Summary and Remarks on CNN

Prof. Steffen Borchers-Tigasson

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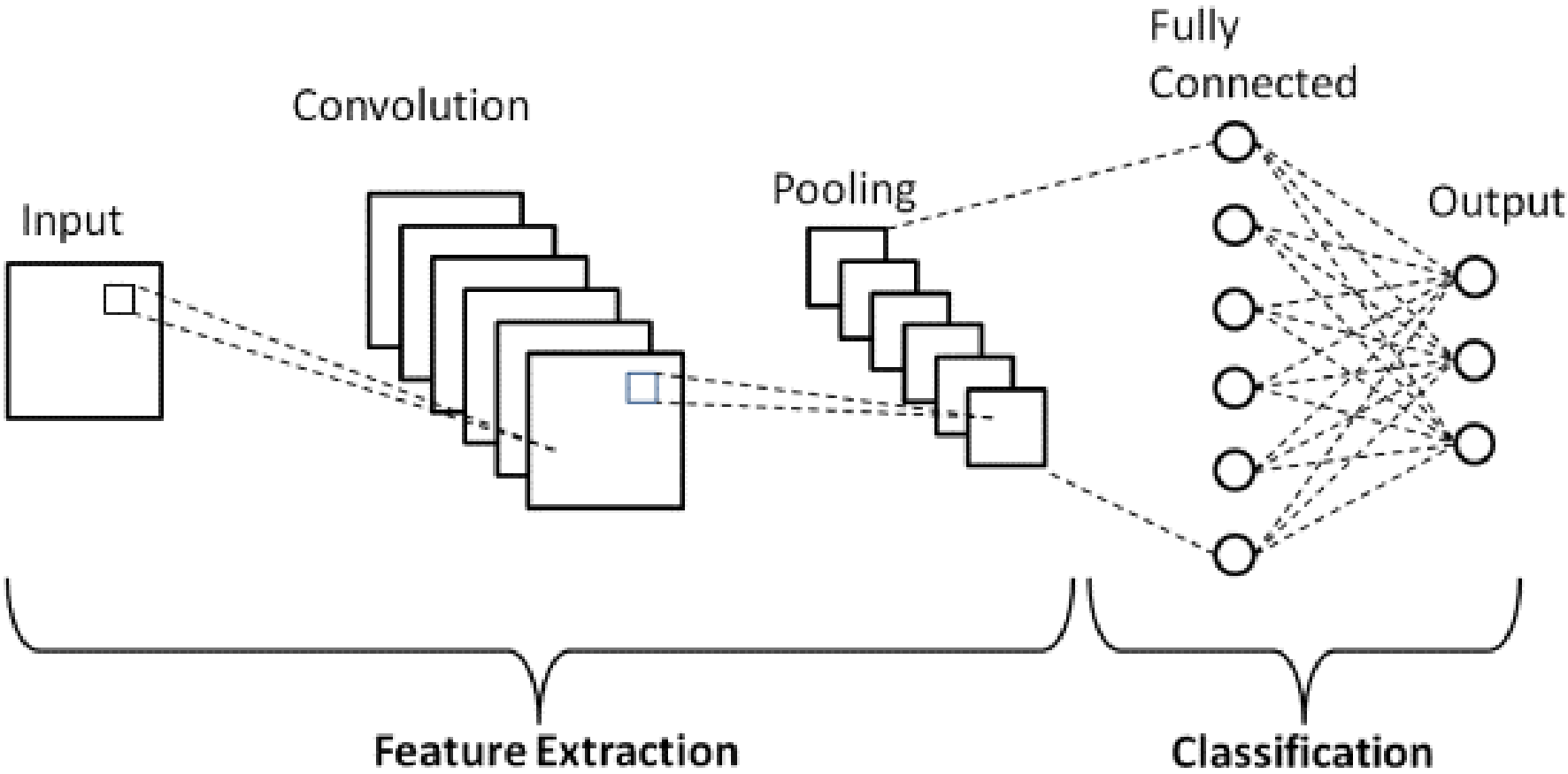
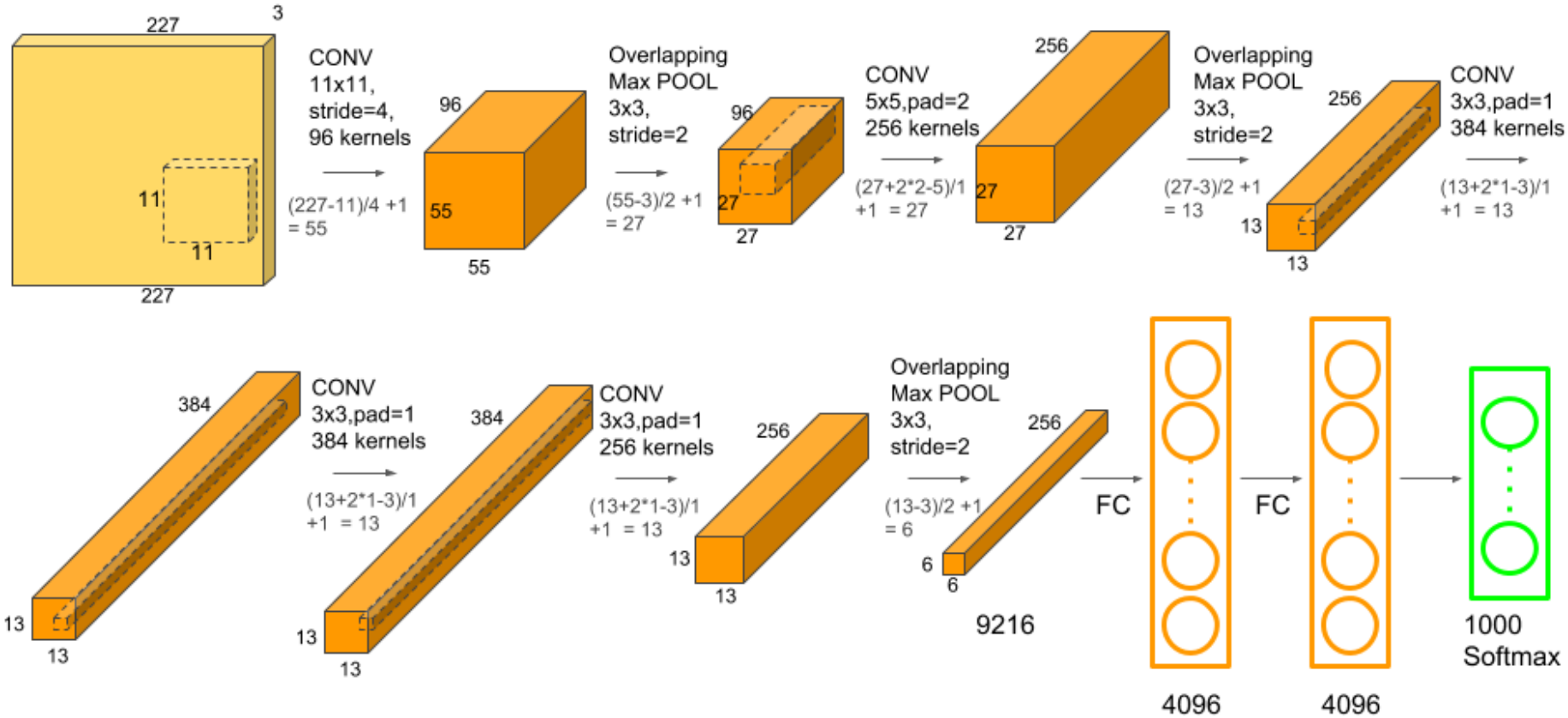
htw.

