

## How Natural are Natural Scenes?

Jan Drewes (1+2), Gesche Huebner (2), Felix Wichmann (3), Karl R. Gegenfurtner (2)

1: Institut de Neurosciences Cognitives de la Mediterranee, CNRS Marseille, France

2: Experimental Psychology, Giessen University, Germany

3: Modelling of Cognitive Processes, Bernstein Center for Computational Neuroscience, Berlin, Germany

Human observers are capable of detecting animals within novel natural scenes with remarkable speed and accuracy. We successfully used linear discriminant analysis to classify a set of 11.000 images into "animal" and "non-animal" images based on their individual amplitude spectra only, however evidently humans do not use this kind of representation in classification tasks (Drewes, Wichmann, Gegenfurtner, VSS 2005 & 2006).

We present a new approach, representing the images from our database by means of frequency, orientation and location. While we were able to improve our general classification performance to 78%, we discovered what appears to be a photographically induced artifact in the animal images of the Corel Stock Photo library: the consistent use of depth of field causes upper image regions to be out of focus, while the image center is always well focused. This affects the distribution of high-frequency energy within an image, explaining why simple classifiers can reach relatively high classification accuracy. However, this does not correlate to human performance. When comparing the well-known Corel Stock Photo library [CSPL] to the newly introduced Tuebingen Natural Image Database [TNID], we recognized comparatively small differences in the accuracy of both our algorithmic classifier (CSPL:78% vs. TNID:73%) and our human subjects (CSPL:89% vs. TNID:81,0%), yet a large difference in the accuracy of the artifact-independent computer classification (CSPL:74% vs. TNID:62%). A detailed analysis of the distribution of relevant information revealed a strong bias towards the upper image half with the center depressed in the Corel database, as opposed to a strong bias towards the lower image border and image center in the Tuebingen database.

These results show a strong effect in a popular image database, greatly affecting algorithmic classification while barely affecting human performance.