Lecture 5: Convolutional Neural Network (CNN) - Overfitting

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CIS 6217 – Computer Vision for Data Representation

College of Computer Science, King Khalid University

Outline

1. Overfitting in CNN
2. Dropout Layer
3. Summary

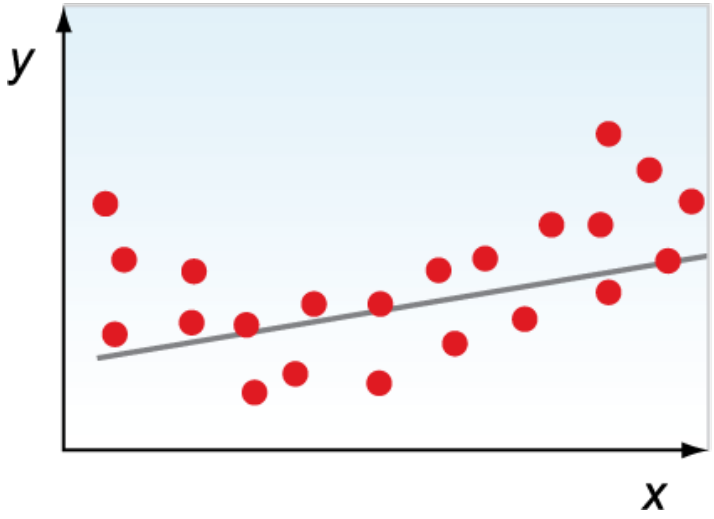
Learning Outcomes

- Explain why fully connected NNs are inefficient for images.
- Describe the concepts of local receptive fields, weight sharing, and convolutions.
- Understand filters/kernels and how they extract spatial features.
- Explain the role of pooling layers in reducing dimensions.
- Illustrate a basic CNN architecture for image classification.
- Implement a simple CNN using PyTorch

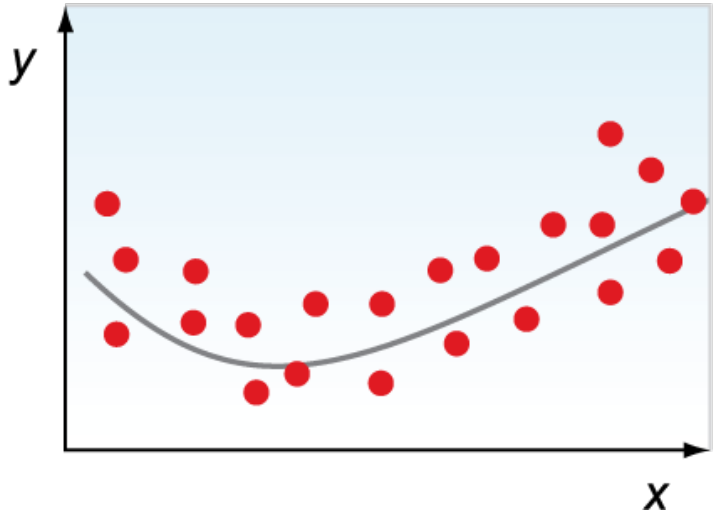
Overfitting

How overfitting occur in CNN?

