Texture Spectral Similarity Criteria Comparison

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ABSTRACT

Criteria capable of texture spectral similarity evaluation are presented and compared. From the fifteen evaluated criteria, only four criteria guarantee zero or minimal spectral ranking errors. Such criteria can support texture modeling algorithms by comparing the modeled texture with corresponding synthetic simulations. Another possible application is the development of texture retrieval, classification, or texture acquisition system. These criteria thoroughly test monotonicity and mutual correlation on specifically designed extensive monotonously degrading experiments.

Keywords

Texture Comparison, Texture Modeling, Texture Retrieval, Texture Classification, Texture Acquisition

1 INTRODUCTION

An automatic texture comparison represents a significant but not completely solved complex problem [Hai14]. Such a method would be advantageous to support texture model development where a comparison of the original acquired and to be modeled texture with synthesized or reconstructed ones would help with the optimal model parameter set. There are other possible applications, such as texture database retrieval or texture classification or segmentation, etc. Although there already exist approaches for these tasks, e.g., [Har73, Gal75, Law80, Wys82, Man96, Oja02, Hai06], etc., they do not rank textures according to their visual similarity. Moreover, most methods are limited to mono-spectral textures, a notable disadvantage as color is the most significant visual feature [Hav19].

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The psycho-physical evaluations [Hai12], i.e., quality assessments performed by humans, currently represent the only reliable alternative. Methods of this type require both time-demanding experiment design setup and performing, rigorously defined and controlled conditions, and a representative collection of testers, i.e., a sufficient number of individuals, ideally from the general public, naive concerning the goal and design of the experiment. Therefore such experiments are highly impractical and generally demanding, and they cannot be performed on a daily base, on demand, or even in real-time. These experiments are also impracticable in the case of hyper-spectral textures, as not all spectra can be visualized simultaneously due to the limited trichromatic nature of the human perception system.

The criteria mentioned and compared in this paper are intended for the spectral texture composition comparison, i.e., for a specific subset of the general texture comparison problem. The textures are compared as independent sets of pixels where the pixel are treated as vectors of real vector space while the positions of the pixels in the textures are not considered. Texture spectral composition comparison deals with the appearance and amount of pixels that occur in only one of the compared textures and also with the ratio of occurrences of pixels appearing in both textures.