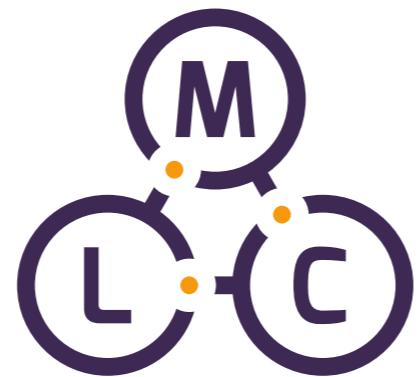


Convolutional Neural Networks and Image Processing

Jiří Materna

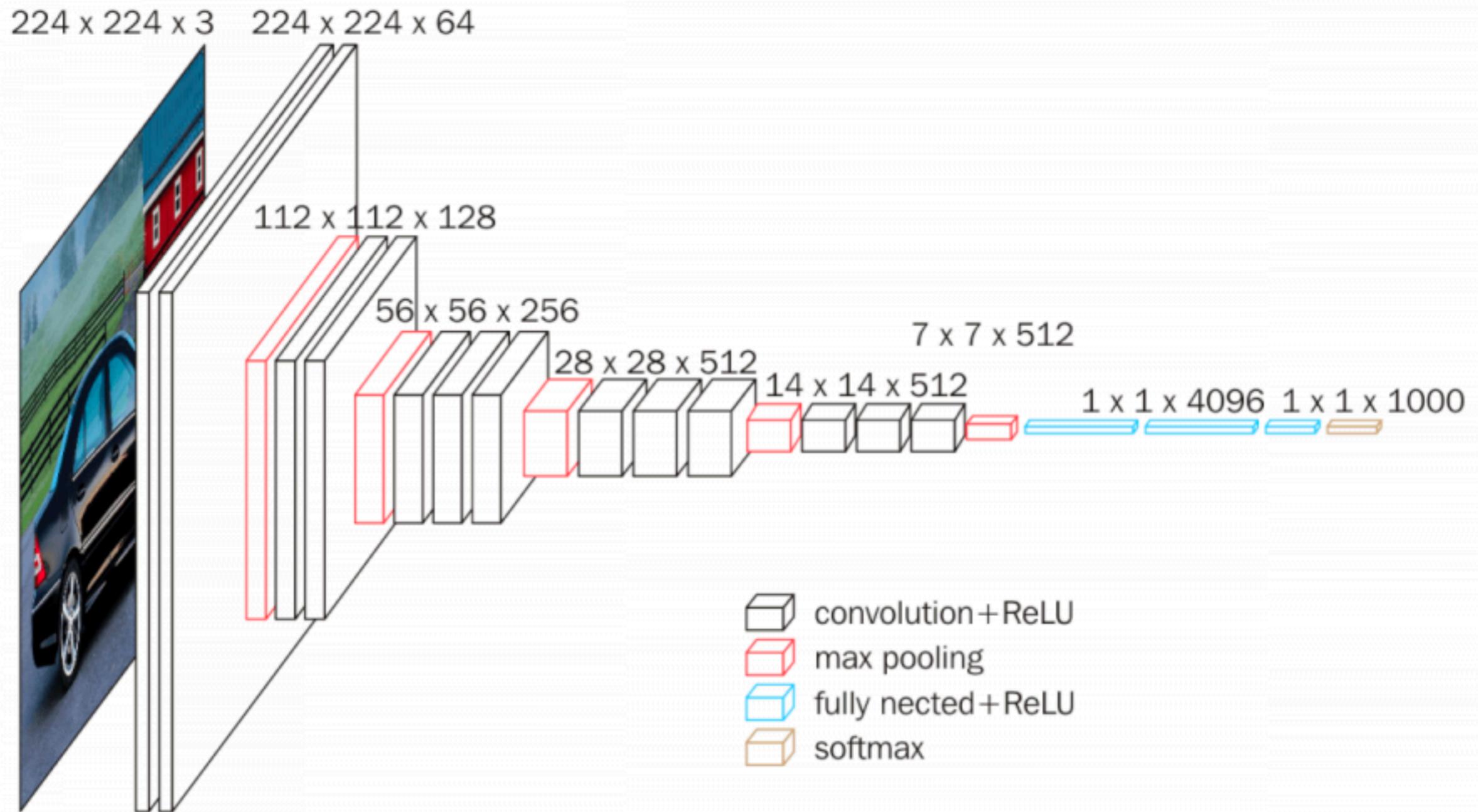


Machine
Learning
College

Image processing

- VGG 16 and ResNet
- Transfer learning and fine-tuning
- Image classification
- Batch normalization and data augmentation
- U-net and Image segmentation
- GANs and superresolution
- Neural network explainability
- Adversarial patch

