- Keras is a specification for deep learning models.

  - ML usually focuses on tabular data.

    ↳ dl can also be applied to images.

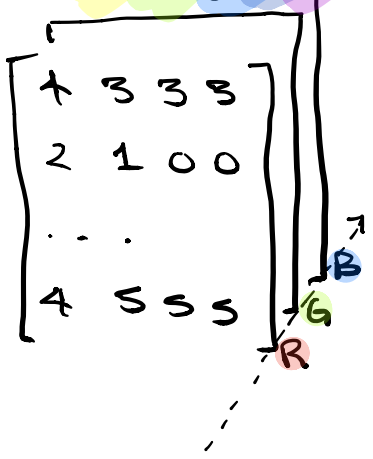
    — images are different from tabular data

Black & White Images

$$\begin{bmatrix} 0 & 2 & 3 & 4 \\ 0 & 4 & 3 & 0 \\ \cdots & & & \\ 0 & 1 & 1 & 1 \end{bmatrix}$$

2D Tensor.

Colour Images



Images use,

Tensor ←

like a matrix but with arbitrary dimensions.

TENSORS ||

Convolutions

◇ DL. applies convolutions to tensors.

- Convolutions are small tensors that can be applied to small x-sections of other tensors.

  → when used to detect patterns can be referred to as "filters".

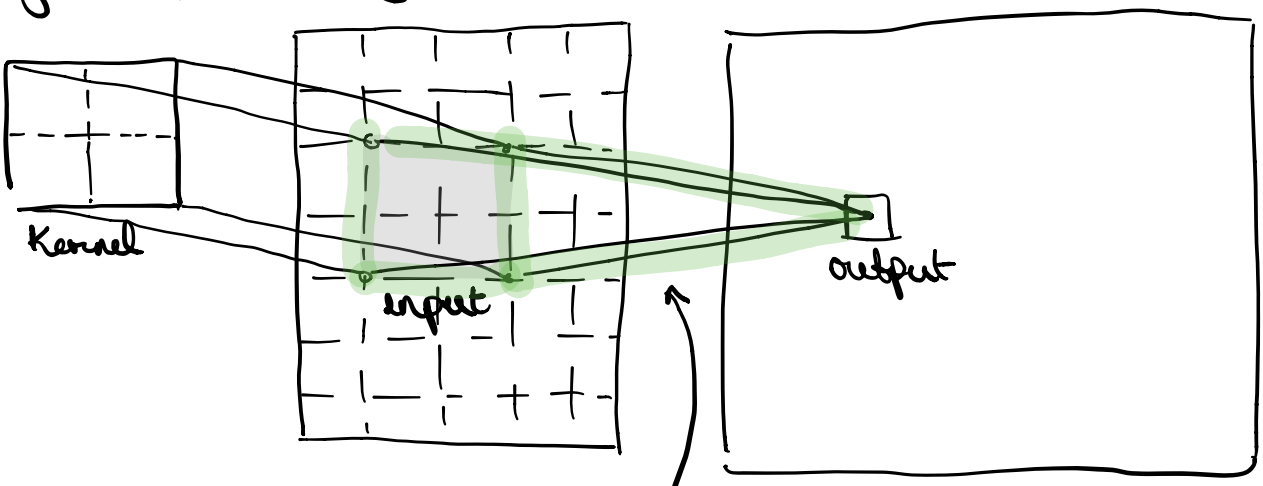
$$\begin{bmatrix} 1 & 1 \\ -1 & -1 \end{bmatrix}$$ } A convolution.

Applying convolutions to tensors is done by array-style multiplication

$$\begin{bmatrix} 1 & 2 & \cdots \\ 3 & 4 & \cdots \\ \cdots & & \end{bmatrix} \begin{bmatrix} 1 & 1 \\ -1 & -1 \end{bmatrix}$$

$1(1) + 2(1) + 3(-1) + 4(-1)$

Diagram of Applying a Tensor



Filters are computed/chosen using gradient descent/backpropagation → optimization techniques.

A mapping of where a certain (filter) pattern can be found in the input