# A DCT-Based Total JND Profile for Spatiotemporal and Foveated Masking Effects


**Abstract:**

In image and video processing fields, Discrete Cosine Transform (DCT)-based just-noticeable difference (JND) profiles have effectively been utilized to remove perceptual redundancies in pictures for compression. In this paper, we solve two problems that are often intrinsic to the conventional DCT-based JND profiles: 1) no foveated masking (FM) JND model has been incorporated in modeling the DCT-based JND profiles and 2) the conventional temporal masking (TM) JND models assume that all moving objects in frames can be well tracked by the eyes and that they are projected on the fovea regions of the eyes, which is not a realistic assumption and may result in poor estimation of JND values for untracked moving objects (or image regions). To solve these two problems, we first propose a generalized JND model for joint effects between TM and FM effects. With this model, called the temporal-foveated masking (TFM) JND model, JND thresholds for any tracked/untracked and moving/still image regions can be elaborately estimated. Finally, the TFM-JND model is incorporated into a total DCT-based JND profile with a spatial contrast sensitivity function, luminance masking, and contrast masking JND models. In addition, we propose a JND adjustment method for our total JND profile to avoid overestimation of JND values for image blocks of fixed sizes with various image characteristics. To validate the effectiveness of the total JND profile, an experiment involving a subjective distortion-visibility assessment has been conducted. The experiment results show that the proposed total DCT-based JND profile yields significant performance improvement with much higher capability of distortion concealment (average 5.6-dB lower PSNR) compared with state-of-the-art JND profiles. The MATLAB source code of the proposed total DCT-based JND profile is publicly available online at https://sites.google.com/site/sunghobaecv/jnd.