

Module 16:

Group-level Analysis I

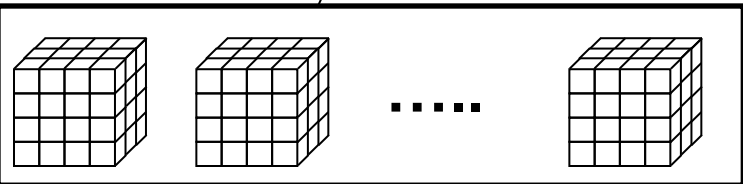
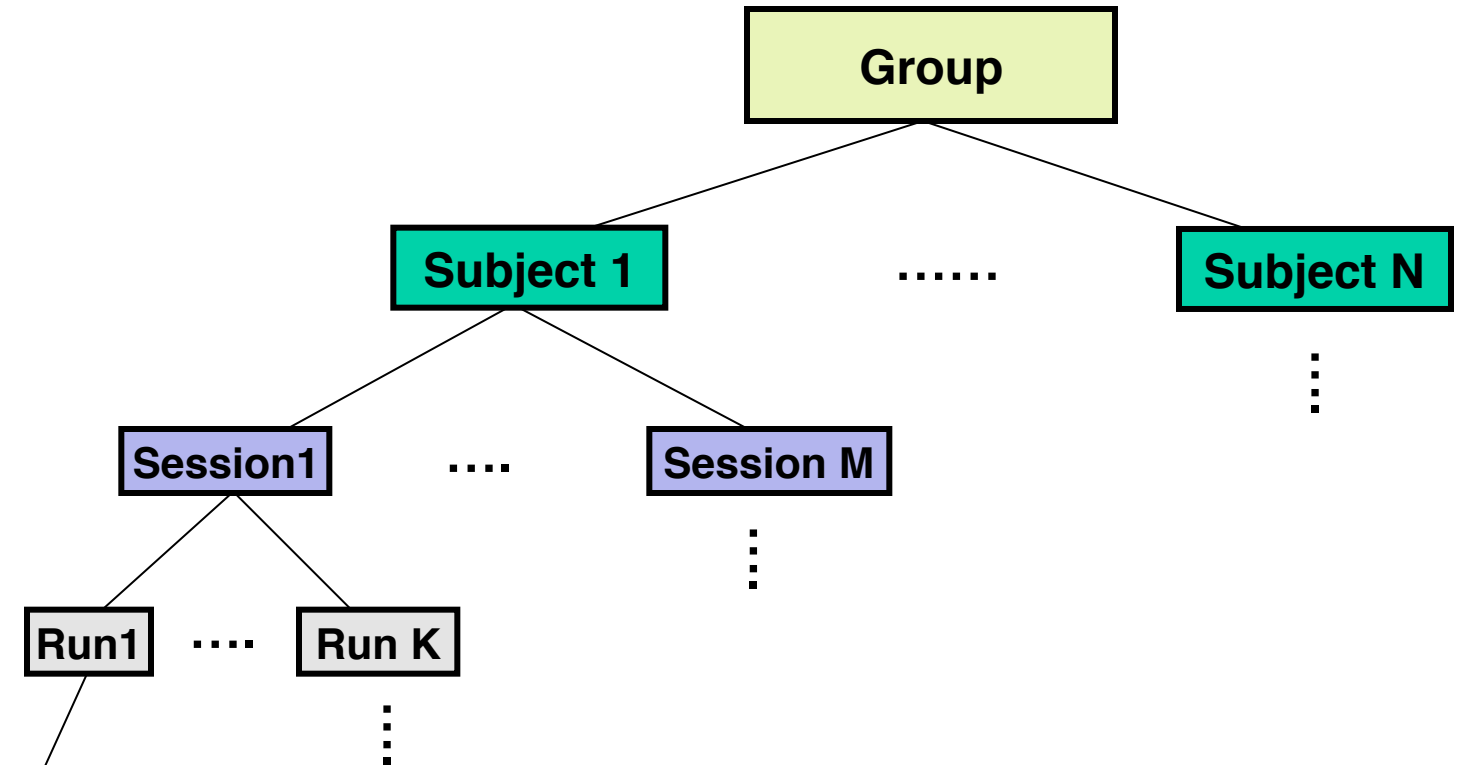
Multi-level Analysis

- fMRI experiments are often repeated for:
 - Several runs in the same session;
 - Several sessions on the same subject;
 - Several subjects drawn from a population.

Motivation

- Multi session/subject experiments may:
 - Increase the **sensitivity** of the overall experiment (more data is available);
 - Allow you to determine whether the observed effects are common and stable **across**, or **between**, groups;
 - Allow for **generalization** of your conclusions to the whole population of subjects.
- This data is hierarchical in nature, with lower-level observations nested within higher levels.

Hierarchical Structure



Multi-level Models

- **Multi-level models** have been specifically developed for analyzing hierarchically structured data.
- They allow different variance components to be introduced at each level (e.g. within-subject and between-subject variance).
- They provide a framework for performing **mixed-effects** analysis.

Types of Analysis

- In fMRI data analysis we often discriminate between **fixed-effects analysis** and **mixed effects analysis**.
- These analysis differ in the type of assumptions they make and which types of conclusions they provide.

Types of Analysis

- Fixed-effects analysis
 - The true response magnitude is fixed in all subjects.
 - The only source of variation is due to measurement error.
 - Significance based on estimated response relative to measurement error variance.
 - We are only interested in making conclusions about the subjects currently being studied.

Types of Analysis

- Mixed-effects analysis
 - The subject-level effects are random variables.
 - There are two sources of variation, one due to measurement error and the other due to differences in response magnitude between subjects.
 - Significance based on estimated response relative to both sources of variance.
 - The results are generalizable to a population of subjects.

Comments

- **Fixed effects models** show the effects seen in a particular set of subjects, i.e. case studies.
- **Mixed effects models** imply that sampling a new group of subjects from the same population would give similar results.
- Mixed effects models tend to be more interesting, but are also more conservative.

End of Module



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