

STSM REPORT

STSM Application number: COST-STSM-BM1205-16454

STSM Grantee: Lukasz Surazynski

STSM title: Optoelectronic methods of tissue screening

Home Institution: Gdansk University of Technology

Host Institution: University of Oulu

STSM period: 01.02.2014 – 31.03.2014

STSM purpose: Analysis of Near-Infrared spectroscopy in field of tissue screening, especially skin lesions, validation of the method.

Description of the work carried out during the STSM: Preliminary studies have shown benefits and weaknesses of non-invasive methods of skin cancer detection. Since near-infrared spectroscopy is commonly used in medicine, the aim was to validate this method in early skin cancer detection. Despite of the fact that there were attempts to utilize near-infrared light in skin lesions measurement with promising results [1] there is still space to develop this method.

During research skin cancer metabolism was studied, basing on the fact that skin lesions can be characterized by different metabolism than a healthy skin, e.g. sugar consumption, oxygenation. It was deduced that utilizing near infrared spectroscopy (NIRS) may lead to obtain reliable, proper data, which supports medical doctors in skin lesions diagnosis.

The next step was the preparation of the device. Since NIRS was currently used in brain measurements some minor and major modifications were needed in order to measure wide spaces of the skin. Device was expanded with several detectors as much as inner modifications were made (acquisition of data, changes in light sources). The detectors were attached in known distances from the light source, three modulated wavelengths of light was used (660 nm, 830 nm, 905 nm). Finally, skin located between hand and elbow was measured with the device.

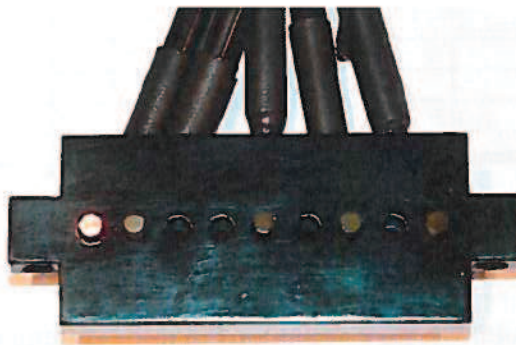


Fig. 1 Light source with four detectors

[1] Truong, Bao CQ, H. D. Tuan, and H. T. Nguyen. "Near-infrared parameters extraction: A potential method to detect skin cancer." *Engineering in Medicine and Biology Society (EMBC), 2013 35th Annual International Conference of the IEEE*. IEEE, 2013.

Description of the main results obtained:

Measurement has shown that there are no significant differences between the spectra of all healthy regions of the skin. Oxygenation and deoxygenation of the tissue was changing but spectra remain constant, while investigating limited - one location. Results are shown on figure 2.

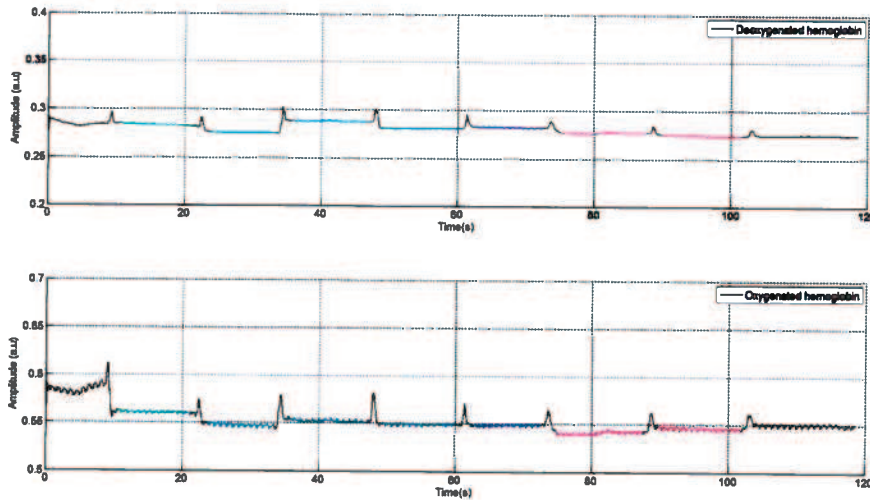


Fig. 2 Measurement of healthy skin, Hb, HbO vs time (black spikes indicates changes in probe placement)