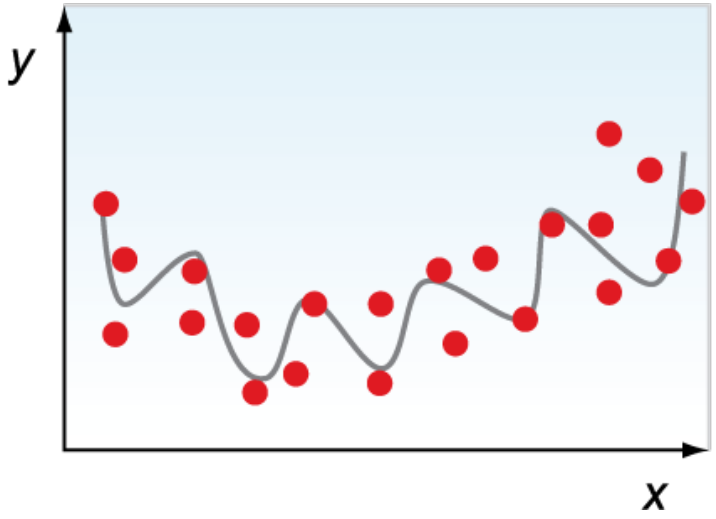
Underfitting



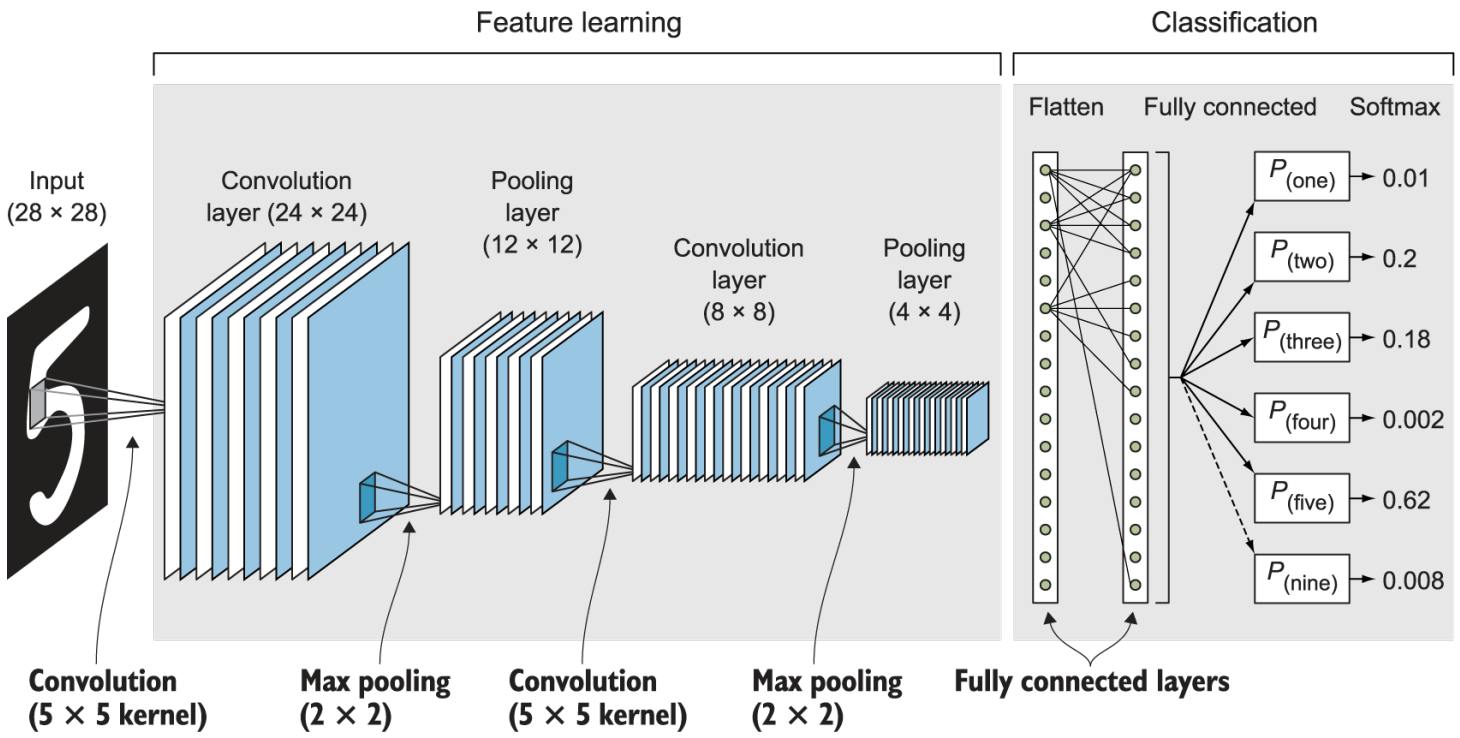
Just right!



