

Simulation of attention steering processes

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Abstract

Being limited by the construction of the human eye which narrows the region of accurate vision to only a small visual angle, the human viewer is forced to move his eyes to build up an adequate internal representation of the environment. This process is supported by attentional steering procedures which determine the sequence of locations to be fixated. Intentional (top-down) and stimulus-driven (bottom-up) processes are to be distinguished. A number of parameters exist for stimulus-driven processes which specify the amount of attentional attraction. Essential aspects are contrast relations, luminance profiles and complexity relations which can be determined by algorithms of digital image processing. Viewing habits were combined with these factors and were implemented in a simulation model. The simulation model calculates attention attracting areas within the visual field. This information then was used to steer a two-axis camera system. The system operates completely autonomous and is able to scan the environment on the basis of salient stimulus properties. The occurring problems when implementing the system are also reported on.

Introduction

A reason why a human viewer has to move his eyes is based on the fact that the visual resolution of the eye decreases from the center to the periphery (Anstis, 1974; Blake & Sekuler, 2006). As a consequence it is necessary that eye movements bring the foveal area to bear on peripheral objects so their shapes are clearly discerned. Furthermore, in order to build up an adequate internal representation of an environmental scenario, the eyes have to move across the visual field. This scanning procedure is mainly guided by attentional processes. Attention can be interpreted as a psychological mechanism for handling physiological restrictions of the eye but can also be seen as a decision mechanism which supports the selection of stimuli in space by the criterion "relevance" (Hoffman, 1998). For a better understanding of these processes it can be helpful to simulate the course of the internal events taking place. A system that simulates attentional processes can be implemented in robotic systems monitoring environmental aspects. In order to develop such a system it is necessary to gather the most important factors involved in this attention steering process.

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