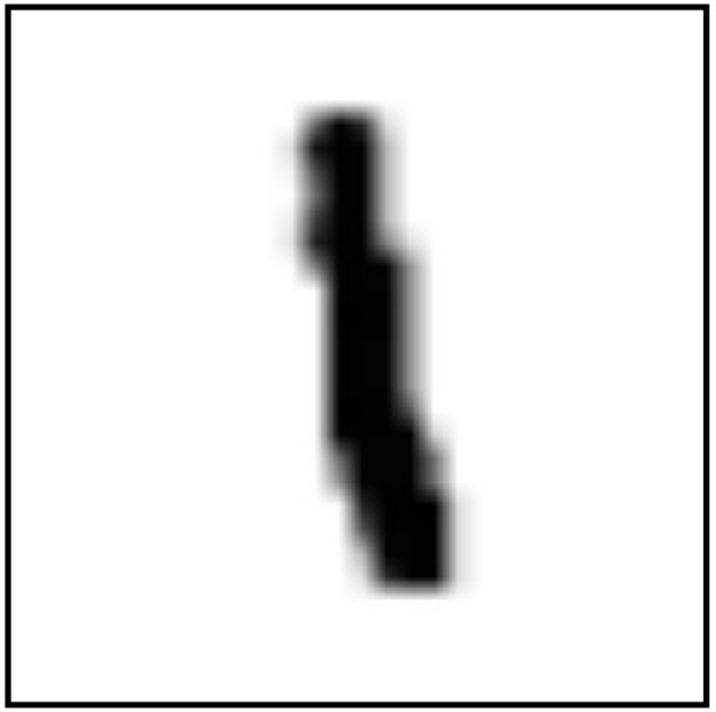
08 Dimensionality Reduction

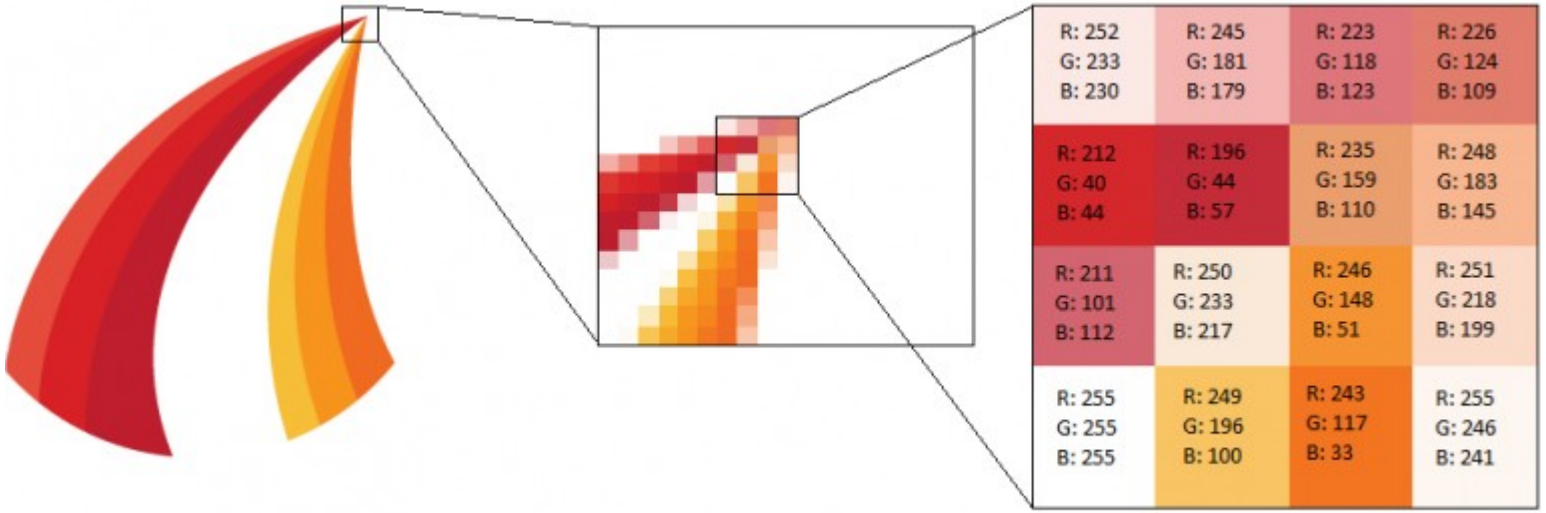
CVL@PIEAS

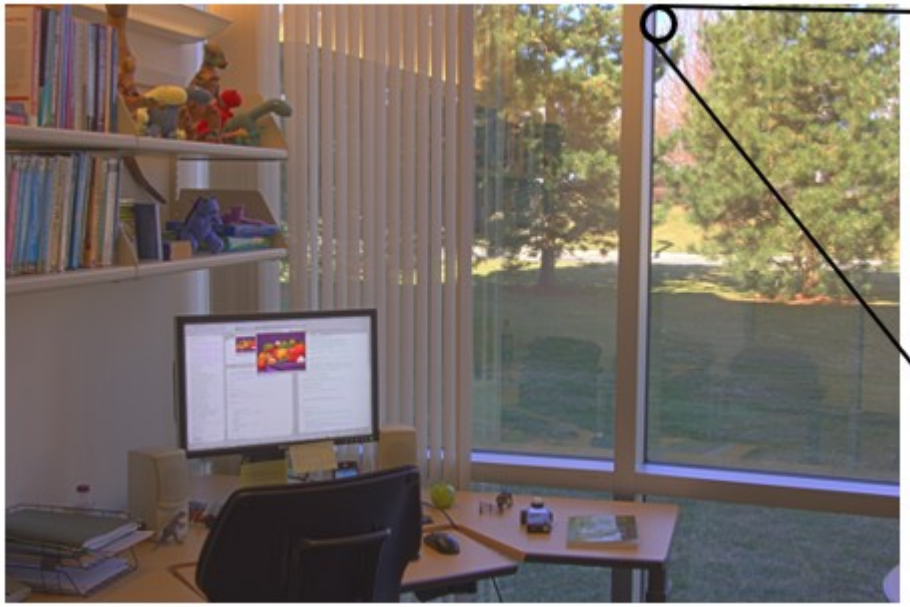


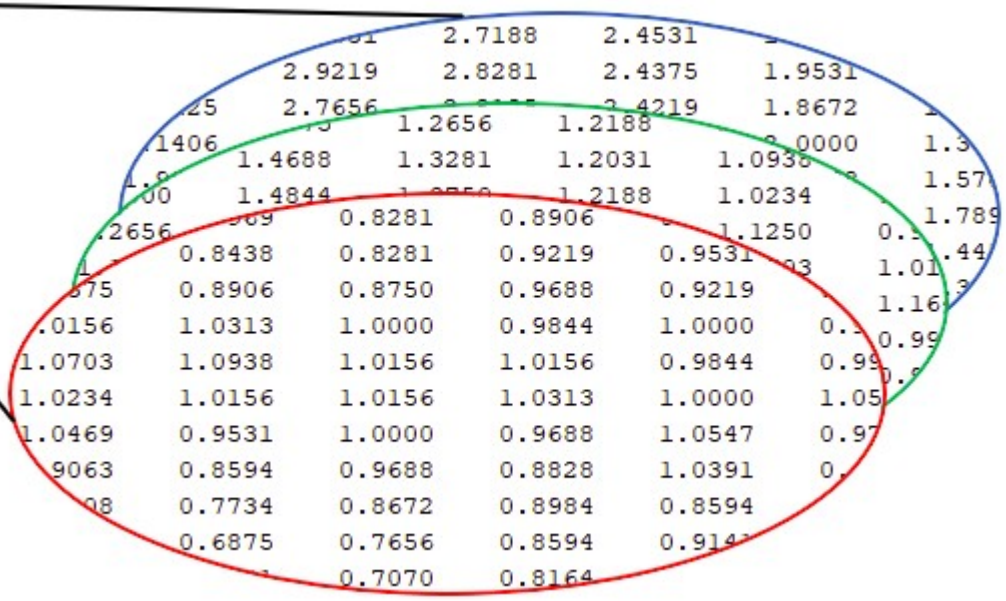
$\approx$

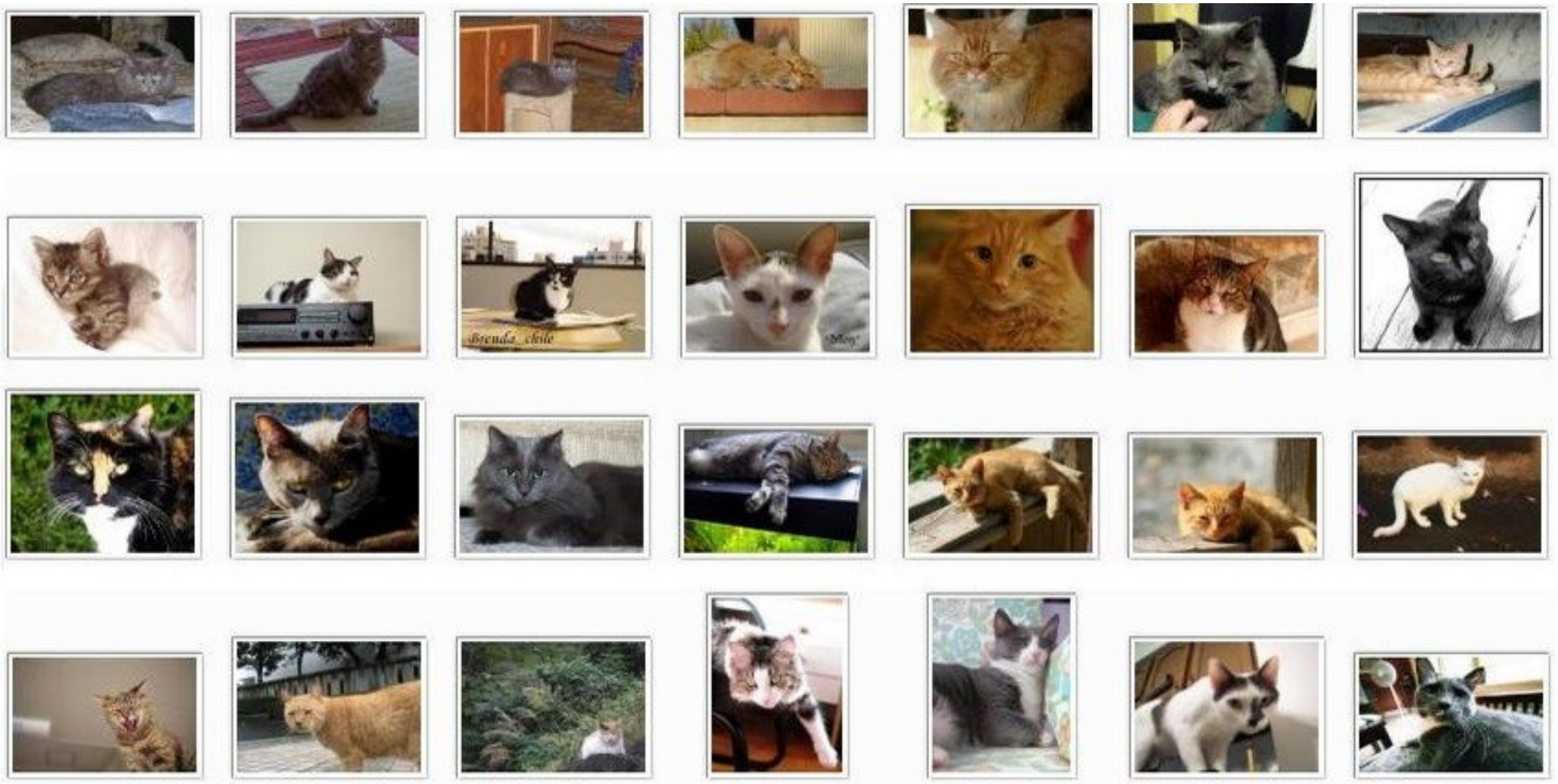
$$\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & .6 & .8 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & .7 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & .7 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & .5 & 1 & .4 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & .4 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & .4 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & .7 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & .9 & 1 & .1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & .3 & 1 & .1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix}$$

- Images are arrays of numbers, to a machine.

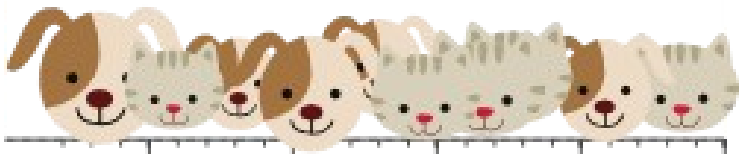

R: 252 G: 233 B: 230
R: 245 G: 181 B: 179
R: 223 G: 118 B: 123
R: 226 G: 124 B: 109
R: 212 G: 40 B: 44
R: 196 G: 44 B: 57
R: 235 G: 159 B: 110
R: 248 G: 183 B: 145
R: 211 G: 101 B: 112
R: 250 G: 233 B: 217
R: 246 G: 148 B: 51
R: 251 G: 218 B: 199
R: 255 G: 255 B: 255
R: 249 G: 196 B: 100
R: 243 G: 117 B: 33
R: 255 G: 246 B: 241



