A very short introduction to multivariate pattern analysis (MVPA) for neuroscience

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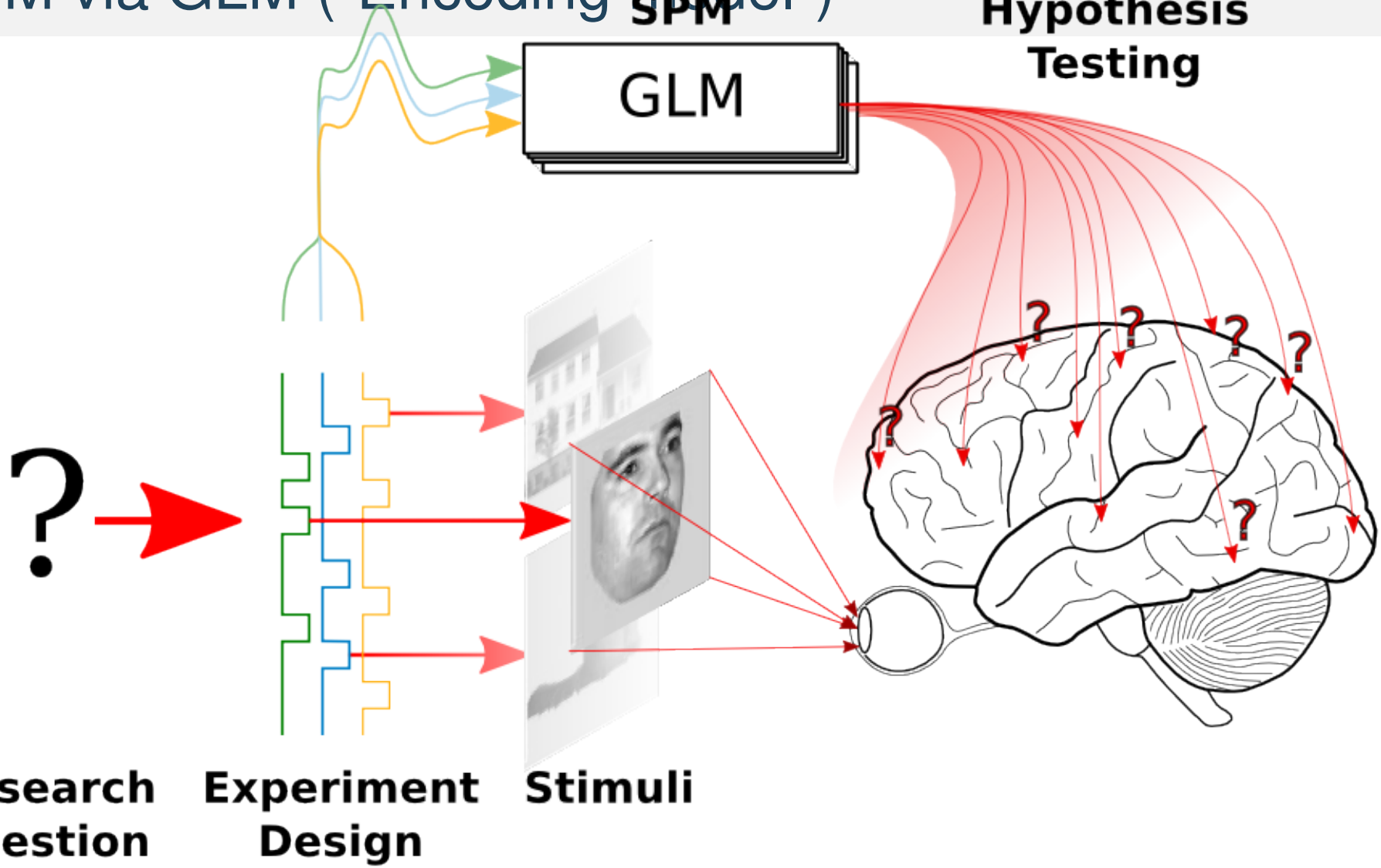
SPM via GLM ("Encoding model")



