Facilitating neuroimaging marker discovery and validation: The predictive mapping approach

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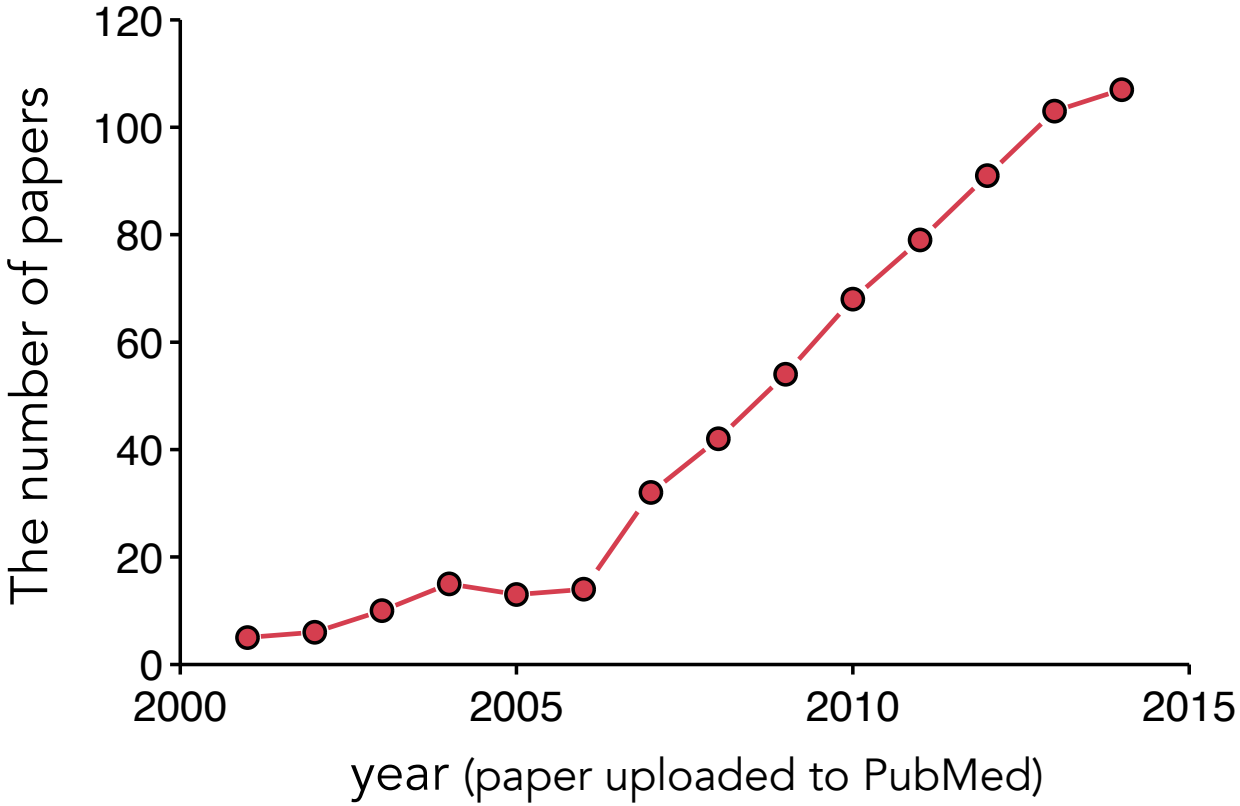
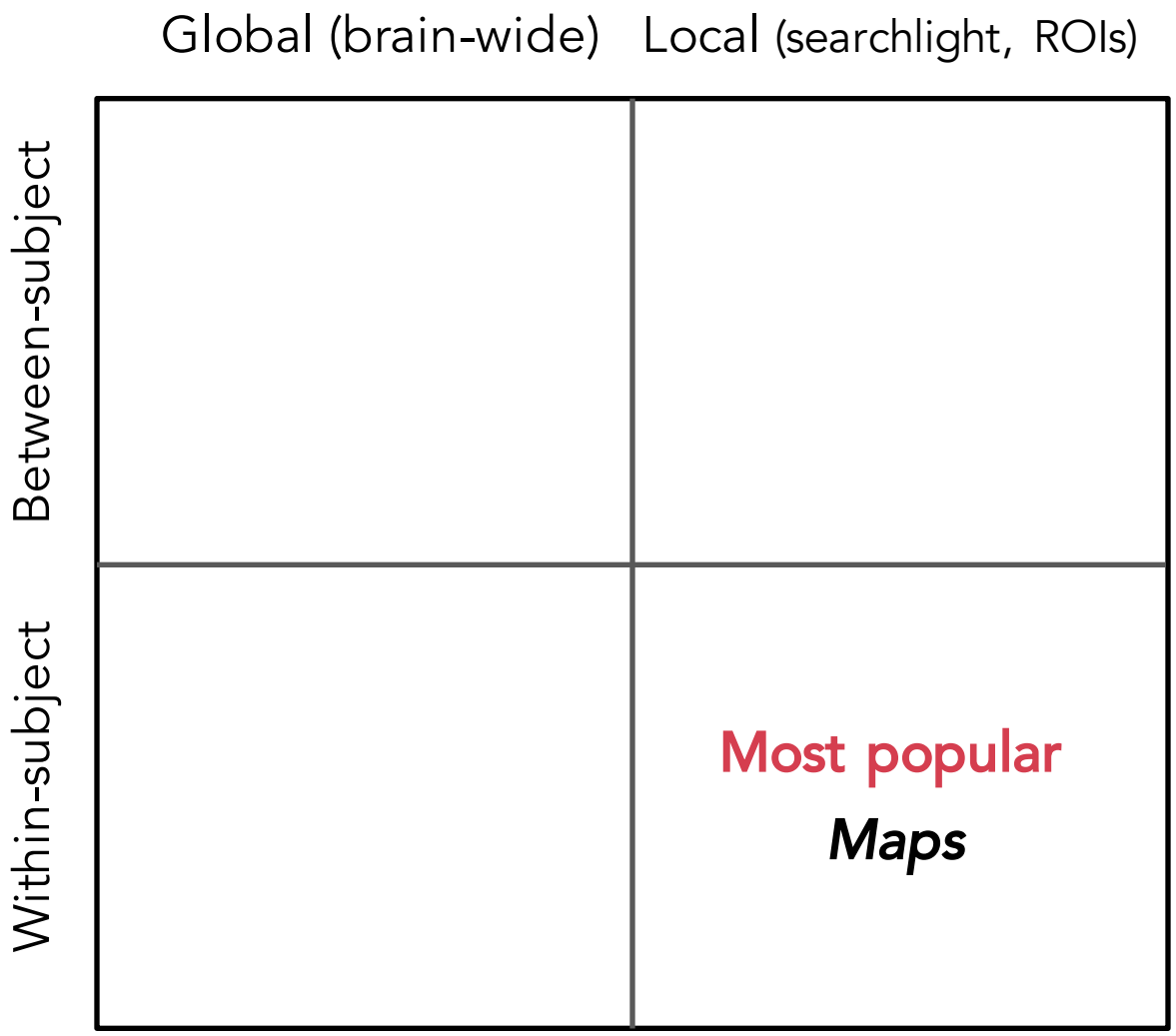
Multivariate pattern analysis (MVPA) has become very popular!

