

Professor Slawomir Nasuto, (<https://www.reading.ac.uk/biomedical-engineering/staff/slawomir-nasuto>), is a professor of Cybernetics in the Biomedical Sciences and Biomedical Engineering Division, School of Biological Sciences, at the University of Reading, UK. He is heading the Brain Embodiment Laboratory, where interdisciplinary research is conducted at the interface of biomedical engineering, neuroscience and cognition. Nasuto has received an MSc in Mathematics from the University of Marie Curie-Sklodowska in Lublin, Poland in 1993 and a PhD in Cybernetics from University of Reading in 1999. He has been a member of academic staff at Reading since 2000. Professor Slawomir J Nasuto's research interests span computational neuroscience and neuroanatomy, developing systems for neural morphology reconstruction, analysis of signals generated by the nervous system including EEG, single neuron and multivariate spike trains or EMG and their applications for Brain Computer Interfaces and Animats (robots controlled by neural cultures).

Description of activities during the visit to the Federal University of Uberlandia, hosted by Prof Adriano de Oliveira Andrade and Centre for Innovation and Technological Assessment in Health (NIATS):

The visit lasted from 27th August 2024 till 11 September 2024. On 28th August Prof Nasuto participated in the discussions about the overall project Parkinson's Brazil aims, augmented by the presentations of the graduate, postgraduate and postdoc team members.

In particular Prof Nasuto was able to appreciate the proposed span of the works and comment on the possible data inclusions in the overall proposed database. He also could see the presentation about the virtual reality game for assessment of motor and non-motor symptoms of Parkinson's Disease (PD). Resulting discussions ranged over the possible modification to the game, to allow for varying the level of difficulty, as well as a possibility to extend the game to record EEG in order to monitor participant engagement and ultimately develop a Brain Computer Interface extension. It was decided that such an extension will be a focus of a PhD study in the UK co-supervised with prof Andrade to maximise the potential for synergy with the main project. Several challenges were addressed in discussions about the game, including a need for a data co-registration solution, as well as a possibility of developing an alternative game control around motion capture system. Such options will also be investigated in the UK.

Another presentation on the experimental system comprised of wearables to obtain signals informing about the freezing of gate (FOG) characteristics of the PD was discussed. During the presentation and in ensuing discussions over the next several days a plan of analysis of the obtained data has been formulated with progressively refined signal processing methodology that will be implemented in order to assess the utility of such data to predict FOG in advance. Such an ability would offer a possibility of developing an assistive technology to support people with PD in order to mitigate risks of FOG occurring in daily life activities.

A presentation on epidemiological data regarding Parkinson's Disease deaths incidence association with pesticides use resulted in discussion of potential extensions of the analysis that could include going beyond mere correlation via mendelian randomisation and including machine learning methods to probe potential interactions between pesticide effects on PD incidence.

On 29th August Prof Nasuto trialled the game developed by prof Andrade's team for monitoring and rehabilitation of the motor and non-motor symptoms of PD. Participation in the demo

helped to understand the approach to individual objectives and was a starting point to subsequent discussions about possible future directions.

Prof Nasuto presented a research seminar on Friday 30th August on his research on long range dependence in EEG signals and its potential relevance as a promising and underexplored marker of Parkinson's Disease and its various symptoms.



The afternoon was devoted to participation in some motor competence tests which deepened Prof Nasuto's understanding of the methods for gathering the data in the project.



The week commencing on 2nd September was devoted to the participation in the Brazilian Biomedical Engineering Congress, where Prof Nasuto delivered an invited talk about the

progress of Brain Computer Interfaces over the last decade.



The remaining 2 days of the visit, 9th and 10th of September, were devoted to continued discussions regarding further details of the possible analysis approaches and methods for data collection using inertial sensors and EMG array that could inform a classification of PD tremor types and relate them to activity of muscle synergies. An interesting further possibility was explored to augment the epidemiological investigation of pesticides in PD by forming at Reading a PhD project to be jointly co-supervised on neurobiological mechanisms regarding corresponding pesticides' toxicities.

In summary, the visit was very productive and successful in establishing firmer plans for coordinated activities involving Prof Nasuto's co-supervision of students and researchers from Center for Innovation and Technological Assessment in Health (NIATS), participation in work meetings to monitor the research and in production of resulting research outputs.