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Color in Texture and Material Recognition

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Recognizing real-world materials in images is a challenging task due to the rich variations of lighting conditions, appearance, and surface properties. Color and textures are important components of material appearance. The study of texture and material recognition has a long history in image analysis and computer vision. This has led to a large collection of color and texture features which, combined with classifiers from artificial intelligence theory, are the main constituents of a material recognition pipeline. The ongoing development of new sensors and the discovery of new application areas, as we see in this special section, results in an ongoing demand for performance evaluations of both existing and new color and texture descriptors.

Recent works that deal with large collections of images taken from the Internet or that exploit large-scale machine learning techniques have renewed interest in these topics. The most relevant intuition is that features from other domains, such as object recognition, may achieve comparable or sometimes better performance than those achieved with features specially designed for texture and material classification. Also the new paradigm of end-to-end learning where both representation (descriptors) and classifier are learned jointly is expected to have profound influence on color and texture recognition. In this special section, we have several papers that report results of deep learning applied to material recognition.

We were happy to see that the papers submitted to the special section were a mix of application papers and theoretical advances in color and texture recognition. The applications range from the textile and food industries to face recognition and remote sensing. Also, several aspects of color imaging are addressed, such as optimal color space selection and texture complexity perception. The special section was suggested by participants of the Workshop on Color in Texture and Material Recognition that we organized in 2015 and that has been held in conjunction with the 18th International Conference on Image Analysis and Processing. Among the twelve accepted papers, four are in fact extended versions of works presented to the workshop.

The ongoing revolution on convolutional deep learning is represented with several articles in this special section. [Cusano et al.](#) show that features obtained from deep learning methods obtain excellent results for color texture classification. [Sun et al.](#) compare both hand-crafted and deep features for the task of facial expression recognition. [Furferi et al.](#) show that neural networks can be used to improve the modeling of the nonlinear relationship in physics based reflection models. This theory is evaluated for the task of color matching of fabric blends.

Several papers propose new descriptors or improvements to existing ones. An extension to the color domain of the popular local binary patterns (LBP) texture descriptor is proposed by [Ledoux et al.](#) Contourlets have been applied by [Fang et al.](#) to improve C-V active contour model to preserve detailed information in remote sensing images. [Polec et al.](#) propose a new feature that is based on the orthogonal transform, which is especially good for periodic textures.

Several papers proposed evaluations and combinations of descriptors for various applications. [Martino et al.](#) evaluate several texture/shape features for material recognition on time-of-flight cameras. Furthermore, they show that combining multiple transforms increases performance. [Bello-Cerezo et al.](#) evaluate several color spaces for material classification. They find that CIELAB outperforms many of the other color spaces for this task. [Singh and Singh](#) evaluate a large set of classifiers for the task of color prediction of the rice paddy plant leaf. Finally, [Ciocca et al.](#) apply genetic programming for the task of estimating the complexity of texture images. They evaluate several features, including roughness, memorability, number of regions, and chroma variance for this task.

The special section is completed with two interesting application papers. [Chen and Wang](#) propose a method for the detection of color-band resistors. The paper also addresses specular reflection suppression. [Trujillo et al.](#) study color features for the automatic screening of Salmonella strains.

We would like to thank all of the authors who have submitted articles to this special section. We also acknowledge the reviewers who have helped in the process of selecting the papers. And finally, we would like to thank the JEI editorial staff members for their help throughout the process.

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