Towards skin cancer screening by non-invasive optical device

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What and Why?

Skin cancer is the most common type of cancer. It is essential to create an effective, non-invasive and inexpensive cancer screening method in order to diagnose skin cancer as early as possible.

Setup and Method

A setup of portable, optical, non-invasive screening device was tested in Oncology Center of Latvia on ~150 patients by imaging malignant tumors: Malignant Melanoma (MM), Basal Cell Carcinoma (BCC), as well as benign leisons: Seborrheic Keratosis (SK), Hyperkeratosis, Hemangioma and other Benign Nevi.

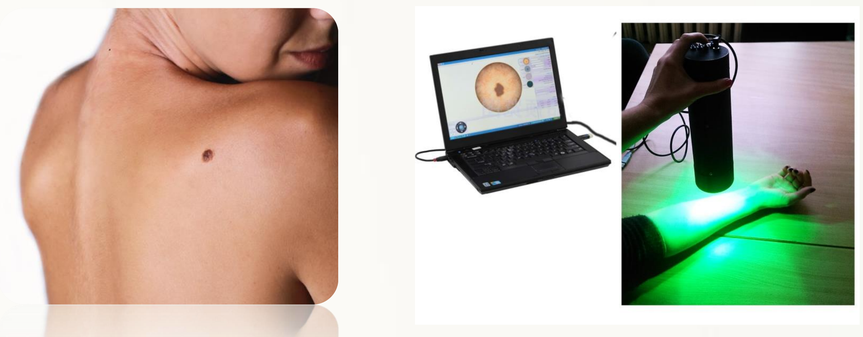
A simple CMOS sensor (IDS UI-3581LE-C) with surrounding ring of LED illuminators at **525nm, 405nm** (AF), **660nm, 940nm,** two cross-positioned polarisators - all put in a 3D-printed case, the whole system is connected via USB and run by *uEye Cockpit.Ink* image capturing software and later images are processed with *MATLAB* software.

Results and Conclusions

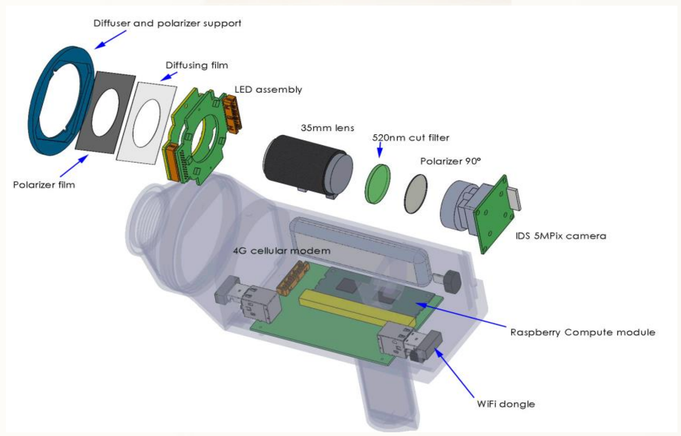
The method is very useful at distinguishing MM and benign nevus, however, it does not distinguish BCC and Benign Nevi. This does not a pose a problem as dermatologists can easily differentiate them.

A capability to take autofluorescence photobleaching measurements will be added to the setup which might give more accurate results for pigmented lesions.

By combining the diffuse reflectance and autofluorescence (AF) image analysis it is possible to distinguish skin lesions suspected of malignant melanoma and get a preliminary result, without taking a biopsy. This device is very useful for primary care doctors and dermatologists.



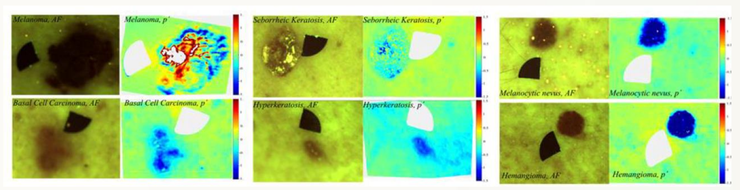
The clinical setup and patient skin screening