Overfitting



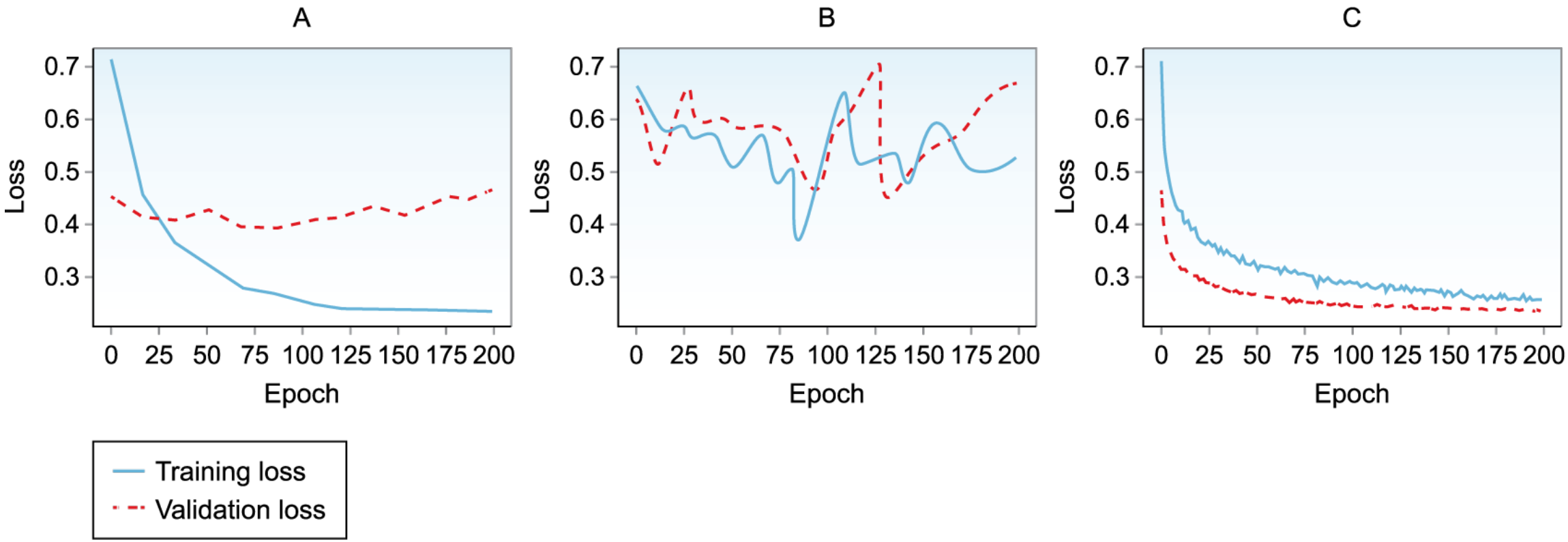
Basic Components of CNN



Deep Learning for Vision Systems by Mohamed Elgendy (2020)

Overfitting

- Overfitting occurs when a CNN learns patterns that fit the training data too closely, including noise or irrelevant features.

