Ryerson University

Department of Electrical & Computer Engineering
Faculty of Engineering & Architectural Science

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Instructor:	Rodina Bassiouny

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Student Last Name	Student First Name	Student Number	Section	Signature*
Sajin	Tahmid	500830210	6	T.S.

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Analysis

1. What exactly is the XDoG filtering doing? How can it produce such different styling just by changing the filtering parameters? Provide examples.

The XDoG filter can be used to detect various edges within an image, or different areas of changing intensities. The XDoG filter uses the difference of the gaussians method to produce different positive and negative edges within an image. The parameters of the XDoG filtering method include ϕ, ε and ρ. The XDoG filter produces images with different effects as shown below in Figure 1.

The parameter of ε can be used to change the impact of the noise. Changing the parameter of ϕ and also decreasing the parameter of ε can also remove noise and produce a image as shown in Figure 1.

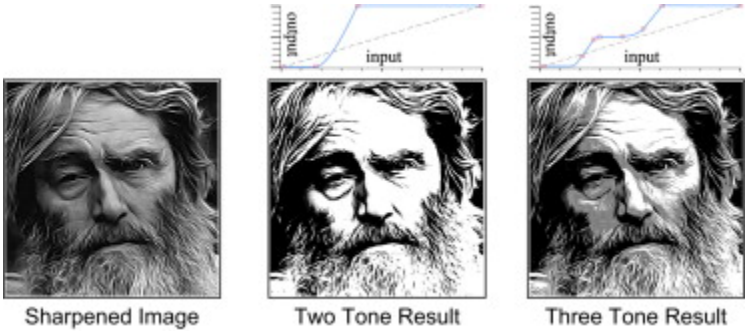

Figure 1: XDoG filter operation results.

2. The XDoG paper [4] describes a filtering step using an "edge tangent flow". How can this improve the appearance of the XDoG output? If you were to implement it, how would it be done?

The edge tangent flow method is when a smooth direction field is able to maintain the flow of the important image features. The edge locations using the edge tangent flow method can be determined at different points which forms the edge tangent flow. To implement the edge tangent flow method, the edge flow field first will need to be obtained from the input image, and then the different neighbouring areas will be blurred with a filter. As a result, only the important details will retain the original directions.

3. What is the purpose of computing the level set? What happens if we skip that step?

The purpose of the level set is to show the set of points in the domain of the function in the locations of constant values. The level sets are good in computing different complex and differing contour areas. The level set also produces a cleaner image that is free of any noise or distortions. If the step of computing the level set, the resulting image may contain excessive noise.

4. What effect do you create when you set a pixel's intensity value to its histogram bin index? Consider a variety of values for N, e.g. 2, 5, 10, 50, etc.

As histograms contain bins, the bins of a histogram consist of certain intensity range values. Changing the bins of the histogram will produce the bins to get grouped differently. The bin's width will affect the histogram's local areas of the image which have higher incidence. If the bin size is too large, there will not be enough change or differentiation in the histogram. Likewise, if the bin size is too small, the data cannot be grouped well.

5. What do we gain by applying the extra step of using connected components after generating the level sets?

The method of connected components is mainly used in the field of deep learning and computer vision to obtain the connected areas of an image. Connected components will search through an image and group based on the pixels and cluster them into components on the pixel's connectivity in different regions.