Convolutional Neural Networks: Basic Structure

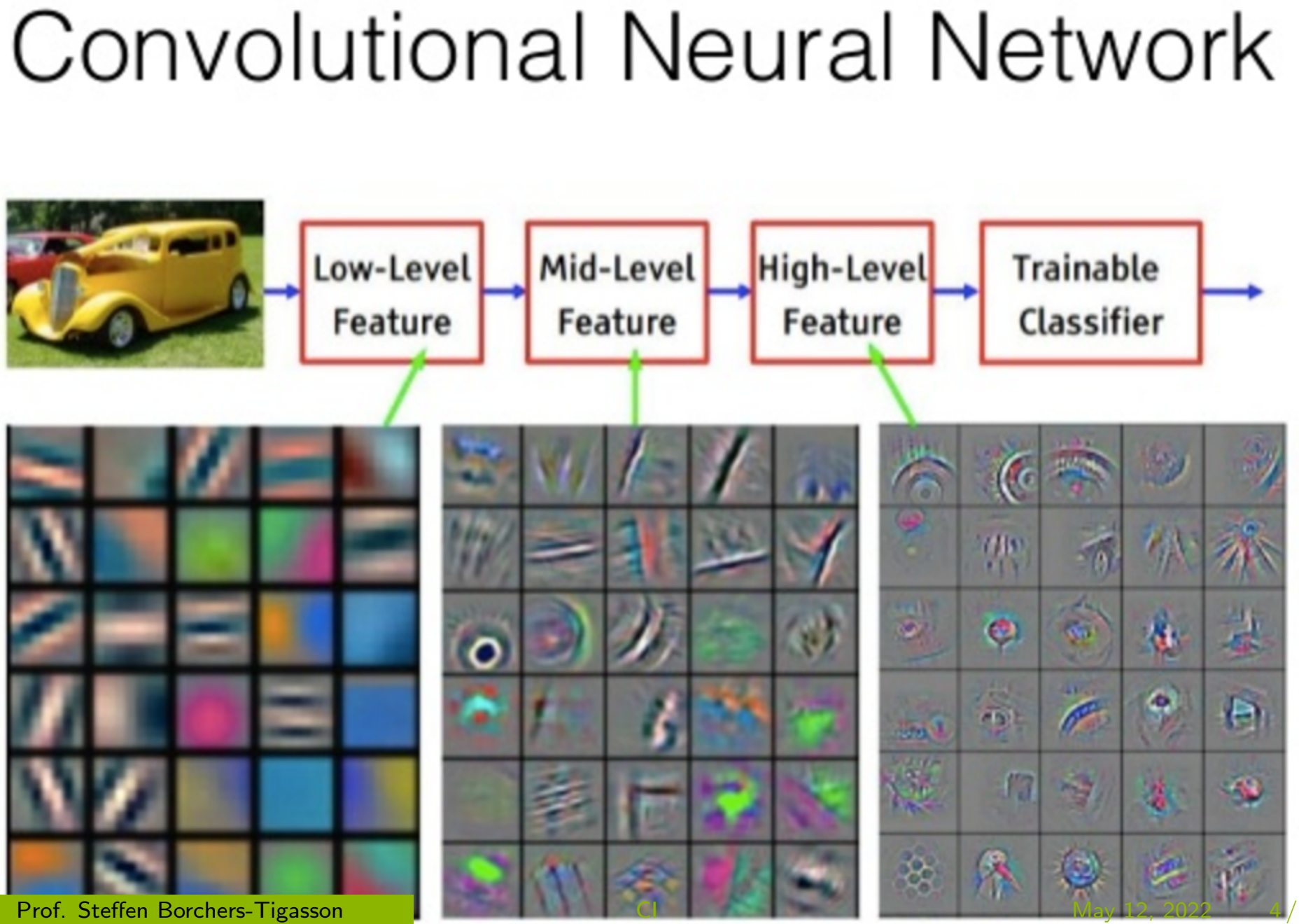


Convolutional Neural Networks: AlexNet Example

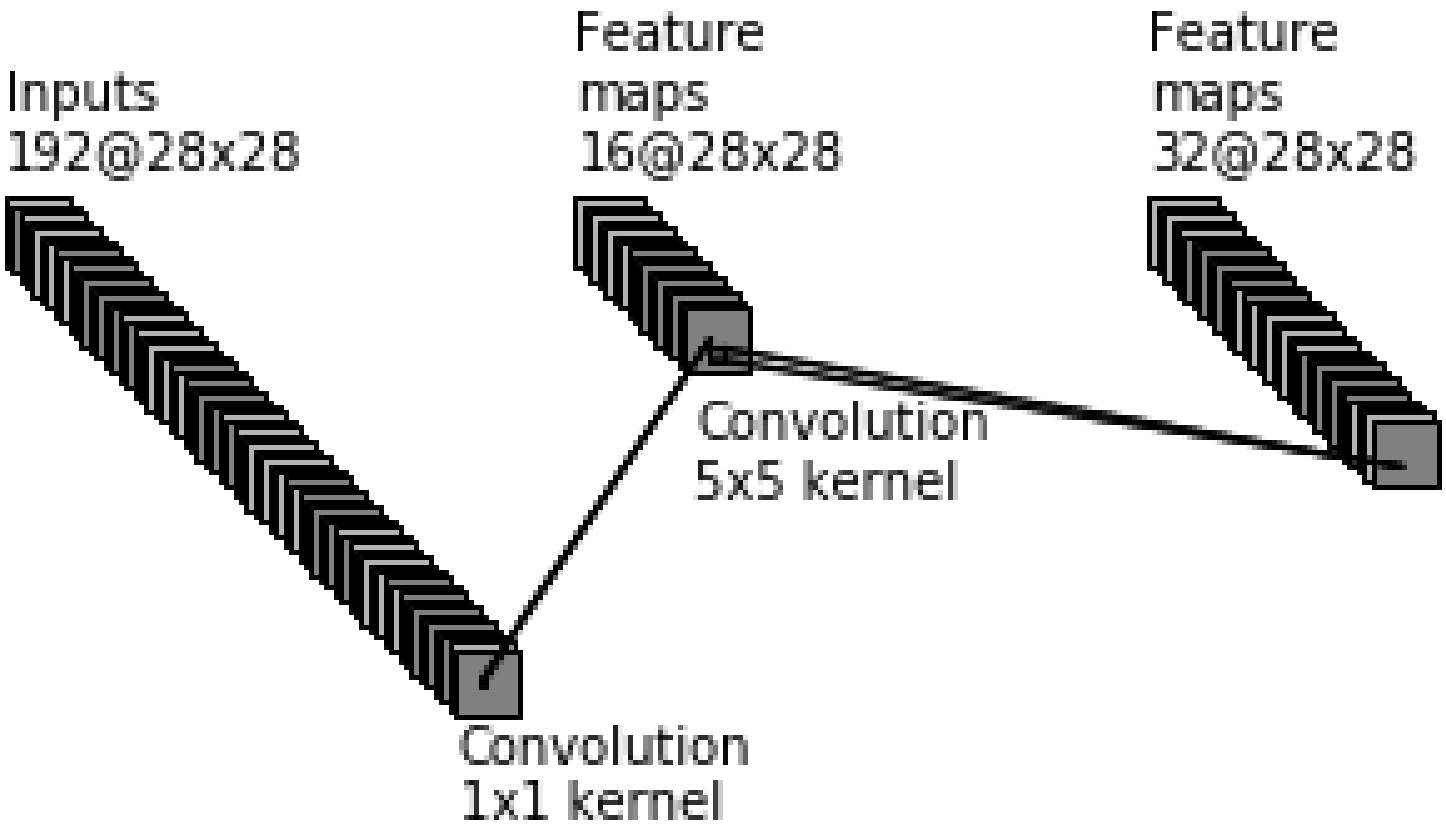


AlexNet 2012

Convolutional Neural Networks: Feature Maps



Convolutional Neural Networks: Special Kernels



