Image filters

Convolution matrix:

In image processing, a *kernel*, *convolution matrix*, or *mask* is a small matrix. It is used for blurring, sharpening, embossing, edge detection, and more. This is accomplished by doing a convolution between a kernel and an image.

Convolution is the process of adding each element of the image to its local neighbors, weighted by the kernel. This is related to a form of mathematical convolution. The values of a given pixel in the output image are calculated by multiplying each kernel value by the corresponding input image pixel values. This can be described algorithmically with the following pseudo-code:

```
for each image row in input image:
for each pixel in image row:
      set accumulator to zero
      for each kernel row in kernel:
      for each element in kernel row:
            if element position  corresponding to pixel position then
                  multiply element value  corresponding to pixel value
                  add result to accumulator
            endif
             set output image pixel to accumulator
```

Filters:

- Blur:

  1 2 1

  2 4 2

  1 2 1

- Sharpen:

  0 -1 0

  -1 5 -1

  0 -1 0

- Edge enhancement:

  0 0 0

  -1 1 0

  0 0 0

- Edge detection:

  0 1 0

  1 -4 1

  0 1 0

- Emboss:

  -2 -1 0

  -1 1 1

  0 1 2

Credits and further reading:

https://en.wikipedia.org/wiki/Kernel_(image_processing)

http://setosa.io/ev/image-kernels/ (nice detailed tutorial)

https://docs.gimp.org/en/plug-in-convmatrix.html

http://www.roborealm.com/help/Convolution.php