International Workshop on Computer Vision, April 26-30, 2004, IPM, Tehran

Shape, Illumination and Material Properties from Surface Appearance

J.-O. Eklundh
The Computer Vision and Active Perception Laboratory
Royal Institute of Technology (KTH)
Sweden

The appearance of a surface depends on its material, as well as the illumination and the surface shape. The aim of this work is to develop a computational framework in which all these aspects are taken into account, allowing discrimination of materials and also determination of qualitative shape and illumination properties. We have investigated learning methods for discriminating material properties independent of viewing direction using patches of the CUReT database as input. The signatures used have been based on the statistics of the output of local luminance operators, originally proposed by Leung and Malik (2001). A recent method for computing such signatures, or textons, presented by Varma and Zisserman (2002) has served as a starting point for our work. They compute textons in 2D and use them to classify the 3D textures of the CUReT database. The above method performs classification by finding the smallest chi square distance between measured and learned texton histograms. We have developed alternative methods, one based one a probabilistic model, another using Support-Vector Machines. Our aim has in particular been to apply the methods not only to databases of images, but also to real world scenes. One particular problem in this context concerns the effect of scale. Viewing distance is critical for the appearance of a surface and its material. In our talk we'll discuss these issues and also briefly indicate on-going work towards integrating these methods into a single framework.

References

[1] T. Leung and J. Malik, *Representing and recognising the visual appearance of materials using three-dimensional textures,* Internat. J. Comput. Vision **43** (2001), 29-44.
[2] M. Varma and A. Zisserman, *Classifying images of materials: Achieving viewpoint and illumination independence,* Proc. 7th ECCV **3** (2002), 255-271.
[3] P. Nillius and J.-O. Eklundh, *Automatic estimation of the projected light source direction,* Proc. CVPR'01 **1** (2001), 1076-1083.
[4] E. Hayman, B. Caputo, M. Fritz, and J.-O. Eklundh, *On the significance of real-world conditions for material classification,* Proc. 8th ECCV (to appear).