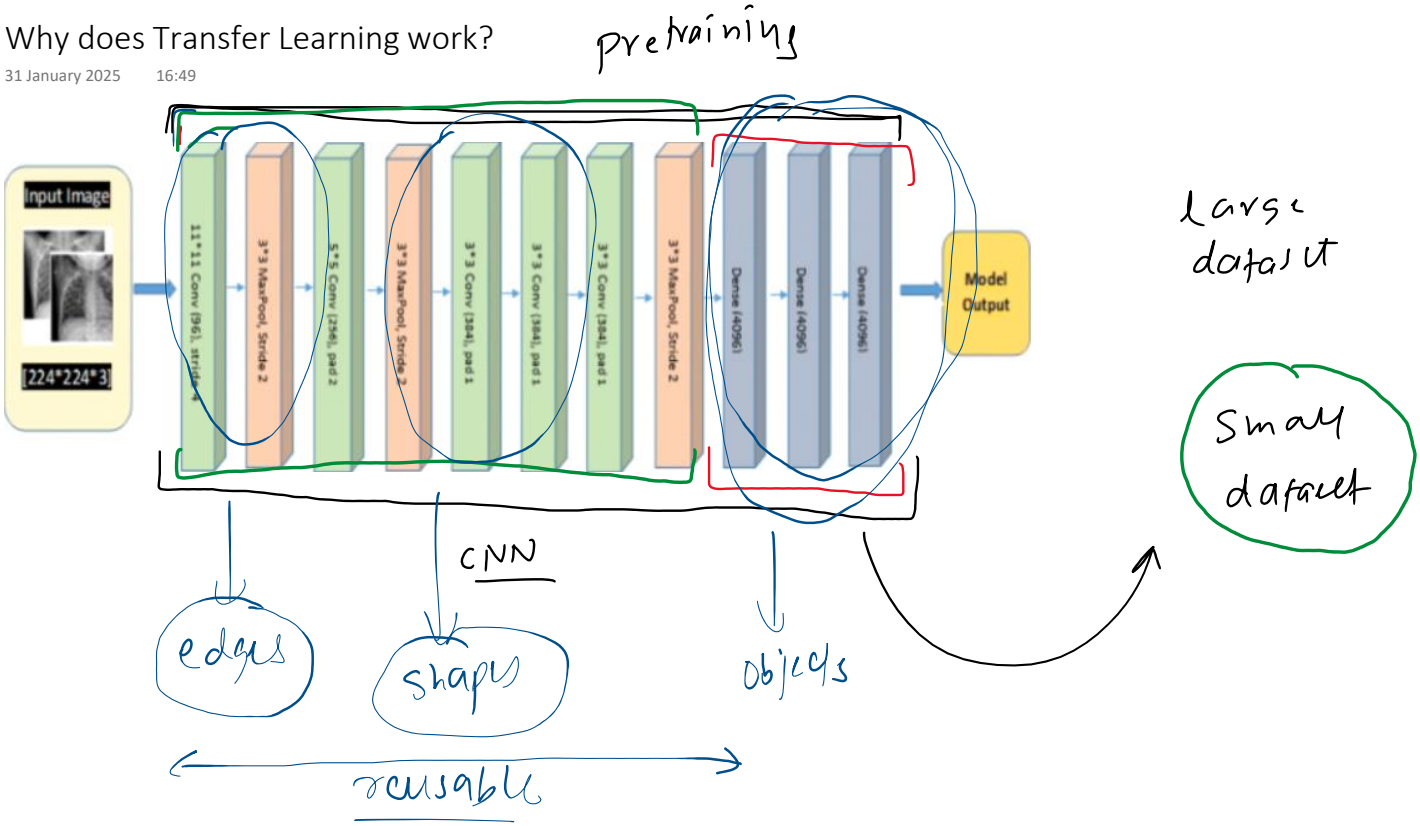

Workflow

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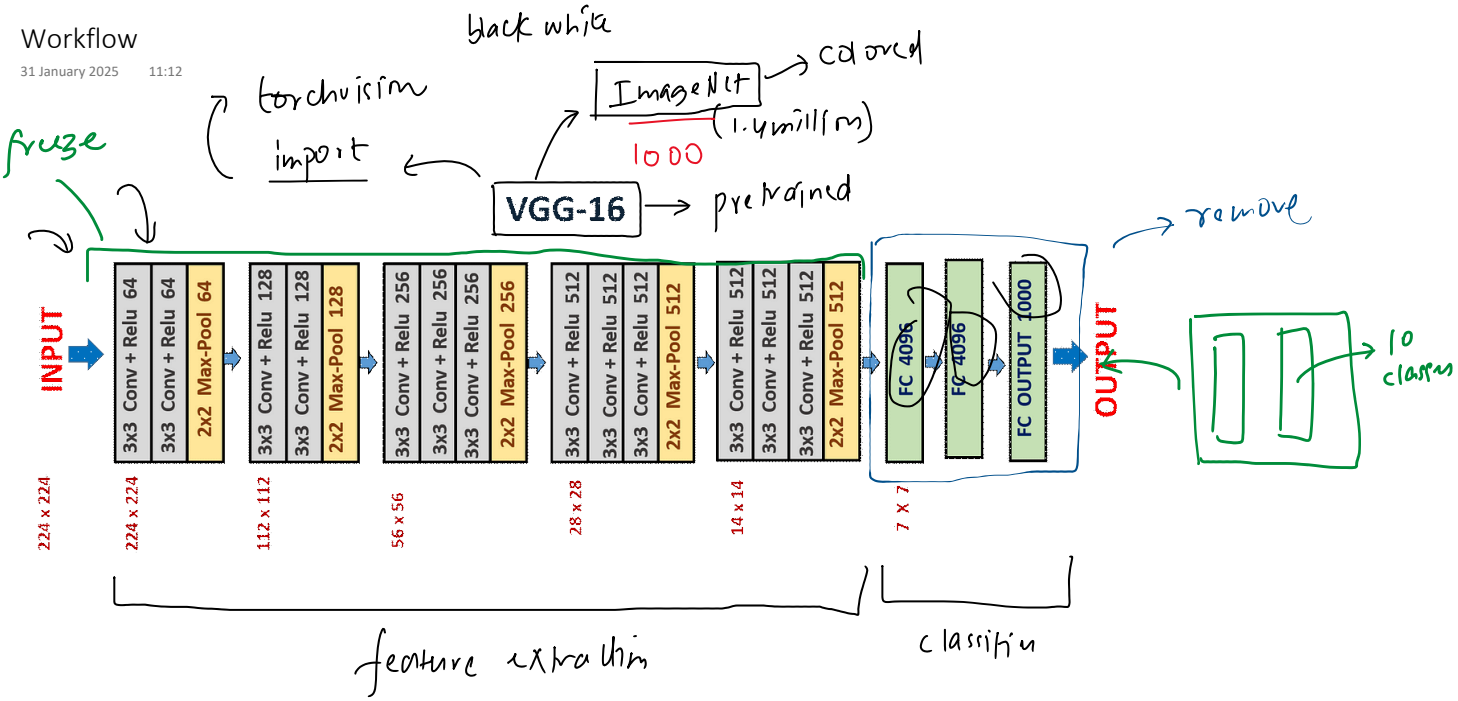


1) import
2) detach classifier
3) attach classifier
4) freeze fe layer
5) train

Data prepare

[modify]

tabular (1, 784)

pixel1	pixel2	pixel3	pixel4	pixel5	pixel6	pixel7	pixel8	pixel9	...	pixel775	pixel776	pixel777	pixel778	pixel779	pixel780	pixel781	pixel782	pixel783	pixel784
0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0

(1, 28, 28) 1) ~~reshape (28, 28)~~ → 2d (matrix) → PIL

(1,28,28) 1) ~~reshape (28,28)~~ → 2d (matrix) → PIL

→ 2) ~~datatype~~ → ~~(np.uint8)~~

→ 3) ~~1D → 3D~~ → (3,28,28)

→ 4) tensor → PIL image (3,28,28)

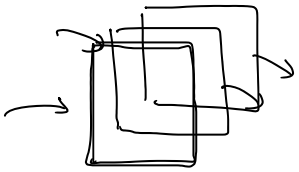
5) ~~resize (3,256,256)~~ →

6) ~~center crop~~ (3,224,224) →

7) ~~tensor (scale)~~ → (0,1) →

8) ~~normalize~~ →

$$p = \frac{p - \mu}{\sigma}$$



(3,224,224)

