PhD Student: Video-based sleep movement analysis in Parkinson’s disease

Eindhoven (Noord-Brabant), Eindhoven University of Technology

Job description

Do you have a keen interest in applying state-of-the-art video analysis techniques to real-world patient-based clinical research? The Ph.D. position in our laboratory is for those with an ambition to push the boundaries of this field and the ability to interface with clinical researchers.

This project is focused on sleep disorders in Parkinson’s disease. Patients with Parkinson’s often suffer from severe nocturnal sleep disruption. The reasons for this are complex, and range from difficulties turning around in bed to abnormal motor activity during sleep. Interestingly, some Parkinson’s patients report so-called “sleep benefit”, a beneficial effect of sleep, with a feeling of temporary decreased symptoms just after awakening.

The PhD candidate works in close collaboration with clinical sleep researchers from the Radboud University Medical Centre in Nijmegen. The ultimate goal is to develop video-based techniques to monitor and quantify body movement patterns in the home environment for extended periods of time. A first project will involve developing monitoring techniques to detect and quantify sleep benefit. These techniques may then be extended towards a more general outcome parameter for Parkinson’s disease, e.g. to monitor treatment response. A second line of research involves the monitoring of nocturnal motor activity, both for diagnosis and long-term follow up.

The research challenge for video analysis comes from the semantic interpretation of real-world videos so that clinically relevant information is extracted. This involves advanced automatic human posture and behavior analysis and activity recognition. The problems to solve will include dealing with various, and often poor, lighting conditions, videos from night vision cameras, advanced video analysis and machine learning.

In this context, the goal of the PhD project is to investigate, develop and test algorithms for

- human detection and activity recognition,
- analysis of Parkinson’s patient behavior,
- clinically relevant information extraction.

We aim at contributing to the video analysis research by developing the following algorithms:

- approaches for derivation of clinically-relevant movement parameters using video (such as posture, stride length, stride velocity, arm swing, etc.);
- movement parameter recording in the home environment in natural conditions (varying lighting conditions, dynamic obstruction, etc.);

- using the developed techniques to assess spontaneous motor activity just after awakening as an indicator of sleep benefit; this pertains to a clinically highly relevant outcome parameter, which can be recorded in a relative small and controlled environment (i.e. the bedroom);

- extending the developed techniques to monitor motor activity during the day (adding multiple rooms in the house, separation from other subjects in the environment, and developing objective outcome parameters);

- nocturnal movement pattern assessment in relation to sleep quality (body position changes, difficulties turning around in the bed, etc.);

- assessing sleep-related movement disorders characteristic of PD, such as REM sleep behavior disorder.

Requirements

University Graduate
The ideal candidate should hold a MSc degree in computer science or electrical engineering with emphasis on signal processing, image/video processing, computer vision and good programming skills, preferably in C or C++. In addition, the candidate needs to be able to work closely with clinical researchers with expertise in sleep disorders, Parkinson’s disease and movement analysis.

Organization

Video Coding and Architectures (VCA) research group

The Video Coding and Architectures research group (http://vca.ele.tue.nl) is one of the leading groups in the Netherlands in designing real-time video analysis and coding systems. It is involved in various EU projects such as ITEA – Information Technology for European Advancement, as well as in industrial delivering of advanced video technology. VCA group is a part of the Signal Processing Systems department within the Electrical Engineering Faculty at the Eindhoven University of Technology in the Netherlands. The group carries out long-term research on image-processing algorithms and also applied research on video-processing hardware architectures or specific implementations. Research topics include, among others, video content analysis, medical image analysis, multiprocessor video systems, video segmentation, 3D scene reconstruction, multi-view video compression.
**Conditions of employment**

Estimated maximum salary per month: according to the Dutch law

Employment basis: Temporary for specified period
Duration of the contract: 4 years
Maximum hours per week: 38

**Additional Information**

Additional information about the vacancy can be obtained from:

Dr. S. Overeem  
E-mail address: Sebastiaan.Overeem@radboudumc.nl

Dr. S. Zinger  
E-mail address: s.zinger@tue.nl

Or additional information can be obtained through one of the following links.

- About the organization: http://vca.ele.tue.nl/
- Eindhoven University of Technology: http://w3.tue.nl/en/

**Application**

You can apply for this job before 31-05-2014 by sending your application to:

Prof. Dr. Peter H.N. De With  
E-mail address: p.h.n.de.with@tue.nl

and

Dr. S. Zinger  
E-mail address: s.zinger@tue.nl