VGG 16

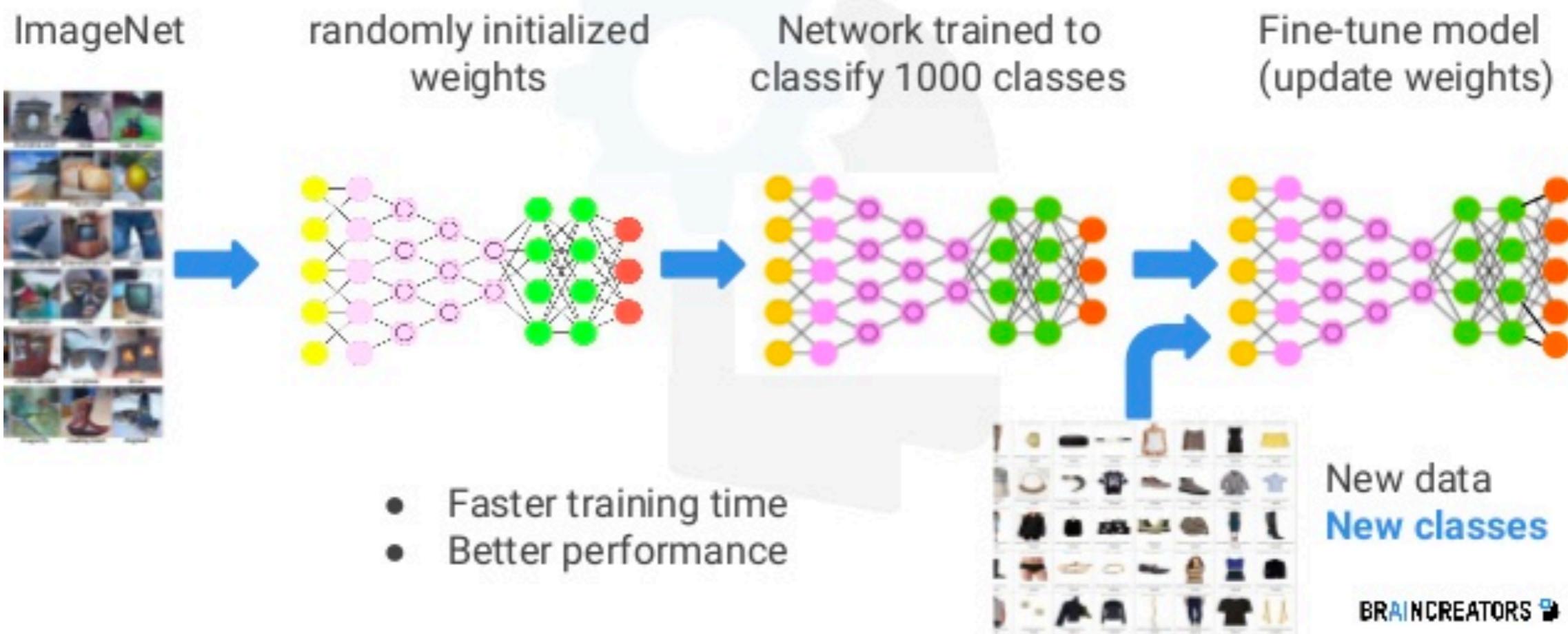


ResNet



Finetuning

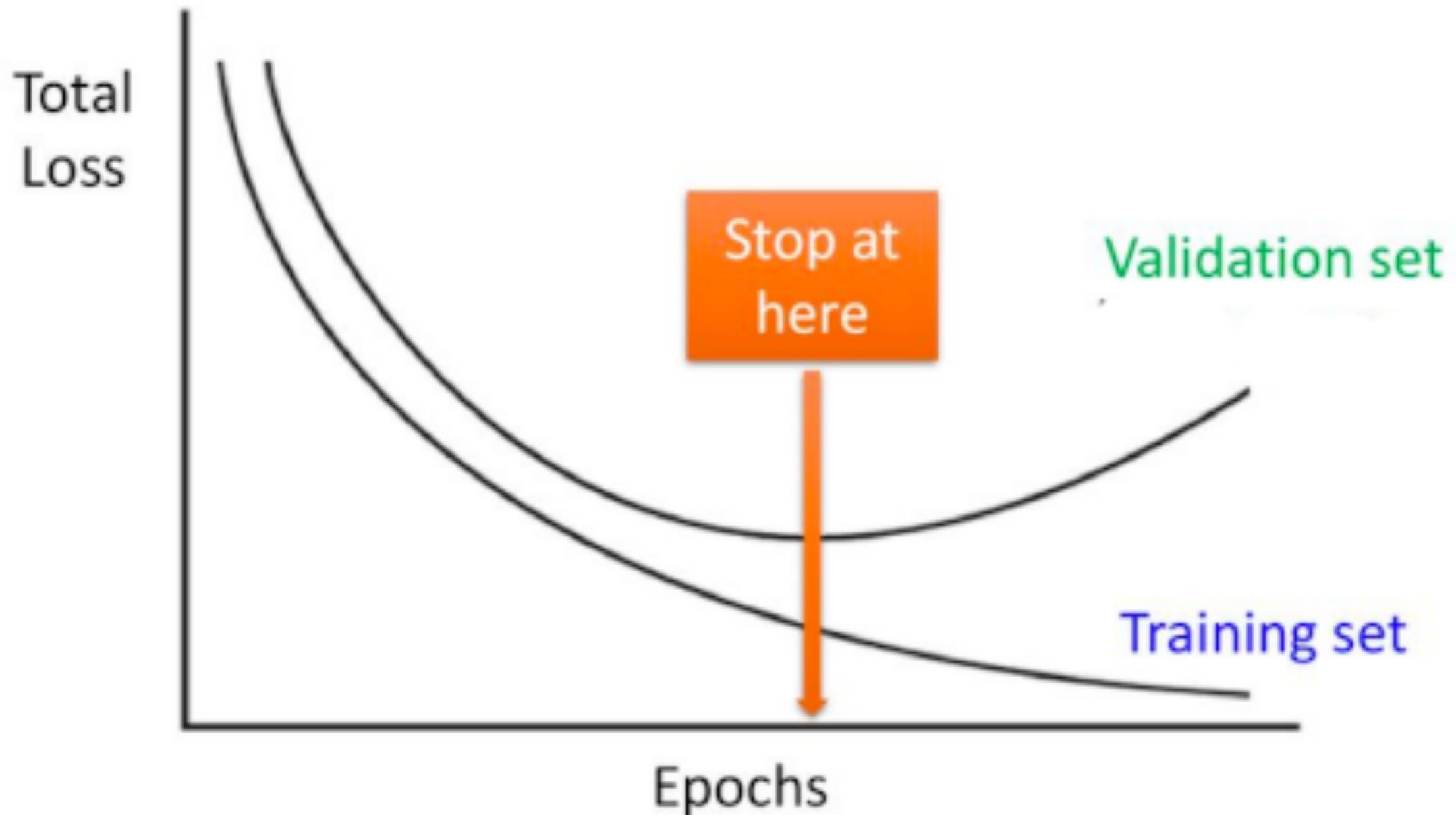
Transfer Learning



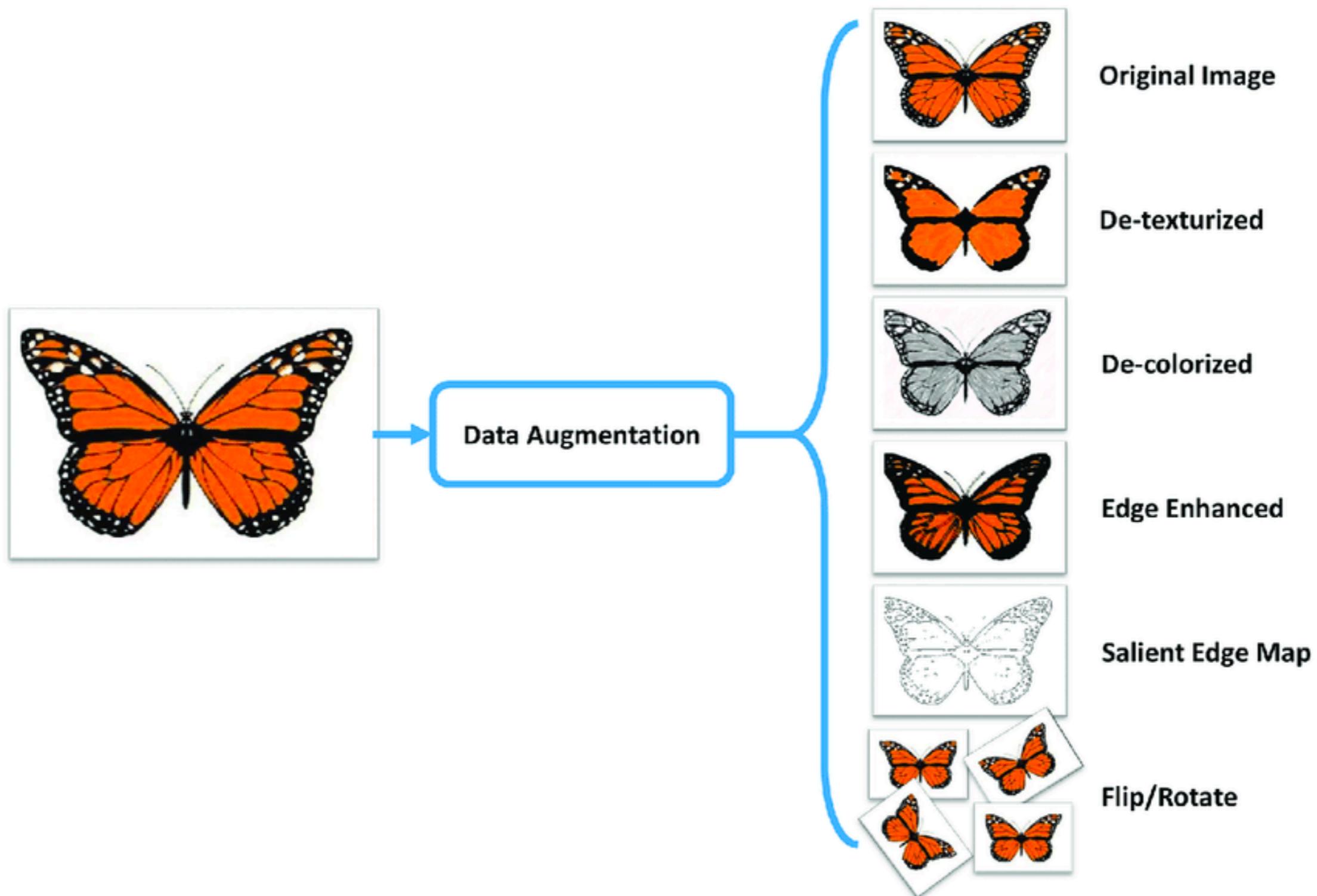
Transfer learning example

01-Transfer_learning.ipynb

Early stopping



Data augmentation



Batch normalization

Input: Values of x over a mini-batch: $\mathcal{B} = \{x_1 \dots m\}$;

Parameters to be learned: γ, β

Output: $\{y_i = \text{BN}_{\gamma, \beta}(x_i)\}$

$$\mu_{\mathcal{B}} \leftarrow \frac{1}{m} \sum_{i=1}^m x_i \quad // \text{mini-batch mean}$$

