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## Image Quality Enhancement for Skin Cancer Optical Diagnostics

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Biophotonic area as many others research fields strongly rely on obtained image quality. The quality of image is a combination of the capabilities of hardware (camera/image sensor), optical system and image post processing. A lot of biophotonic methods use reference sample and calibration in post processing. That allows reducing the effect of all imperfections. Nevertheless, some of the methods require images of sufficient quality before post processing. That happens when imaged object reacts in nonlinear and dynamical way and obtaining of a calibration function is not possible. Some of imaging sensors implement pre-processing when illumination is close to extreme zones (dark or bright), therefore it might bring errors to diagnostics, since diagnostic algorithms expect that intensity and image pixel values have linear relationship.

We focus on two specific methods that are used for skin cancer optical diagnostics: fluorescence photo-bleaching and diffuse reflectance. Experiments of photobleaching [1] require high level of homogeneity of ultraviolet illumination source, since skin reacts in nonlinear and dynamical way to illumination intensity. Since obtained image includes all optical system's imperfections, there is a task to separate optical imperfections that could be compensated from light source illumination non-uniformity that is hardly correctable. Along with homogeneity issue, photo-bleaching demands stable illumination intensity all over the experiment time. Since experiment might last up to 20s [2], light emitting diodes heat up and change their intensity. The paper proposes several techniques for minimizing intensity changes, including thermal controlling, intensity correction with and without feedback loop. Diffuse reflectance algorithms have less strict requirements, nevertheless the problem of getting in the extreme zones remains.

Our research includes techniques for separating image imperfection sources among optics, illumination and imaging sensor. We propose methods for parametrizing of image sensor to obtain maximal quality and checking if the region of interest is in the extreme zones (bright or dark). We propose the set of experiments that will allow to evaluate imaging system and to get the optics' calibration function. The calibration function includes illumination non-uniformity/instability, optics imperfections (e.g. lens vignetting), thermal noise, gain noise, and intensity curve nonlinearity. All above mentioned image enhancement techniques can improve the quality of disease detection for skin cancer diagnostics as well as for other applications, where image post processing is limited.

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