COMPREHENSIVE ASSESSMENT OF THE CONDITION OF BONE AND MUSCLE TISSUES USING QUANTITATIVE ULTRASOUND (BoMUS) (2022 – 2024)

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Project partners:

1) Institute of Electronics and Computer Sciences
2) Riga Technical University

Aim of the project: The project aims at the research of the scientific basis for a novel ultrasonic technology (BoMUS) for the complex characterization of bone and muscle condition in terms of the tissue composition and structure. BoMUS technology is based on advanced processing of ultrasonic signals obtained by scanning of human limbs, using different acoustic modes and applying pattern recognition methods.

Detailed description:

The project aims at the research of the scientific basis for a novel ultrasonic technology (BoMUS) for the complex characterization of bone and muscle condition in terms of the tissue composition and structure. BoMUS technology is based on advanced processing of ultrasonic signals obtained by scanning of human limbs, using different acoustic modes and applying pattern recognition methods. Decision rules or a number of informative ultrasonic features help evaluation of the factors-of-interest (FOI) or determinants of quality of bone and muscle tissues. FOI include cortical thickness, porosity and degree of mineralization in bone and lean muscle content, subcutaneous and intramuscular fat and edema in muscle. The key innovation is the analysis of multi-dimensional digital signal matrices at different ultrasonic frequencies using elements of artificial intelligence. The unification of the bone and muscle parts in a common diagnostic system is particularly beneficial within the concept of bone and muscle relationship and common monitoring in aging, physical activity, immobilization, osteoporosis and sarcopenia. BoMUS will overcome limitations of existing quantitative ultrasound and expand its diagnostic power. The project's activities include experimental design, laboratory studies, and development of data processing, technology verification and dissemination of results. The results will open a perspective for further R&D to a higher TRL and steps to commercialization.

Publications and presentations:

1. Sisojevs, A., Tatarinov, A. and Chaplinska, A. Evaluation of Factors-of-Interest in Bone Mimicking Models Based on DFT Analysis of Ultrasonic Signals. In: Proc. 12th Int. Conf. on Pattern Recognition Applications and Methods (ICPRAM 2023), pp. 914-919. DOI: 10.5220/0011742800003411. (Conference paper, SCOPUS, Online presentation).

2. Sisojevs A., Tatarinov A., Kovalovs M., Krutikova O., Chaplinska A. (2022) An approach for parameters evaluation in layered structural materials based on DFT analysis of ultrasonic signal.

Proc.11th Int. Conf. on Pattern Recognition Applications and Methods, Vol.1: ICPRAM, 307-314. DOI: 10.5220/0010878400003122. (Conference paper, SCOPUS).

3. E. V. Glushkov, N. V. Glushkova, O. A. Ermolenko and A. M. Tatarinov, "Extracting guided wave characteristics of bone phantoms from ultrasonometric data for osteoporosis diagnosis," 2022 Days on Diffraction (DD), St. Petersburg, 2022, IEEE Publisher, pp. 35-40, doi: 10.1109/DD55230.2022.9961013. (Conference paper, SCOPUS).

4. A. Tatarinov, A. Sisojevs, A. Chaplinska. “Identification of Osteoporosis Diagnostic Signs in Cortical Bone Models Examined by Axial Transmission Ultrasound” 23th Int, Workshop on Quantitative Muskuloskeletal Imaging, QMSKI 13-17.06.2022. Noordwijk, Netherlands. https://qmski.org/. (Oral presentation).

5. A. Tatarinov, A. Sisojevs, A. Chaplinska. Pattern recognition based approach for extraction of factors of interest from ultrasonic data. Int. Workshop on Embedded Digital Intelligence (IWoEDI’2023), Riga, 2023. (2 page abstract, oral presentation).

6. A. Tatarinov. Quantitative ultrasound of bone and muscle. Health Tech Hub Styria Pitch & Partner, 30.03. 2023, Graz, Austria. (Oral presentation).