1x1 Convolutions

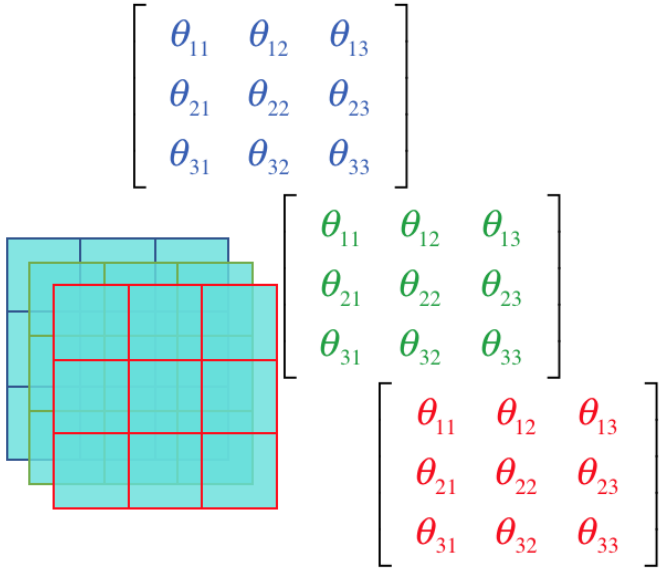
use 1x1 Convolutions for dimensionality reduction, See LeNet and Inception

Convolutional Neural Networks: Keras Implementation

```
model = Sequential()
model.add(Conv2D(40, (15, 15), activation='relu',
padding='same', input_shape=(64, 64, 1)))
model.add(MaxPooling2D((2, 2), padding='same'))
model.add(Conv2D(40, (15, 15), activation='relu', padding='same'))
model.add(Conv2D(1, (15, 15), activation='linear', padding='same'))
print(model.summary())
```