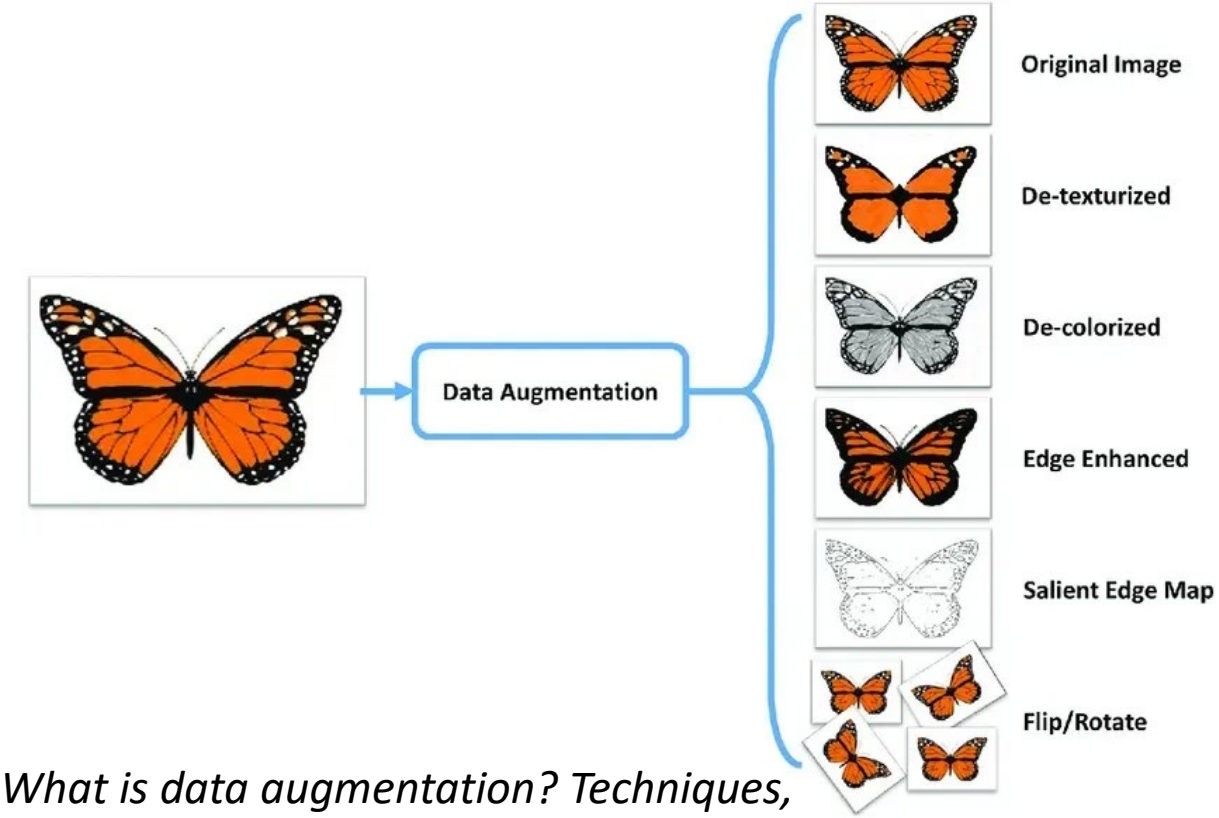


What are the causes of overfitting?

- CNN Architecture
- Dataset
- Training

Data Augmentation

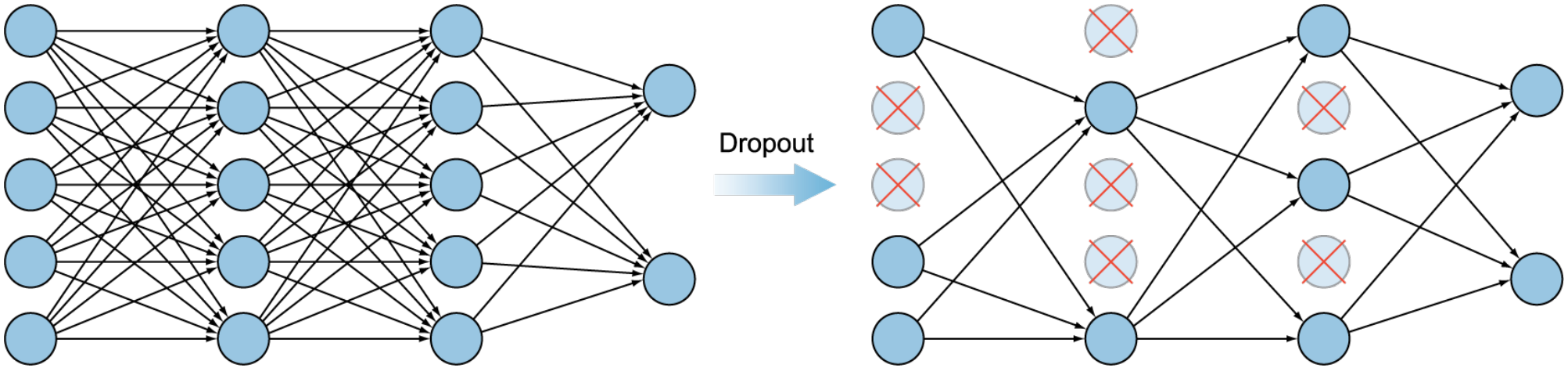
- Artificially increasing the size of data used for training a model.
  - Augmented Data
  - Synthetic Data



