

AbstractID: 3751 Title: Detectability Study on OCT in the presence of speckle with Hotelling Observer

Purpose:

To study the detectability performance of an Optical Coherence Tomography imaging system in the presence of speckles within the framework of the Hotelling observer.

Method and Materials:

Optical Coherence Tomography (OCT) is a non-invasive imaging modality widely used in in-vivo study of tissues. Optical propagation in biological samples is dominated by scattering due to fluctuations in refractive index. This random fluctuation in the index makes it necessary to model the samples as random fields and statistical analysis the tool of choice. The Hotelling observer, a numerical observer that forms its test statistic based on the covariance of the input data, will be used in the classification task of distinguishing one class of sample from the other. The input of the Hotelling observer (i.e., the OCT signal) is considered to be generated by mixing the reference beam with the backscattering of the mean field in the sample. The scattering is handled by using the 1st Born approximation. Poissonian imaging noise will be considered.

Results:

An expression of the detectability index is derived for a classification task within the framework of the Hotelling observer. With this expression, we study how the sample properties and the layout of the optical system affect the performance of an OCT system.

Conclusion:

This work sets the foundation for the assessment of the OCT system and system optimization with respect to a classification task. The stochastic model used to describe the sample is more general in the sense that it goes beyond Gaussian statistic, and the functional form is easy to adjust to include different types of sample.