Transfer Learning

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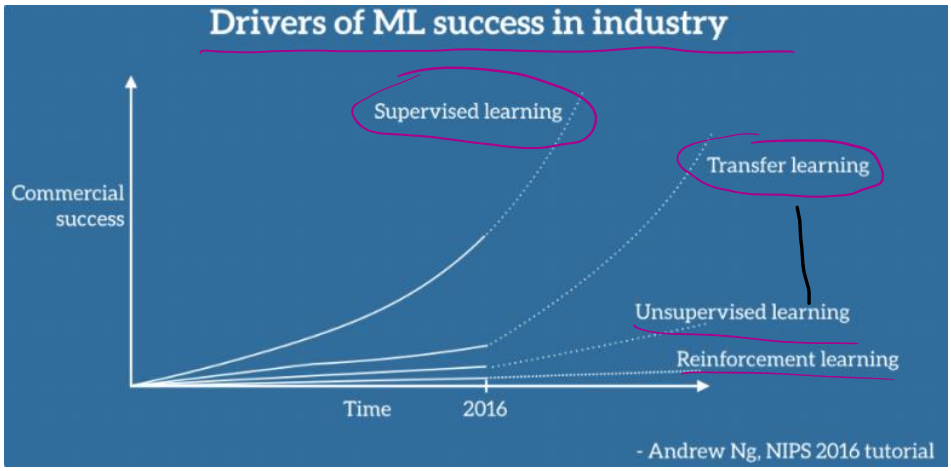
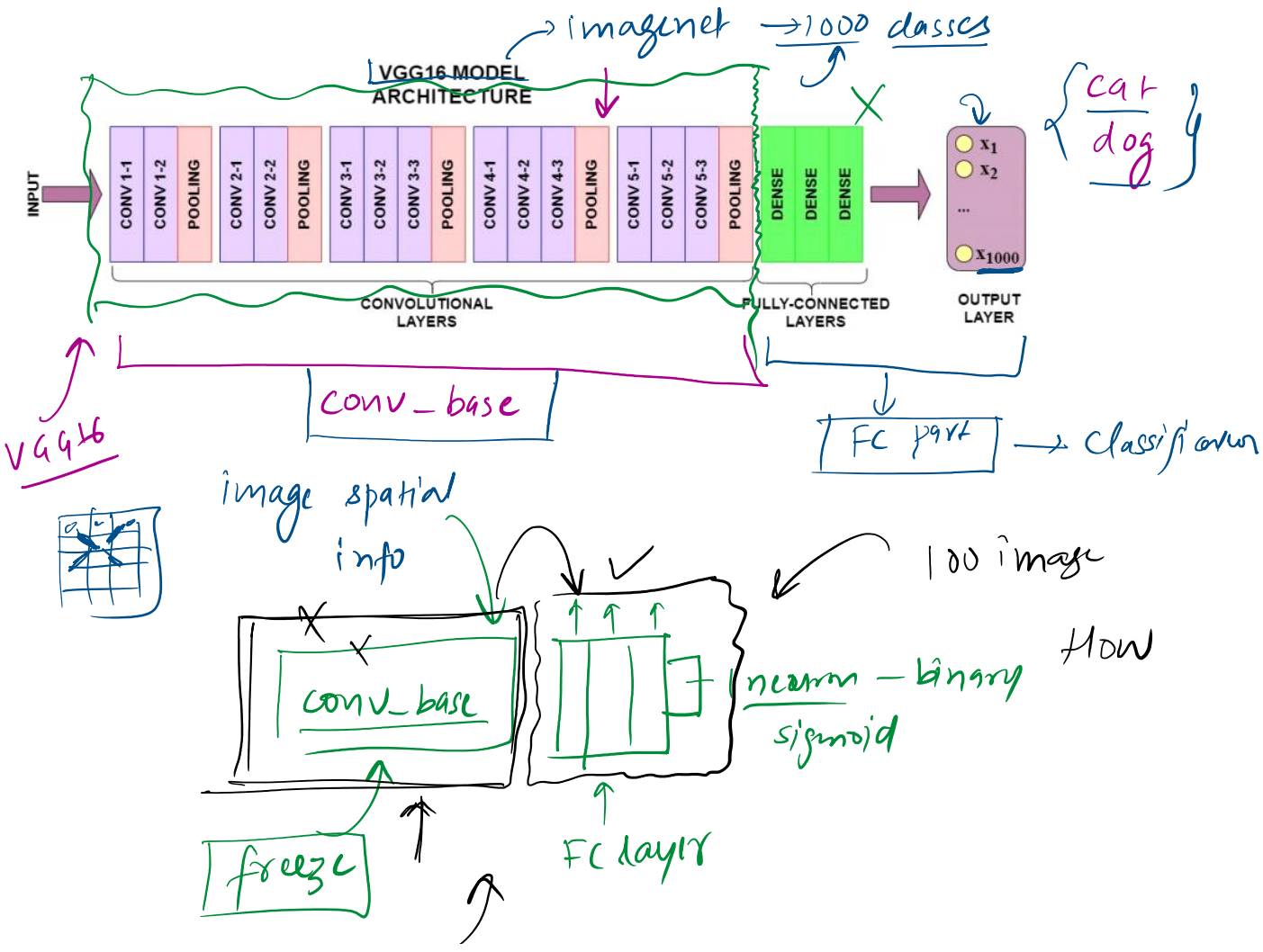
Transfer learning is a research problem in machine learning that focuses on storing knowledge gained while solving one problem and applying it to a different but related problem.





