About CIFAR – 10 Dataset

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CIFAR-10 dataset is one of the well-known datasets in deep learning.
↓
image classification tasks

It is often used as a benchmark dataset for testing and evaluating algorithms, especially in the context of CNNs.

Overview of CIFAR-10 Dataset

Dataset Size

60,000 color images

- 50,000 images for training
- 10,000 images for testing

Image Size:

all images are of size 32X32 pixels → 1024 pixels
↓
X_i is vector having that many neurons.

32*32 =

images are colored
↓
(RGB) → meaning each image has 3 channels.

Number of categories/classes:

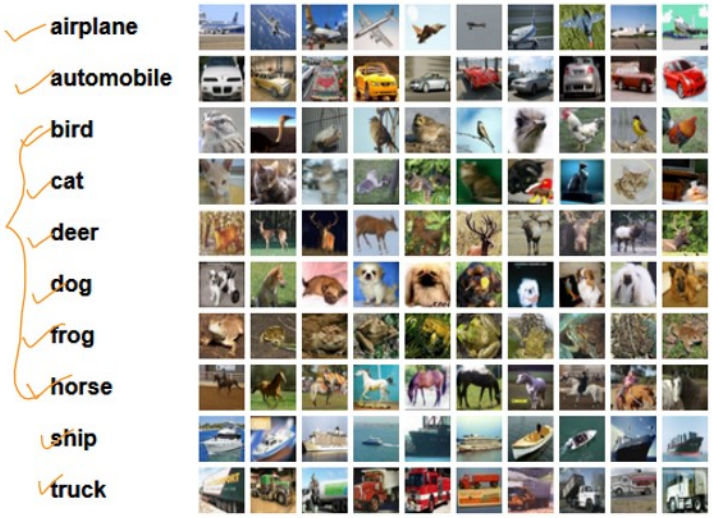
CIFAR-10 dataset has 10 classes
↓
representing objects or scenes or living things.

dataset is balanced

meaning there are 6000 images per class.

1 → 6000
2 → 6000
3 → 6000
⋮
10 → 6000

6000 x 10 → 60,000.



→ Multi-class classification task

The CIFAR-100 dataset

This dataset is just like the CIFAR-10, except it has 100 classes containing 600 images each. There are 5(
Here is the list of classes in the CIFAR-100:

Superclass	Classes
aquatic mammals	beaver, dolphin, otter, seal, whale
fish	aquarium fish, flatfish, ray, shark, trout
flowers	orchids, poppies, roses, sunflowers, tulips
food containers	bottles, bowls, cans, cups, plates
fruit and vegetables	apples, mushrooms, oranges, pears, sweet peppers
household electrical devices	clock, computer keyboard, lamp, telephone, television
household furniture	bed, chair, couch, table, wardrobe
insects	bee, beetle, butterfly, caterpillar, cockroach
large carnivores	bear, leopard, lion, tiger, wolf
large man-made outdoor things	bridge, castle, house, road, skyscraper
large natural outdoor scenes	cloud, forest, mountain, plain, sea
large omnivores and herbivores	camel, cattle, chimpanzee, elephant, kangaroo
medium-sized mammals	fox, porcupine, possum, raccoon, skunk
non-insect invertebrates	crab, lobster, snail, spider, worm
people	baby, boy, girl, man, woman
reptiles	crocodile, dinosaur, lizard, snake, turtle
small mammals	hamster, mouse, rabbit, shrew, squirrel
trees	maple, oak, palm, pine, willow
vehicles 1	bicycle, bus, motorcycle, pickup truck, train
vehicles 2	lawn-mower, rocket, streetcar, tank, tractor

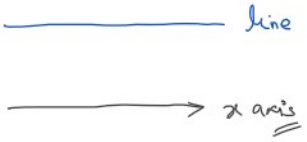
Yes, I know mushrooms aren't really fruit or vegetables and bears aren't really carnivores.

