

GEMMER: GEnome-wide software for Multi-scale Modeling data Extraction and Representation

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Building multi-scale models of biological processes spanning multiple spatial-temporal-functional scales is currently a challenge in computational biology. A critical step in this process is the identification of biological function and spatial localization of interactions that occur among a set of molecules. Several tools to visualize such interactions exist; however, none of these combine the desired properties of: (i) being specific for budding yeast, (ii) allowing simultaneous filtering, clustering and coloring of molecules that are (iii) based on function, abundance and localization.

Here, we present *GEMMER* (GEnome-wide software for Multi-scale Modeling data Extraction and Representation), a web-based tool that allows to generate a high quality visualization of physical and genetic interactions between proteins/genes in budding yeast. Its novel contribution is to allow for the unification of (i) general and function annotation from *Saccharomyces Genome Database* (SGD), (ii) localization and abundance data from both CYCLOPs and Yeast GFP Fusion Localization databases. The tool allows for the simultaneous visualization of an interaction network with colors, clustering and size varying across functional, abundance and spatial scales. Specifically, nodes in an interaction network may be clustered and colored based on localization data and abundance measurements. Furthermore, interactions may be filtered out based on number of total number of experiments, of unique experimental methods, or of number of publications revealing an interaction.

GEMMER utilizes the JavaScript library D3js, AJAX, JSON and PHP around a core application written in Python. A user-friendly form on the main web page allows user input, e.g. which molecule(s) to center the visualization around and how to filter, cluster and color the interactors. Visualization and export options are in SVG format and Excel. Furthermore, for each interaction, hyperlinks to the experimental evidence in the literature are provided.

The authors aim for *GEMMER* to become a go-to tool for the multi-scale modeling community.

Keywords: Multi-scale modeling, Visualization tool, Localization data