Singh, S. (2022) *What is data augmentation? Techniques, examples & benefits*, *Labellerr*. Available at: https://www.labellerr.com/blog/what-is-data-augmentation-techniques-examples-benefits/

Dropout Layers

- Turnoff a percentage of neurons in network layers
- It is a hypermeter

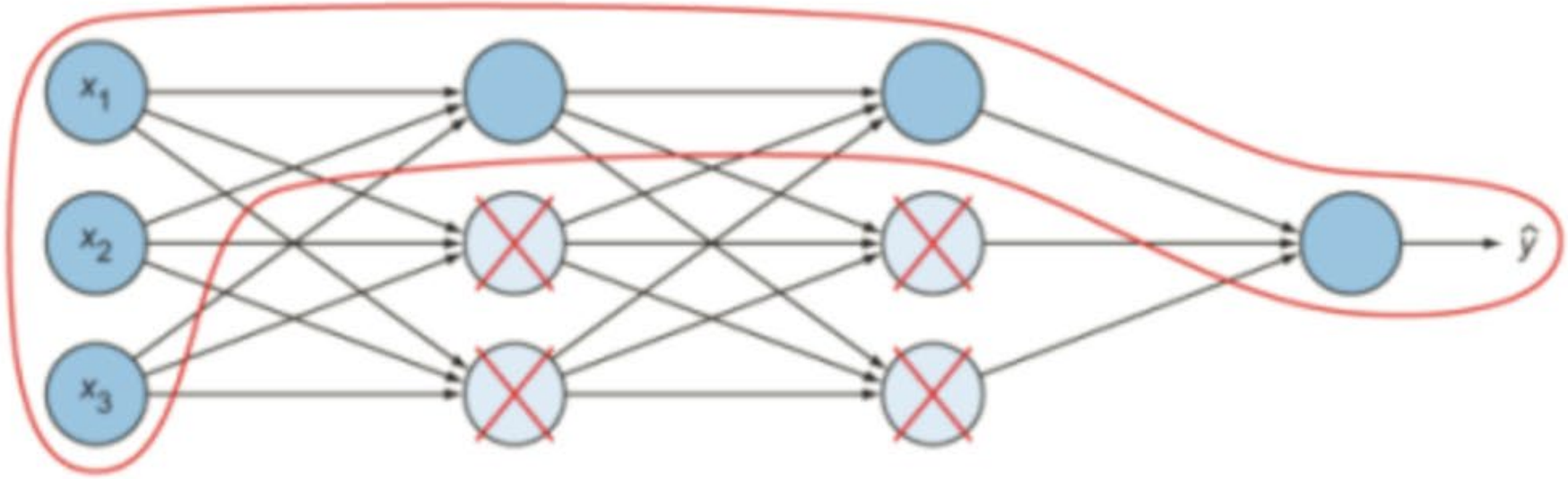


How dropout layer mitigate overfitting?

L2 Regularization

- Penalizes the error function by adding a regulaztion term to it
- It reduces the weight values

L2 regularization reduces the weights and simplifies the network to reduce overfitting.

