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Neurovascular Network Explorer 2.0: a database of 2-photon single-vessel diameter measurements in response to optogenetic stimulation of inhibitory neurons

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Abstract:
Sharing of experimental data is of critical importance in neuroscience allowing a close inspection by the research community and facilitating the use of experimental data for modeling. However, with a few exceptions, data from individual studies conducted by regular size neuroscience labs are not shared. Previously, we provided an example of seamless and low-cost solution for sharing of such data. Specifically, we created a MATLAB® based Graphical User Interface (GUI) engine called Neurovascular Network Explorer 1.0 (NNE 1.0) to interact with a database of 2-photon measurements of sensory stimulus-induced diameter changes of rat cortical arterioles in vivo [1]. NNE 1.0 and the associated database can be downloaded from http://nil.ucsd.edu/index.php?menu=data and then runs either as a MATLAB script or as a standalone program on a Windows platform. The GUI allows browsing the database according to parameters specified by the user, simple manipulation and visualization of the retrieved records (such as averaging and peak-normalization), and export of the results.

Further, we provided NNE 1.0 source code. With this source code, the user can database their own experimental results, given the appropriate data structure and naming conventions, and thus share their data in a user-friendly format with other investigators. Here, we present a second generation of this sharing engine called Neurovascular Network Explorer 2.0 (NNE 2.0). In addition to all previous functionalities, NNE 2.0 provides 3D structural vascular data and supports localization of individual measurements within the vascular network. NNE 2.0 operates on two independent databases from the mouse primary sensory cortex. The first one is analogous to that associated with NNE 1.0 and contains sensory stimulus-induced arteriolar diameter changes. The other one contains arteriolar diameter changes in response to selective optogenetic activation of cortical inhibitory neurons. The experimental data corresponding to these databases have been presented previously in the abstract form [2,3]. The new feature of the structural images may be utilized by the user for computational reconstruction of the microvascular network. Such reconstructions can provide a realistic foundation for bottom-up modeling of the vascular/hemodynamic responses, which are important for understanding cerebral blood flow regulation and physiological underpinning of functional Magnetic Resonance Imaging signals [4]. [1] Sridhar et al., Front. Neuroinform. 2014 May 20;8:56. [2] Uhlirova et al., SFN abstr 2014, 352.10 [3] Tian et al., SFN abstr 2014, 352.11 [4] Gagnon et al., J. Neurosci. 2015 Feb 25;35(8):3663-75.
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