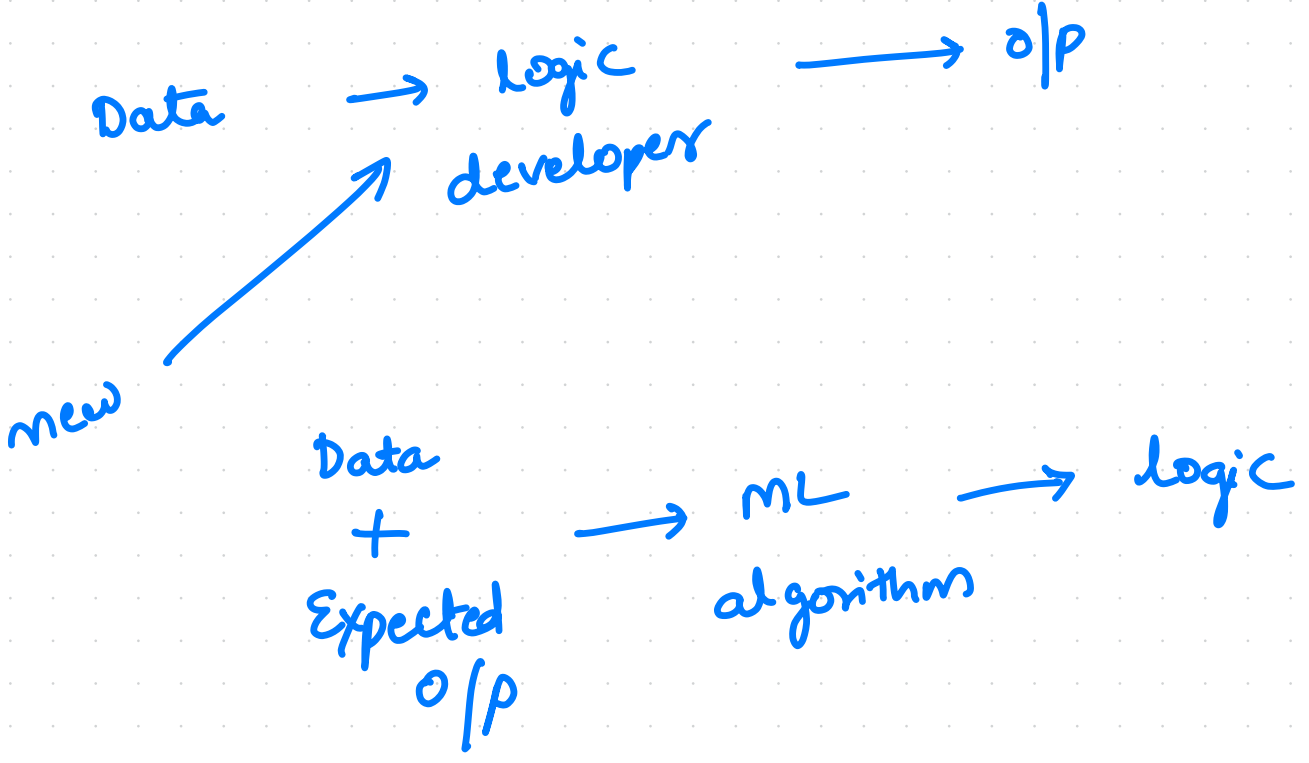
# Deep Learning



# Deep learning

## Overfit

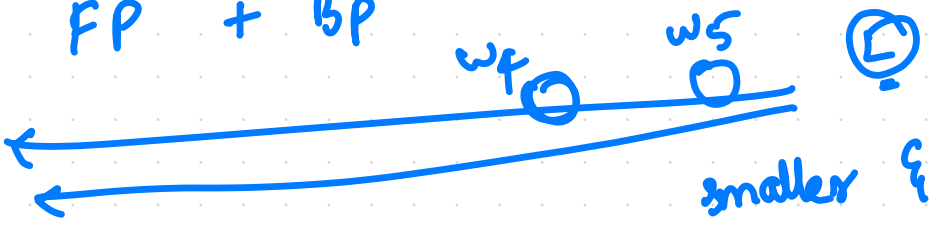
- Regularization: L1 & L2 ✓
- Drop out ✓
- Early stopping ✓