Why Transfer Learning works

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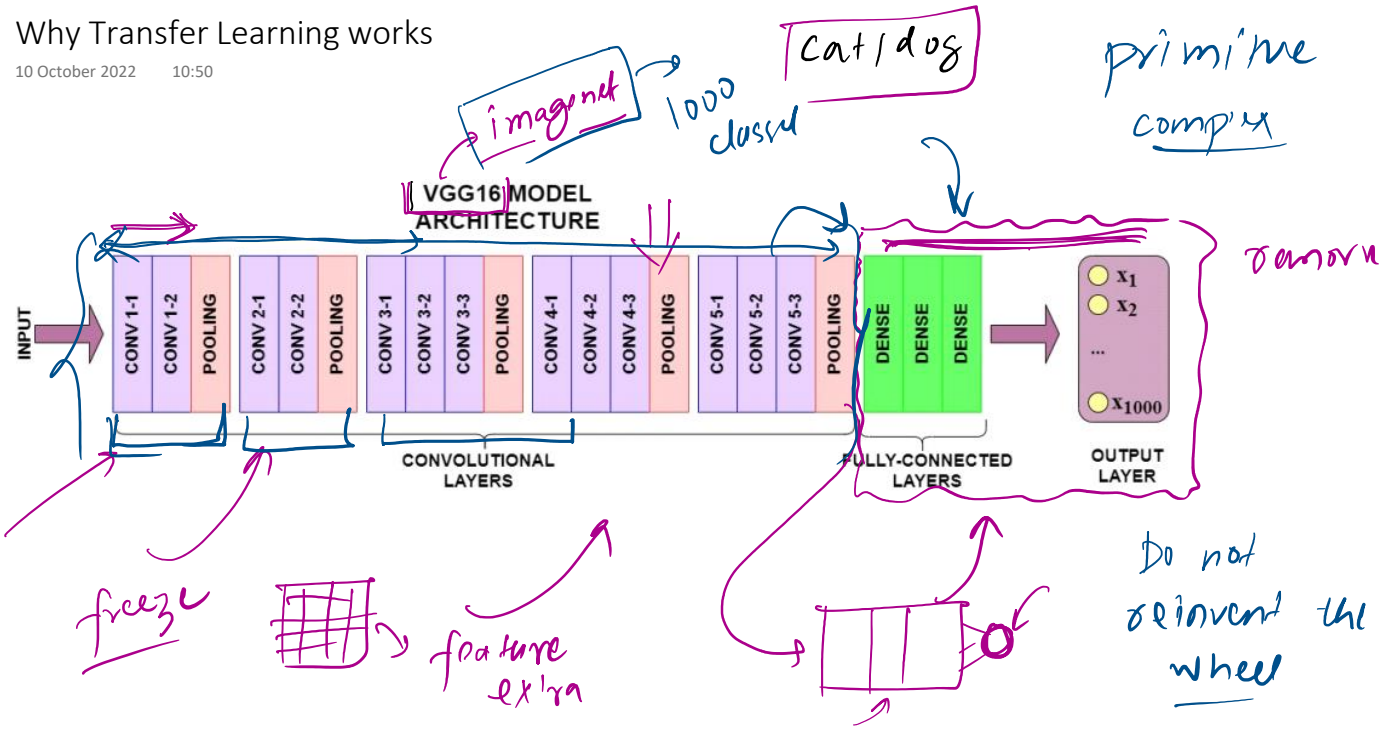