- PubMed search: (multivariate pattern analysis) AND (fMRI)



There are different MVPA approaches



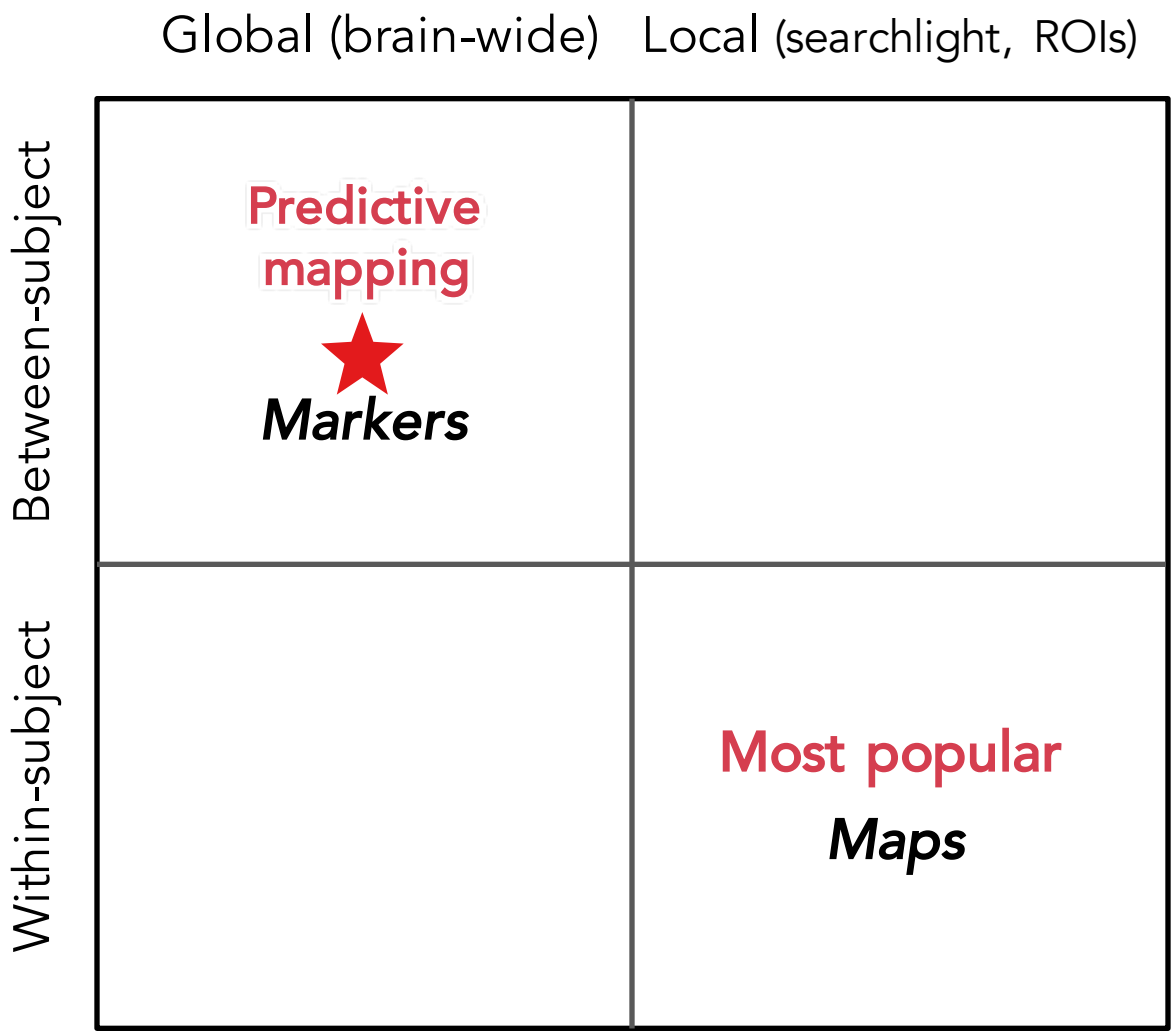
studies

	G	L
B	29	6
W	12	83

Figure 3

