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In-111 Uptake in SPECT Images of Murine Tumors with Varying Antigen Expression: A Topological Approach

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Using computational topology and methods previously developed by Damiano and McGuirl, we analyzed the antibody uptake of single-photon emission computed tomography (SPECT) images of murine tumors. Study data consisted of images of three groups of mice, with each injected with a different xenograft cancer cell line. The cell lines were distinguished by different levels of antigen expression. Images utilized an Indium-111 labeled targeting antibody. We applied time dependent topological structures to analyze the biological processes. Using Morse Theory and dimension zero persistence homology, we analyzed the points of maximum uptake in an attempt to distinguish between uptake behaviors of the different groups and find heterogeneity of uptake within the groups. Statistical analyses indicated that through focusing on areas of high and low uptake, this method distinguished uptake behavior of the antibody in the three different tumor cell lines.