## Underfit

- Increase complexity
- Use pre-trained

Choose optimizers efficiently,
Normalization, Initializers

FP + BP




smaller & smaller

$$w = w - \eta \frac{\partial L}{\partial w}$$

small

$$\frac{\partial L}{\partial w_5}$$

$$\frac{\partial L}{\partial w_4} = \frac{\partial L}{\partial w_5} \frac{\partial w_5}{\partial w_4}$$

$10 - 0.000001$
$= 9.999999$

Vanishing gradients

Exploding Gradients

# Initializers

Glorot & He initialization

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$l_1$ & $l_2$

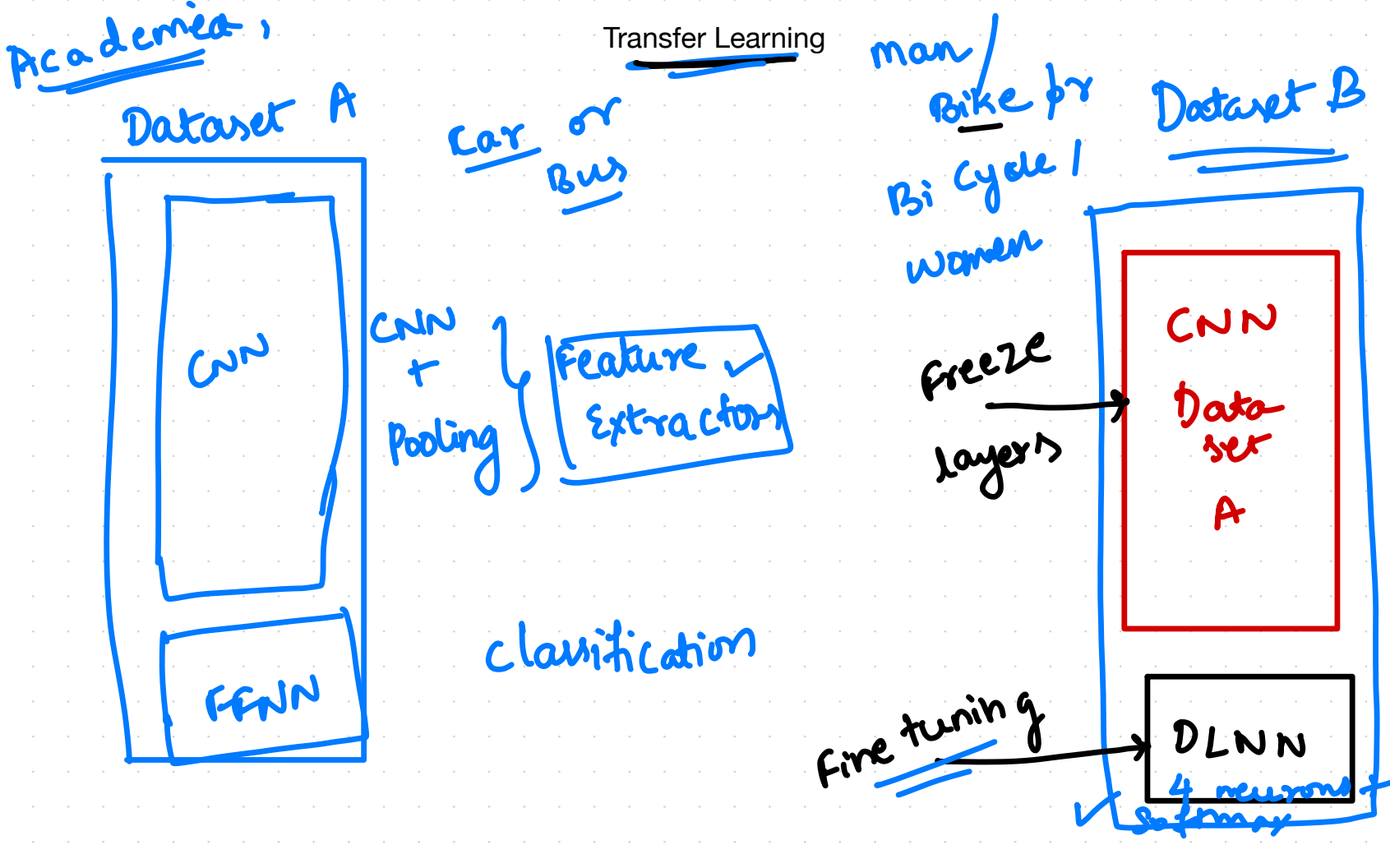
$l_2$ regularization

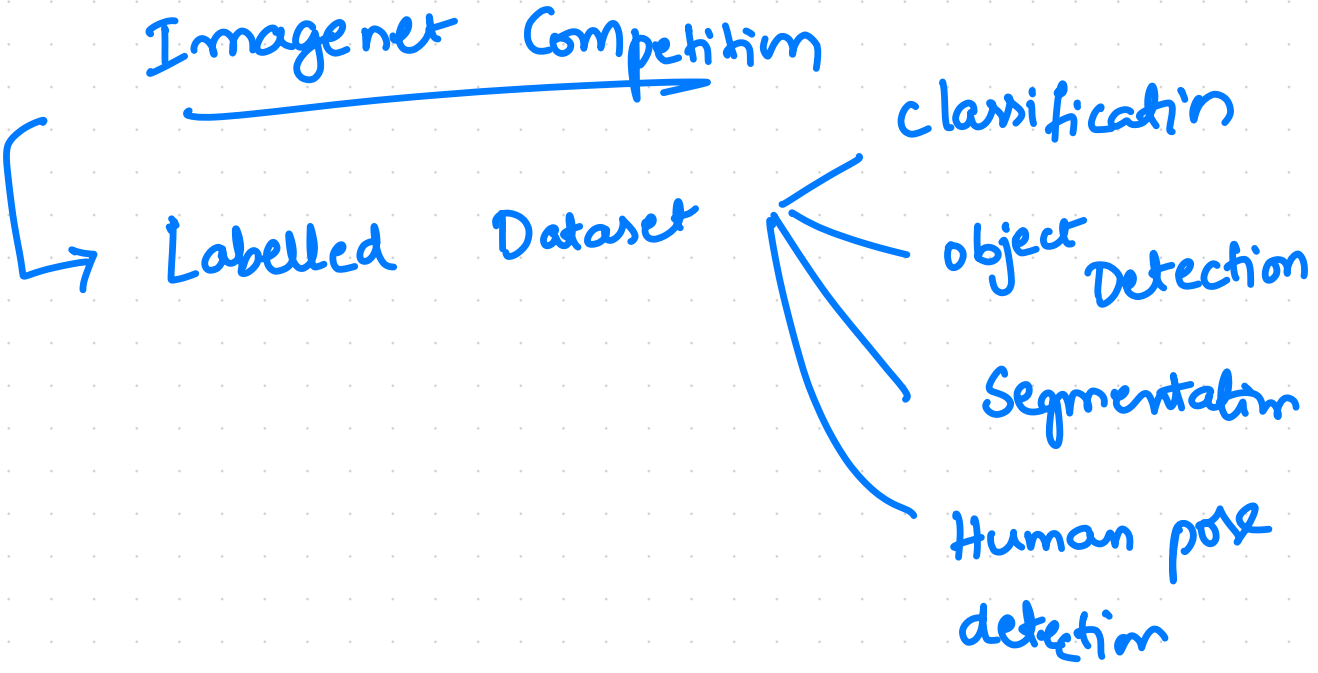
Batch 32 → Forward pass → Loss + $l_2$ loss

