

# 7.1

## Working With Images

### Part 1: Automatic Feature Extraction

Sebastian Raschka and the Lightning AI Team

Sebastian Raschka

Deep Learning Fundamentals, Unit 7

Lightning AI

# First, a little recap ...

# In the previous units, we worked with tabular data

Sepal length	Sepal width	Petal length	Petal length
5.1	3.5	1.4	0.3
4.9	3	1.4	0.2
5.9	3	5.1	1.8
...	...	...	...

# Now, we are going to work with image data **directly**



[https://en.wikipedia.org/wiki/Iris\\_setosa#/media/File:Irissetosa1.jpg](https://en.wikipedia.org/wiki/Iris_setosa#/media/File:Irissetosa1.jpg)



# The traditional approach

“Manual” feature extraction



Sepal length	Sepal width	Petal length	Petal length
5.1	3.5	1.4	0.3
4.9	3	1.4	0.2
5.9	3	5.1	1.8
...	...	...	...

**Convolutional neural networks** perform the  
**feature extraction implicitly**

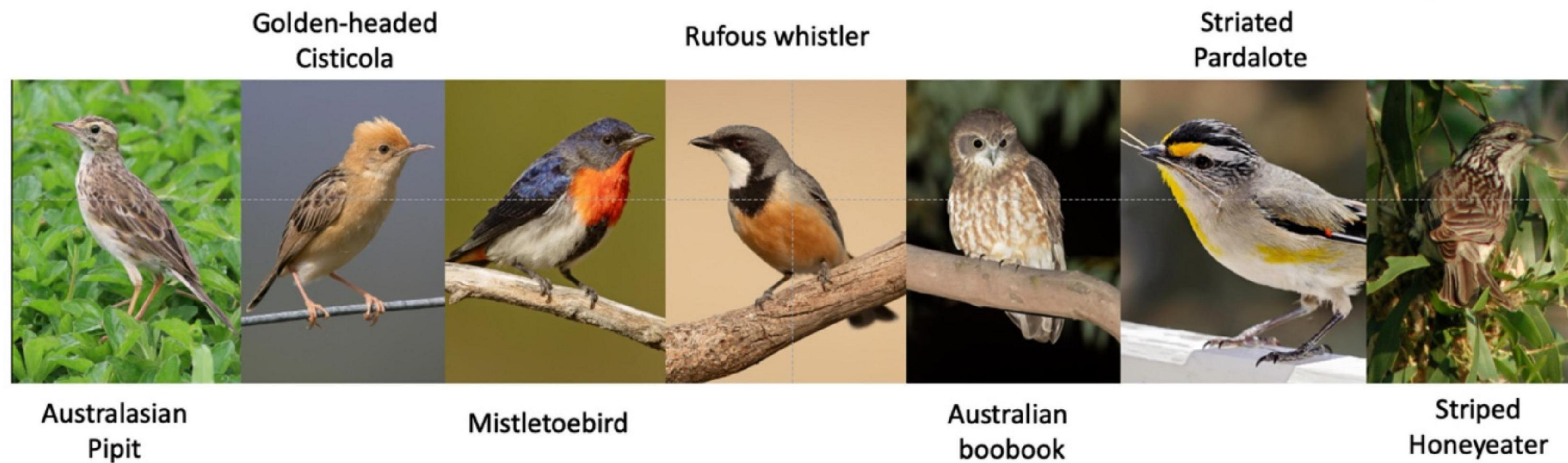
**This allows us to feed neural networks *images* (instead of tables) as input *directly*!**





