Tumor Targeting: Utilizing Spatial Data Science Techniques To Decode the Enigmatic Immune Response With the Goal of Informing Further Efforts to Develop Immunotherapies for Tumor Treatment

Hariharan, Srinath (School: Woodbury High School)

Cancer is one of the deadliest illnesses in the world, and to find a cure for cancer, information must be obtained on the human body's response to tumors. The purpose of this study was to identify the methods that the immune system uses to respond to tumors and to identify spatial patterns in the tumor microenvironment. This was accomplished by using multiplexed-immunofluorescence (MIF) images of the tumor microenvironment provided by Mayo Clinic. The study analyzed the composition of cells at different distances away from the margin between the tumor and stroma regions classified as "intact," where the immune system has no discernable advantage over the tumor. Annotations of the regions were drawn to identify the margin, and the relevant cells were determined using geospatial analysis techniques. It was found that specific types of cells tend to more frequently increase, or decrease, as distance from the margin increases. The study also conducted analysis on different types of regions with tumor pathology. The types examined were part of two groups: "Responder" (patient responded to immunotherapies) and "non-responder" (patient did not respond). The composition of cells in these regions was examined, along with the participation index (a measure of colocation). It was found that certain cell types are more prevalent in responder regions, and tumor cells are more prevalent in non-responder regions. Additionally, certain cells exhibit higher rates of colocation with tumor cells in responder samples. This work fosters better understanding of the immune response to tumors and informs efforts to develop immunotherapies.

Awards Won:

Fourth Award of $500

Fourth Award of $500