Image Processing Design Research

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After searching for existing image processing methods, I stumbled upon OpenCV and found some interesting information on the GeeksForGeeks website [for Geeks, 2021]. I learned that OpenCV is an open-source library with tools to implement computer vision. It treats an image as a two-dimensional function $f(x, y)$ where the value at each coordinate defines the intensity / grey level of that pixel. Then the program can alter this data thus applying a specific filter to the image.

Another cool image processing technique that I found was on another persons open-source old school game engine project [Weremczuk, 2021]. Although not 100% applicable to the drone project, it does contain some interesting image processing techniques that may actually be useful later. In order to render an image in 3D space, it uses two 2D images. The first is a colored image used to represent the terrain, and the second is a greyscale image where each pixel represents the height of the colored pixel in the first image. This rendered image actually uses voxels, or volumetric-pixels, so the objects displayed have actual volume, as opposed to the current polygon system where objects are only represented on their surface (which can lead to glitches where you can see the weird video-game dimenstion inside of objects). But voxels aren't really used much today because GPUs are more catered to creating tons of triangles in the polygon game design system.

Lastly, I checked out a book covering the fundamentals of image processing [Young et al., 1995]. In it, I learned that a digital image is represented in a 2D discrete space derived from a 2D continuous space through sampling, or digitization. An image is broken up into rows and columns, and at the intersection of each row and column lies a pixel with a specific grey level. Now when it comes to transforming digital images, there are different kinds of operations you can apply to an input image to create a desired output, and they can be classified by one of 3 categories. Thee first is a point operation, where an output pixel at a specific coordinate is only dependent on the input pixel at the same coordinate. Then there's the local operation, where an output pixel is dependent upon the corresponding input as well as it's neighbors. Finally there's the global operation where each pixel in the output is dependent on every single pixel in the input. Hopefully these techniques will be very useful when it comes to designing my very own image processing software for the drone project.

References

[for Geeks, 2021] for Geeks, G. (2021). Opencv – overview. https://www.geeksforgeeks.org/opencv-overview/. Accessed: 2021-09-14.

[Weremczuk, 2021] Weremczuk, P. R. (2021). Old school frame buffer game engine. https://github.com/WEREMSOFT/voxelspace-c99-opengl-linux. Accessed: 2021-09-14.

[Young et al., 1995] Young, I. T., Gerbrands, J. J., and van Vliet, L. J. (1995). *Fundamentals of Image Processing*, volume 2.3. Delft University of Technology, Delft, Netherlands. Accessed 2021-9-15.