Design of Image Quality Metric using Tchebichef Moments

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Images are ubiquitous in modern communication, allowing us to transfer information in many different forms (animated and static) and of different content (humans, animals, places, objects) in different genres and communication venues. To increase efficiency, a number of processes - compression, transmission, enhancement etc- are used to transform images for easier transmission; however these cause distortions to occur. Therefore, there is a need for the assessment of the degree of deviance of the duplicated/compressed/enhanced image from the original. As human beings are the end users of the images and their evaluation on the acceptability of the reproduction for their needs is still the critical criterion, human subjective assessment of image quality is still regarded the touchstone or benchmark of quality. However, as has been well-documented in the literature, subjective assessment suffers from a number of limitations that renders it less than perfect. It is time-consuming, expensive and inconvenient.

The current research priority, therefore, has been with finding an objective metric that most closely approximates this subjective evaluation while averting at least its major pitfalls. The objective image quality metric (IQM) can be categorized into three types based on the availability of the reference image. The most popular approach is known as full-reference quality assessment (FRQA), where the quality of a test image is obtained based on the comparison with the reference image which is assumed to be perfect in quality. Unfortunately, as sometimes the reference image is only partially available or not available at all, reduced-reference and no-reference types of quality assessments will come into the play. One direction has been in the working out of mathematical models such as mean squared error (MSE), peak signal-to-noise ratio (PSNR), Peak MSE, Laplacian MSE, Minowski Error etc. While the chief advantages of these metrics are their simplicity and mathematical tractability, they do not correlate well with perceived quality measurement, possibly because they do not take cognizance of the characteristics of the Human Vision System (HVS).

Since the pioneering work on the introduction of orthogonal moments as potential pattern features by us in 2003, there has been a steady growth in utilizing these moments for various applications by the by research community. In this presentation, Tchebichef moments are used as image features in local quality index formulation and image content (block) classification. Tchebichef moments are chosen due to its desirable properties.

Biography

Raveendran Paramesran (SM'03) received the B.Sc. and M.Sc. degrees in electrical engineering from South Dakota State University, Brookings, in 1984 and 1985, respectively. In 1992, he received the Ronpaku Scholarship from Japan to pursue the Doctorate in Engineering degree, which he com- pleted with the University of Tokushima, Tokushima, Japan, in 1994. He was a Systems Designer with Daktronics, Portland, OR, before joining the Department of Electrical Engineering, University of Malaya, Kuala Lumpur, Malaysia, in 1986, as a Lecturer. He was promoted to an Associate Professor in 1995 and in 2003 he was promoted to a Professor. His contributions can be seen in the form of journal publications, conference proceedings, chapters in books, and an international patent to predict blood glucose levels using non-parametric model. He has successfully supervised to completion of 7 Ph.D. students and 11 students in M.Eng.Sc. (masters by research). His current research interests include image and video analysis, formulation of new image descriptors for image analysis, fast computation of orthogonal moments, analysis of electroencephalography signals, and data modeling of substance concentration acquired from non-invasive methods. Dr. Raveendran is currently a member of the Signal Processing Society.