Computational Sensing and Characterization of Microglial Cell Responses to Implanted Microfabricated Neuroprosthetic Devices

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We present an approach for examining structural changes in the branches of microglial cells in brain tissue in response to the implantation of a neuroprosthetic devices. These structural changes indicate the unobservable activation state of the microglial cell. By analyzing the changes to cell branches we can determine the underlying microglial cell activation state; furthermore, by using effective feature selection methods we can describe the structural morphology of the microglial cell branches associated with the different activation states.

Images of brain tissue were automatically processed and split up into individual microglial cells which were then quantified into a set of L-Measures [1]: morphological features that describe each cell. Next, the L-Measures for each cell were analyzed using support vector machines (SVMs) to classify whether or not the microglial cells occurred in implantation areas of the brain. Due to their highly correlated nature, we organized the L-Measures into groups of highly-correlated features and used a Group Lasso SVM [2] to reduce the feature set. With this feature set we can provide concise, interpretable descriptions of the morphology of microglial cells present in implantation and non-implantation areas of the brain.

References


Topic: learning algorithms, other applications
Preference: poster