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NineML – a description language for spiking neuron network modeling: the user layer

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With an increasing number of studies related to large-scale neuronal network modeling, the International Neuroinformatics Coordinating Facility (INCF) has identified a need for standards and guidelines to ease model sharing and facilitate the replication of results across different simulators. To create such standards, the INCF formed a program on Multiscale Modeling with a goal to develop a common standardized description language for neuronal network models. The first version of the proposed standard - the Network Interchange for Neuroscience Modeling Language (NineML) - is designed for the description of large networks of spiking neurons. NineML consists of two layers: an *abstraction layer* that provides the core concepts, mathematics and syntax with which model variables and state update rules are explicitly described and a *user layer* that provides syntax to specify the instantiation and parameterization of a network model in biological terms.

Here we describe the details of the user layer from the first draft proposal of NineML. The user layer provides the syntax for specifying the model and parameters to be used to instantiate the key elements of a spiking neuron network. This includes descriptions of individual elements (cells, synapses, inputs) and the constructs for describing the grouping of these entities into networks. In addition the user layer defines the syntax for specifying a range of connectivity patterns.

The user layer is intended to be primarily machine-readable and uses XML syntax. It is designed with a focus on ease of parsing, verification, and automatic model construction. This does not prevent advanced users from editing the user layer XML descriptions by hand, but the primary means for creation of these descriptions is expected to be software tools that will convert GUI- or script-based representations of objects and properties into valid XML.

NineML aims to provide a tool to explicitly define a spiking neuron network model both conceptually and mathematically in a simulator independent manner. In addition, NineML is designed to be self-consistent and highly flexible, allowing addition of new models and mathematical descriptions without modification of the previous structure and organization of the language. To achieve these goals, the language is being iteratively designed using several representative models with various levels of complexity [1-6] as test cases.

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