

Contrast Enhancement – white paper

March 2022

The logo for Saiwa, featuring the word "saiwa" in a white, lowercase, sans-serif font. A thick green horizontal bar is positioned to the left of the text, extending from the left edge of the page towards the start of the word. A thin green horizontal line is positioned directly beneath the word "saiwa".

saiwa


simple artificial intelligence web application



Contrast Enhancement

Contrast Enhancement in image processing means manipulation and redistribution of pixel intensity to improve their visibility. Contrast enhancement is one of the main pre-processing steps in machine vision systems in real-world environments. It has wide applications across industries, from medical to astronomy to manufacturing, in any case where image processing may occur under sub-optimal illuminating conditions.

Contrast enhancement algorithms are classified into two categories of global and local algorithms. In global algorithms the same output intensity value is assigned to all the pixels having the same input value, independent of their position in the image. On the other hand, in local algorithms intensity adjustment happens according to the characteristics of the spatial neighborhood of each pixel. It has been shown that generally local algorithms obtain better results. For a comprehensive survey on various image contrast enhancement methods, please refer to [1].



In saiwa a local contrast enhancement method is provided which is called **LogLocal Color Correction (LLCC)**. LLCC is an adaptive local contrast enhancement algorithm that improves contrast in dark and bright image regions (as opposed to the methods which are unable to deal simultaneously with both kinds of regions) and obtains better results with reduced halo artifacts. This happens based on a set of logarithmic tone mappings which are locally applied to each pixel depending on the luminance characteristics of its neighborhood [2].






Figure 1 shows a few instances of images before and after contrast enhancement using saiwa interface and based on open source distribution on LLCC algorithm from [3].

Using saiwa interface all three alternative weight maps (weight map assesses the brightness in the neighborhood of a pixel) of the original paper are available to examine on various images, i.e. Gaussian, Mean Curvature Motion (MCM) and Bilateral weight map.



Figure 1. A few low contrast image (left images) instances along with the results (right images) of Contrast Enhancement using saiwa interface.



References:

- [1] Vijayalakshmi, D., Malaya Kumar Nath, and Om Prakash Acharya. "A comprehensive survey on image contrast enhancement techniques in spatial domain." *Sensing and Imaging* 21.1 (2020): 1-40.
- [2] Lisani, Jose Luis. "Adaptive local image enhancement based on logarithmic mappings." *25th IEEE International Conference on Image Processing (ICIP)*, 2018.
- [3] Lisani, Jose-Luis. "Local contrast enhancement based on adaptive logarithmic mappings." *Image Processing On Line* 10 (2020): 43-61.



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