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Sensory nerve infiltration of the intervertebral disc (IVD) is a potential contributor to low back pain with IVD degeneration. Molecular changes of dorsal root ganglia (DRG) in a model of IVD degeneration may reveal a role for sensory nerve activation and infiltration. Quantifying such changes using immunohistochemical (IHC) techniques would be valuable for understanding the underlying disease mechanisms. However, image segmentation of neuronal structures has proved challenging. As a result, attempts to quantify IHC fluorescence intensity of neuronal targets are often not well described, leaving specific methods and sources of bias unknown. This project's objective was to develop a quantitative image processing method to analyze immunolabeled rat DRG neurons in a rodent model of IVD degeneration. All DRG sections were imaged via confocal microscope, stained for IHC targets, and analyzed using ImageJ. The methods developed in this project were semi-automatic, requiring the manual segmentation of neurons in the image. Additional processing included automatic thresholding algorithms and built-in ImageJ functions. The applied algorithms were qualitatively chosen based on their ability to output results with the least error. The examined neuronal parameters were cell area, maximum cell diameter, percentage of positive antibody staining, and fluorescence intensity. Analysis also included the density of satellite cells. Furthermore, all methods developed in this project output continuously distributed data. In contrast with discrete grading scales often used to assess IHC sections, continuous data can enable the use of more powerful statistical tools and potentially provide more insight. In addition, these methods potentially reduce the sources of bias, with the largest one being the manual segmentation of neurons. These methods are also able to detect neuronal cellular changes in a model of IVD degeneration between treatment groups at 20 weeks post-surgery.