"Identifying anatomical regions associated with particular mental processes"

There are different MVPA approaches



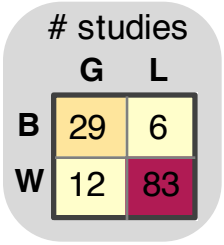
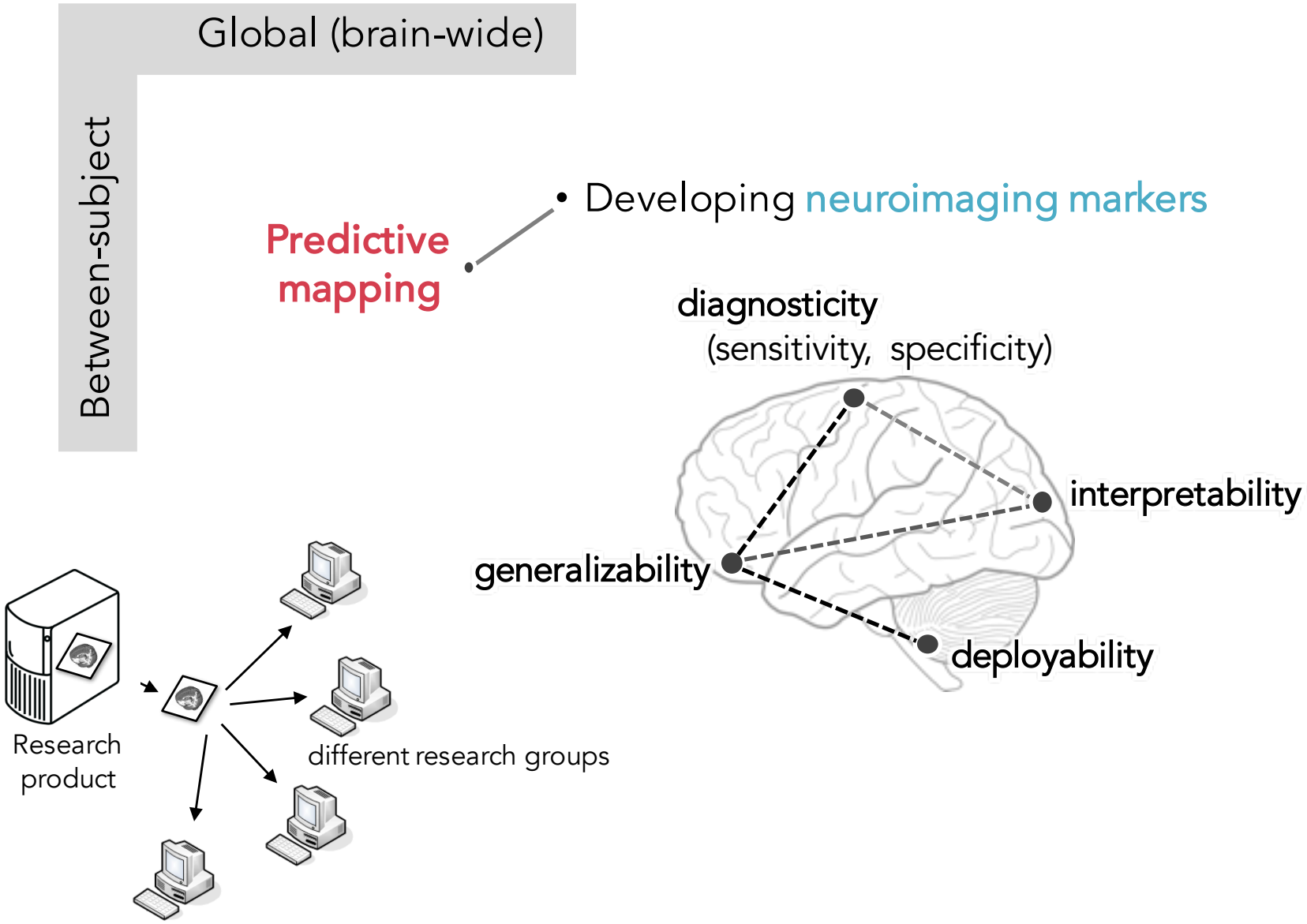


