neuRosim: an *R* package for simulation of fMRI magnitude data with realistic noise

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Statistical analysis techniques for highly complex structured data such as fMRI data should be thoroughly validated. In this process, knowing the ground truth is essential. Unfortunately, establishing the ground truth of fMRI data is only possible with highly invasive procedures (i.e. intracranial EEG). Therefore, generating the data artificially is often the only viable solution. However, there is currently no consensus among researchers on how to simulate fMRI data. Research groups develop their own methods and use only in-house software routines. A general validition of these methods is lacking, probably due to the nonexistance of well-documented and freely available software.

In a response to this gap, **neuRosim** is developed to offer a software package for the simulation of fMRI data. The ultimate goal of the package is to create a general standardized platform that contains fMRI simulation methods that are validated. To this end, the package will contain several functions to simulate BOLD activation and fMRI noise.

In the current version, the functionalities of the package are separated in two layers. First, low-level functions are intended for advanced useRs who want in-depth control over their simulated data. With these functions it is possible to build fMRI data consisting of activation and noise while keeping full knowledge of the structure of the data and having the possibility to manipulate several parameters. Second, high-level functions are created to be used in more standard simulation studies. The power of these functions lies in the fact that they allow the useR to generate a full 4D fMRI dataset using only 3 command lines.

During the presentation, we will discuss the current features of **neuRosim** and our plans for coming updates. Using a variety of examples, we will demonstrate the useR-friendliness for first time useRs and how these examples can be extended to more advanced simulations. Finally, we will show the difference between the implemented simulation methods and discuss briefly how the simulated data can be used in other related *R* packages.