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The U-net Model

A Fully Convolutional Neural Network Model

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Outline

- Learning Goals
- The U-net Model
- Summary

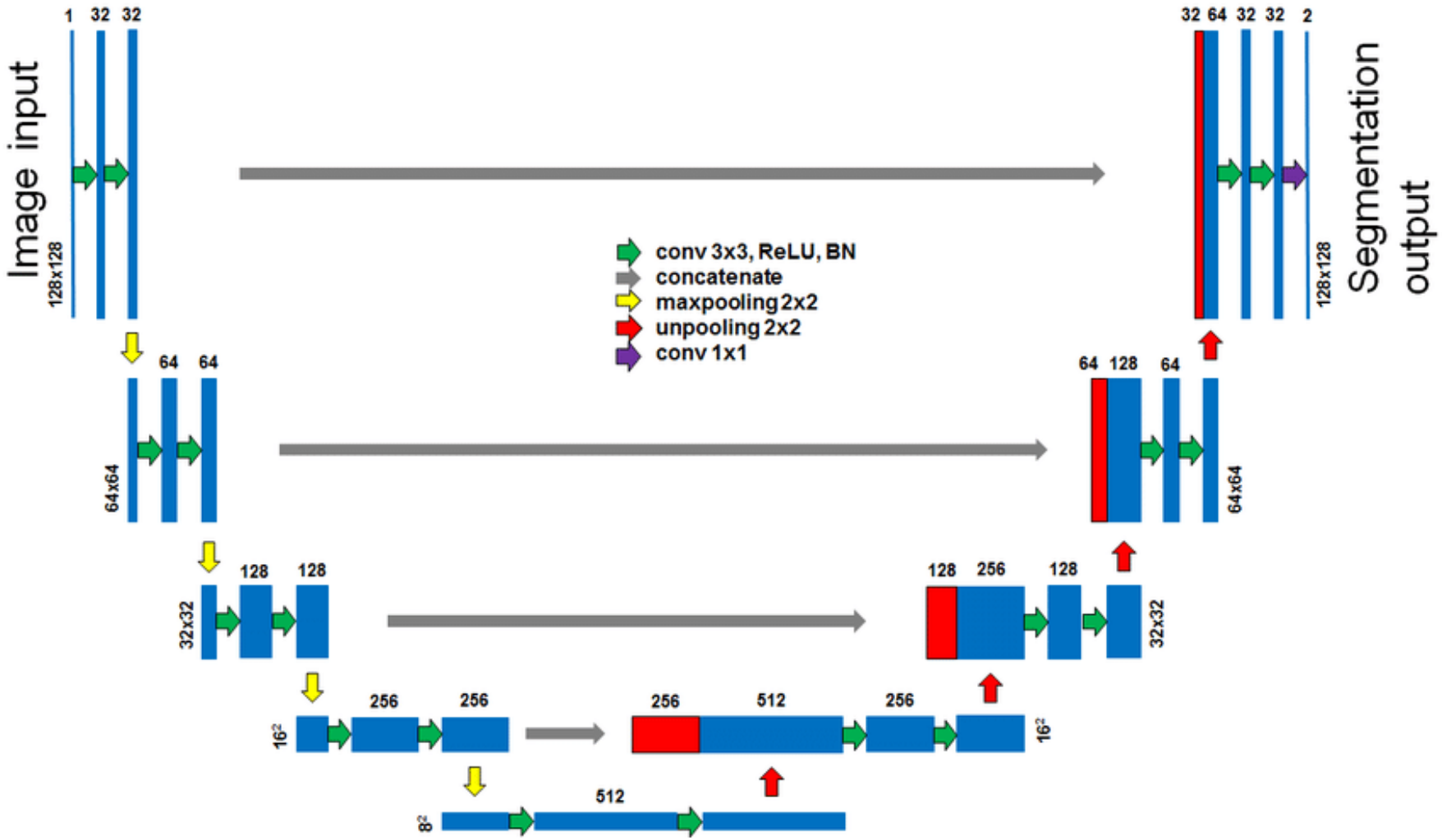
Learning Goals

- Understand the U-net architecture and its building blocks
- Discuss potential applications of the U-net model