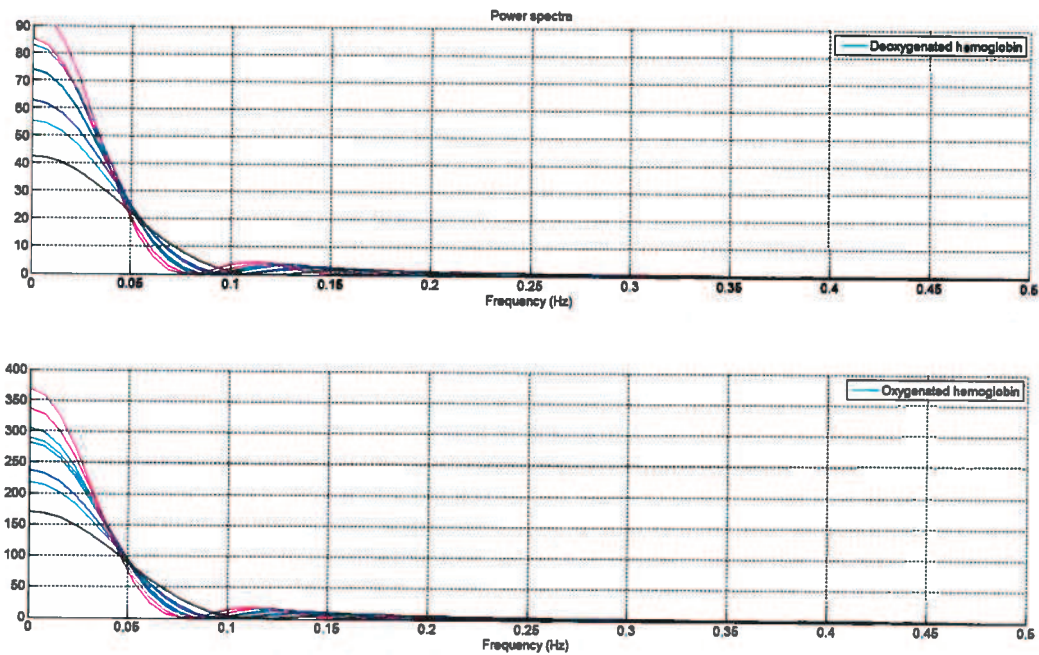


Fig. 3 Power spectra of deoxygenated and oxygenated hemoglobin

On the basis of preliminary results we have concluded that measurement may be promising in field of skin cancer detection. There were efforts put to measure patients with skin cancer. Meanwhile draft of the article with preliminary results was prepared (attachment 1); it should be regarded as expansion of the report.

Mutual benefits for the Home and Host institutions: There are two essential benefits. Firstly it has strengthened cooperation between Department of Metrology and Optoelectronics (Gdansk University of Technology) and Optoelectronics and Measurement Techniques Laboratory (University of Oulu). Secondly this work allowed to further development of the NIRS and found another field to utilize it.

Future collaboration with the Host institution (if applicable): According to previous section and basing on benefits there will be further work under attaching NIRS to skin cancer measurement. The next step contains measurement of patients with skin cancer, finalization of the article and further improvement of the device.

Foreseen journal publications or conference presentations expected to result from the STSM (if applicable): There will be article published in the future, which draft is attached (attachment 1).

Confirmation

Herewith I would like to confirm the completion of the STSM within the Optoelectronic methods of tissue screening project applied by Lukasz Surazynski.

He has worked on this project at the Laboratory of Optoelectronics and Measurement Techniques from 1st February to 31th of March 2014 and fulfilled the objectives of the STSM work plan. During that time he investigated human tissues properties, completed several modifications of the NIRS device and took measurements of skin.

The purpose of the measurements was to validate utilization of Near-Infrared Spectroscopy in field of tissues screening.



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(Matti Kinnunen,
Head of the Laboratory of Optoelectronics
and Measurement Techniques, University of Oulu)