Title
Deep learning to characterize movements and movement disorders during sleep

Main supervisor
Ir. Ruud van Sloun, r.j.g.v.sloun@tue.nl (TU/e)

Other involved staff members
Prof. dr. Sebastiaan Overeem (Principal investigator, TU/e)
Dr. Merel van Gilst (TU/e)
Dr. ing. Hans van Dijk (Kempenhaeghe)
Ir. Sven Plasier (2M engineering)

Location
Can be a combination of TU/e and 2M.

Background
Sleep is essential; after merely one night of bad sleep, both concentration and responsiveness significantly deteriorate. The impact of sleep disorders on society is therefore highly significant. An important group of sleep disorders are characterized by abnormal movement patterns during sleep, such as restless legs syndrome and several forms of sleepwalking. Sleep disorders in patients with Parkinson’s disease on the other hand are often caused by a decrease in nighttime movements, for example due to difficulties turning around. Consequently, the ability to objectively measure, characterize, quantify and ultimately classify sleep related movement patterns is vital for both diagnosis and treatment. Today, such a solution does not exist however.

Description
At the Kempenhaeghe sleep center, we have performed nighttime recordings in a group of sleep disorders patients, using a unique contactless pressure sensor placed under the matrass developed by 2M Engineering. Using these data, the student will develop signal processing solutions that pave the way towards objective and unobtrusive characterization of movement patterns in sleep. To this end, dedicated deep learning algorithms will be developed and adapted to optimally extract relevant information from the given sensing strategy. The initial focus of this project will be on accurate detection and classification of body position changes.

Keywords
Deep learning, Signal processing, sleep disorders, movement

Elective courses
- Adaptive array signal processing (5SSCO) and/or Signal analysis and estimation (5XSBO)
- Machine learning for signal processing (5LSL0)