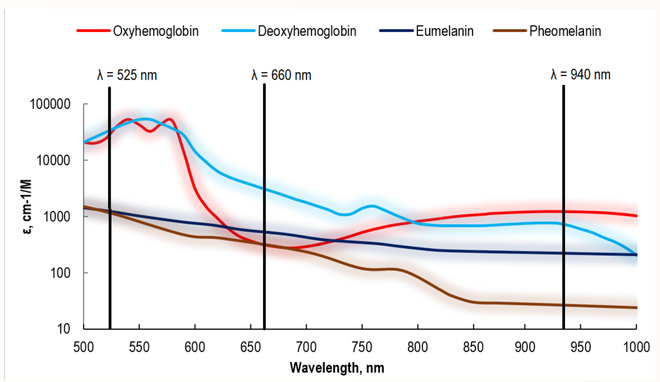
Model and components of the device prototype

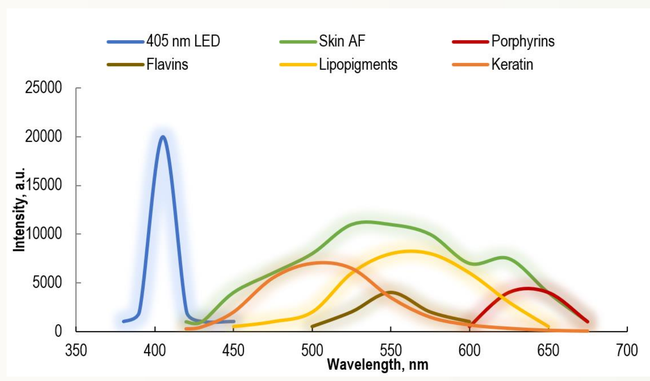
Actual device prototype and cross section

Raw B / G / IR / R images of the lesion

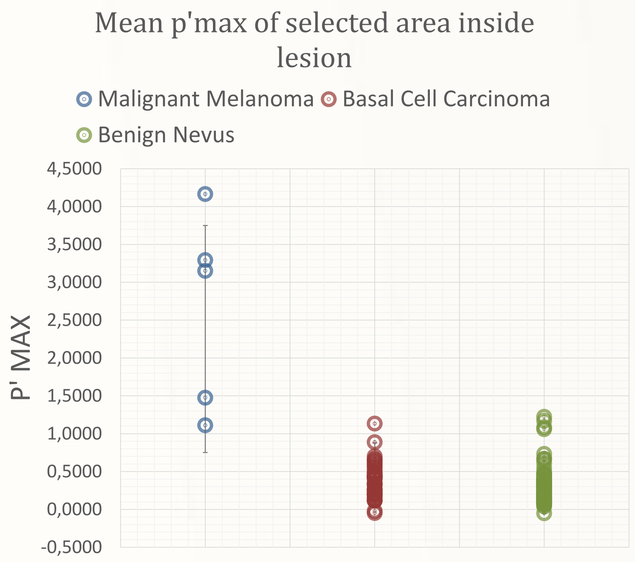


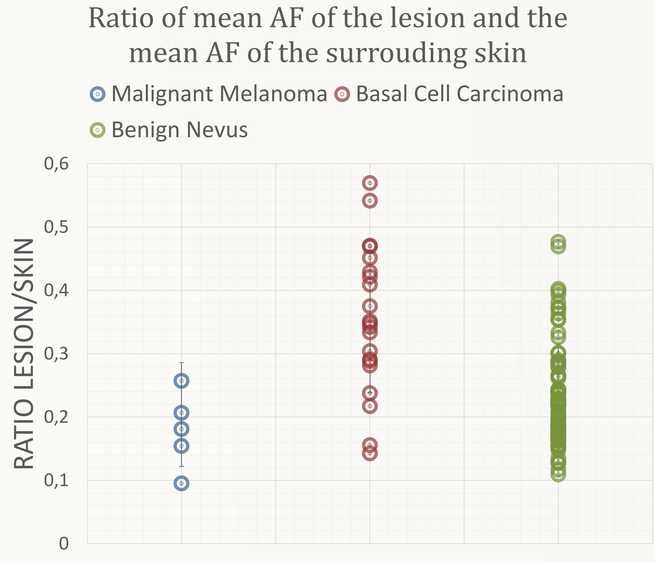
Post-processed Autofluorescence (AF) and diffuse reflectance (DR) maps





Common skin chromophores and fluorophores targeted by the chosen wavelengths [1]





Diffuse reflectance parameter and AF ratio of tested skin diseases

References

[1] Lihacova et al. "A method for skin malformation classification by combining multispectral and skin autofluorescence imaging," Proc. SPIE 10685, Biophotonics: Photonic Solutions for Better Health Care VI, 1068535 (17 May 2018);

Acknowledgments

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