

Cartoon and texture: What is the difference and when can we separate those structures?

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Natural images are typically a composition of cartoon and texture structures. A medical image might, for instance, show a mixture of gray matter and the skull cap. One common task is to separate such an image into two single images, one containing the cartoon part and the other containing the texture part. Using compressed sensing techniques, numerous inspiring empirical results have already been obtained.

In this paper we provide the first thorough theoretical study of the separation of a combination of cartoon and texture structures in a model situation. This will also enable us to at least give a partial answer to the question posed in the title. The methodology we consider expands the image in a combined dictionary consisting of a shearlet tight frame and a Gabor tight frame and minimizes the ℓ_1 norm on the analysis side. Sparse approximation properties then force the cartoon components into the shearlet coefficients and the texture components into the Gabor coefficients, thereby separating the image. Utilizing the fact that the coefficients are clustered geometrically and endowing a Gabor system with a scale, we prove that at sufficiently fine scales arbitrarily precise separation is possible.