

Human versus artificial texture perception

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The performances of current texture analysis algorithms are still poor, especially when applied to a large, diffuse texture domain. Most of these purely computationally driven techniques are created to function within a highly restricted domain. When applied as computer vision techniques, frequently results are judged as not intuitive by the system's users. In the current line of research, after two smaller studies, a large study has been conducted with 450 participants with the aim to unravel human texture classification. The bare bones of texture analysis, as embedded in the human visual system, were taken as starting point. Consequently, three aspects were identified: 1) colorful texture analysis, 2) grayscale texture analysis, and 3) global color distribution. For artificial color analysis, a unique, human inspired color space segmentation was utilized. Artificial texture analysis was based on the co-occurrence matrix. In addition to color and texture, the influence of shape was taken into account. To gather information on the human texture classification process, an online card sorting experimentation platform was used: <http://eidetic.ai.ru.nl/M-HinTS/>. In separate experiments, the participants clustered color and grayscale versions of 54 textures, drawn from the OuTex and VisTex texture databases, into six clusters. Three versions of the experiments were conducted with textures printed in: squares (the 'shapeless condition'), three distinct shapes, (the 'three-shape condition'), and six predefined shapes (the 'six-shape condition'). Both color and shape did have a significant influence on the mutual agreement among the subjects, ranged from 78% (color - 'shapeless') to 60% (gray - 'six-shape condition'). Using artificial clustering techniques we mimicked human's average texture classification in 80% (color - 'shapeless') to 58% (gray - 'six-shape condition') of the cases. Hence, the artificial clustering did have a similar mutual agreement with the participants as the participants had among each others. The success of mimicking human texture classification could not mask the enormous variety among the participants in their classification task. The latter emphasized the impossibility to develop a generic texture classification system, which would resemble human texture classification. However, the results enable the design of a generic model. Subsequently, the model's parameters could be adapted to specific users, if preferred. Then, not only average human texture perception could be mimicked but also specific user characteristics could be replicated, which would be a first step in new cognitive computer vision techniques.