Convolutional Neural Networks: Input Channels

Color image



Parameterized filter

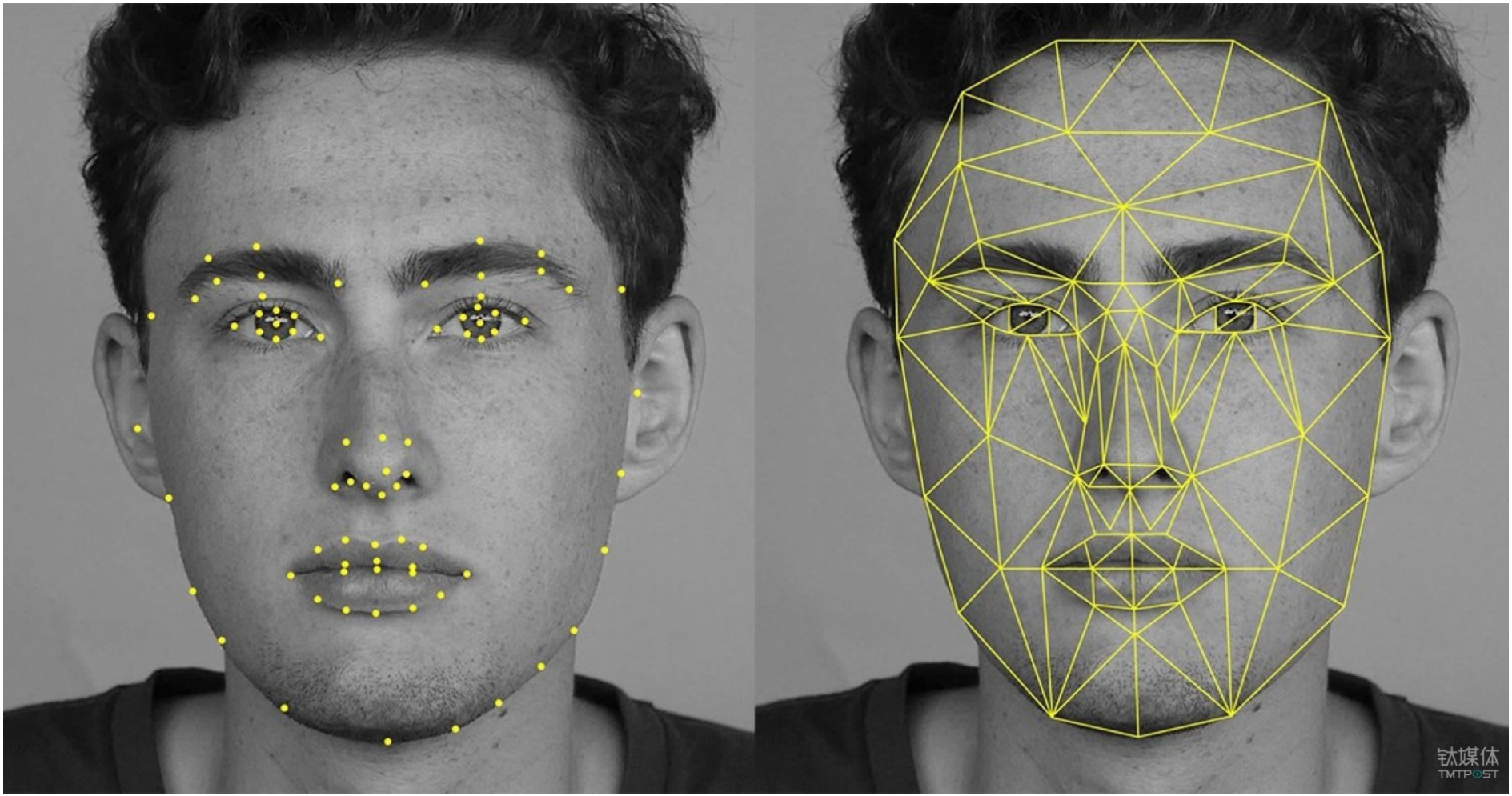
1x1 Convolutions

use 1x1 Convolutions for dimensionality reduction, See LeNet and

Convolutional Neural Networks: Summary