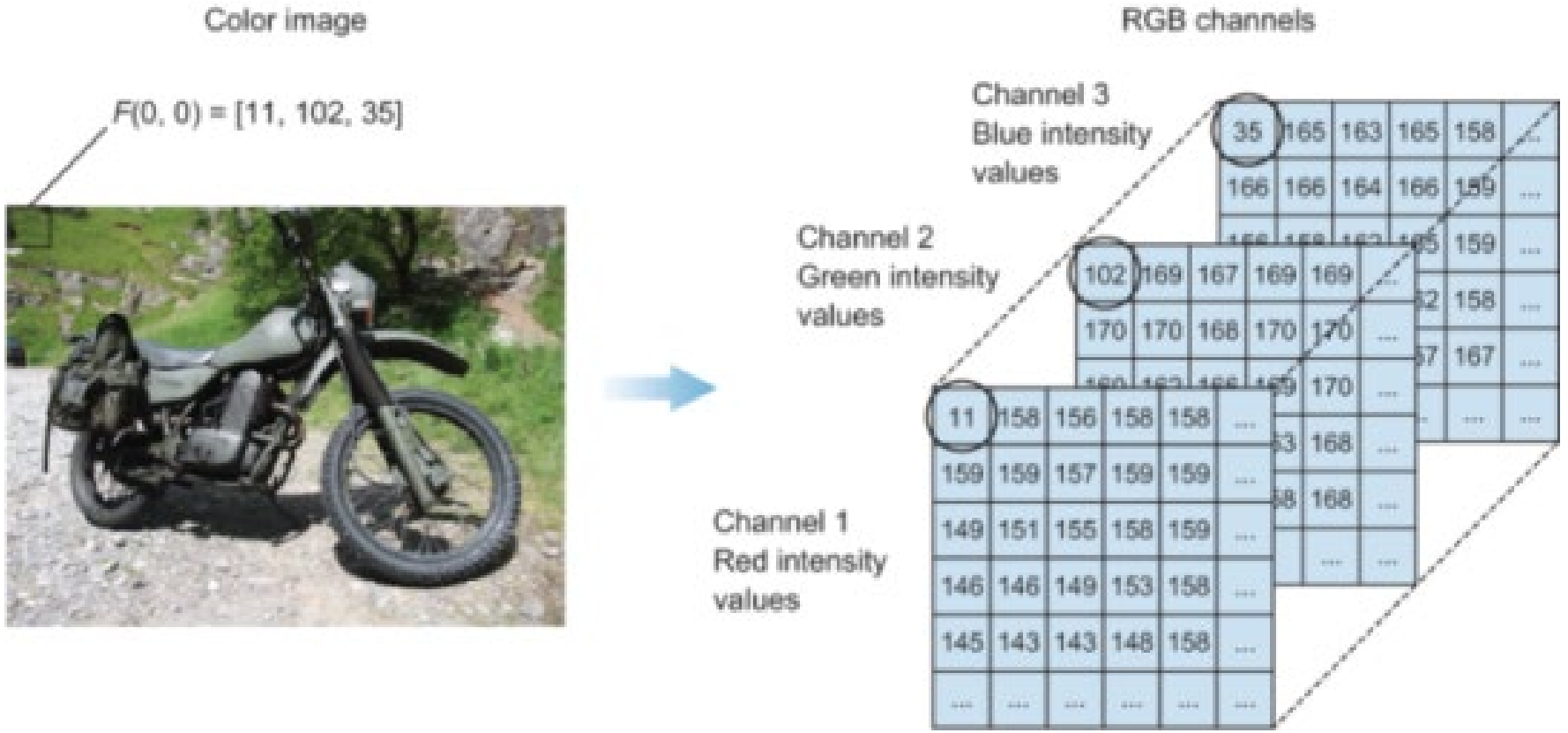


Other Techniques

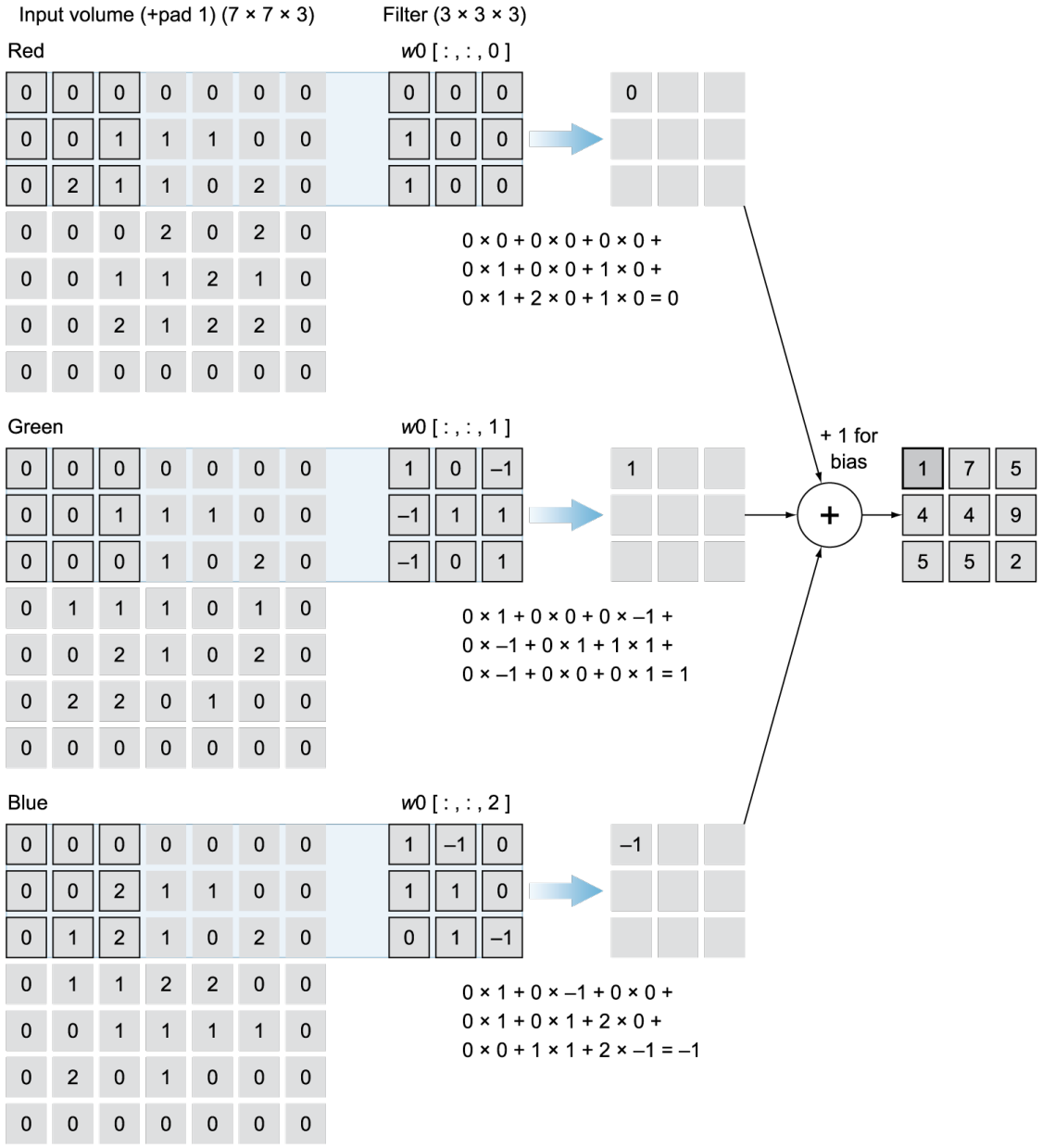
- Reduce Complexity of the network
- Transfer Learning
- Early stopping
- Weight Regularization

CNN for Coloured Images

Coloured images represented by 3 matrices



Performing convolution



Lab: Image Classification for Coloured Images

Start with GoogleColab File (Link)

References

- Guide to CNNs for CV – Khan et al. (2018)
- Deep Learning with Python – Chollet (2018)
- Deep Learning in Computer Vision – Awad & Hassaballah (2020)

- Deep Learning for Vision Systems by Mohamed Elgendy (2020)