Concept of dimensions

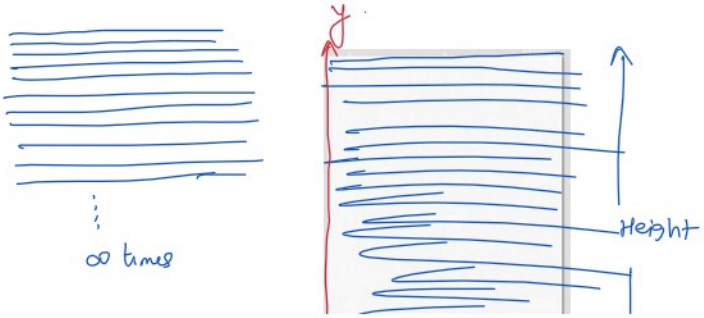
Array → ndim

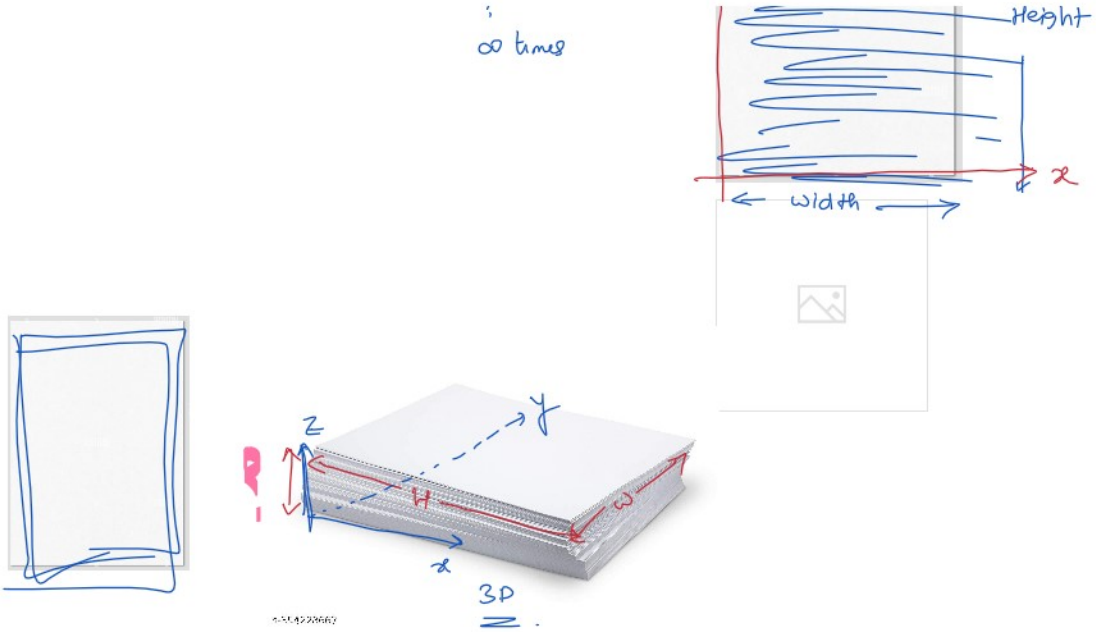
n-dimensions

1-D



2-D






```
model = models.Sequential()

model.add(layers.Conv2D(32, (3,3), activation = 'relu', input_shape = (32,32,3))) ## added a 2D convolutional layer with 32 filters, each of size: 3 x 3, activ
model.add(layers.MaxPooling2D((2,2))) ### adds a max pooling layer with pool size of 2 x 2, to reduce the spatial dimension -- by half
model.add(layers.Conv2D(64, (3,3), activation = 'relu')) ### added a 2D convolutional layer with 64 filters, each of size: 3x3, activation function is 'ReLU'
model.add(layers.MaxPooling2D((2,2))) ### Adds another max pooling layer of similar size 2x2
model.add(layers.Conv2D(64, (3,3), activation='relu')) #added a 2D convolutional layer with 64 filters, each of size, 3x3, activation function is 'ReLU'
```

no. of filters = 32

```
Model: "sequential_2"
```

Layer (type)	Output Shape	Param #
conv2d_4 (Conv2D)	(None, 30, 30, 32)	896
max_pooling2d_2 (MaxPooling2D)	(None, 15, 15, 32)	0
conv2d_5 (Conv2D)	(None, 13, 13, 64)	18,496
max_pooling2d_3 (MaxPooling2D)	(None, 6, 6, 64)	0
conv2d_6 (Conv2D)	(None, 4, 4, 64)	36,928

```
Total params: 56,320 (220.00 KB)
Trainable params: 56,320 (220.00 KB)
Non-trainable params: 0 (0.00 B)
```

First layer : Conv2D

Input shape: (32, 32, 3)

32 x 32 image for 3 channels

R, G, B.

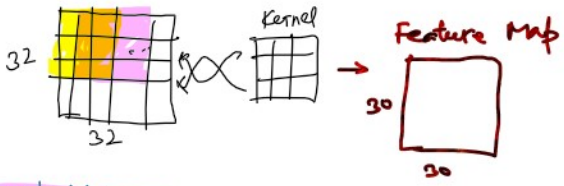
output shape (30, 30, 32)

?

32 - 3 + 1 = 30

32 - 3 + 1 = 30

(filter size or kernel)



- no padding
- default stride #1

Number of parameters

Formula for the number of parameters in a conv2D layer is:

(kernel height x kernel width x input channels + 1) * no. of filters

(bias)

$= ((3 \times 3 \times 3) + 1) * 32$

$= 28 * 32 = 28 * 32 = 896$

Note: The additional '1' accounts for the bias term.

Second Layer: MaxPooling2D

Input shape: (30, 30, 32)

output shape: (15, 15, 32)

# of kernels / filters.

Spatial dimensions are reduced by half because of 2x2 max pooling operation with stride #2

No parameters are learnt in the MaxPooling layer, so param # = 0.