Image: Shutterstock/Andrey\_Popov

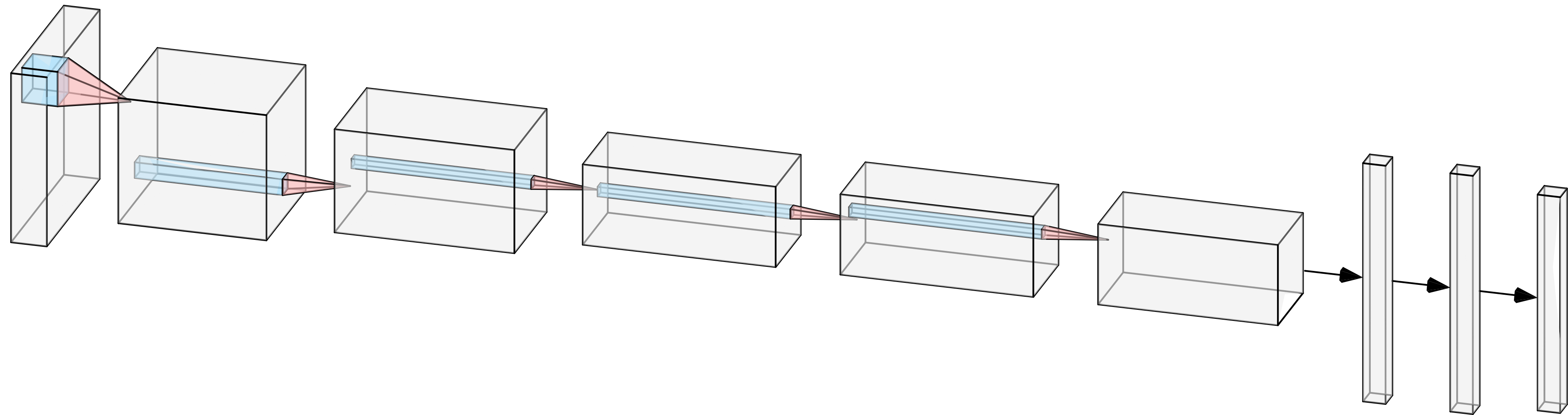




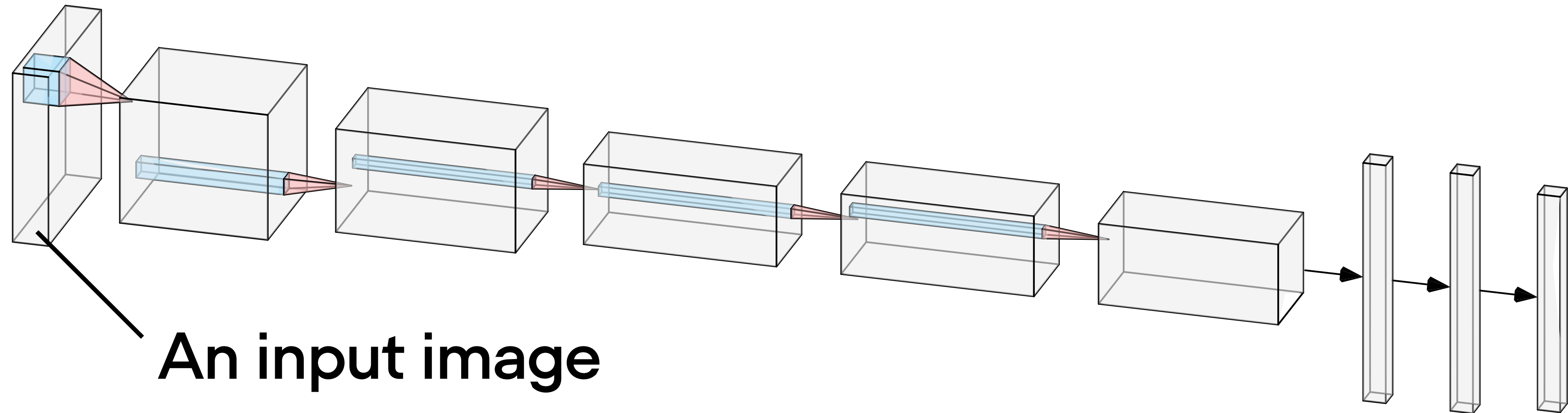
Source: [https://www.frontiersin.org/files/Articles/810330/fevo-10-810330-HTML-r1/image\\_m/fevo-10-810330-g001.jpg](https://www.frontiersin.org/files/Articles/810330/fevo-10-810330-HTML-r1/image_m/fevo-10-810330-g001.jpg)