Figure 3

"Identifying multivariate patterns of brain activity optimized to be predictive of, and sensitive and specific to, a particular type of mental process"

There are different MVPA approaches



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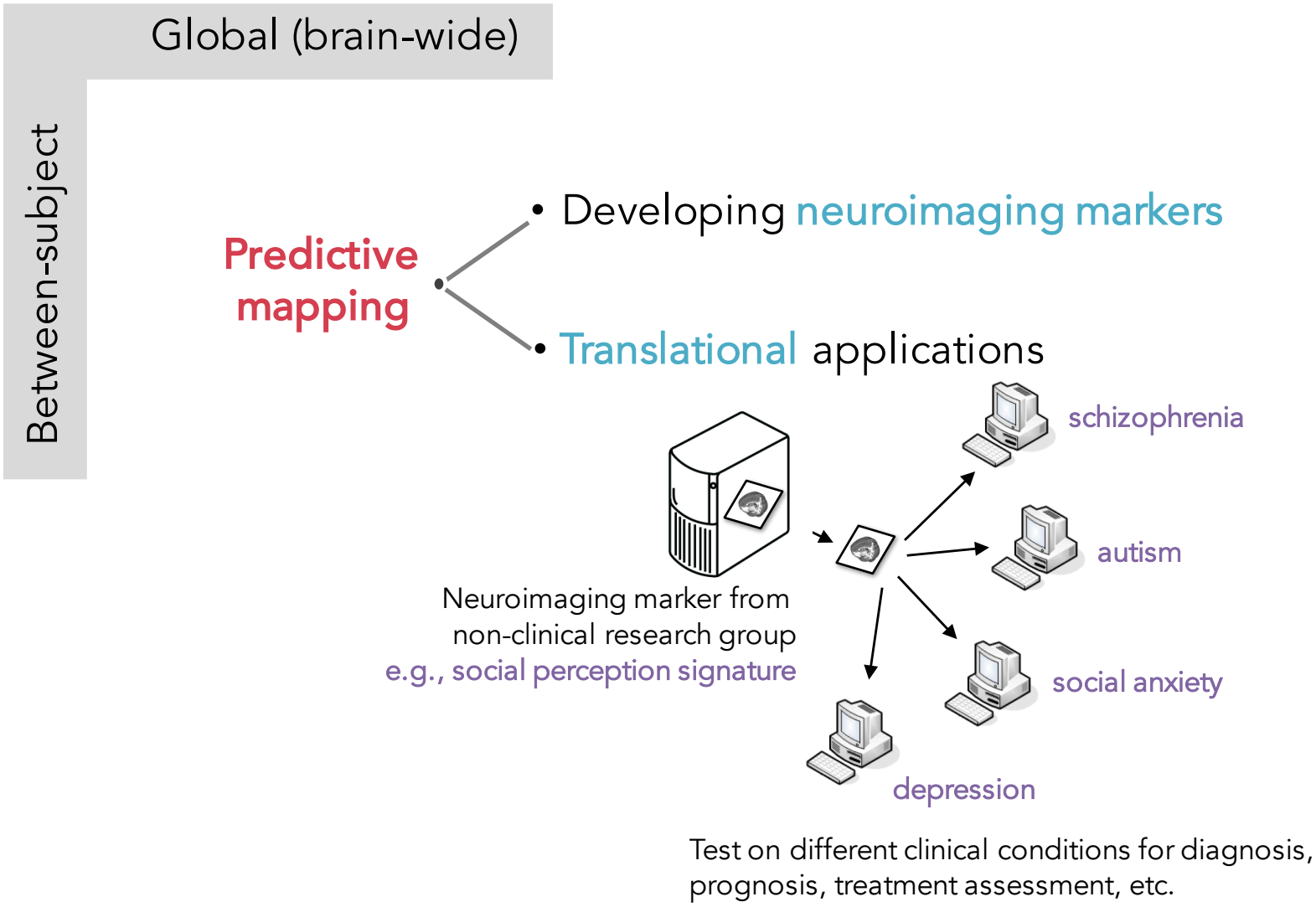
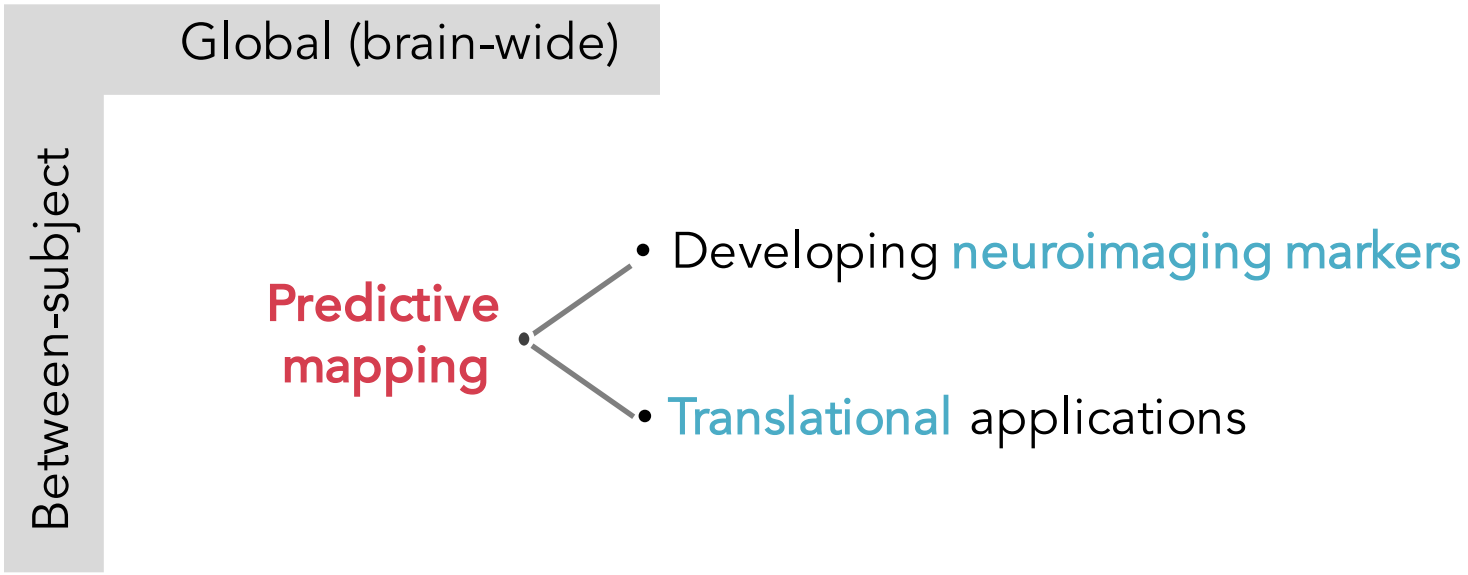
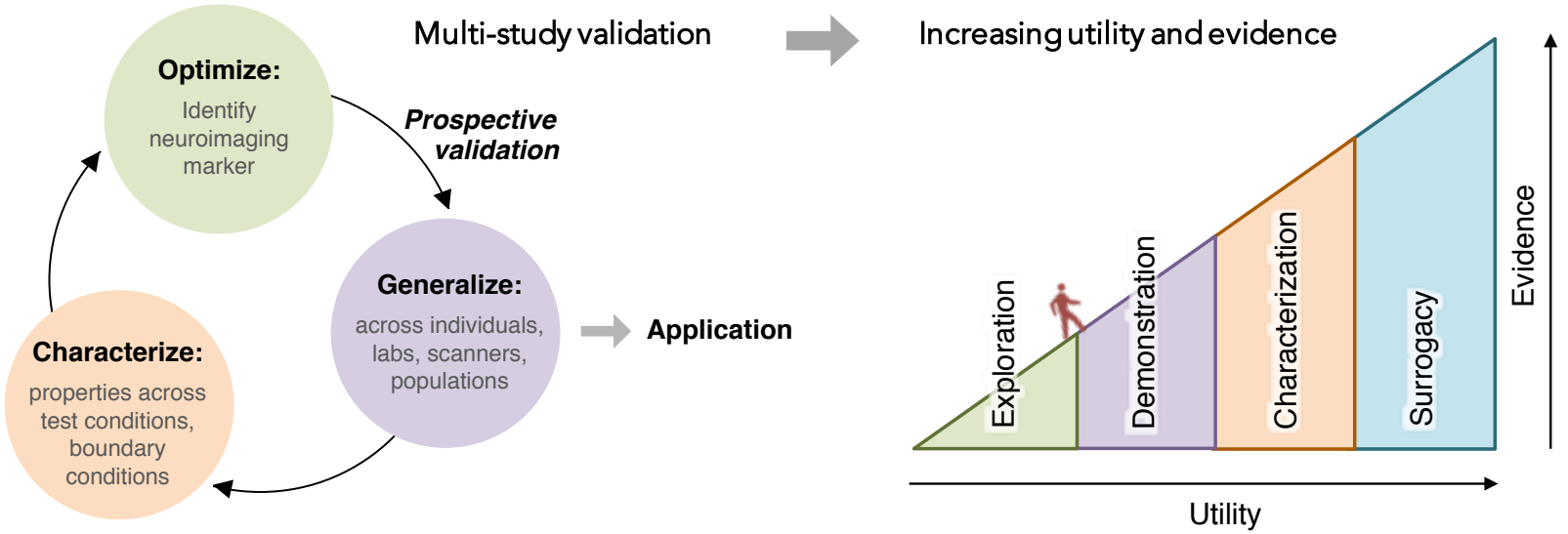


