Edge detection is a type of image processing technique that uses kernel convolution to detect intensity transitions in the image pixels. It involves finding regions in an image where there is a sharp change in intensity. This means that a kernel being used as a filter can have varying orientations based on the intensity transition pattern on an image. A high value indicates a step change and a low value indicates a shallow change. A filter kernel to detect intensity transitions in the x direction will have negative pixel values at the left and positive pixel values at the right with 0 pixel values down the middle. The figure one below shows examples of pixel kernel for both x and y axis.

In this experiment, the Sobel edge detection is employed by using different flavors of Sobel filters in the kernel convolution of an image “lena.png”. The output of either of the filters individually could be negative if one side is much bigger than the other . Gx will represent how strong the gradient of an edge is horizontally while Gy estimates the same information on the horizontal axis. The output of either filters will mostly be a mostly grey image for the result of both filters with black on one side of each edge and white on the other depending on the orientation of the edge. Bringing the results of both x and y together can be used to determine how big the edge is. This is referred to as the magnitude of the image. If the gradient either x or y direction is large we get a relatively large gradient but when the value of the gradient in both directions is big we get a pretty large value for the magnitude. Edge orientation of the edge can also be calculated using the inverse tan of ***(Gy/Gx).***  This is useful in finding structures or objects in an image.

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**Conclusion**

From the results, Sobel edge detection is an effective tool for detecting edges in an image . Sobel uses small kernels. Since images change a lot so there could be edges based on noise which are not really edges. It would be proper to use a Gaussian filter to remove high frequency components before applying Sobel filters for better edge detection.

Ultimately, Sobel Edge operator is an effective kernel convolution technique for detecting edges