PhD Title: Markerless Human Gait Analysis using Ultra-Wideband Radar approaches augmented by Artificial Intelligence

Description: This PhD extends BioEngineering Research Centre's work on self-regulating and non-contact impulse radio ultra-wideband (IR-UWB) based human gait analysis augmented by artificial intelligence. The work provisions a non-tactile assistive biomedical application for home or field sites settings for the remote monitoring of human gait and action classification to identify traits and abnormalities negating wearable sensor needs. The physical gait parameters must be determined via signal processing, using theoretical, and subsequently computational studies. Other state-of-art marker-based systems will be available in house to validate the gait parameters obtained from IR-UWB system. This PhD studentship will involve a combination of theoretical, computational, and experimental work, providing the student with a complete and holistic training and a diverse research experience whilst working alongside other research members working on similar topics.

The main objectives of this project are:

1. IR-UWB Gait Database Handling: Human participant recruitment to improve the gait database. The gait database would be handled and maintained by the PhD student.

2. Mathematical Modelling for Wireless Channel estimations: Mathematical models must be developed encompassing wireless channel implications to handle multi-path reflections and mirror the results of normal environment to mitigate delay, angular, and frequency dispersion.

3. Theoretical Modelling to Determine Physical Gait Features: Alternative antenna transceiver designs must be investigated to gather UWB gait data, to determine optimum gait identification.

4. Bio-mechanical Gait Parameter Extraction: Develop on existing work to determine joint angles, stance (posture), and step duration for overall improved gait detection.

5. Machine Learning Application for Gait Classification: There are eight basic pathological gaits attributed to neurological conditions: hemiplegic, spastic diplegic, neuropathic, myopathic, Parkinsonian, choreiform, ataxic (cerebellar) and sensory. Gait classification can be addressed employing conventional machine learning or deep learning to identify and differentiate gait patterns from based on extracted bio-mechanical features.

This PhD is a School of Engineering Bursary covering fees and a £18k stipend per annum for three years. As part of the candidate's academic development, the bursary agreement includes that the successful PhD candidate engages in 4 hours per week student contact time, comprising lab class assistance and extracurricular activity development. If you have any informal query, please email the supervision team directly. We encourage applications from underrepresented groups.

Supervisory Team: The successful applicant will be working with Prof. Sandra Dudley and Dr Michael Berthaume and Dr Soumya Rana. You will work alongside a range of new and experienced PhD students in a collaborative environment. Informal enquiries should be directed to Sandra (dudleyms@lsbu.ac.uk). Please send a copy of your CV with a covering letter directly to Prof. Dudley before applying.

Requirements: Applicants must have (or be expected to gain) a first class or an upper second-class Honours degree (or the international equivalent), or an MSc. Enthusiastic and self-motivated candidates from all countries with a background in Engineering, Material Science, Chemistry or a related discipline are encouraged to apply. A strong interest in laboratory working is advantageous.