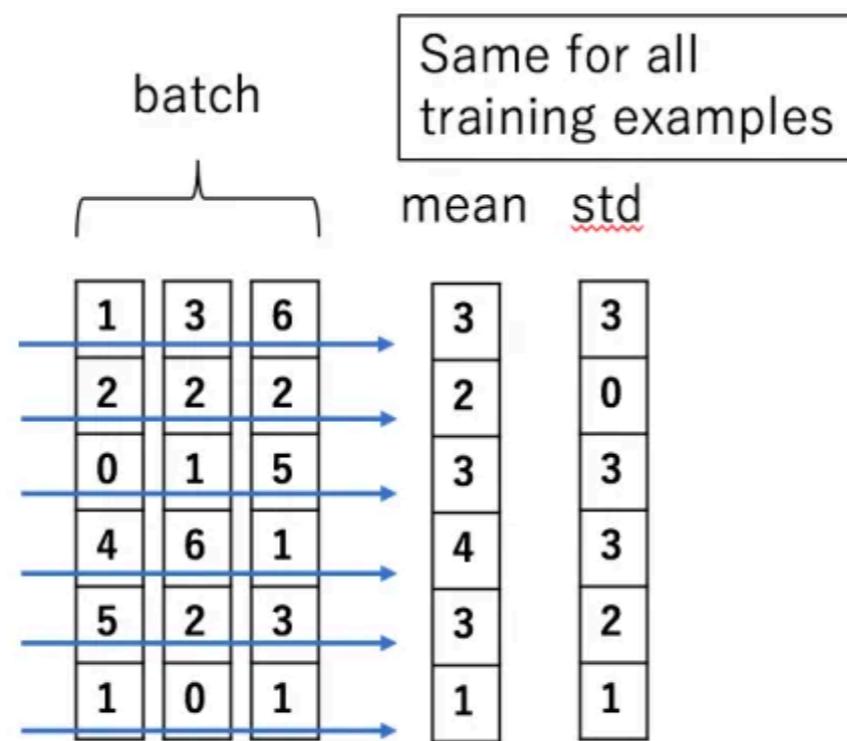
$$\sigma_{\mathcal{B}}^2 \leftarrow \frac{1}{m} \sum_{i=1}^m (x_i - \mu_{\mathcal{B}})^2 \quad // \text{mini-batch variance}$$

$$\hat{x}_i \leftarrow \frac{x_i - \mu_{\mathcal{B}}}{\sqrt{\sigma_{\mathcal{B}}^2 + \epsilon}} \quad // \text{normalize}$$

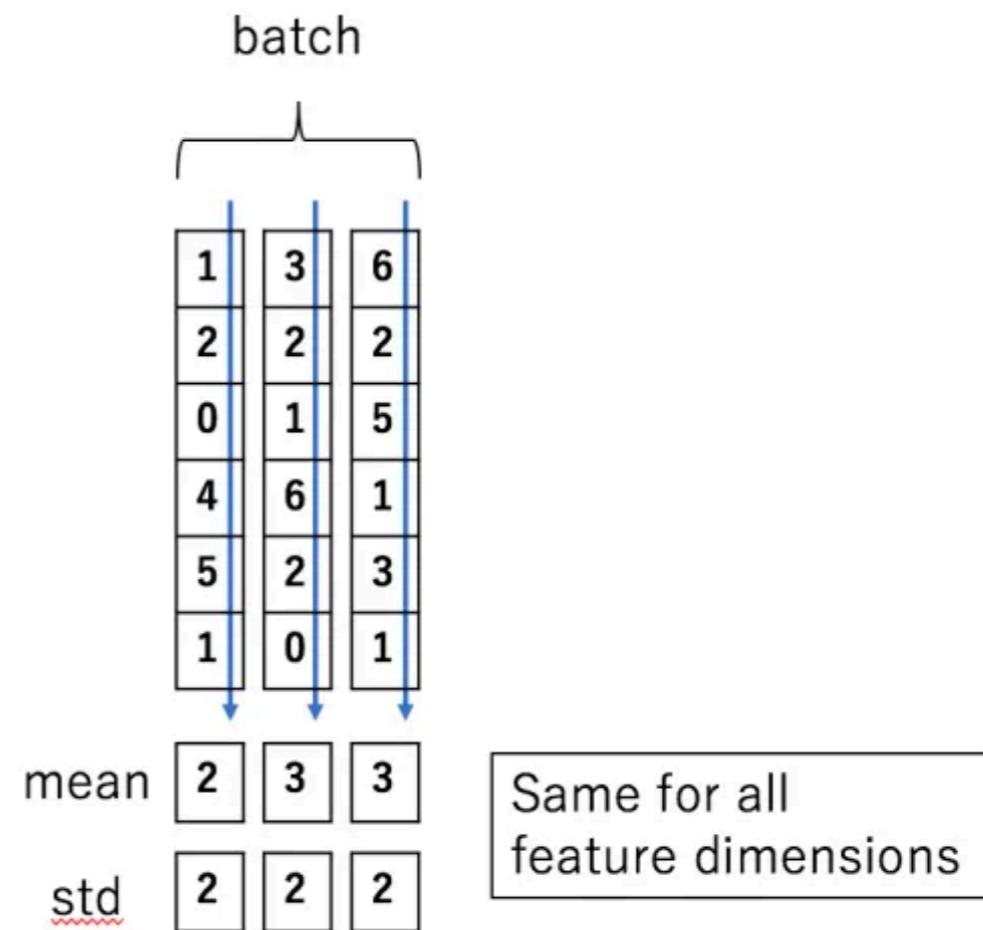
$$y_i \leftarrow \gamma \hat{x}_i + \beta \equiv \text{BN}_{\gamma, \beta}(x_i) \quad // \text{scale and shift}$$