Ways of doing Transfer Learning

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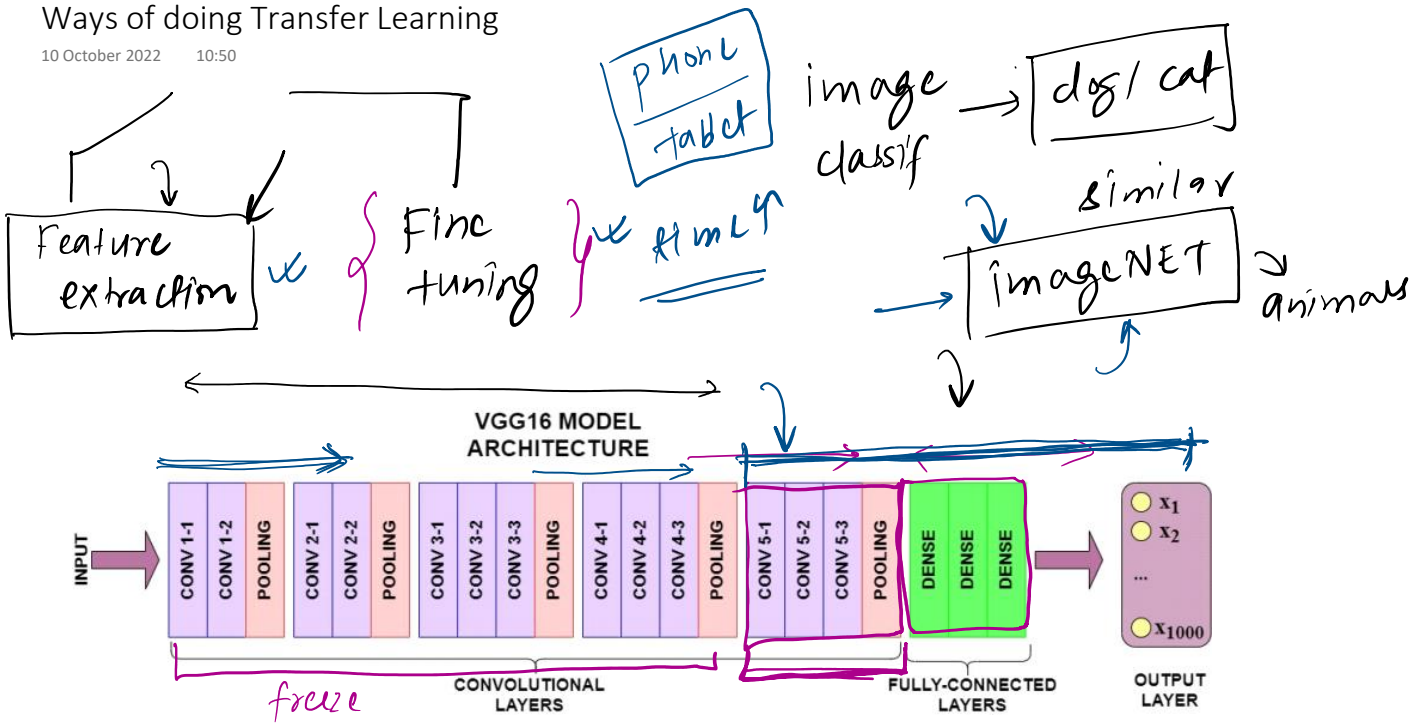

Why use Pretrained models?