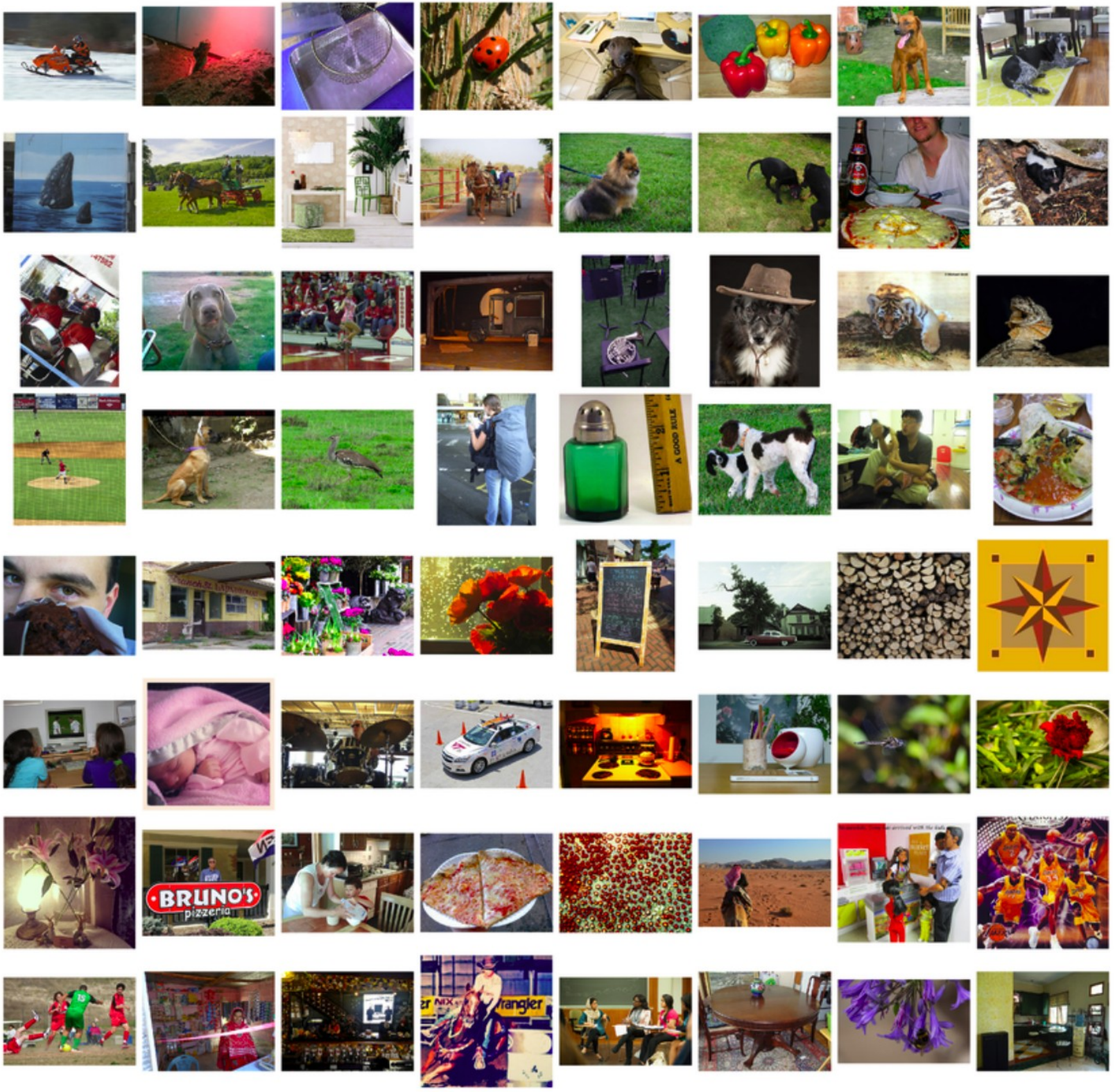

2.7188 2.4531
2.9219 2.8281 2.4375 1.9531
2.7656 2.4219 1.8672
1.2656 1.2188
1.4688 1.3281 1.2031 1.0938
1.4844 1.2188 1.0234
0.8281 0.8906 1.1250
0.8438 0.8281 0.9219 0.9531
0.8906 0.8750 0.9688 0.9219
1.0313 1.0000 0.9844 1.0000
1.0938 1.0156 1.0156 0.9844
1.0156 1.0156 1.0313 1.0000
0.9531 1.0000 0.9688 1.0547
0.8594 0.9688 0.8828 1.0391
0.7734 0.8672 0.8984 0.8594
0.6875 0.7656 0.8594
0.7070 0.8164

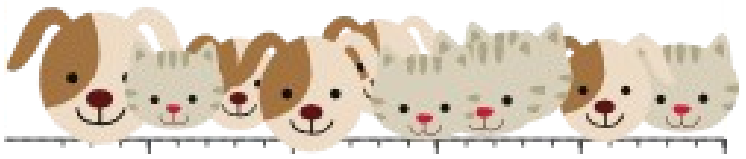


- Are all of these same, how to classify ?

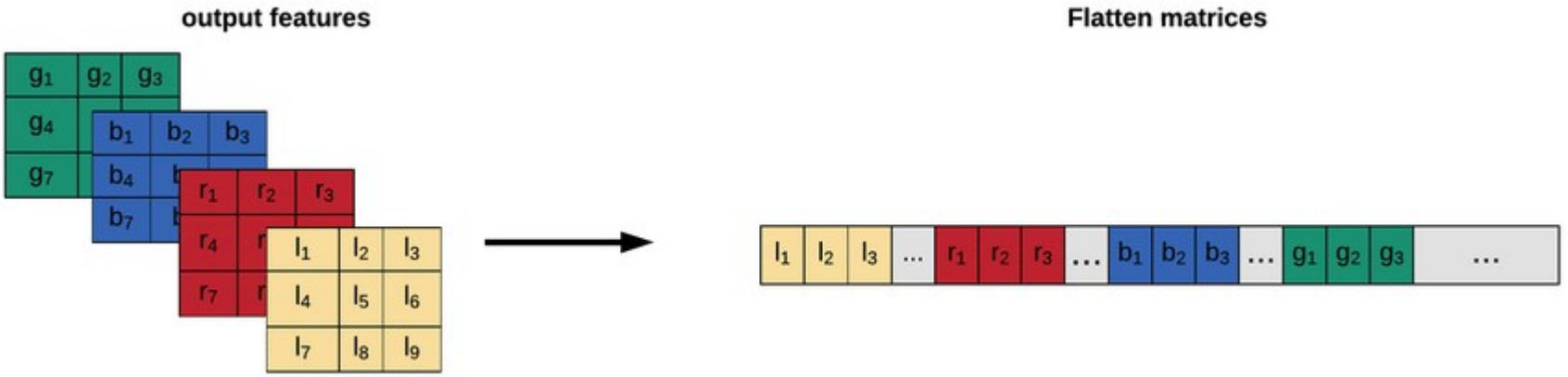


-
- Simple value for image measuring “catness”

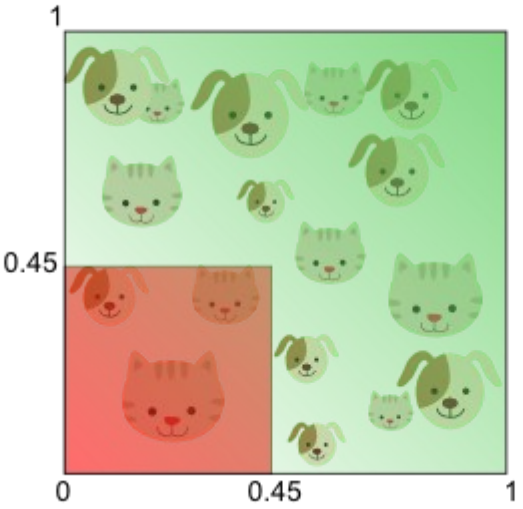

BRUNO'S
pizzeria

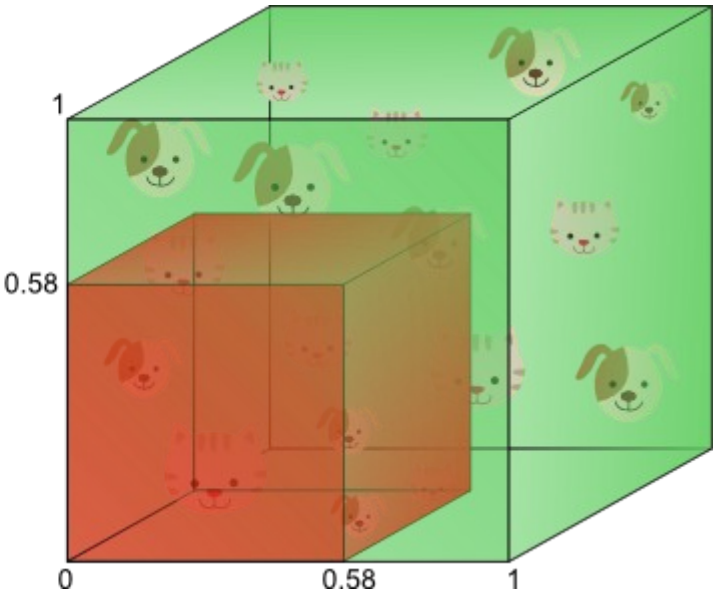


Feature 1



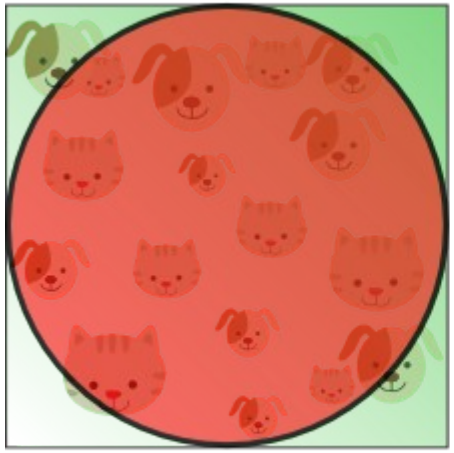
- Real Image > 128*128*3 = 49152 dimensional !

