

Analysis of fMRI scenarios using live sequence charts

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In recent years, we have witnessed a deluge of experimental data in the neurosciences, with a remarkable increase in the number of fMRI-related publications. However, integrating the accumulated information into a unifying paradigm is a daunting task, due to the variability and complexity of the experimental setups and the presentation of the results. We take advantage of recent developments in the modeling and analysis of complex computerized systems, specifically the language of live sequence charts (LSC). The language is used for specifying behavior using multi-modal scenarios, allowing the use of experimental scenarios as the basis for behavioral specification. The LSC formalism has been combined with natural language processing (NLP) to allow programming the behavior using structured English. By surveying recent fMRI publications, we have reformulated their results as structured English requirements, which were then 60 automatically transformed into LSCs. The resulting model can be validated and tested for the consistency; it also has the potential of prediction, which would lead to new experiments. More specifically, brain-area activations for each surveyed experimental paradigm were modeled using LSCs. These automatically created a unified area-based model that relates a general experimental design to its corresponding activated brain areas. Self-consistency of the surveyed publications was then possible, with the power to predict which areas will be activated in a novel experiment. This approach will hopefully make it possible to unite numerous data into a comprehensive model.

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