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Unified Descriptions and Depictions of Network Connectivity

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Computational neuroscientists have not yet agreed on a common way to describe high-level connectivity patterns in neuronal network models. Furthermore, different studies use different symbols to represent connectivity in network diagrams. This diversity of connectivity descriptions and depictions makes it more difficult to understand and reproduce modeling results. This issue is compounded by the fact that certain aspects of the connectivity that would be necessary for its unambiguous interpretation, such as whether self-connections are allowed, are sometimes omitted from descriptions. A review of published models from the databases ModelDB [1] and Open Source Brain [2] reveals that, despite models mostly still having simple connectivity, ambiguities in their description and depiction are not uncommon. From the use of connectivity in existing models, along with a review of simulation software (e.g., NEST [3]) and specification languages (e.g., CSA [4]), we derive a set of connectivity concepts for which we propose unified terminology with precise mathematical meanings [5]. We further propose a graphical notation to represent connectivity in network diagrams. These standardized descriptions and depictions enable modelers to specify connectivity concisely and unambiguously. Moreover, the derived concepts may serve to guide the implementation and naming of high-level connection routines in simulators like NEST.

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Topic area

models and applications

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