Layer normalization

Batch Normalization



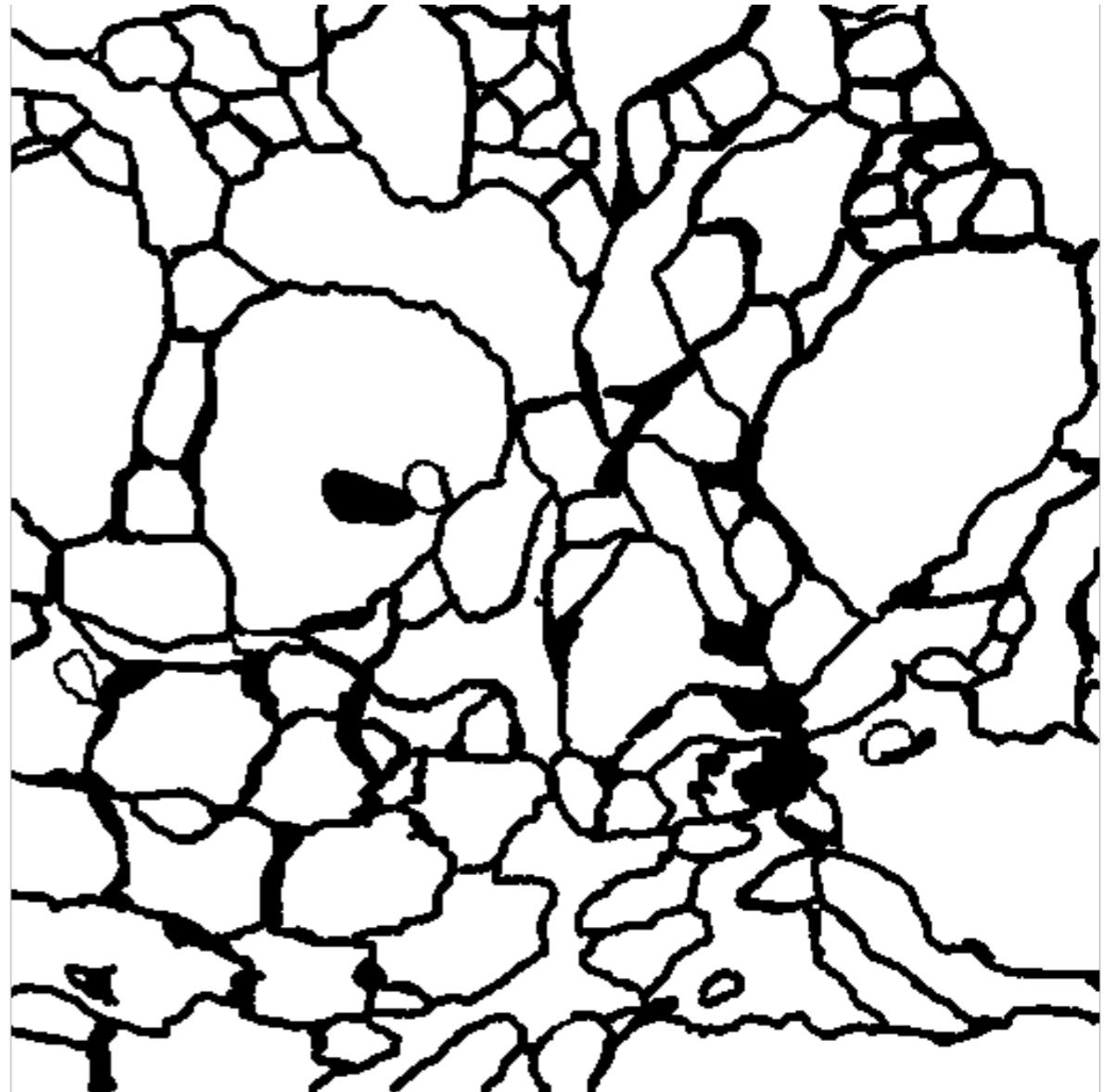
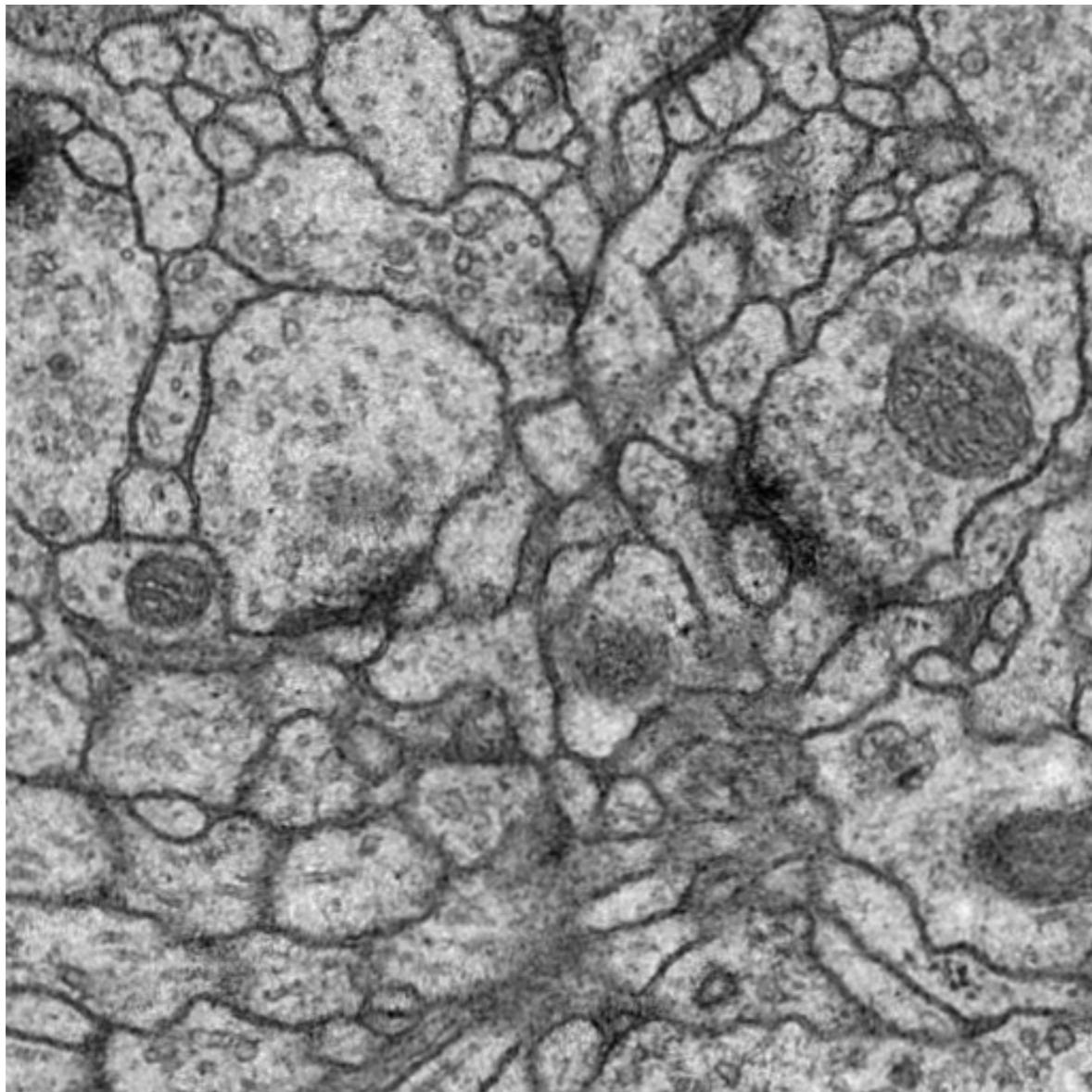
Layer Normalization



