Master thesis proposal

# Radar based gait monitoring and analysis for medical applications

Gait abnormality is one of the main causes of chronic disability in the elderly population, and their incidence varies greatly with aging. Gait abnormalities can lead to mobility limitations, which are associated with loss of autonomy, reduced quality of life, increased fall risk, repeated hospitalizations, and premature death. From the clinical point of view, the importance of human gait analysis lies in the fact that gait disorders affect a high percentage of the world's population and are key problems in neurodegenerative diseases such as multiple sclerosis, amyotrophic lateral sclerosis, Parkinson's disease, certain types of dementia etc. It has long been known that there is a direct relationship between cognitive impairment severity and increased gait abnormalities, in both elderly people and younger adults. Therefore, constant monitoring of changes in gait enables early diagnosis of different diseases and facilitates studying the course of disease for designing adequate treatment. For these reasons, it is important to detect gait abnormalities and monitor alterations in walking patterns over time.

The traditional methods used to analyse gait parameters in clinical conditions are semi-subjective, carried out by specialists who observe the quality of a patient's gait by making him/her walk. This is sometimes followed by a survey in which the patient is asked to give a subjective evaluation of the quality of his/her gait. The disadvantage of these methods is that they give subjective measurements, particularly concerning accuracy, and precision, which have a negative effect on the diagnosis, follow-up, and treatment of the pathologies. Moreover, thorough clinical gait studies based on these methods are often time-consuming, costly and lack reproducibility. Rapid progress in new technologies has given rise to devices and techniques which allow an objective evaluation of different gait parameters, resulting in more efficient measurement and providing specialists with a large amount of reliable information on patients' gaits.

Radar technology has appeared as an outstanding candidate for constant gait monitoring due to its safety, reliability, and ability to serve as an effective device for contact-less motion monitoring of subjects in the surrounding settings and environments, while preserving privacy. The applications of radar technology in elderly care, and medical diagnosis have emerged to be front and centre in indoor human monitoring, including fall motion detection, classifications of daily activities and vital sign monitoring. In comparison with other non-wearable sensing modalities for indoor human monitoring, such as infrared reflective light, refractive light, video cameras, and in-ground force platforms, radar-based gait monitoring is not affected by occlusions, lighting conditions and clothing.

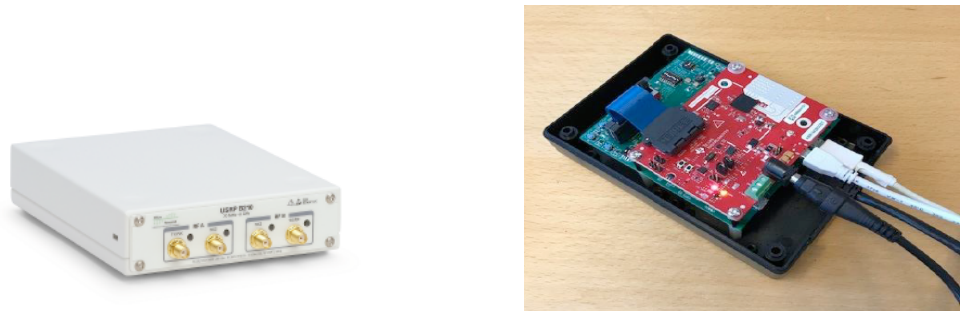

Figure 1 Two different types of radar systems

In this master thesis project, you will perform a preliminary investigation on using radar technology for gait measurement and analysis. The main work of this project include:

1) Make state-of-art review in the field
2) Design and perform experimental studies for gait measurement using different radar systems (Fig.1)
3) Develop a data analysis method for extracting important gait parameters/characteristics that are of clinical importance from the measurement data

The long-term goal of the project is to enable early prediction and prevention of diseases through daily gait monitoring.

## Prerequisite:

Master students in biomedical engineering (MPBME), wireless, photonics and space engineering (MPWPS) or other electrical engineering and engineering physics programs. Knowledge of EM waves and microwave radar, and experience of signal processing are merit.

**Project length**: can be 6 months or one year

**Number of students**: one or two

## Contacts:

For more information about this project, please contact:

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