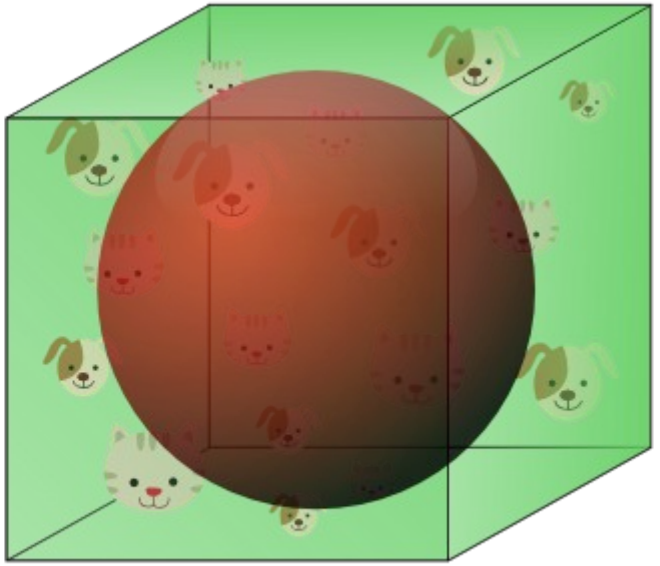


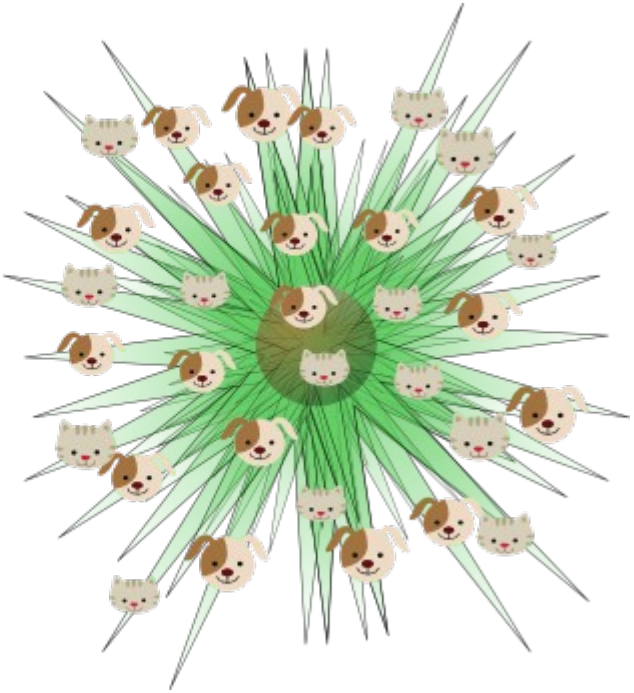


How many types of “*ness” to measure ?

- Which ones ?

