Doctoral School of Information and Biomedical Technologies
Polish Academy of Sciences (TIB PAN)

SUBJECT:

Quantitative ultrasound imaging with thermal contrasting

SUPERVISOR:

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DESCRIPTION:

The work concerns ultrasonic quantitative methods [1] such as imaging of attenuation and scattering coefficients, as well as imaging of statistical and textural parameters of tissue. These methods are the subject of numerous studies oriented, among others on diagnosing neoplastic lesions [2] and early assessment of tumor response to chemotherapy [3,4]. In the mentioned studies, the temperature of the examined tissue is not interfered in any way. However, it is known that some acoustic parameters of the tissue (e.g. speed of sound, attenuation) significantly depend on its temperature [5]. It is possible, therefore, that a non-apparent tissue structure will become apparent after the temperature change. Heating and cooling can therefore have the potential to contrast tissue structures. There is also a possibility to get a new type of diagnostic information by measuring parameter-temperature characteristics.

The work includes design and construction of a module that will heat / cool the imaged material. Tissue phantoms with different acoustic properties will also be made. Ultrasound data will be collected and analyzed as part of the research. In the first place it will be collected from the aforementioned tissue phantoms and in the further research from animal tissues in vitro. An ultrasound scanner with a research module will be used to collect the data. Data analysis will focus on the aspects of using temperature as a contrast agent in quantitative ultrasonography and on testing the effectiveness and repeatability of determining the temperature characteristics of individual quantitative parameters.

BIBLIOGRAPHY:

1. Quantitative Ultrasound in Soft Tissues, eds. Jonathan Mamou, Michael Oelze, Springer, 2013.

2. Breast-lesions characterization using Quantitative Ultrasound features of peritumoral tissue, Klimonda et al., Scientific Reports, 2019.

3. Response monitoring of breast cancer patients receiving neoadjuvant chemotherapy using quantitative ultrasound, texture, and molecular features, Sannachi et al., PLoS One, 2018.

4. Monitoring breast cancer response to neoadjuvant chemotherapy with ultrasound signal statistics and integrated backscatter, Piotrzkowska-Wróblewska et al., PLoS One, 2019.

5. Foundations of biomedical ultrasound, Richard S. C. Cobbold, Oxford University Press, 2007.

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