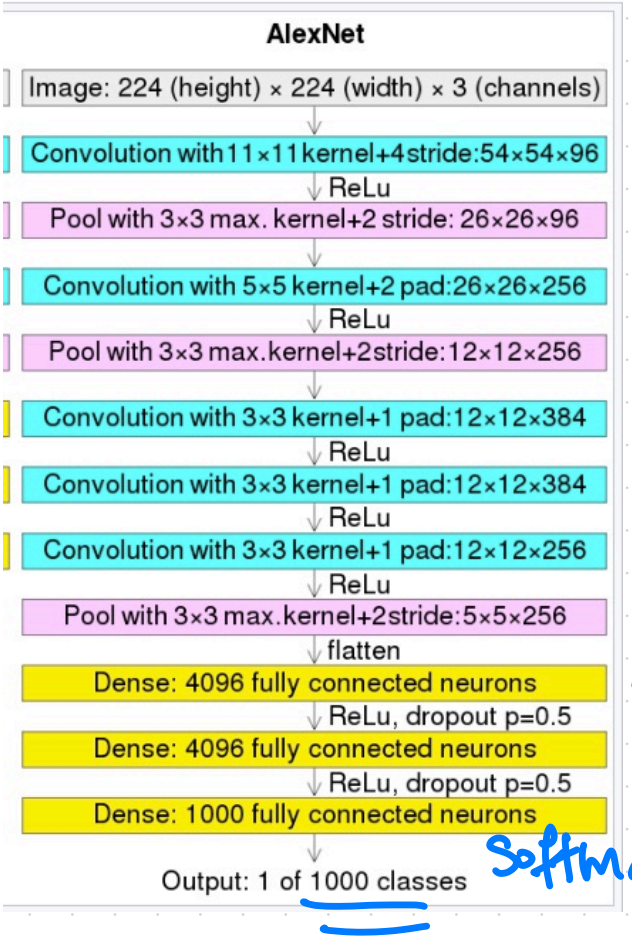
$l_1$ loss

$l_1$ - $l_2$ (L)

Transfer Learning




Imagenet Competition
Labelled Dataset
classification
object Detection
Segmentation
Human pose detection




| Layer | # filters / neurons | Filter size | Stride | Padding | Size of feature map | Activation function |
|---|---|---|---|---|---|---|
| Input | - | - | - | - | 227 x 227 x 3 | - |
| Conv 1 | 96 | 11 x 11 | 4 | - | 55 x 55 x 96 | ReLU |
| Max Pool 1 | - | 3 x 3 | 2 | - | 27 x 27 x 96 | - |
| Conv 2 | 256 | 5 x 5 | 1 | 2 | 27 x 27 x 256 | ReLU |
| Max Pool 2 | - | 3 x 3 | 2 | - | 13 x 13 x 256 | - |
| Conv 3 | 384 | 3 x 3 | 1 | 1 | 13 x 13 x 384 | ReLU |
| Conv 4 | 384 | 3 x 3 | 1 | 1 | 13 x 13 x 384 | ReLU |
| Conv 5 | 256 | 3 x 3 | 1 | 1 | 13 x 13 x 256 | ReLU |
| Max Pool 3 | - | 3 x 3 | 2 | - | 6 x 6 x 256 | - |
| Dropout 1 | rate = 0.5 | - | - | - | 6 x 6 x 256 | - |

| Layer | # filters / neurons | Filter size | Stride | Padding | Size of feature map | Activation function |
|---|---|---|---|---|---|---|
| - | - | - | - | - | - | - |
| - | - | - | - | - | - | - |
| - | - | - | - | - | - | - |
| Dropout 1 | rate = 0.5 | - | - | - | 6 x 6 x 256 | - |
| Fully Connected 1 | - | - | - | - | 4096 | ReLU |
| Dropout 2 | rate = 0.5 | - | - | - | 4096 | - |
| Fully Connected 2 | - | - | - | - | 4096 | ReLU |
| Fully Connected 3 | - | - | - | - | 1000 | Softmax |

classification