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MEDICAL CEPHALOMETRIC IMAGE ENHANCEMENT FOR RADIOGRAPHIC IMAGES

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Abstract

Cephalic radiographs are widely used by dentists, surgeons, and maxillofacial radiologists for diagnosis, surgical planning, and implant evaluation. One of the main challenges in cephalometric radiography is to clearly display both soft and bony tissue in the same image. A great deal of work has been devoted to making the different structures more visible by increasing the local contrast at the edge of each image element. Unsharp masking (UM) is one of the most widely used techniques. UM identifies the bone structures well but cannot recover the soft-tissue boundary, where the transition between soft tissue and background is smooth and poorly defined. An alternative approach is based on analyzing the histogram to remap the grey levels (GL) so that the dynamic range both for soft-tissue regions and for bone-tissue regions is maximized. The most widely used technique in clinical practice is global Gamma Correction (GC) because it can run in real-time. However, no single γ allows clear visibility of both tissues. Another approach is Image Equalization (IE) produces results very similar to those obtained with GC.

In this project we present a new algorithm, called the soft-tissue filter that can make both soft and bone tissue clearly visible in digital cephalic radiographies under a wide range of exposures. It uses a mixture model made up of two Gaussian distributions and one inverted lognormal distribution to analyze the image histogram. The image is clustered in three parts: background, soft tissue, and bone using this model. Improvement in the visibility of both structures is achieved through a local transformation based on gamma correction, stretching, and saturation, which is applied using different parameters for bone and soft-tissue pixels.

Keywords: Digital radiography, histogram-based clustering, image enhancement, local gamma correction, mixture models, soft tissue filter (STF).