

Perceptual Color/Shape Descriptors based on Spatial Distribution: A Top-Down Approach

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Abstract

Color features are the key-elements widely used in content-analysis and retrieval. However, most of them show severe limitations and drawbacks due to their inefficiency of modeling the human visual system with respect to color perception. Moreover, they cannot characterize all the properties of the color composition in a visual scenery. In this paper we present a perceptual color feature, which describes all major properties of prominent colors both in spatial and color domains. In accordance with the well-known *Gestalt* law, we adopt a top-down approach in order to model (see) the whole color composition before its parts and in this way we can avoid the problems of pixel-based approaches. In color domain the dominant colors are extracted along with their global properties and quad-tree decomposition partitions the image so as to characterize the spatial color distribution (SCD). We propose two efficient SCD descriptors; the proximity histograms, which distill the histogram of inter-color distances and the proximity grids, which cumulate the spatial co-occurrence of colors in a 2D grid. Both approaches are configurable and provide means of modeling SCD in a scalar and directional way. Combination of the extracted global and spatial properties forms the final descriptor, which is neither biased nor become noisy from the presence of such color elements that are not visible for humans in both spatial and color domains. Finally a penalty-trio model fuses all color properties in a similarity distance computation during retrieval. Experimental results approve the superiority of the proposed technique against well-known global and spatial descriptors.



Biography of Moncef Gabbouj, Ph.D., Professor

MONCEF GABBOUJ (M'85-SM'95) received his BS degree in electrical engineering in 1985 from Oklahoma State University, Stillwater, and his MS and PhD degrees in electrical engineering from Purdue University, West Lafayette, Indiana, in 1986 and 1989, respectively. Dr. Gabbouj is a Professor at the Department of Signal Processing at Tampere University of Technology, Tampere, Finland, currently on sabbatical leave as Senior Research Fellow of the Academy of Finland. He was Head of the Department during 2002-2007. Dr. Gabbouj was a visiting professor at the American University of Sharjah, UAE, in 2007-2008. His research interests include multimedia content-based analysis, indexing and retrieval; nonlinear signal and image processing and analysis; and video processing and coding.

Dr. Gabbouj served as Distinguished Lecturer for the IEEE Circuits and Systems Society in 2004-2005. He served as associate editor of the *IEEE Transactions on Image Processing*, and was guest editor of Multimedia Tools and Applications, the European journal *Applied Signal Processing*. He is the past chairman of the IEEE Finland Section, the IEEE CAS Society, Technical Committee on DSP, and the IEEE SP/CAS Finland Chapter.

Dr. Gabbouj was the recipient of the 2005 Nokia Foundation Recognition Award and co-recipient of the Myril B. Reed Best Paper Award from the 32nd Midwest Symposium on Circuits and Systems and co-recipient of the NORSIG 94 Best Paper Award from the 1994 Nordic Signal Processing Symposium. He is a member of IEEE SP and CAS societies.