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Content-aware contrast ratio measure for images

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Abstract

In image fidelity assessment it is often necessary to quantify the level of visibility between a structure of interest or foreground and its surrounding background, i.e., the contrast ratio. Today, there is no standard procedure to measure the contrast ratio in digital images. The conventional measures of (local) contrast ratio consist of measuring the difference between dark and light intensity points of local image patches and/or image sub-bands. However, such techniques fail in computing the contrast ratio under complex (highly textured) backgrounds because they ignore the surrounding local content which is known to influence the contrast ratio.

In this paper, we use bimodal histograms to represent a set of pixels likely to be inside the foreground and another set likely to belong to the background. Then, the local contrast ratio is estimated as the ratio between the mean intensity values of the two histogram modes using either Weber's or Michelson's contrast formula. Our experimental results for the contrast altered images from two public general purpose image databases demonstrate high correlation (>90%) between the proposed contrast ratio measure and the perceived contrast differences rated by humans. Moreover, the proposed measure has been evaluated for a database of interventional chest X-ray images and likewise it was able to successfully predict the perceived contrast differences reported by the expert image users (cardiologists and radiologists).

Keywords: image content analysis, image contrast ratio, image fidelity

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