

Using machine learning to segment and quantify the neuropil space in the brain of the North American beaver (*Castor canadensis*)

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The North American beaver (*Castor canadensis*) is a large rodent species native to North America. Like most rodents, beavers have smooth (lissencephalic) brains however, this external organizational simplicity is contradicted by their apparent behavioral complexity (e.g., dam building), raising the question as to how beavers can perform these complex tasks with such diminutive brain organization. To address this question and develop an approach which could be readily acquire cell profiles in this understudied species, we surveyed the neuropil space (a proxy for cortical connectivity) using a combination of design based stereological sampling and machine learning. A sub sample consisting of image stacks of the frontal and visual cortex of the beaver brain were manually labelled and four models were developed and trained using varying sampling parameters. The resulting output from each model was then visually compared for accuracy to select the most optimal model for use. The results of this pilot study are discussed in consideration of the feasibility, accuracy, and challenges to ongoing analysis of the beaver cortical surface.