UNOBTRUSIVE MONITORING OF OBSTRUCTIVE SLEEP APNEA THE UMOSA PROJECT

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ABSTRACT

Obstructive sleep apnea (OSA) is one of the most common sleep disorders. People with sleep apnea (partially) stop breathing for several seconds, multiple times per night. The gold standard for the diagnosis of OSA and other sleep disorders is commonly referred to as polysomnography (PSG). During a PSG, multiple parameters are measured to evaluate brain activity, heart rate, respiration rate, nasal airflow, body posture and limb movement. The large number of wired sensors used during a PSG may influence actual sleep quality, which may result in a less representative assessment of sleep.

Several proofs of principle have demonstrated that most vital signs parameters or surrogates relevant for diagnosing OSA can be continuously measured in a fully contactless manner. Within the UMOSA project, four fully contactless measurement techniques were selected and will be further developed to be able to monitor sleep and to diagnose the presence of (obstructive) sleep apnea events. First, remote photo-plethysmography, which is the contactless counterpart of conventional pulse oximeters, using plethysmography as the measurement principle to measure instantaneous heart rate and heart rate variability. Second, speckle vibrometry uses an interferometric technique to measure cardiac and respiratory signals at the chest even when covered with one or more textile layers. Third, remote thermography measures respiration and nasal flow by aiming passive thermal radiation detectors at the nostrils and the area around the person's head. Fourth, a high resolution near infrared camera and an infrared light source are used for the detection of body motion, body posture and respiration motion under no visible light conditions.

Based on the results of laboratory research in healthy participants, the UMOSA measurement setup is installed in the center for sleep medicine Kempenhaeghe for a clinical feasibility study. Planned simultaneous recordings of the UMOSA setup and reference PSG allow the evaluation of the setup's performance in sleep disordered patients in a clinical environment. Results should demonstrate the setup's accuracy, coverage and feasibility to measure vital signs parameters, estimate sleep stages and its ability to detect (obstructive) sleep apnea events. Results may also point out potential redundancy within the setup.