**Optimization of band selection in multispectral and narrow-band imaging: an analytical approach**

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**Abstract:** Hyperspectral imaging is a promising clinical imaging modality with multiple applications in wound care, dermatology, and ophthalmology. However, with current technologies, hyperspectral imagers are quite large and expensive devices, which are affordable just for hospitals. Multispectral imaging can be a cost-effective alternative for hyperspectral imaging and is capable of bringing diagnostics to primary health care. Multispectral imaging uses known features of tissue chromophores in order to simplify imaging device design. However, with limited number of bands, the proper band selection becomes of high importance. The goal of the current study is to develop an analytical model for optimization of band selection for multispectral and narrow-band imaging techniques (e.g. narrow-band microscopy).

*Methods:* The contrast ratio has been proposed for quantification of image quality of subsurface inhomogeneities in skin [1]. Based on a tissue model, we developed an analytical model, which links the contrast ratio with optical tissue parameters.

*Results*: We have obtained an explicit analytical solution for the dependence of maximal contrast ratio on optical tissue parameters. Then, we linked the minimally observable contrast ratio (*cmin*) with a camera bit depth (*d*): *cmin=1/(2d-1)* . Based on this analysis we were able to derive an explicit expression, which links camera properties with the minimally detectable changes in optical tissue parameters (both scattering and absorption).

*Discussion:* The proposed analytical model can be used for rapid assessment and optimization of multispectral and narrow band imaging techniques. Also, it can be used for estimation of the accuracy of imaging techniques. The developed model confirms the utility of the contrast ratio for tissue imaging as a versatile metric, which can be used in various analytical and numerical models.

**References:**

1. G. Saiko, A.Douplik, Contrast Ratio Quantification during Visualization of Microvasculature, Adv. Exp. Med. Biol, 2018

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