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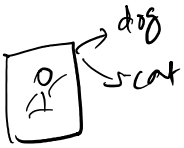
1) Data hungry → image data → labelled data → cat dog → google



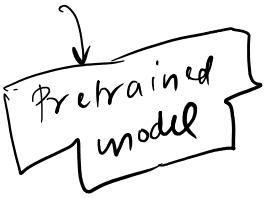
labelling

10000 photos

manually

pinterest

2) Time → model → training



ImageNET Dataset

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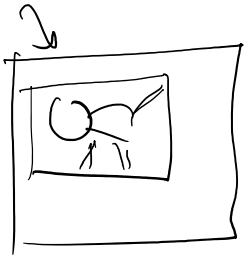
Visual Database of images (Why What and How)



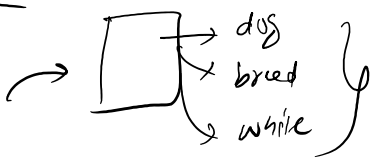
Why

2006 → Fei fei Li → model and algorithms

1.4 million images → 1.4 crore image → 20,000 categories → labelled

1 million images → to label → bounding box

↳ object local



How → crowd sourcing

→ Amazon mechanical Turk

↳ Dataset → Deep learning

ImageNET challenge

ILSVRC

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Imagenet challenge → 2010 → Dataset → subset → 1 million → 10 → 20,000 classes → 1000 classes

14 crore

100 image

Machine learning → feature extraction → SIFT, HOG

2010 → 28%.

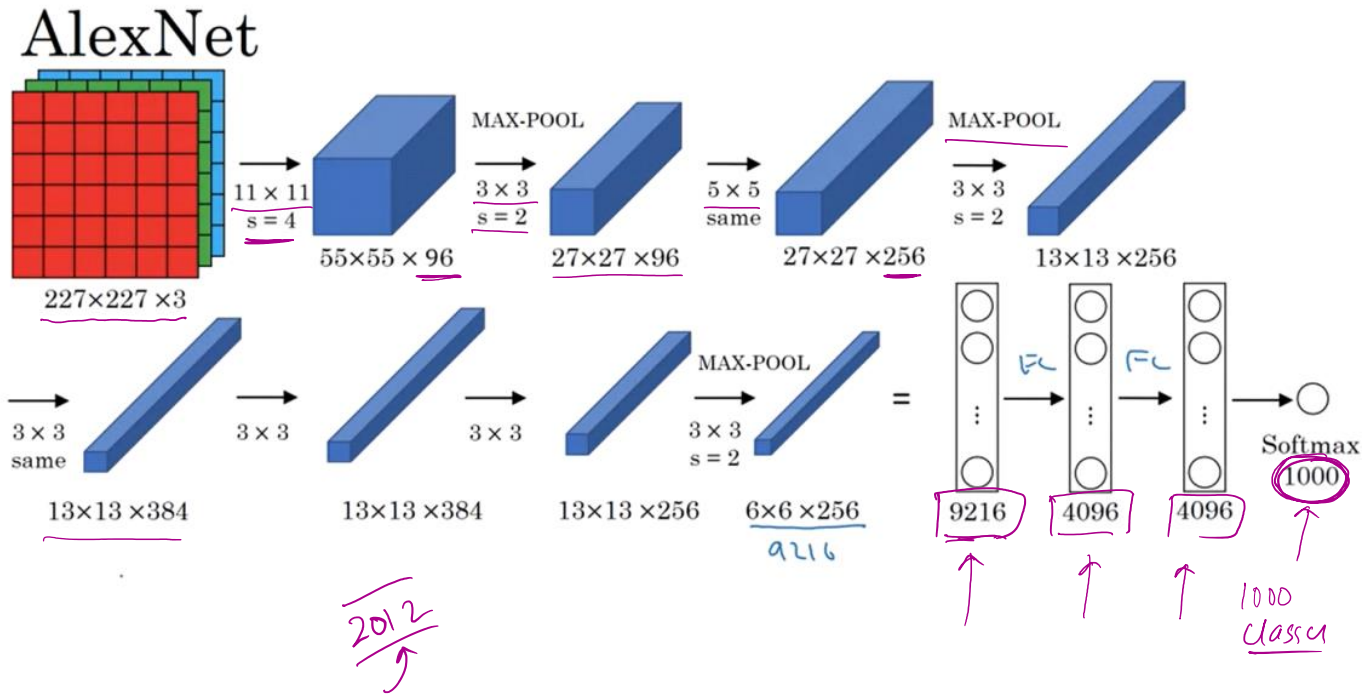
2011 → 25%.

2012 → 16%. → CNN

2013 →

2012 → DL → AlexNET → CNN → relu

Deep GPU



[Krizhevsky et al., 2012. ImageNet classification with deep convolutional neural networks]

Andrew Ng

Famous Architectures

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