Practical example on regularization and normalization

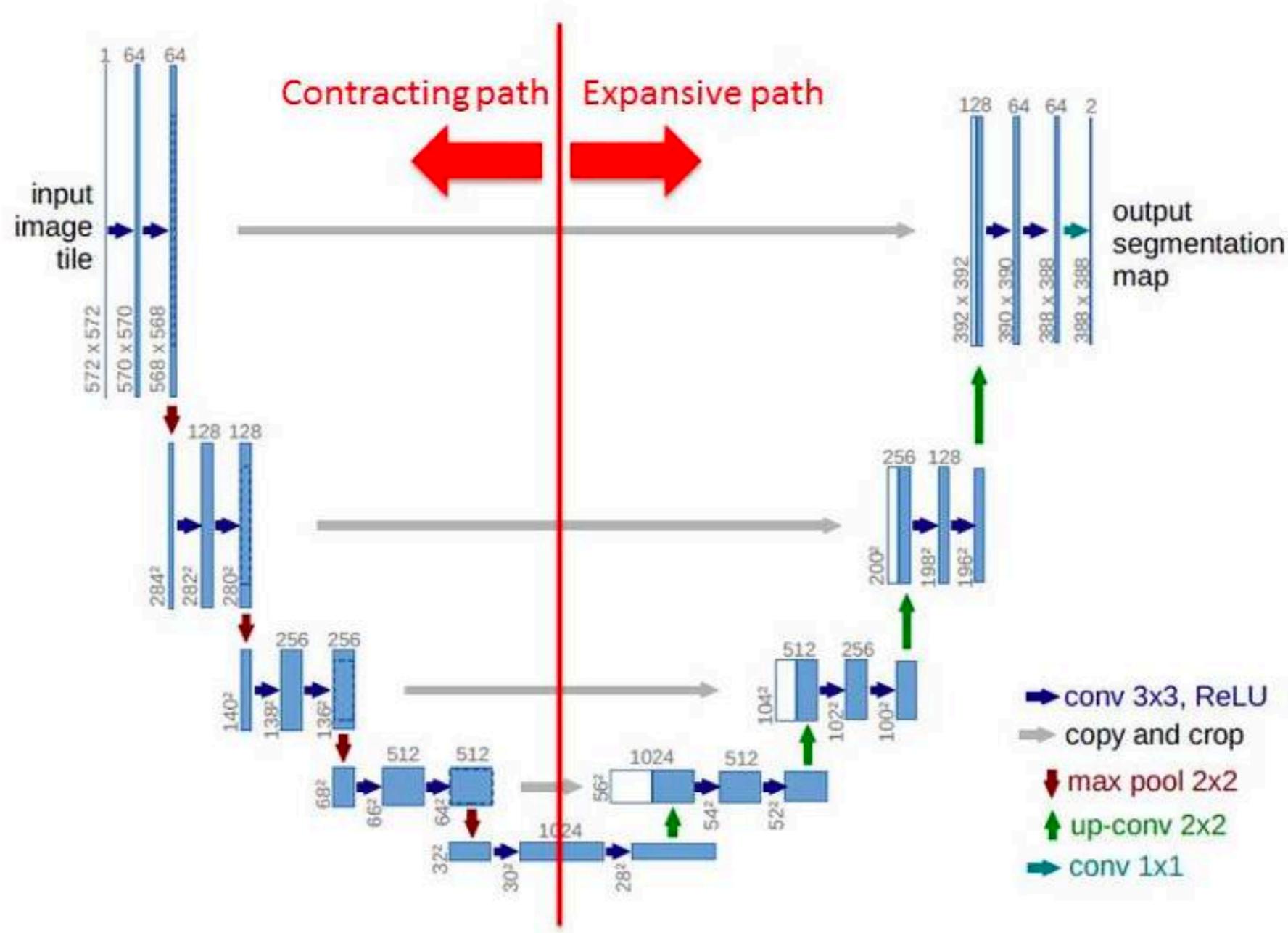
[05-Normalization-and-regularization-assignment.ipynb](#)