The U-net Model

- The U-net is a fully convolutional neural network (i.e., no fully connected layers)
- Initially proposed for biomedical image segmentation problems
- It maps an input of size N into an output also of size N (if the convolutions are padded)

The U-net Model



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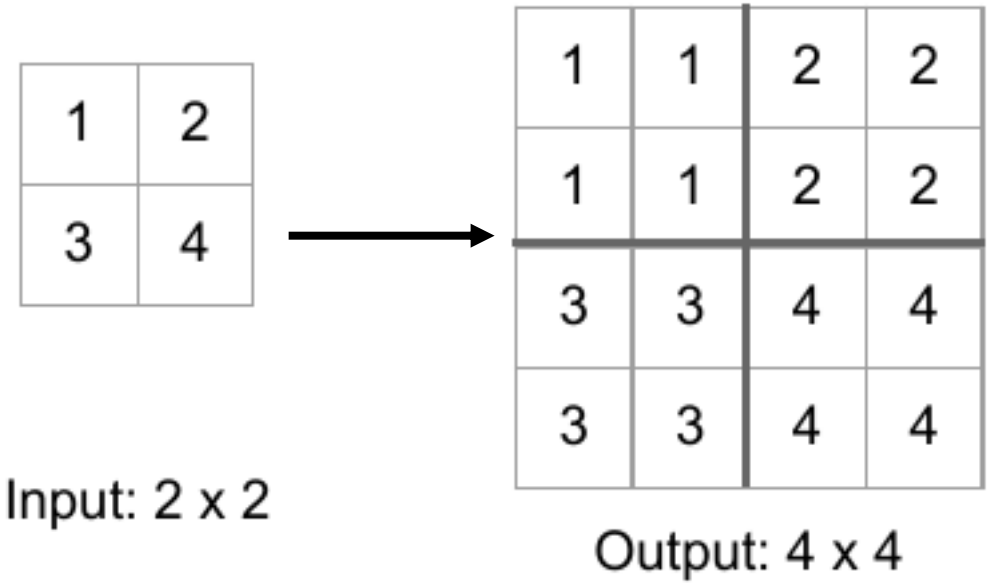
Up Sampling

- Opposite effect of max-pooling
- Many ways to do it
- Simplest way is nearest neighbor interpolation
- UpSampling2D -> Keras layer



