Perceptual Metrics for Image Database Navigation (The Kluwer International Series in Engineering and Computer Science, Volume 594) (The Springer International ... Series in Engineering and Computer Science)

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The increasing amount of information available in today's world raises the need to retrieve relevant data efficiently. Unlike text-based retrieval, where keywords are successfully used to index into documents, content-based image retrieval poses up front the fundamental questions how to extract useful image features and how to use them for intuitive retrieval. We present a novel approach to the problem of navigating through a collection of images for the purpose of image retrieval, which leads to a new paradigm for image database search. We summarize the appearance of images by distributions of color or texture features, and we define a metric between any two such distributions. This metric, which we call the "Earth Mover's Distance" (EMD), represents the least amount of work that is needed to rearrange the mass is one distribution in order to obtain the other. We show that the EMD matches perceptual dissimilarity better than other dissimilarity measures, and argue that it has many desirable properties for image retrieval. Using this metric, we employ Multi-Dimensional Scaling techniques to embed a group of images as points in a two- or three-dimensional Euclidean space so that their distances reflect image dissimilarities as well as possible. Such geometric embeddings exhibit the structure in the image set at hand, allowing the user to understand better the result of a database query and to refine the query in a perceptually intuitive way.

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