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Brain glial cell analysis using artificial intelligence: defining the role of Sharpin in AD.

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Microglia and astrocytes are crucial glial cells in the central nervous system, with microglia primarily involved in regulating neuroinflammation and clearing cellular debris, while astrocytes support neuronal activity, modulate synaptic function, and help regulate the inflammatory response. In neurodegenerations, morphological and functional changes in microglia and astrocytes represent the pathological status and may contribute the disease progression. Alzheimer's disease is the most common neurodegenerative disorder and is characterized by the formation of amyloid plaques and neurofibrillary tangles resulting in the loss of memory and cognition. The chronic inflammation observed in Alzheimer's disease involves astrocytes and microglia, exacerbating disease progression and impairing glial cell function. Recent research suggests several methods to apply the artificial intelligence (AI) to the brain image processing and quantification. However, the AI coding and debugging knowledge required to adapt these tools for brain research could be a barrier for general neuroscience researchers to utilize them effectively. In this study, we tested Teachable Machine AI (Google), which is a new machine learning platform which doesn't need significant programming, to analyze images of glial cells. Sharpin is a component of the LUBAC complex regulating NF-κB activity and resulting inflammation process, the mutations of which has association with Alzheimer's disease. However, the role of Sharpin in microglia and astrocyte activity regulating the inflammatory response is not well defined. We trained the machine learning tool using images of astrocytes and microglia from amyloid beta-treated and control groups. We then analyzed the images of astrocytes and microglia derived from Sharpin mutant mice to assess their similarity to the trained images. Our results suggest the potential usability of simple machine learning tools in brain imaging for researchers who are not proficient in AI coding.

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