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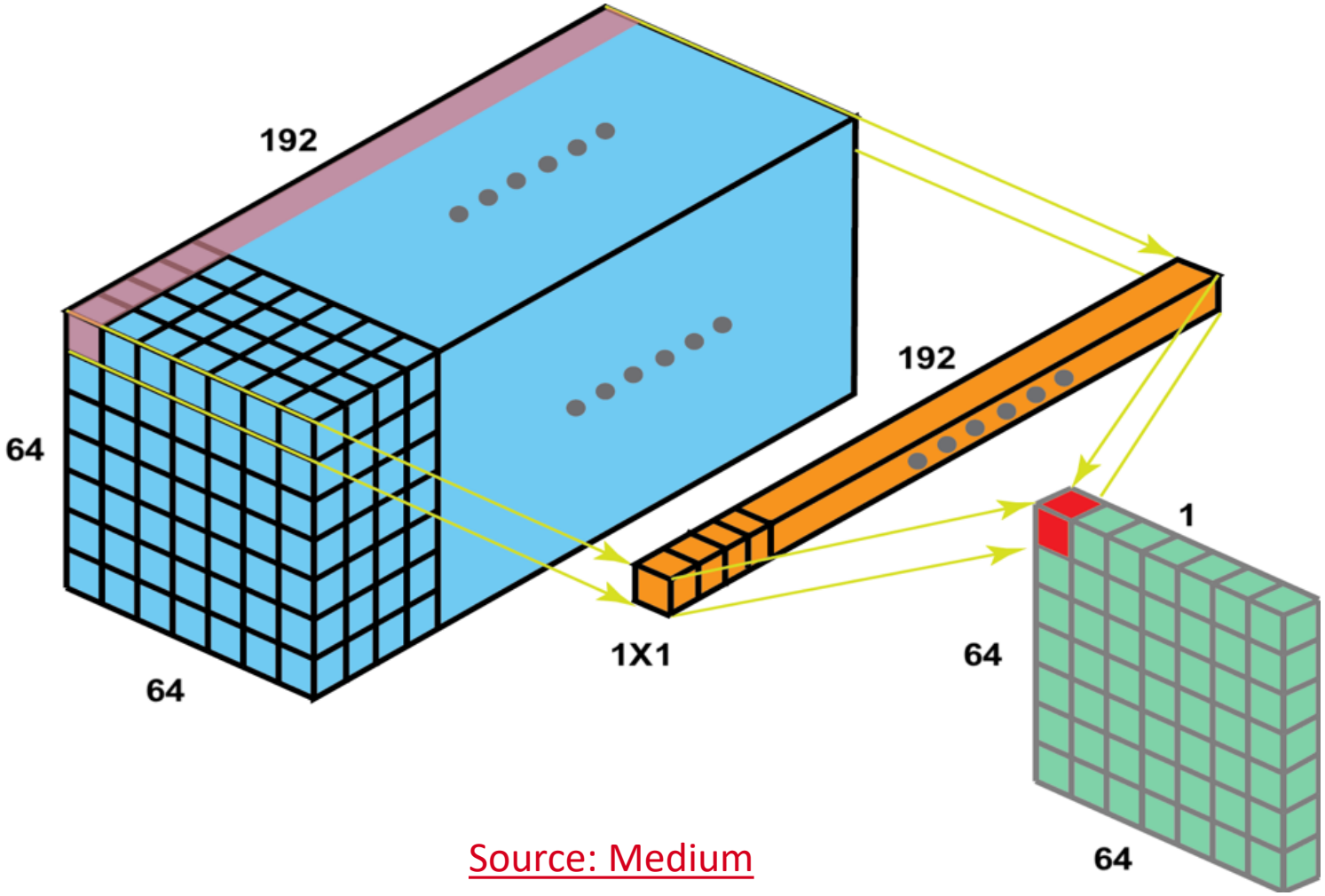
1x1 Convolution