Image segmentation



U-Net

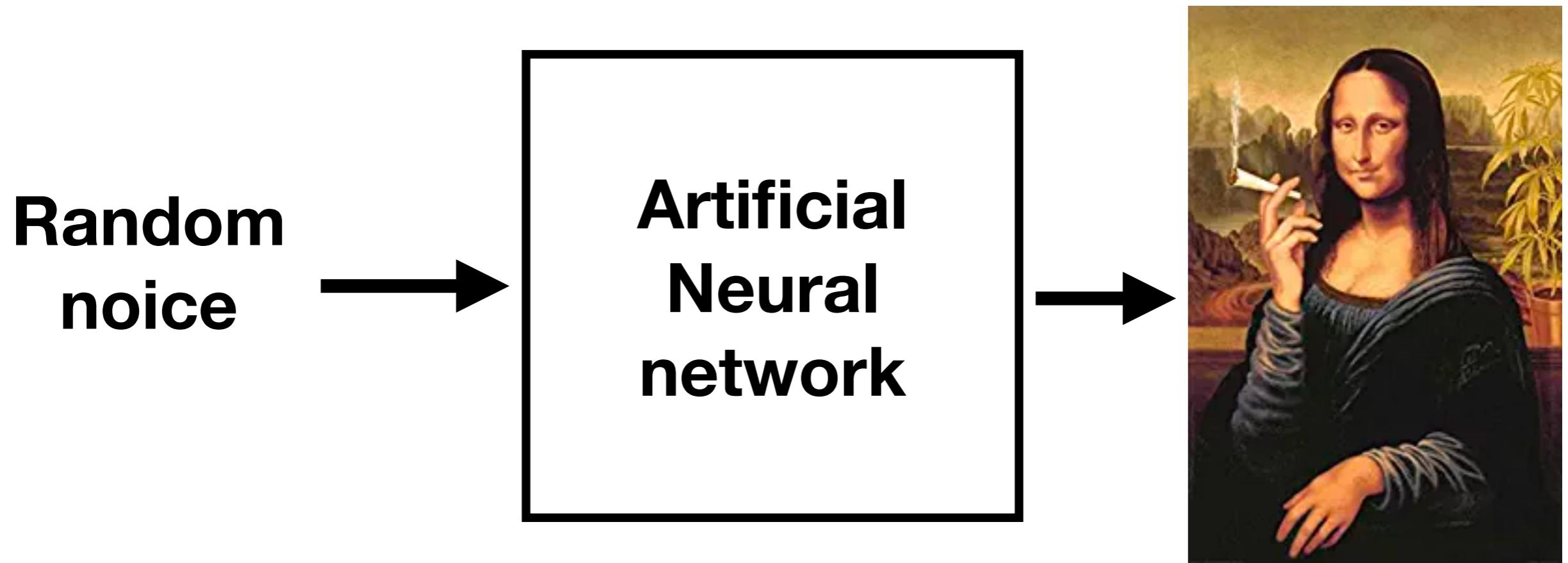
Network Architecture



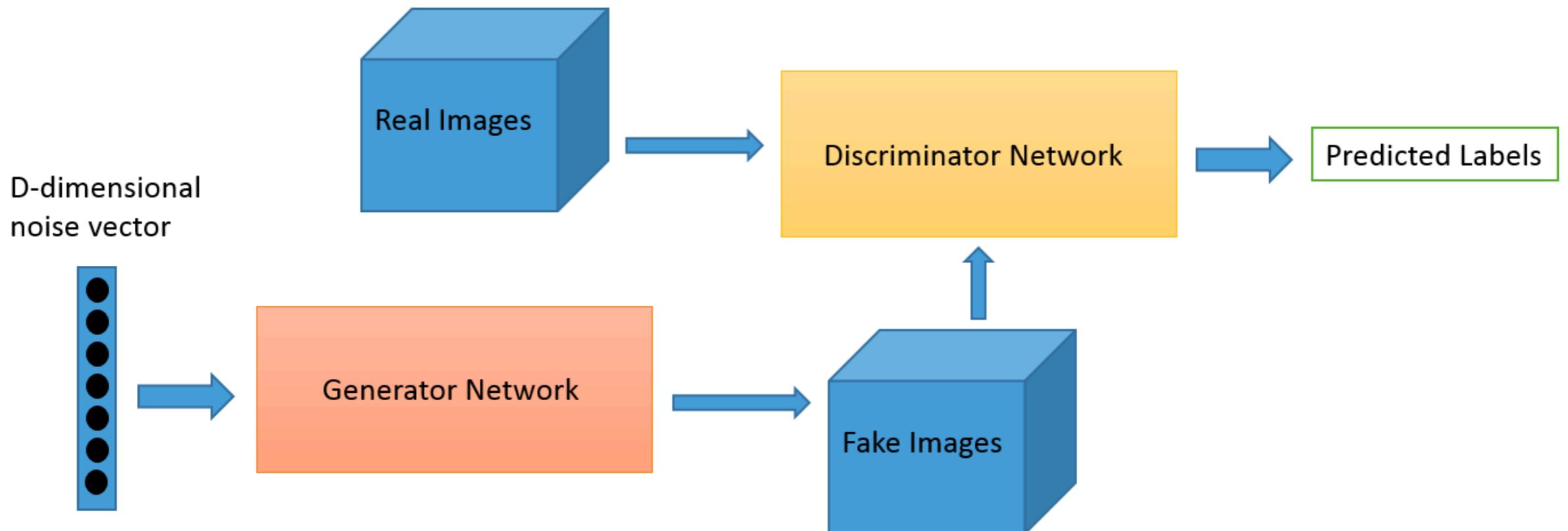
U-Net segmentation example

03-Segmentation.ipynb

Generative models with neural networks



Generative Adversarial Networks



Superresolution

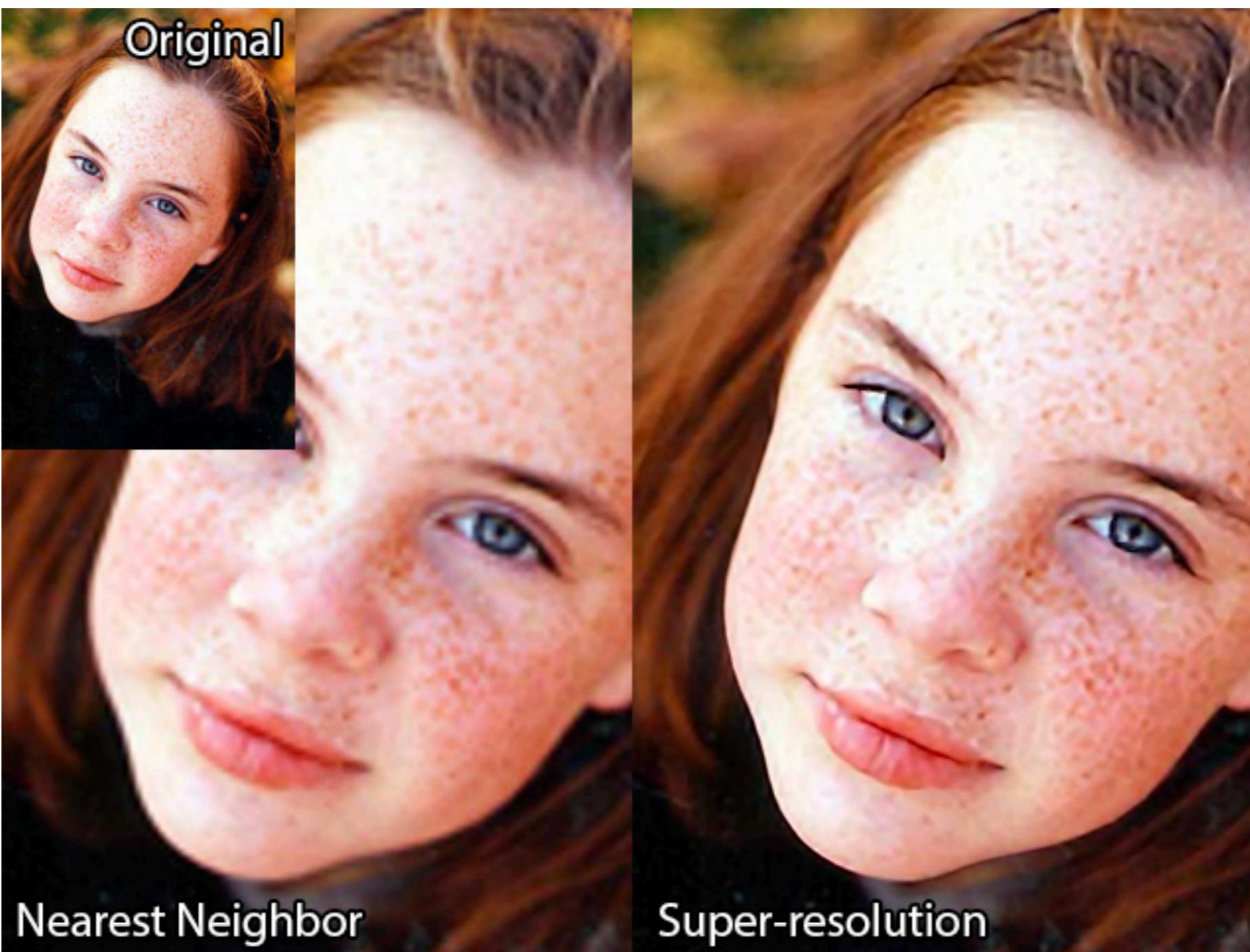
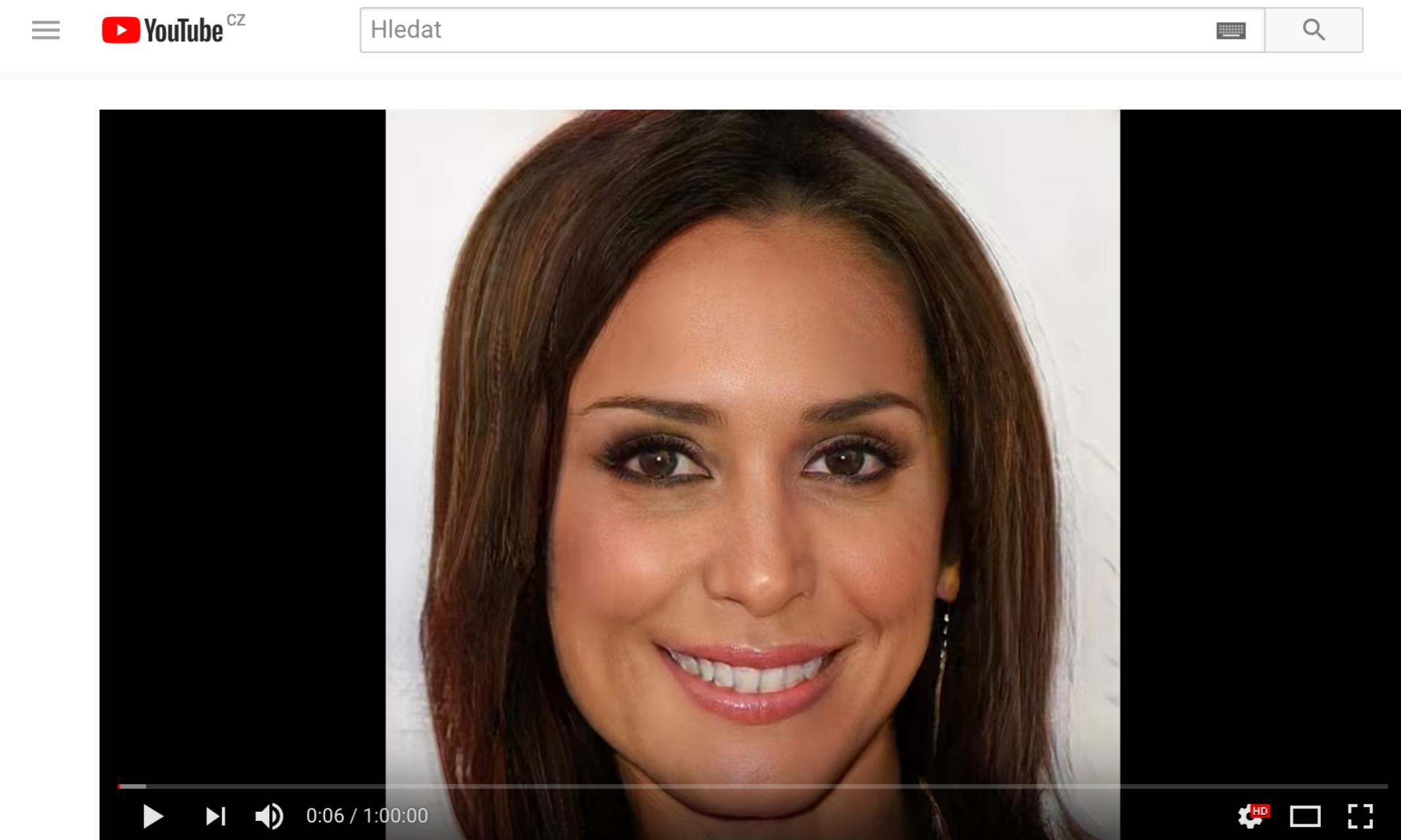