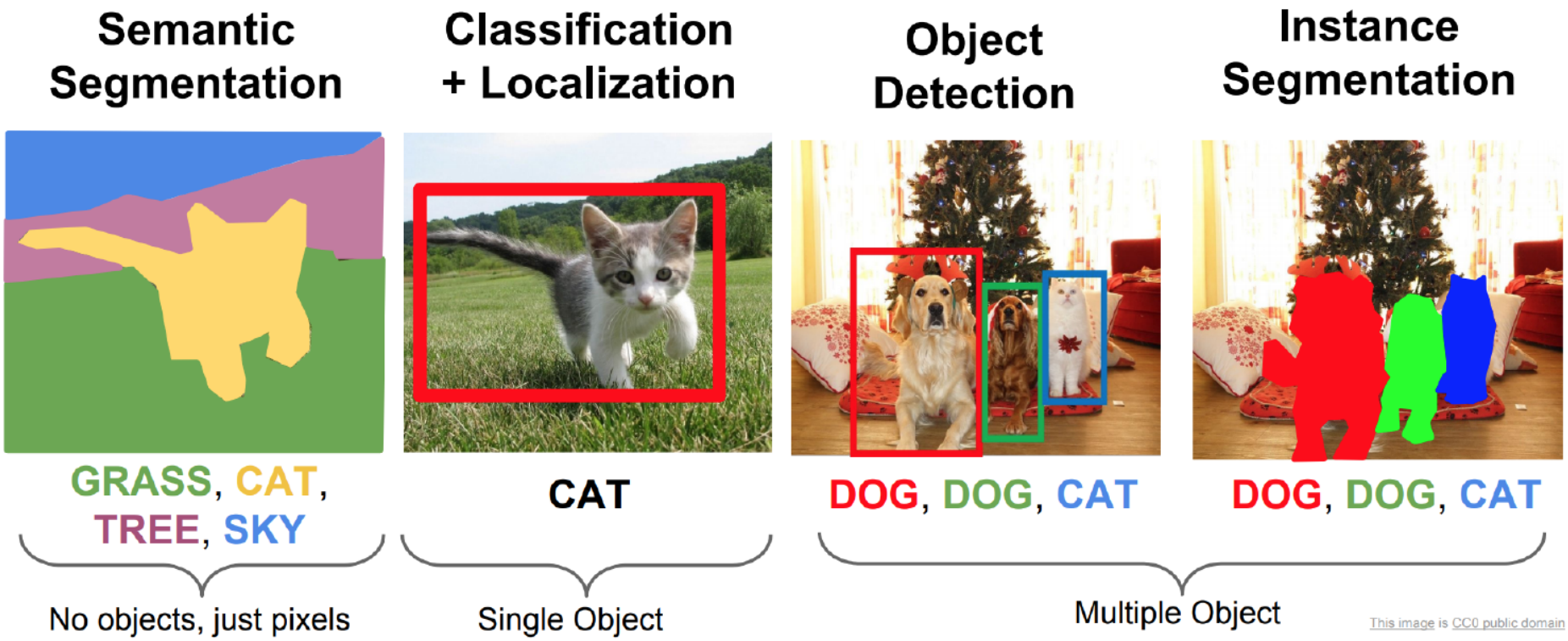
- very powerful, widely used in computer vision
- typically, the CNN layers can be recycled, no need to relearn these parameters; just relearn the dense layers
- idea of convolutions applies to 1D, 2D, and 3D inputs