# Convolutional layers are feature extractors

# A typical convolutional neural network architecture



# A typical convolutional neural network architecture



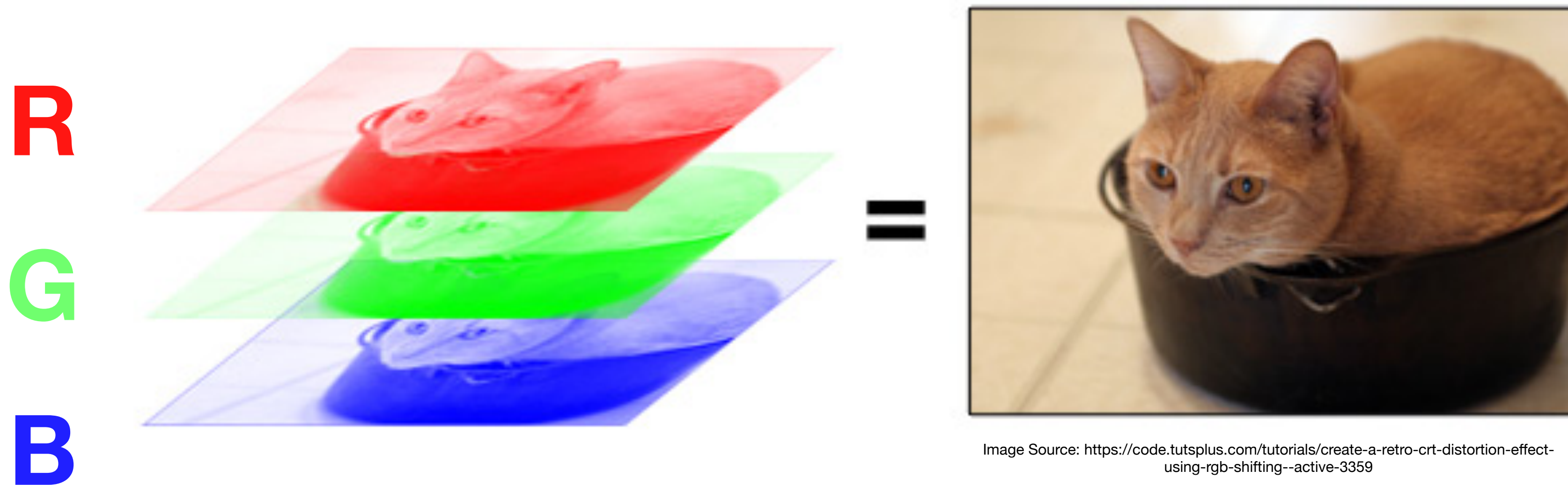


# RGB Image



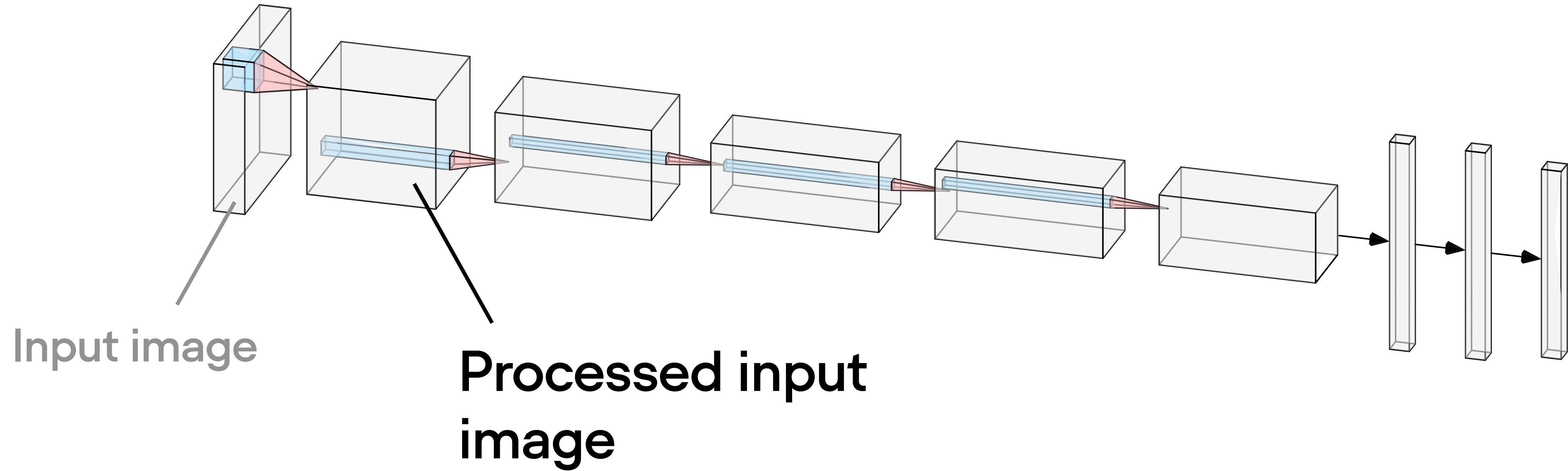
Image Source: <https://code.tutsplus.com/tutorials/create-a-retro-crt-distortion-effect-using-rgb-shifting--active-3359>

