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Objective quality assessment of JPEG- and JPEG2000-compressed CT neuro images

We have employed various objective image fidelity measures to evaluate the quality of JPEG- and JPEG2000-compressed CT neuro images. Lossy compression degrades image quality. As the compression ratio is increased, JPEG produces blocking and ringing artifacts whereas JPEG2000 introduces blurring and ringing in the reconstructed images. Although subjective methods to evaluate quality of compressed medical images are complicated and difficult to conduct, they are the most accepted way for measuring diagnosis reliability. In order to overcome the problems with subjective quality assessment and to automate the process of assessing degradations, there is a need for reliable objective quality assessment of medical images. Although there is no generally accepted objective quality measure for medical images, Mean Squared Error (MSE) is widely used. It is, however, well known that MSE does not correspond well with the human visual system (HVS). We are therefore led to the question, "Which quality measures should be used that best correspond to visual and diagnostic quality?"

The HVS is highly sensitive to structural information and distortions (e.g. JPEG blockiness, "salt-and-pepper" noise, ringing effect, blurring). The structural similarity (SSIM) index, introduced by Wang and Bovik [2], assumes that images are highly structured and that there exist strong neighbouring dependencies among pixels. On the other hand, these features are completely ignored by the MSE.

We also introduce another approach to measure the quality of compressed CT images, the so-called "Weberized L^2" method. It is a weighted version of the MSE that incorporates the Weber model of perception.

We analyze the quality maps of compressed images associated with the L^1, L^2, Weberized L^2 and SSIM measures. Our investigation supports the conclusions of an extensive subjective quality evaluation study conducted by radiologists in Koff et al. [1] . The presence of edge artifacts introduced by JPEG2000 compression

is revealed only by the SSIM quality map and may explain the results of Koff et al.. In conclusion, our study suggests that the SSIM measure and the SSIM quality map provide the most promising approach to predict subjective quality assessment of compressed brain CT images.

References

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