Computer Vision: Further applications



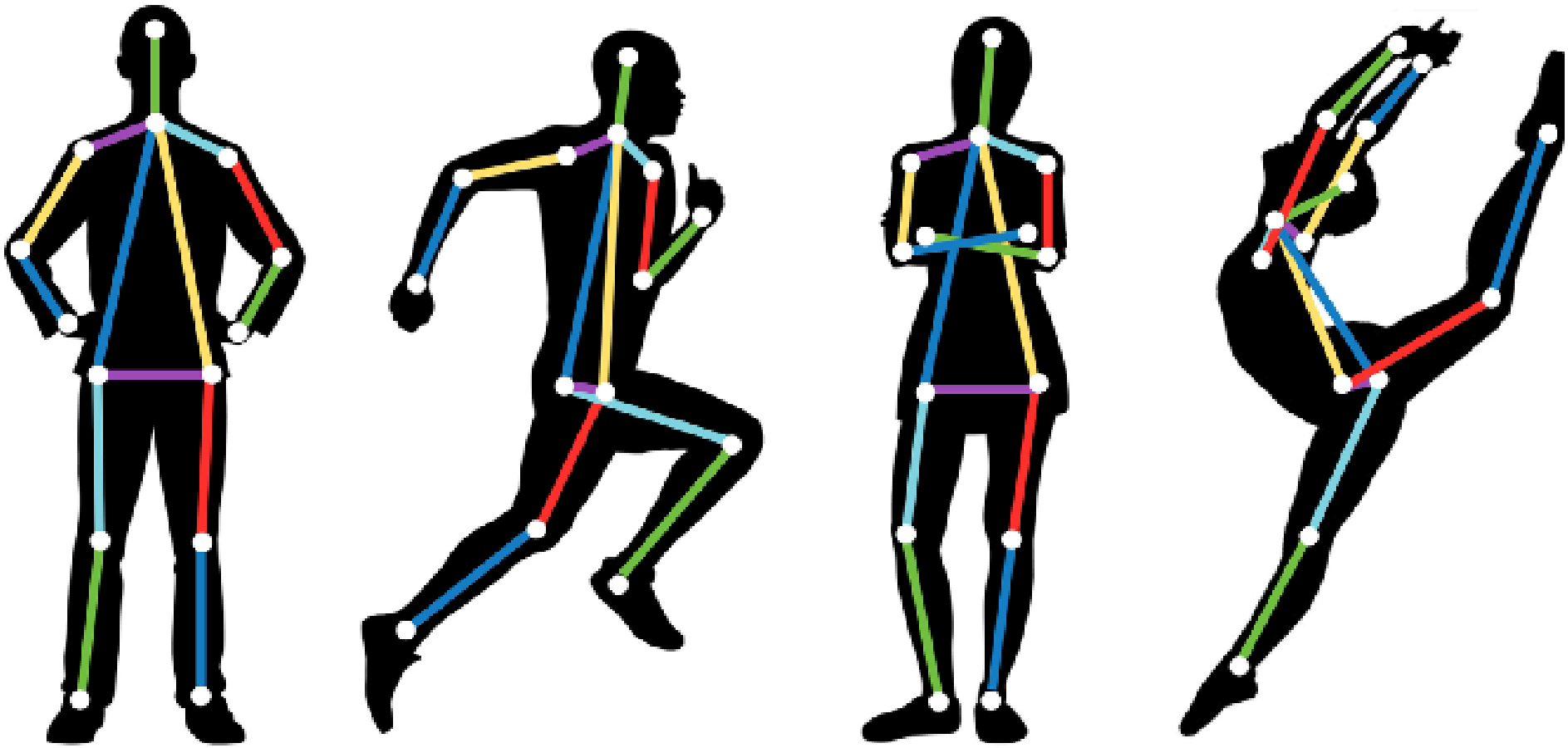
- Face detection

Computer Vision: Further applications



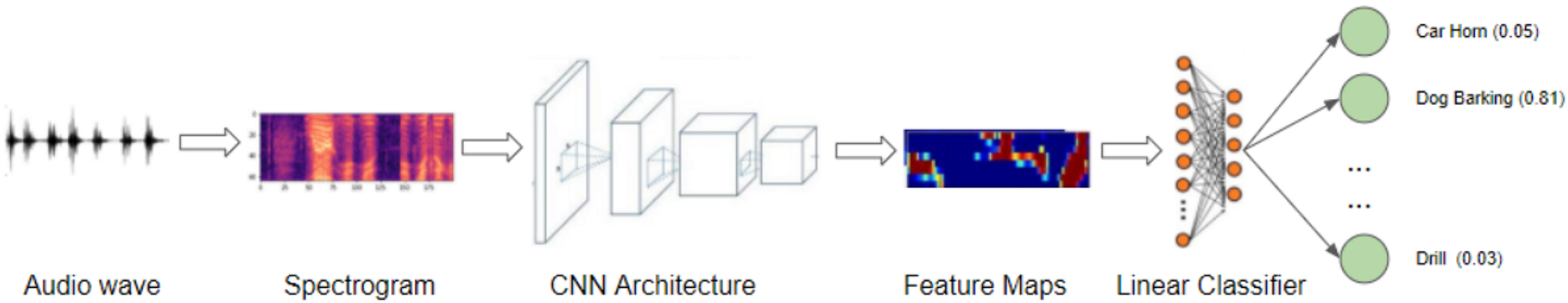
- object detection very powerful, see YOLOv5(pytorch)
- Mask RCNN for Instance segmentation

Computer Vision: Further applications



- Pose Estimation
- Optical flow estimation

CNN: Further applications



- sound classification
- Re-Identification

CNN General Remarks

- a lot of applications
- easy to reuse and reporpose
- many more applications!
- avoid overfitting: regularization; dropout and data augmentation useful
- for current CNN Backbones, approx. 1500 Pictures/Class are required

CNN: Further applications