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Brain correlates of natural scene perception, a Fixation-Related fMRI approach.

Temporal and spatial characteristics of fixations are affected by image properties, including high-level scene characteristics and low-level physical characteristics. The influence of these factors is modulated by emotional content of an image. Here, we aimed to establish whether brain correlates of fixations reflect these modulatory effects. We scanned participants and measured their eye movements, while presenting negative and neutral images in various image clarity conditions, with controlled object-background composition. The fMRI data were analyzed using novel fixation-based event-related (FIBER) method, which allows tracking brain activity linked to individual fixations. Fixating an emotional object was linked to greater deactivation in the lingual gyrus than fixating the background of an emotional image, while no difference was found for neutral images. Deactivation in the lingual gyrus might be linked to inhibition of saccade execution. This was supported by longer durations of fixations falling on the object than on the background in the negative condition. Furthermore, increasing image clarity was correlated with fixation-related activity within the lateral occipital complex. This correlation was significantly stronger for negative images. Overall, emotional value of an image changes the way low- and high-level scene properties affect characteristics of fixations as well as fixation-related brain activity

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Sensing and Sensor Fusion at the Chair for Medical Information Technology

The chair for Medical Information Technology (MedIT) at the RWTH Aachen University in Germany performs research in various areas of medical engineering. With over 20 researchers, current projects range from unobtrusive sensing of vital signs, from infants to elders, over exoskeletons, to automation and control in the intensive care unit. In the first part of the presentation, an overview of ongoing projects and research activities is given.

The second part of the presentation concentrates on the project “UNOSECO”, which focuses on sensor fusion for multimodal cardiorespiratory signals. First, we present a synthesizer approach for artificial signals. Based on a system of coupled oscillators, we obtained and validated signals with both deterministic coupling and realistic statistical distributions for several modalities. Moreover, we developed an approach for multimodal motion artifacts. Here, the mathematical tool of “copulas” plays a central role in modeling multivariate dependencies. Based on a random vector for duration and power of the artifacts, sensor-specific signal generators synthesize realistic motion artifacts. In the future, we hope to combine both approaches to generate realistic virtual sensor signals for algorithm development, for example using deep learning. Finally, as an application scenario in the area of unobtrusive sensing, for example to monitor elderly subjects at home, we present an armchair equipped with several sensors. In a study with healthy volunteers using motion capture, the influence of motion artifacts was measured. Moreover, we analyze and demonstrate the potential of sensor fusion for monitoring vitals sings.