# RGB Image

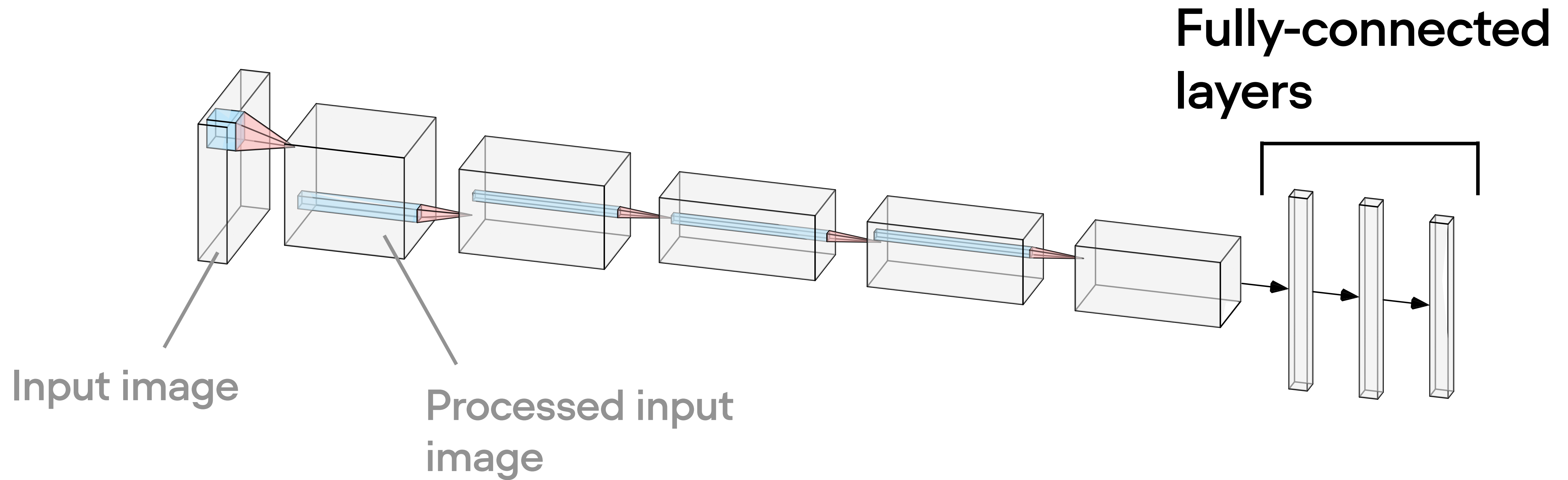


Color image as a stack of matrices

# A typical convolutional neural network architecture

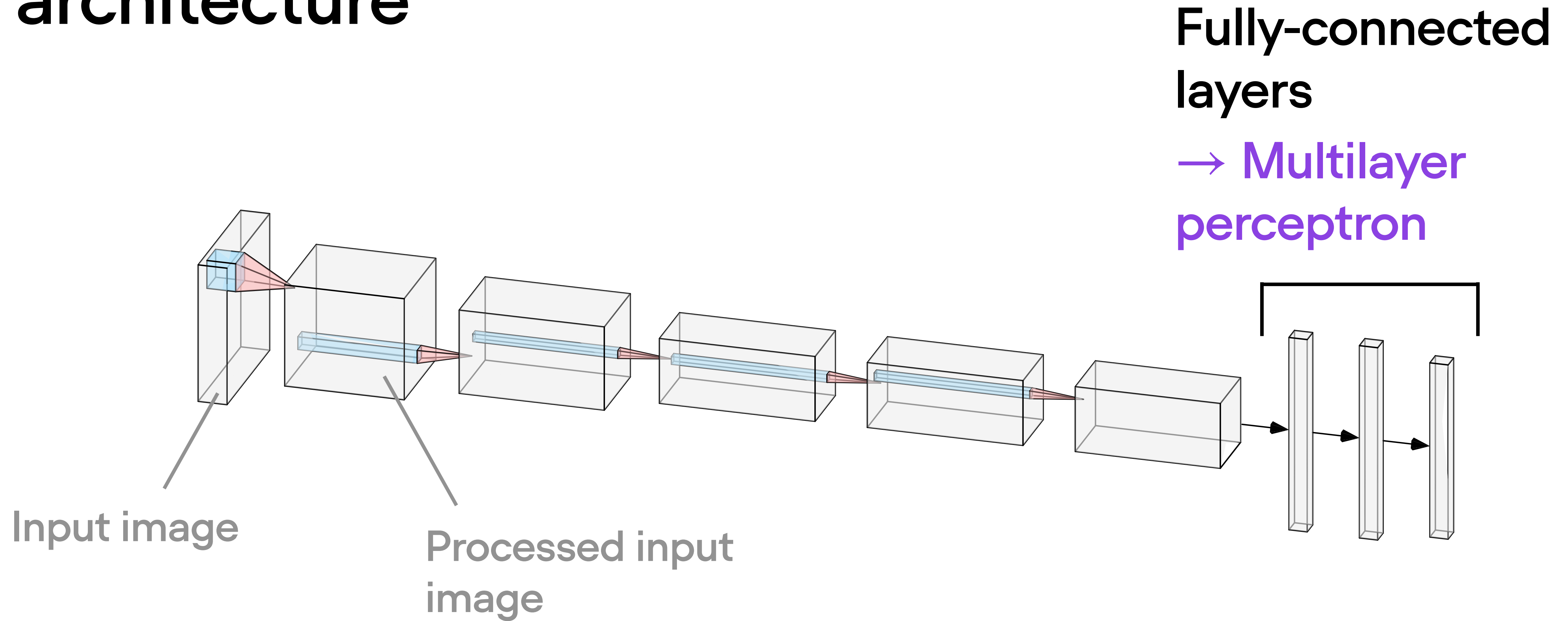


