

Lossless JPEG transcoding

ECE 533 Project proposal
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Problem

Some image processing and image transmission systems require images to be decoded and re-encoded again, with little or no change at all. With lossy compression algorithms such as JPEG, this process results in a loss of quality, even if the recompressed image is not modified.

Proposed approach

The goal of this project is to modify an existing open-source JPEG implementation to be able to perform lossless transcoding. The problem will be restricted to image transcoding with the same resolution and quality factor on source and destination. To achieve this, the decoder will:

- 1) Decode the image.
- 2) Calculate the quantized DCT coefficients of the blocks of the decoded image (i.e. it will partially re-encode the image, until the quantization stage).
- 3) Compute the differences between the corresponding DCT coefficients of the original and partially re-encoded images.
- 4) Store those values using a lossless and space-efficient compression scheme.

When re-encoding the image, the stored values will be used by the encoder to correct the re-encoded DCT coefficients and achieve a lossless transcoding implementation.

Though this process might seem useless at a first glance (we end up getting the same image as the original one), it is in fact useful in real applications, because when re-encoding the image, the original one may not be available. The fact that the original image is not needed at re-encoding time is also the key difference of the proposed approach versus other previous implementations of lossless JPEG transcoding.

Applications

Lossless JPEG transcoding has many relevant applications. For example, it can be used by editing software to avoid a quality loss in the unedited parts of the image. With some additional modifications, it can also be used to perform lossless rotation (by multiples of 90°) and other simple geometric transformations on JPEG compressed images.

References

- 1) R. C. Gonzalez, R.E. Woods, "Digital Image Processing", 2nd Edition
- 2) Independent JPEG Group - <http://www.ijg.org/> : Their widely used software package includes an utility that performs lossless transcoding, *jpegtran*
- 3) JPEGClub - <http://jpegclub.org/> : Offers some modifications to *jpegtran* program that allow lossless rotation/crop on JPEG compressed images.