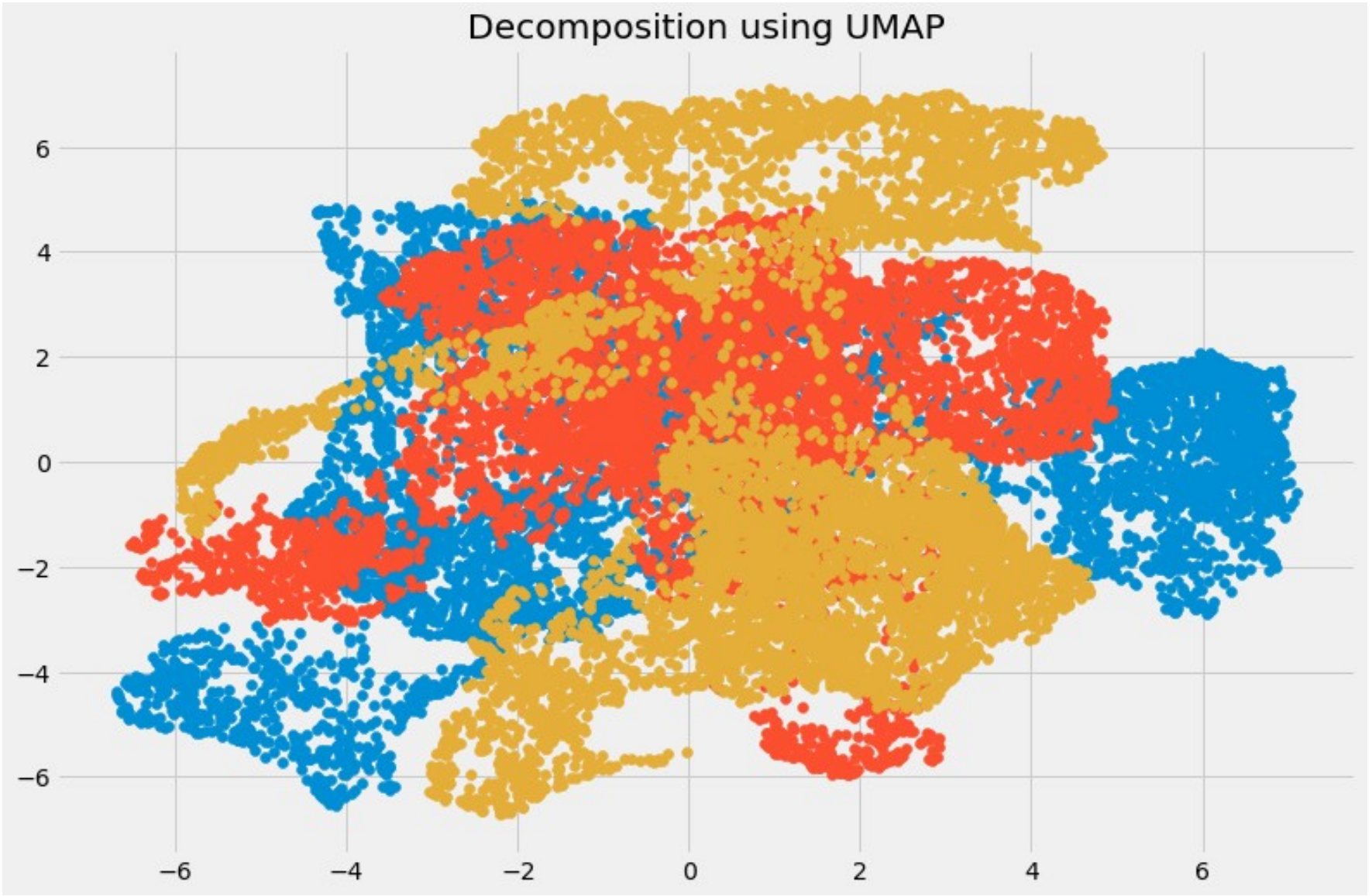




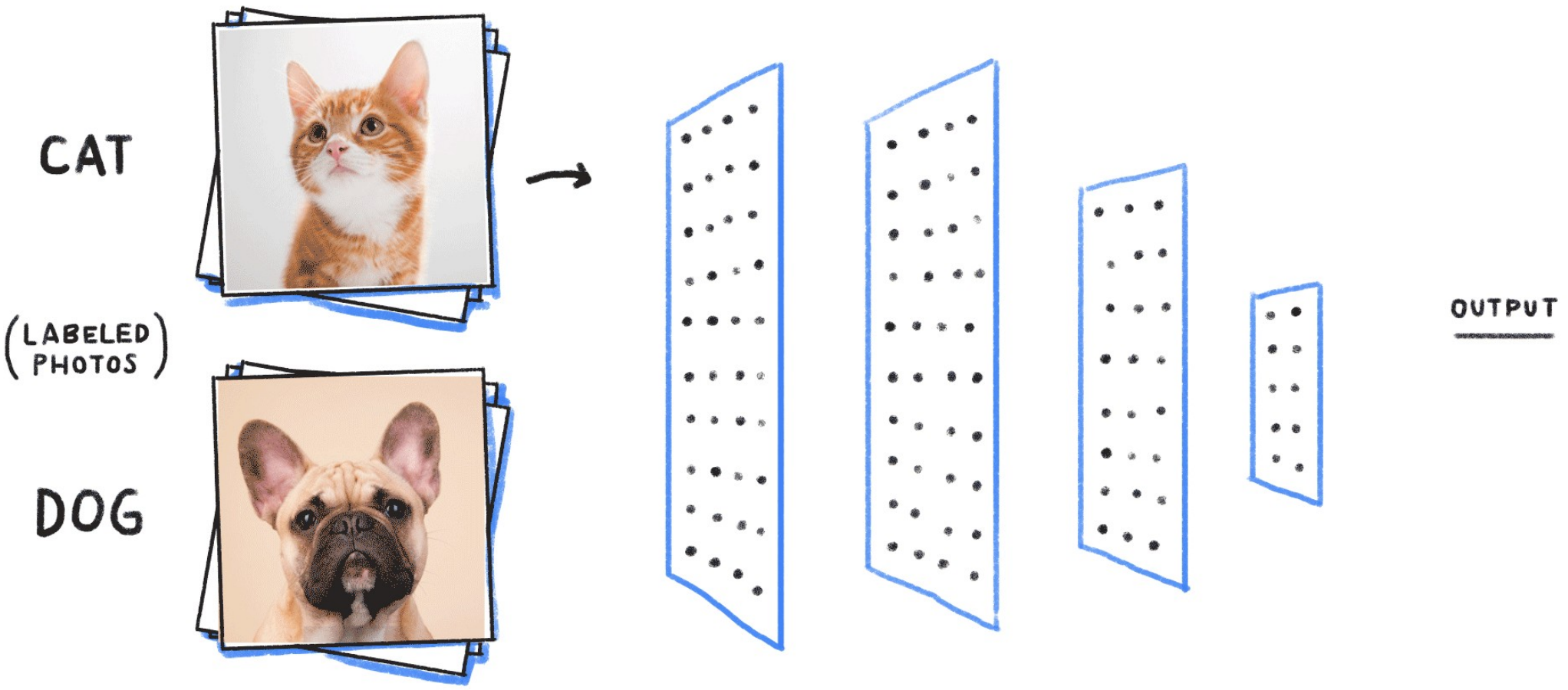


Curse of Dimensionality, High Dimensional Data, ...

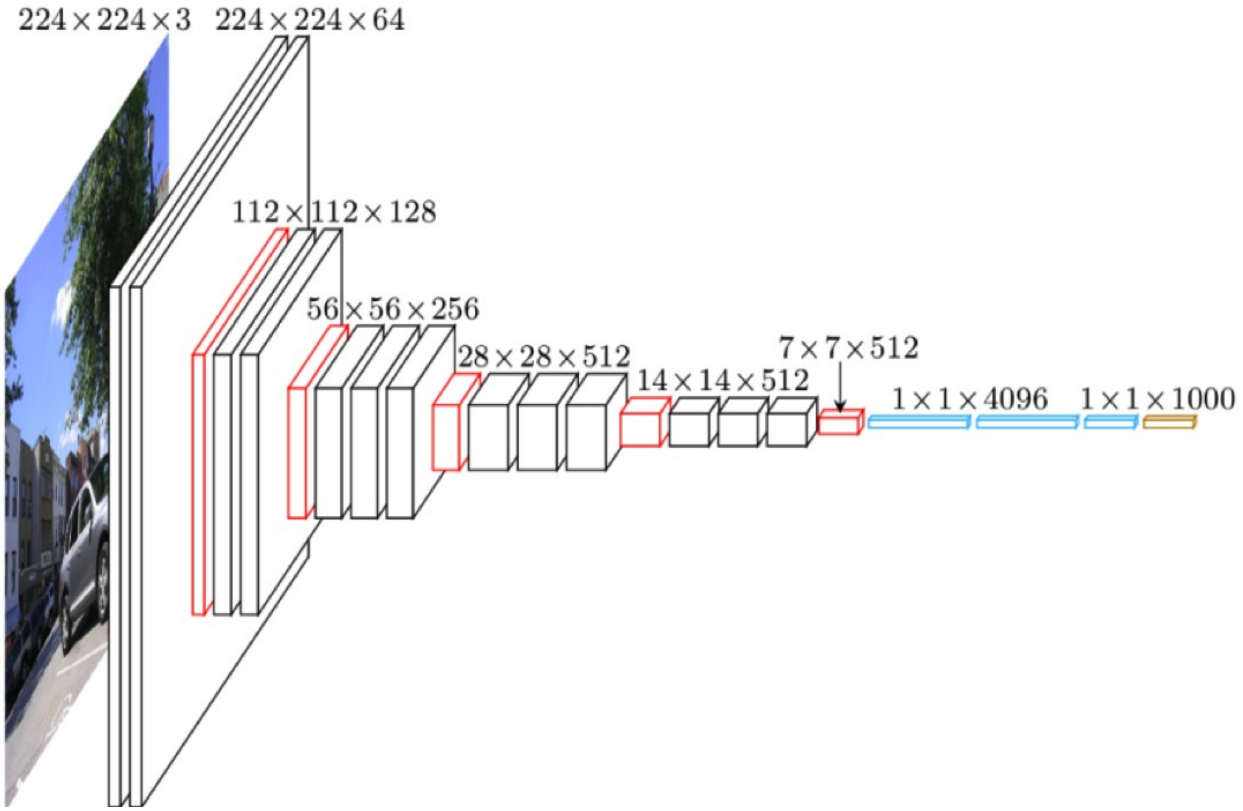
- https://www.visiondummy.com/2014/04/curse-dimensionality-affect-classification/


