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H025 - BrainTrawler: A Web-Based Visual Analytics Framework for Big Brain Network Data in their Spatial Context

Florian Ganglberger[1], Emre Tosun[1], Lisa Frauenstein[1], Nicolas Swoboda[1], Joanna Kaczanowska[2], Wulf Haubensak[2], Katja Bühler[1]
[1]VRVis Research Center, Biomedical Visualization, Vienna, Austria
[2]Institute of Molecular Pathology, Vienna Biocenter, Vienna, Austria

Recent advances in neuroimaging allowed big brain initiatives and consortia to create vast resources of brain data that can be used by researchers for their own projects. Understanding the relationship between genes, structure, and behavior is one of the driving questions of neurocircuit research. This requires fusion of spatial data at varying resolutions such as whole brain gene expressions, structural and functional connectivities, as well as non-spatial data like gene lists related to behavior. Current analytical workflows in neuroscience involve time-consuming manual aggregation of the data and only sparsely incorporate spatial context to operate continuously on different scales.
We propose a web-based framework to explore heterogeneous neurobiological data in an integrated visual analytics workflow. This allows experts to embed and explore their own experimental data in the context of public data resources, without resource heavy local computation. On-demand queries on volumetric gene expression and connectivity data enable an interactive dissection of networks, with billions of edges, in real-time, and based on their spatial context. Relating data to the hierarchical organization of common anatomical atlases allows experts to compare multimodal networks on different scales. Additionally, 3D visualizations have been optimized to accommodate domain experts' needs for publishable network figures.
We demonstrate the relevance of our approach for neuroscience by exploring fear and anxiety-related functional neuroanatomy in the mouse and cross species comparisons to human (cf. Poster by Griessner et al.).