

Perceptual hierarchy of natural scene categories

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Grouping natural scene into perceptive categories is of interest both in psychology and in computer vision (particularly for content-based image retrieval). We present a method to determine natural image categories that are relevant to discriminate in that purpose, according to human perceptual organisation. It is based on an extension of the “computer scaling” experiment that study how human observers judge image similarity (Rogowitz *et al.*, 1998, SPIE 3299, San Jose, CA; Guyader *et al.*, NNSP 2002). We project the induced perceptive space by Curvilinear Component Analysis (Demartines, Hérault, IEEE Neural Network, 1997, 8(1):148-154) onto a plan, where relevant groups emerge. The novelty is to assess the statistical validity of image associations with a bootstrap process that leads to quantify the “image connexion strength”.

The resulting hierarchical organisation of categories undermines previous results of classification hierarchy (Vailaya, Jain, Zhang, 1998, Pattern Recognition 31, 1921-1936). In particular, we show that images containing people or animals disturb the hierarchy and lead to favoured links between categories. It is congruent with the fact that “alive subjects” engender perceptive asymmetries, which are also studied. Other results concern the role of colour on perceptual categories, which slightly modifies the hierarchical organisation in comparison with grey level images.