# **Everything Matters: The ReproNim Perspective on Reproducible Neuroimaging**

This paper addresses the reproducibility concerns surrounding the re-executabiliy of publications in Neuroimaging, which need to be able to generalize across different observation processes and sample populations. The name of the paper alludes to the fact that every factor in the computational procedure, spanning from the computational environment, tool selection and versions, statistical models, and the characteristics of the studied population can ultimately affect the conclusions reached about a biological process.

The premise is addressed through the proposed ReproNim system, whereby computational studies can be made “reproducible by design”, incorporating machine-readable pipelines, rather than relying on the human-readable descriptions of variable completeness and precision seen in current research. ReproNim deals with cases based around data acquisition from laboratories, rather than data being queried from accessible resources. The paper goes on to describe the current status of the key tools used in ReproNim.

The first tool is ReproIn, which automates the acquisition, preparation, and layout of collected MRI scans in BIDS data structures, alongside a version management system. This wrapper for incoming data ensures the data is ready for local distribution in a scalable and flexible manner, and no information is lost. The BrainVerse tool annotates the workflow of the project (semantic coding, merging, inclusion of new data). The NICEMAN tool manages the computational environments and computation taking place through a specification describing environments across data and software distributions. Environments can be traced, validated, compared, and satisfied. Lastly, NeuroBlast allows to search, share and discover matching and similar studies based on tasks, analyses, and activation patterns in data.

The results section shows some use cases illusrating the “ReproNim vision”. One case is the FreeSurfer pipeline dataset having excellent inter-version commonality with the ABIDE dataset, but showing substantial differences from the ANTs pipeline analysis on the same dataset. Another case shows that old studies may not generalize to new ones (which use more samples and newer technology) in studies relating gender to hippocampal volume over time. The last case defines a procedure to “*unambiguously define the data, workflow, execution environment and results of a neuroimaging analysis, in order to generate a verifiably re-executable publication.*”

This paper relates to the topics discussed in the meeting as it presents the building blocks of a pipeline which ensures the reproduceability of studies in Neuroimaging. ReproNim could feasibly be fashioned into an automated system where formatted code and data is submitted and checked for reproduceability and consistency amongst other studies. It could be extended to compare similar datasets to ensure the data collected displays similar characteristics and trends to existing literature and resources.

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