REAL-TIME TISSUE SEGMENTATION AND DIFFERENTIATION USING POLARIZATION IMAGING

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White light polarization optical imaging is a well-known technique [1] for revealing features of biological tissues. This work applies the principles of spectrally and spatially resolved polarization imaging to the practical tasks of segmenting and differentiating tissues in real time. Special emphasis is made on applications in endourology, specifically, differentiating urinary system stones from surrounding soft tissue.

Spectrally resolved polarized reflectance images of soft kidney tissue and various stones have been collected in the visible spectral range. The analysis of the absolute reflectance revealed statistically significant differences in the responses of almost all stones (except Calcium Oxalate Monophosphate) and soft tissue between 530 and 590 nm. These differences can be attributed to the presence of hemoglobin in soft tissue. Segmentation of inhomogeneous stone samples in terms of stone types represent a more challenging problem.

Possible implementation of the automated differentiation between stones and soft kidney tissues based on the spectrally and spatially resolved polarized light reflectance is discussed and directions of future research are outlined.

References:

[1]. Jacques SL, Roman JR, Lee K. Imaging superficial tissues with polarized light. Lasers in Surgery and Medicine: The Official Journal of the American Society for Laser Medicine and Surgery. 2000;26(2):119-29.