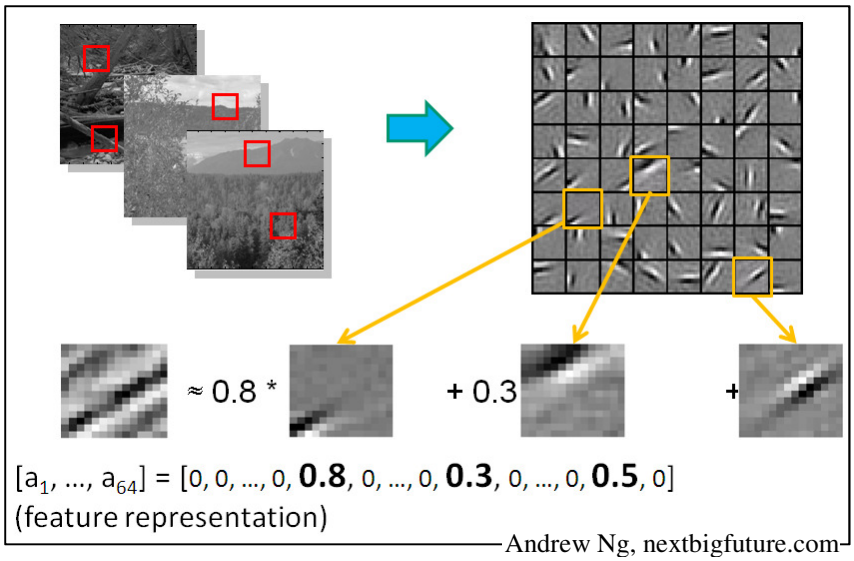
STUDENT PROJECT offered at the Institute for Neurobiology

EBERHARD KARLS UNIVERSITÄT TÜBINGEN

Student project in visual cognition

Binocular Image Statistics and Receptive Fields

Background.
Receptive fields of cortical visual neurons are optimized to deal with naturally occurring image variance. A commonly used objective function in models of the optimization process is a combination of quality of image reconstruction and sparseness of coding. Using these constraints, the model by Olshausen & Field (1996) predicts realistic, Gabor-like receptive of various scales, as are found in the visual cortex. In the current project, the idea will be extended to binocular receptive fields.



Project. In this project, the Olshausen and Field algorithm will be re-established (from implementations available on the web). The extension to stereopsis will be achieved by considering natural grayscale stereograms and binocular image patches as a training set. From the resulting binocular receptive fields, disparity tuning curves will be calculated in order to allow comparisons to neurophysiological single unit recordings.

Methods. MatLab programing, image processing, statistical analysis.

Level. The project is currently planned as a BSc-project. Extension to a MSc-project is possible.

Supervisor. Mallot / Ecke. Hanspeter.mallot@uni-tuebingen.de

References

Lappin JS (2014) What is binocular disparity? *Frontiers in Psychology* 5: 870. DOI: 10.3389/fpsyg.2014.00870

Olshausen BA, Field DJ (1996) Emergence of simple-cell receptive field properties by learning a sparse code for images. Nature 381: 607-609

Poggio GF, Poggio T (1984) The analysis of stereopsis. Annual Review of Neuroscience 7:379-412

Date posted: April 2015