Decomposition using UMAP
6
4
2
0
−2
−4
−6
−6
−4
−2
0
2
4
6

Extra Information

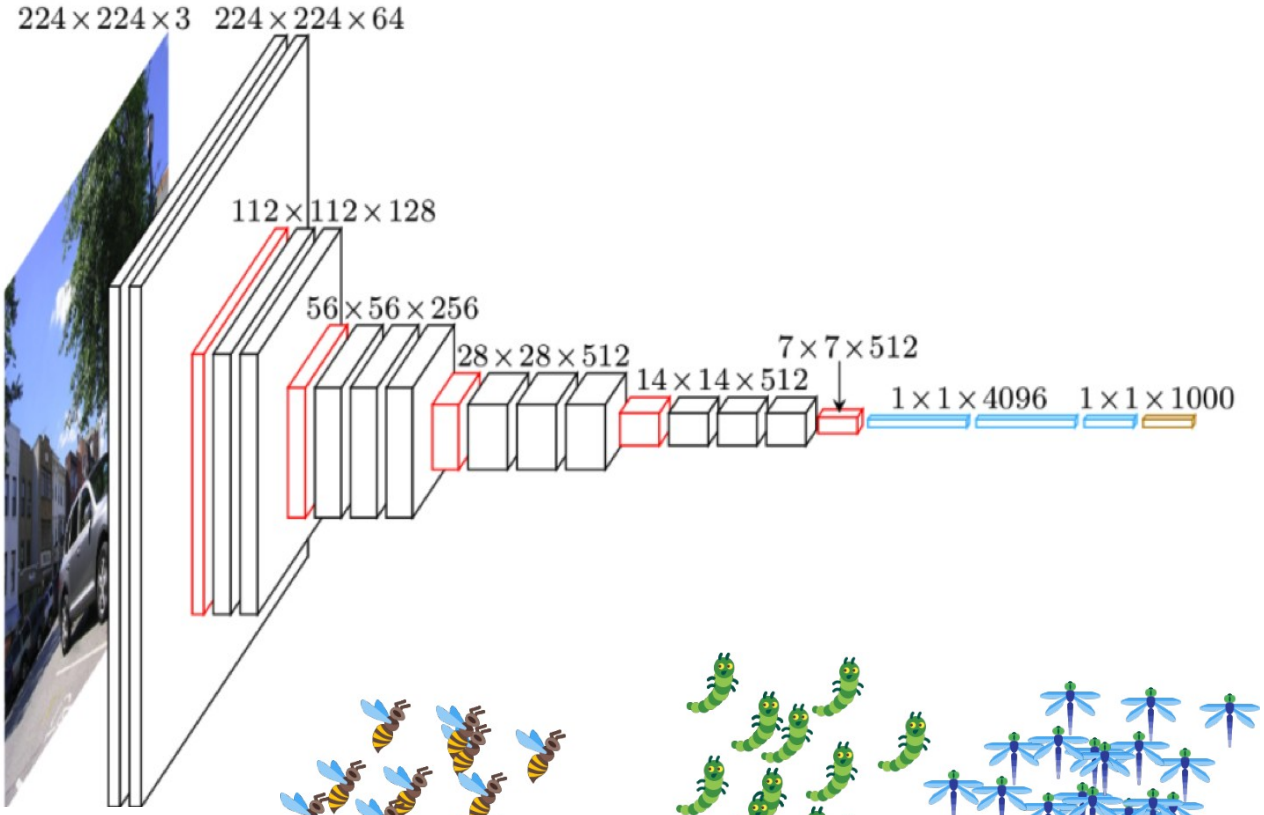

CAT
(LABELED PHOTOS)
DOG
OUTPUT

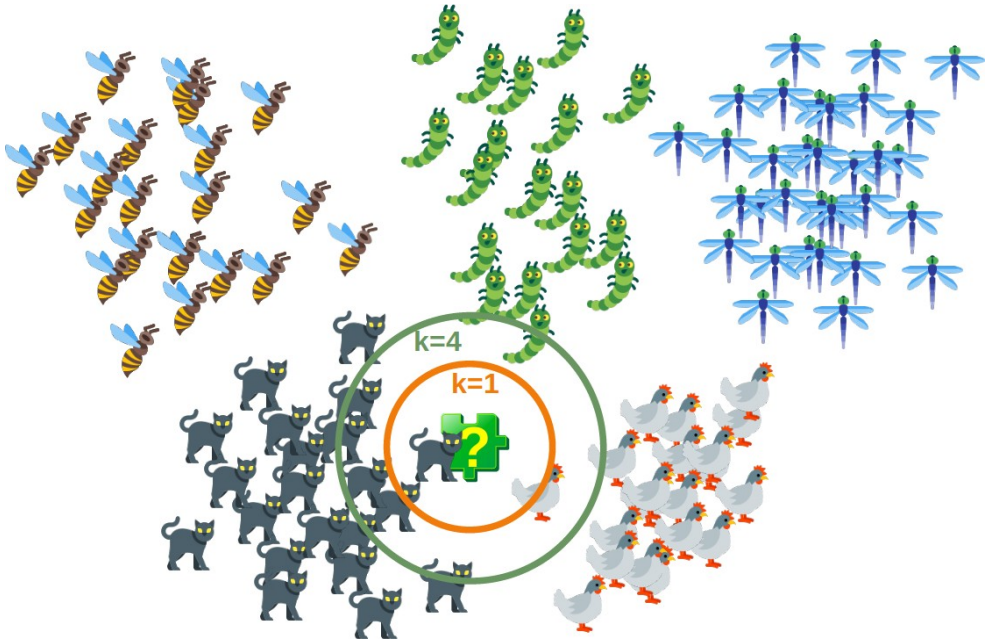
predict



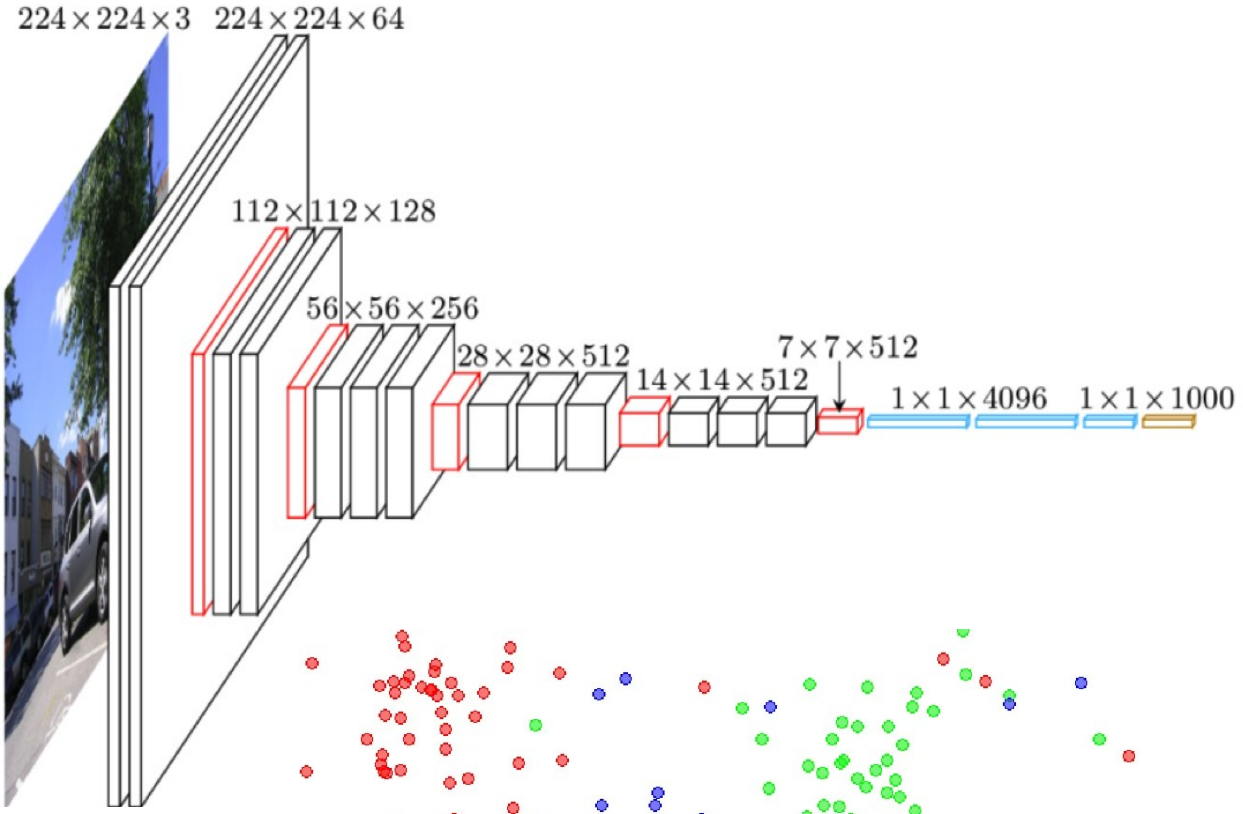
- https://www.jeremyjordan.me/object-detection-one-stage/