Multi-study validation of neuroimaging markers





Review paper summary

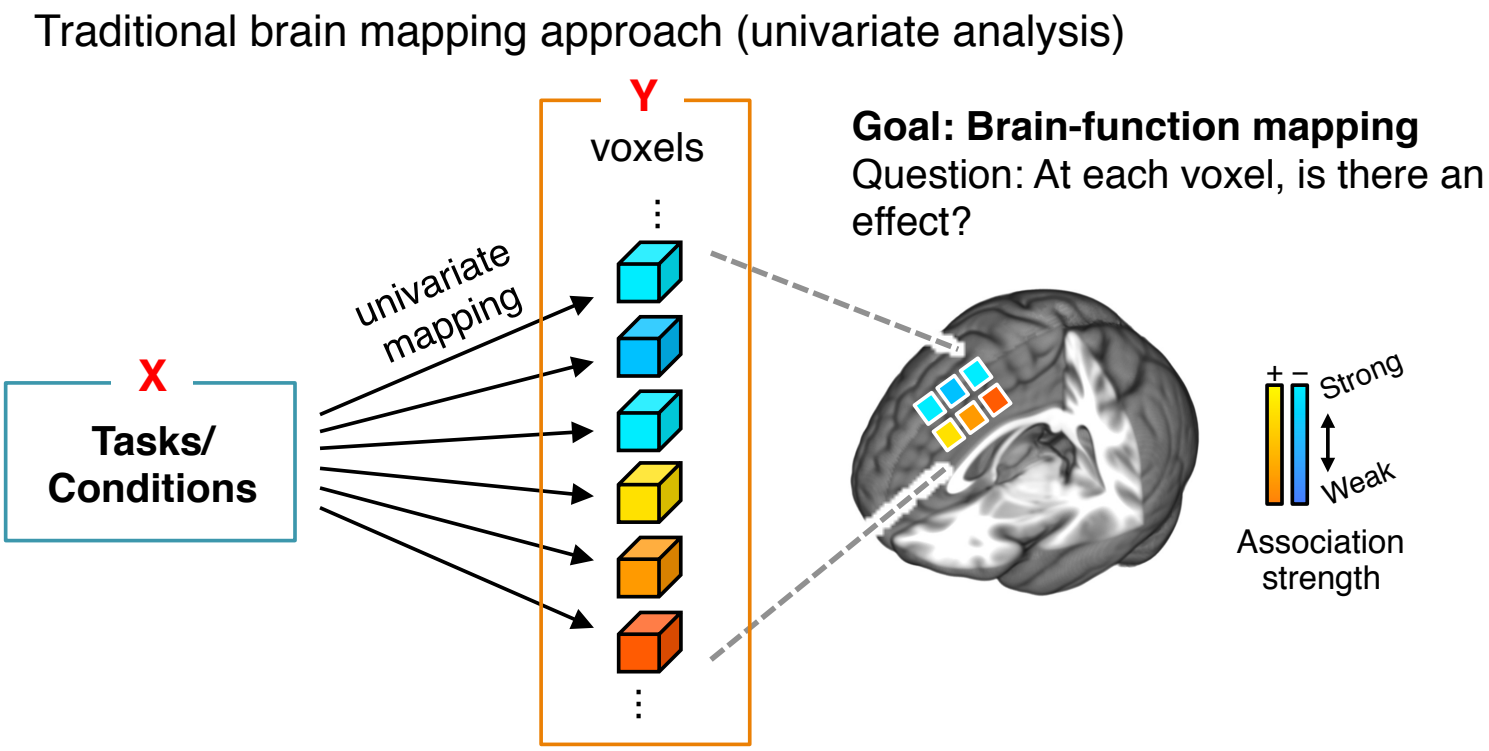
- Introduced the predictive mapping approach (basic concepts)