Source: Medium

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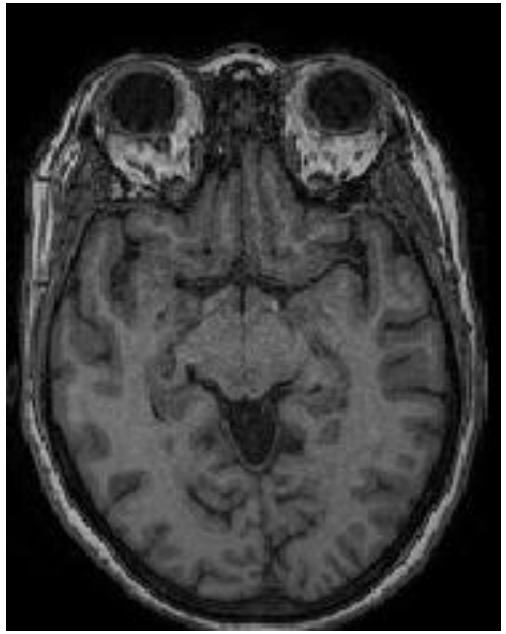
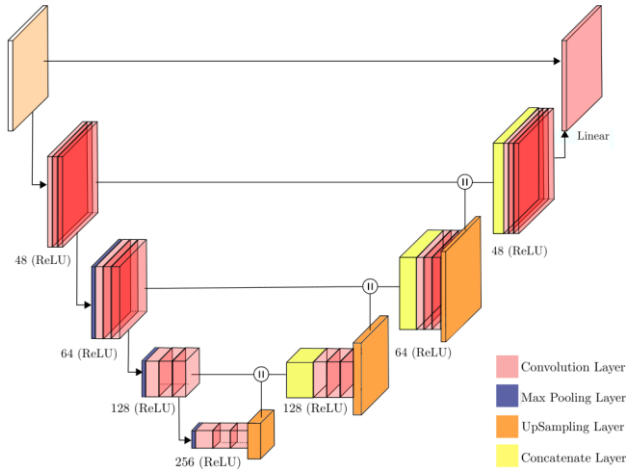
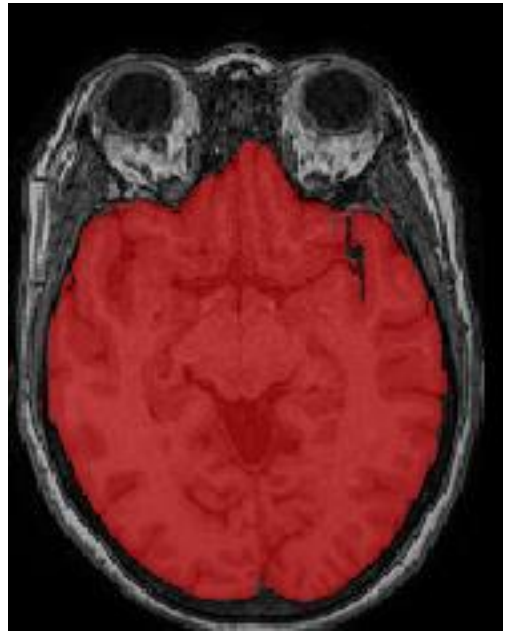
U-net - Segmentation

Segmentation = pixel-wise or voxel-wise segmentation







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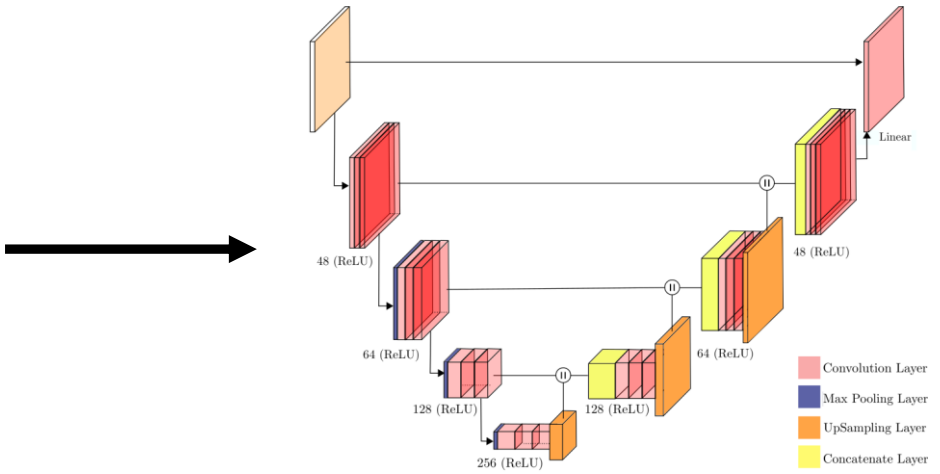
U-net –Regression



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Metrics

- For regression:
  - Mean squared error
  - Mean absolute error
  - …
- For segmentation:
  - Dice coefficient
  - Jaccard coefficient
  - …

Summary

- The U-net is a very powerful deep learning model that maps inputs to outputs of the same size
- The model works across different scales of the input signal/image
- It is a fully convolutional model that is independent of the input size

Thank you!

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