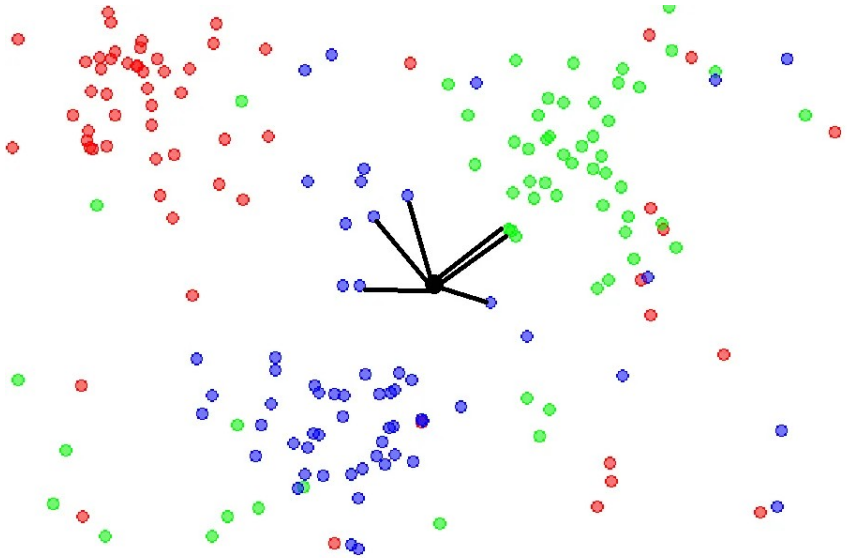
predict


224 × 224 × 3
224 × 224 × 64
112 × 112 × 128
56 × 56 × 256
28 × 28 × 512
14 × 14 × 512
7 × 7 × 512
1 × 1 × 4096
1 × 1 × 1000

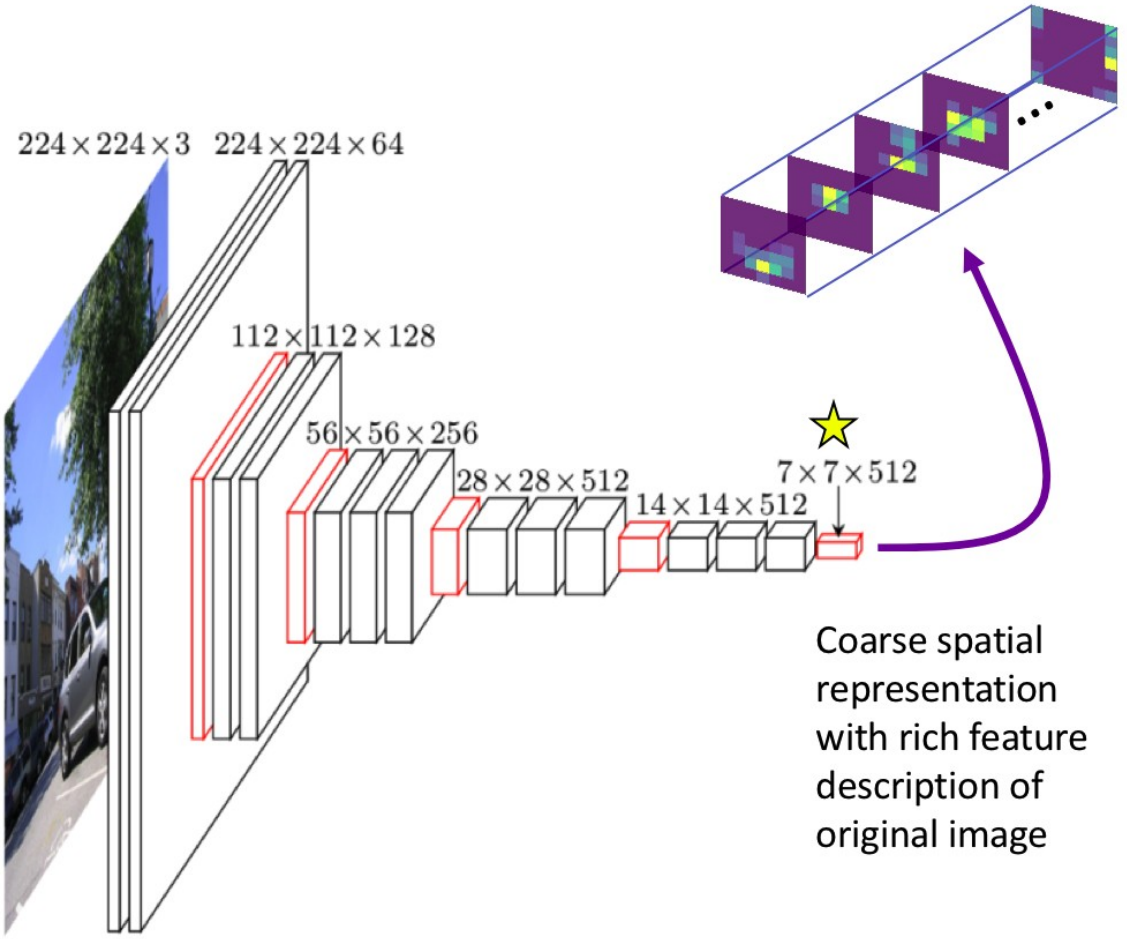

k=4
k=1
?