Image synthesis



One hour of imaginary celebrities

95 832 zhlédnutí

TO SE MI LÍBÍ NELÍBÍ SE SDÍLET ...

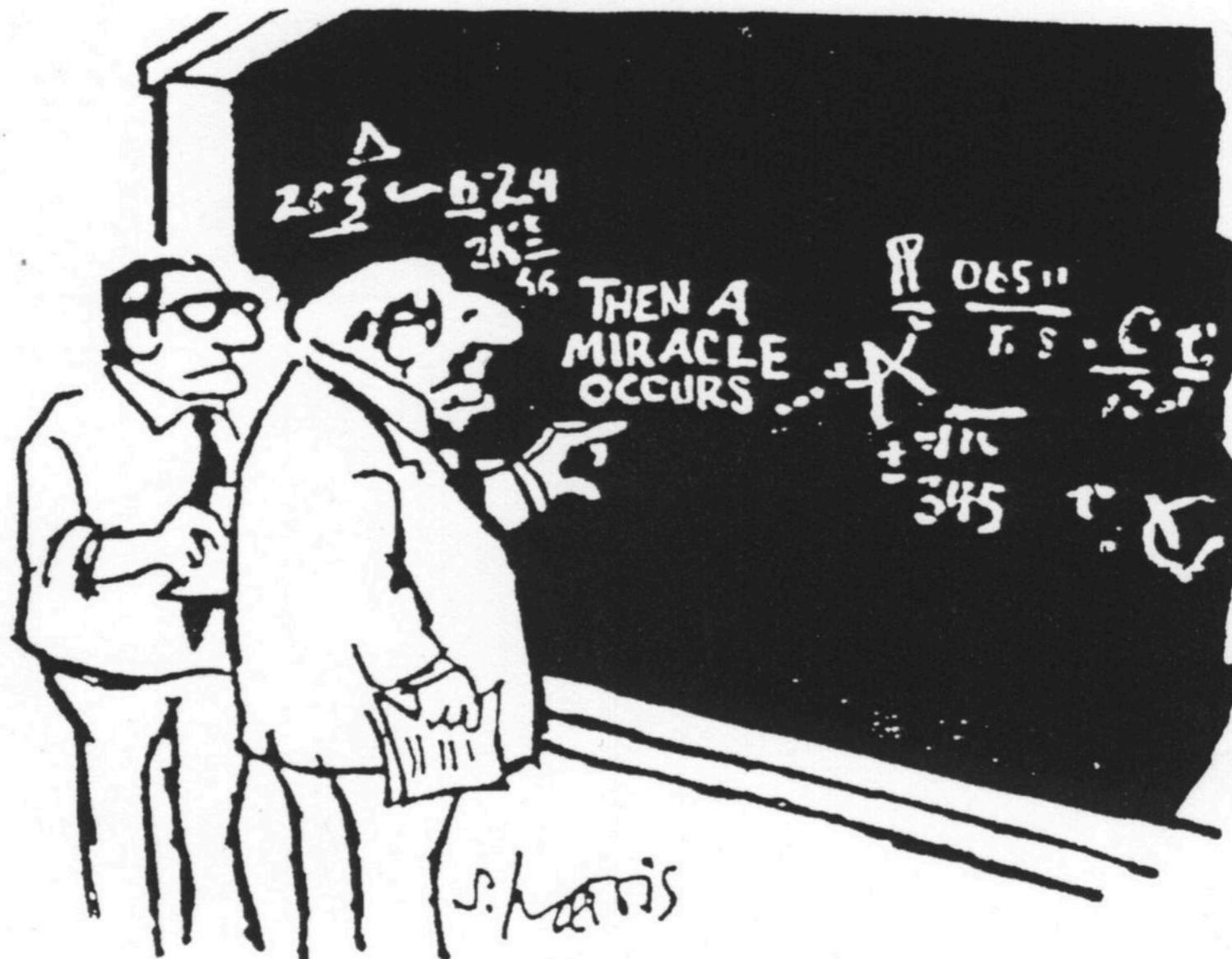
Which one is fake?