  Predictive mapping: a type of multivariate pattern analysis (MVPA) combined with experimental designs optimized for marker development

  It aims to develop multivariate, system-level predictive models that are sensitive and specific to particular outcomes of interest and can be prospective tested on new individuals and new study samples.

Review paper summary

- Introduced the predictive mapping approach (basic concepts)
- by contrasting it to traditional mapping (univariate analysis) and information-based mapping



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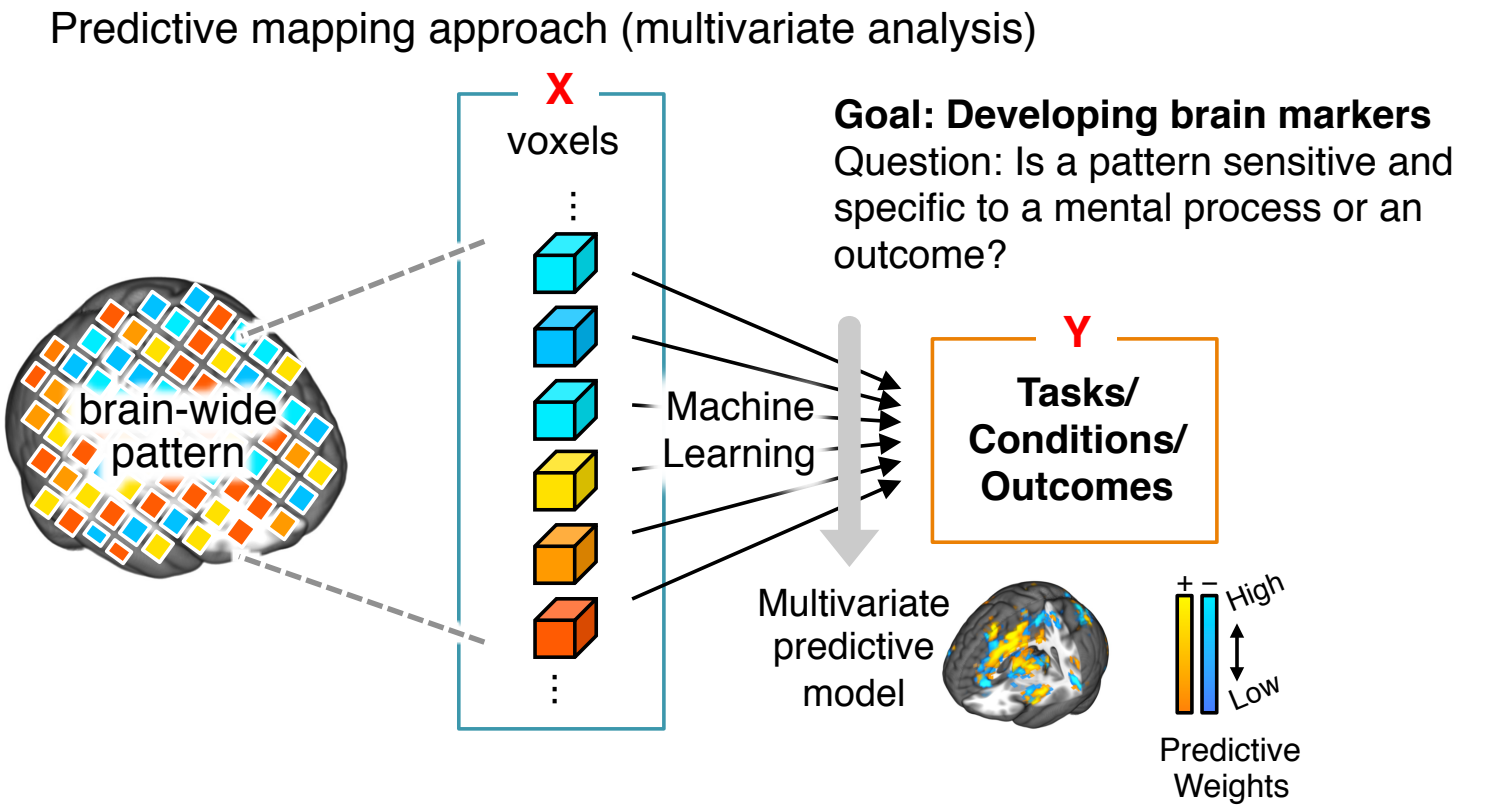