predict

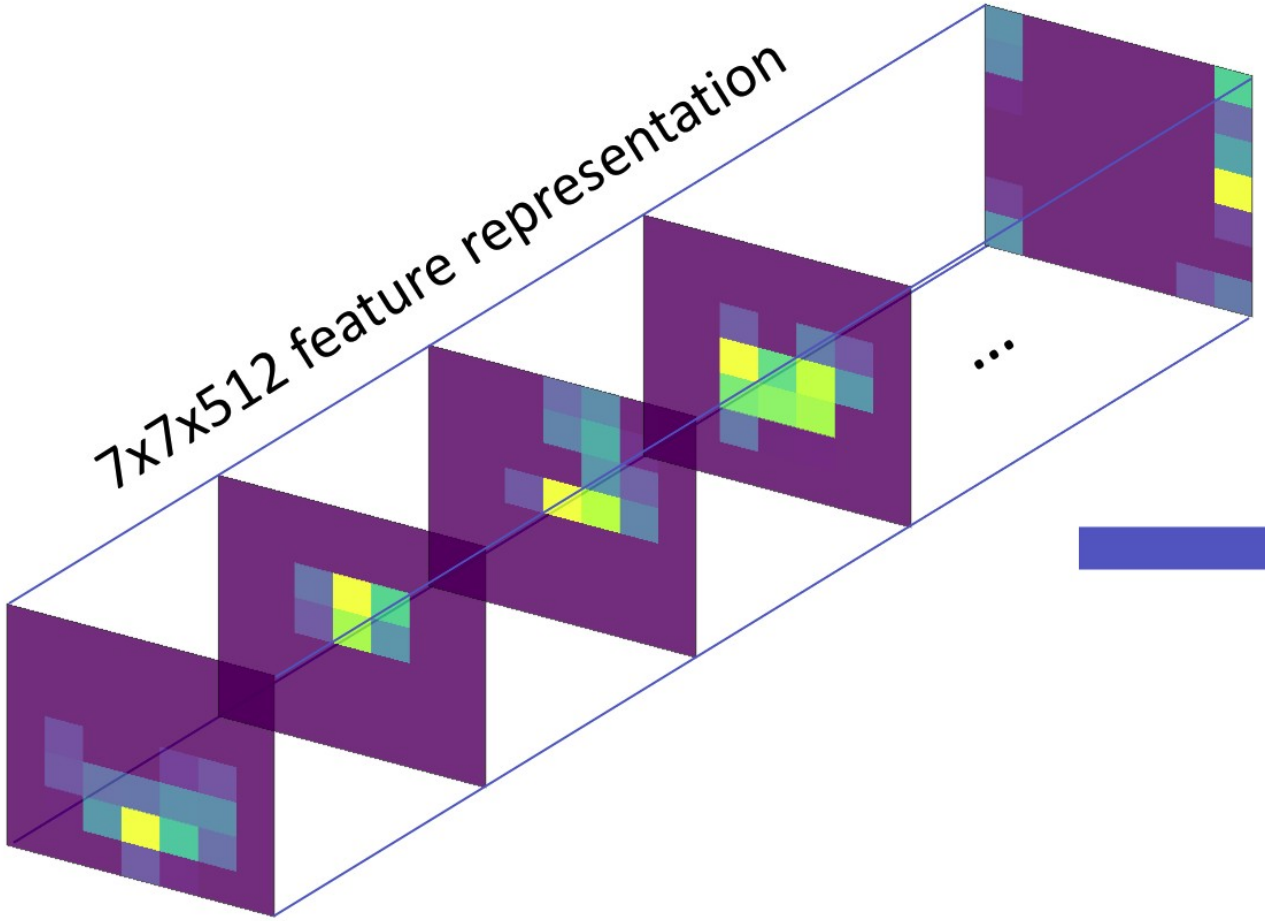

224 × 224 × 3
224 × 224 × 64
112 × 112 × 128
56 × 56 × 256
28 × 28 × 512
14 × 14 × 512
7 × 7 × 512
1 × 1 × 4096
1 × 1 × 1000

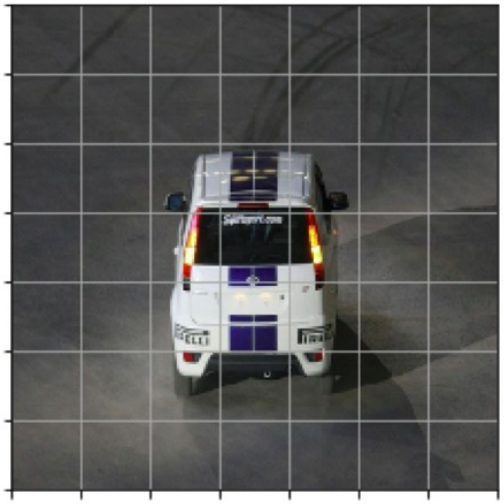


predict



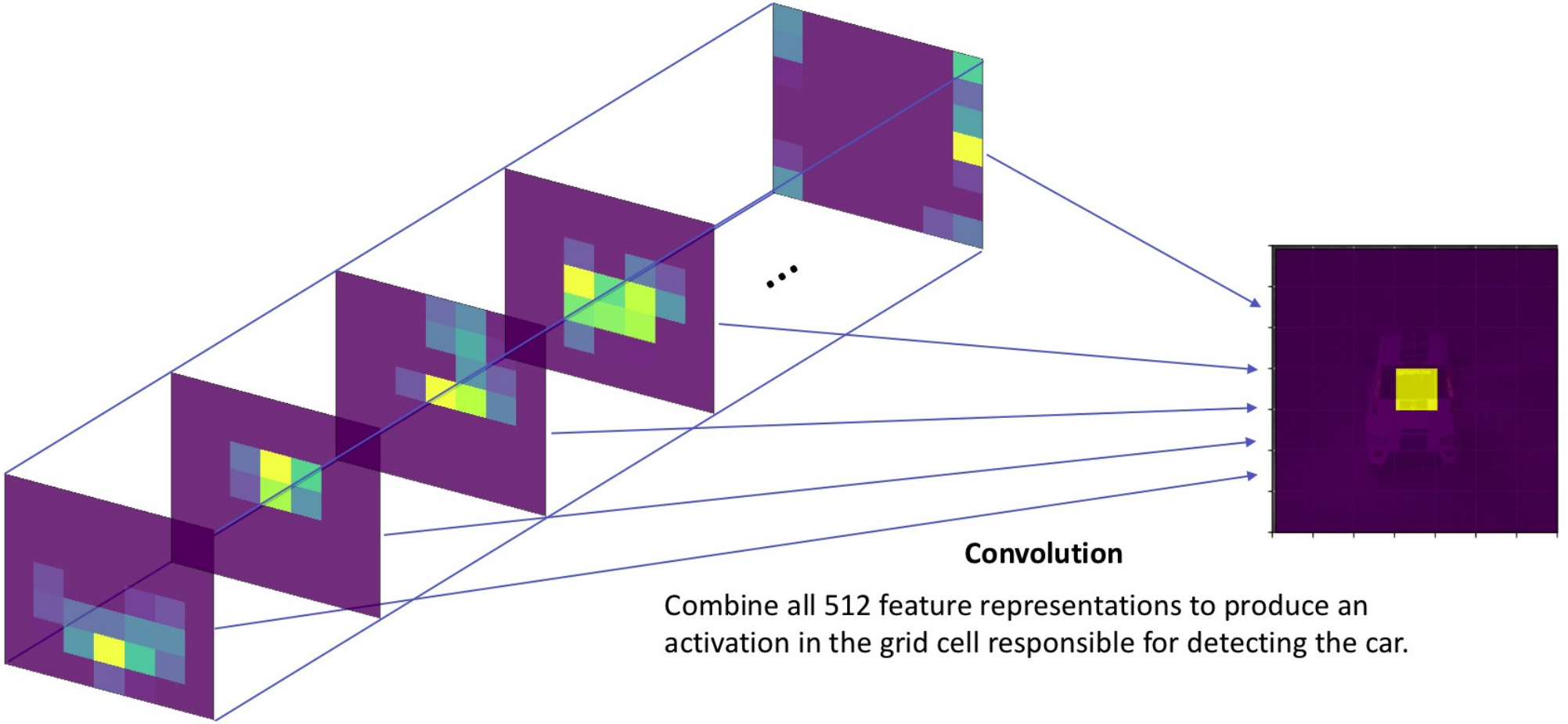
Coarse spatial representation with rich feature description of original image





Visualizing the corresponding regions of each “pixel” in the 7x7 feature maps with the original 224x224 image

- 512 images for one image, small but many



Convolution

Combine all 512 feature representations to produce an activation in the grid cell responsible for detecting the car.