Multiscale Statistical Analysis of Lung Cancer Tissue Using the Backscattering of Polarized Light

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Lung cancer accounts for the majority of cancer-related deaths each year. Despite its prevalence, current detection methods can take up to 10 days and cost up to $300 for one screening. The goal of my study was to design a system using linear polarization principle, stokes parameters, and the principles of optical density that can detect the stage progressions of lung cancer in a more time- and cost-efficient manner. In this study, I analyzed the effects of cancer stains on the optical properties of tissue, the range of rotation required to detect the differences in light opacity, and statistical analysis measurements needed for differentiation of stages of lung cancer and necrosis. I found that the cancer stain damages the optical properties of the tissue so that there is no clear difference between cancerous and healthy tissue, and only 1 degree of rotation is necessary to see a clear pattern difference for different stages. From an engineering perspective, my project is the first to combine wavelet analysis with polarization principles, in addition to removing the need for the staining process in a diagnostic test. It is also societally significant as it allows for a quicker and more cost effective screening method for lung cancer.