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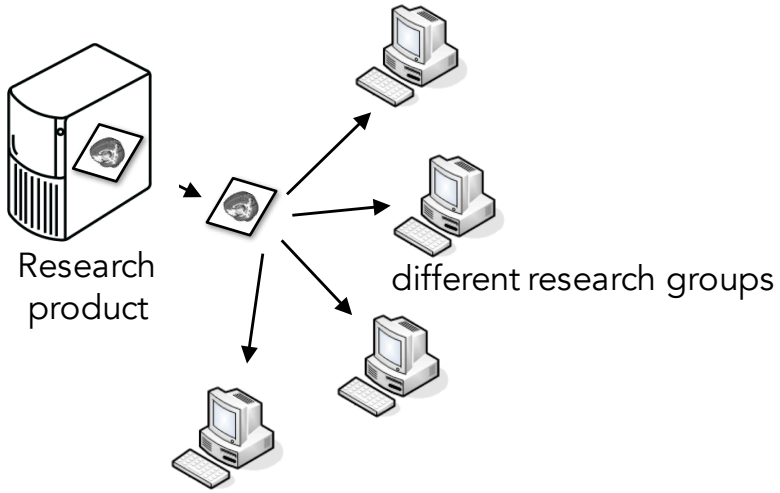

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- Suggested a set of evaluation criteria for neuroimaging markers for its validation

Development Stages	Criteria	Definition	Test setting
Discovery	1 Diagnosticity	Sensitivity: positive results when a target psychological or behavioral process is engaged	Positive control
		Specificity: positive results exclusively when the target process is engaged	Negative control
	2 Interpretability	Neuroscientifically interpretable model	Neuroscience literature, meta-analysis, animal models, lesion studies
Validation	3 Deployability	Easy to apply the marker across different research groups and clinics	Well-specified predictive model, simple and standardized testing procedure
	4 Generalizability	Generalizable across different laboratories, scanners, populations, and variants of testing conditions	New test studies (with multi-study, multi-site efforts)

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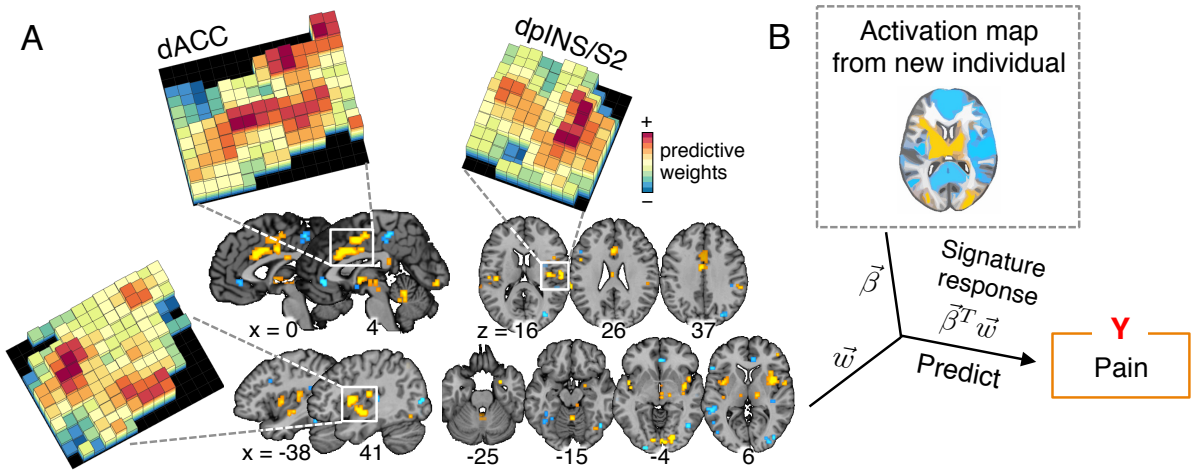
- Provided an exemplar of a neuroimaging marker using the Neurologic Pain Signature

Figure 7



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- Provided an exemplar of a neuroimaging marker using the Neurologic Pain Signature
- Presented literature survey results and discussed broader implications and recommendations