Generative Adversarial Networks

04_GANs.ipynb

Neural network explainability



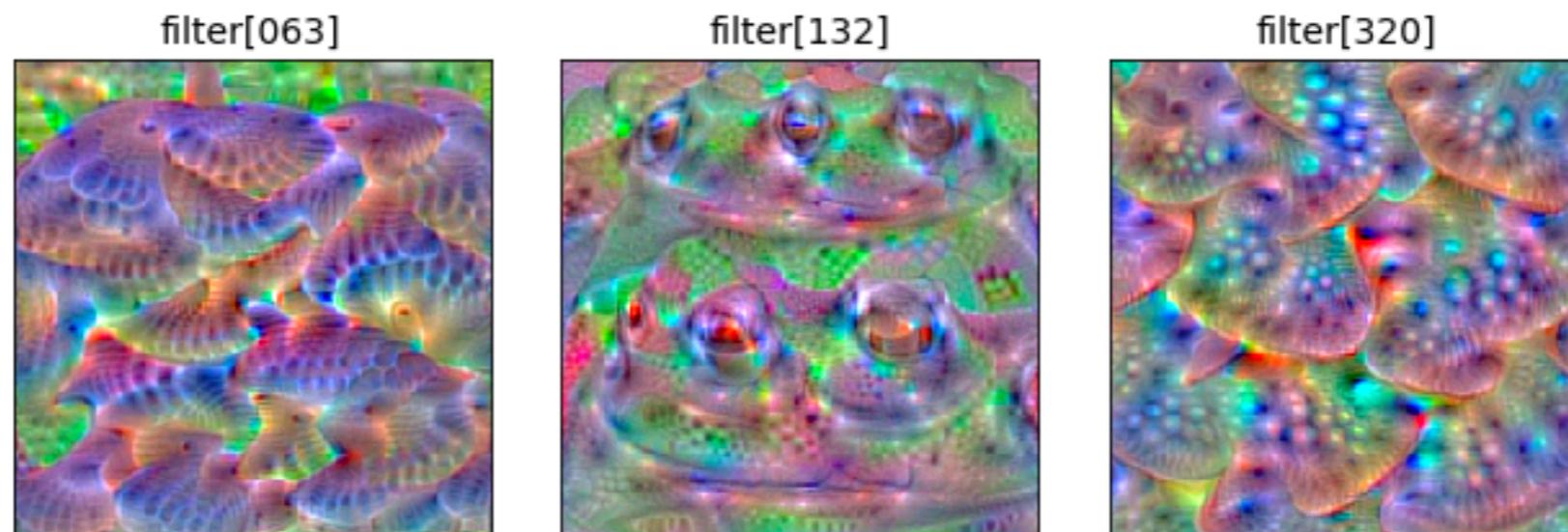
I think you should be a little
more specific, here in Step 2

Activation Maximization

Visualized output classification Layer



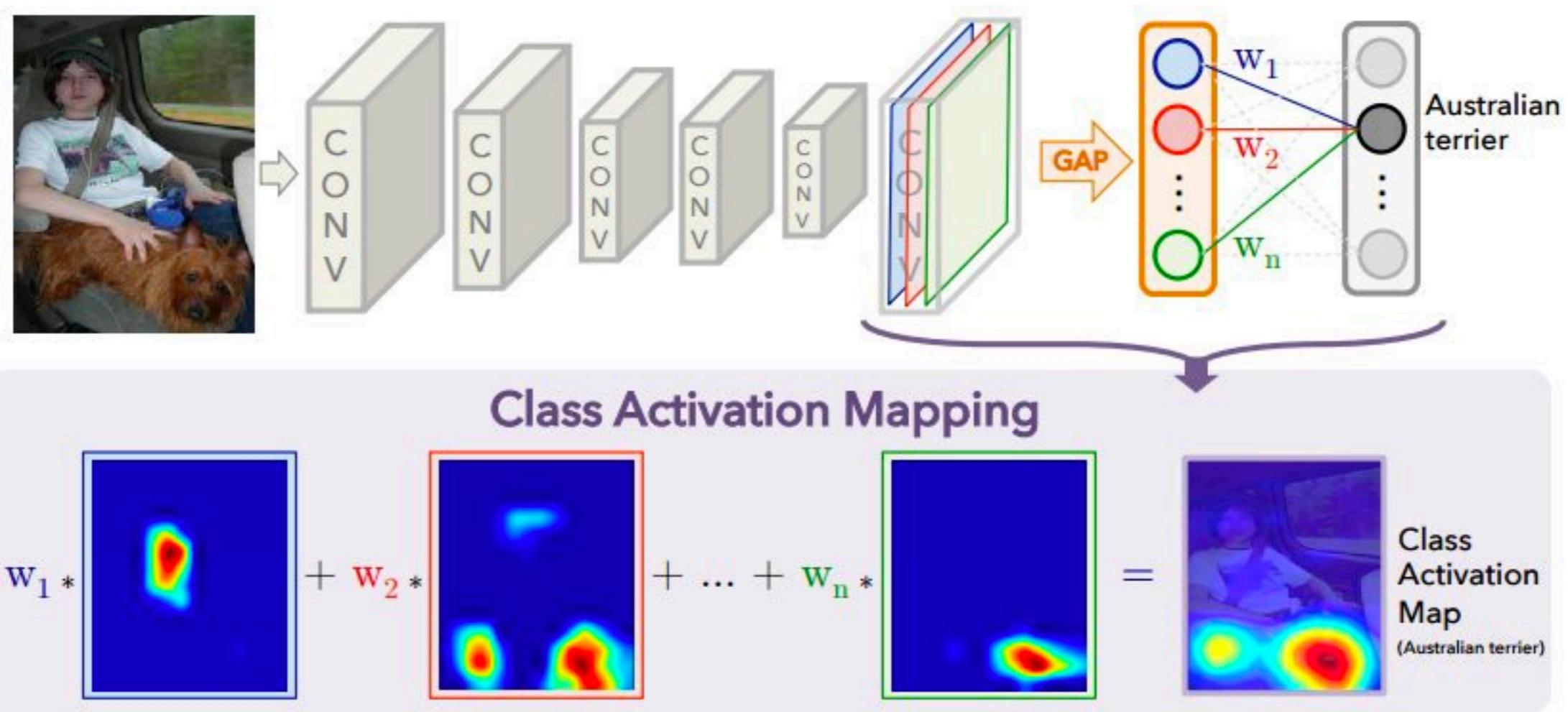
Visualized hidden convolutional layers



Grad-CAM heat maps



CAM heat maps



Convolutional Neural Networks Explainability in Keras

5-Explainability.ipynb

Adversarial Patch