# A typical convolutional neural network architecture

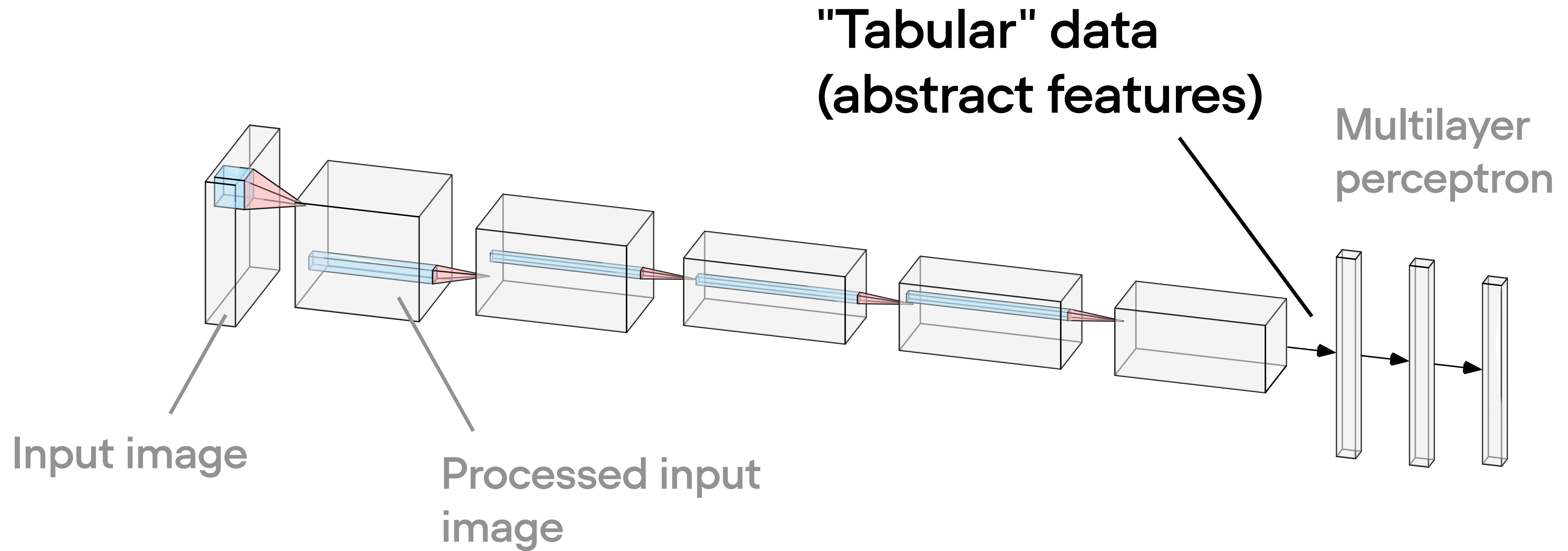




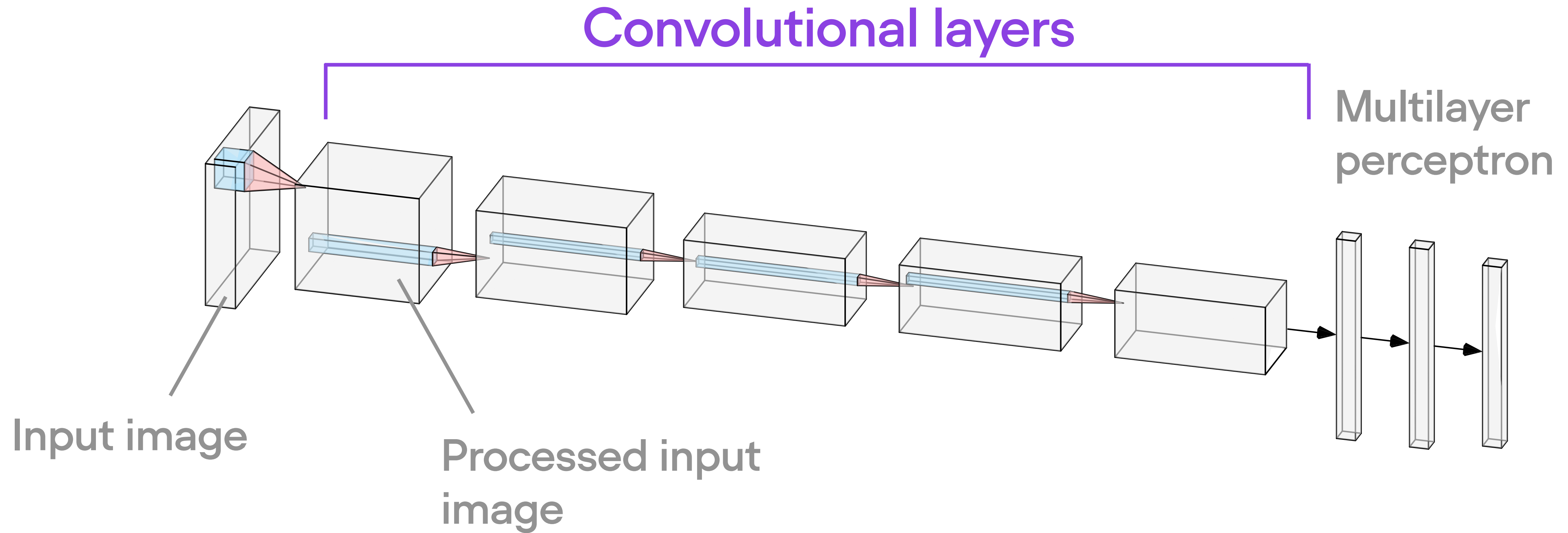
# A typical convolutional neural network architecture



# A typical convolutional neural network architecture



# A typical convolutional neural network architecture



# Convolutional layers — why do we need these?



# Next: Image Data And Its Challenges