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Automatic Detection of Neurons in Large Cortical Slices

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ABSTRACT OF THE TALK

The analysis of neuron distribution inside the cerebral cortex is getting more and more attention. It allows assessing, for instance, age-related and pathological decay and preferential connections; moreover, it complements well studies on functional morphology aimed to discovering information coding in neuron assemblies. A large obstacle to these studies is the huge amount of time required by an operator to manually mark the single neurons. We present here an innovative solution for automatize the entire process: starting from a set of tile images of a given cortical slice, the system stitches all the tiles together, identifies the grey areas and cover them with a mesh. Neurons are automatically identified and their local distribution determined. Key element of the method is a reliable neuron identification algorithm based on a novel multilayer shape analysis of the blobs identified in the tiles images. This allows identifying on average 87±6% of the total neurons in the slice, with a false positive ratio of 14±9%, in a relatively short processing time. The

algorithm was tested on Nissl-stained cortical slices of the BA4 Human area, 10□m thick, acquired as a meander of tiles (≈3,000 images for a slice of medium size) at 40x magnification, which gives a resolution of 0.264 micron/pixel. Preliminary results on cortical lamination of Human BA4 area are reported. This method is the first automated algorithm for the analysis of a large high-resolution cortical slice.