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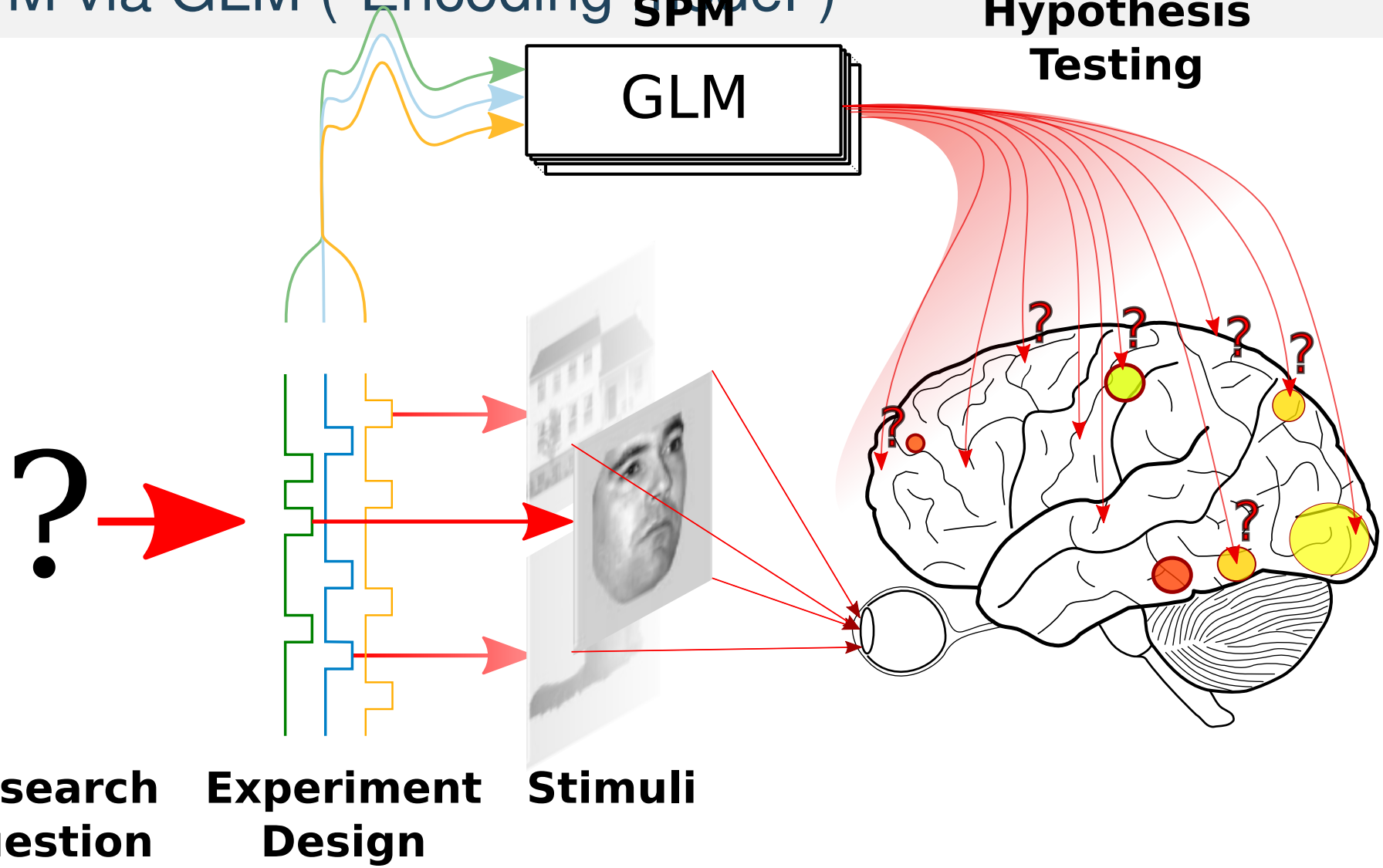

$p(\text{brain activity}|\text{behavior})$

That's not enough

Eric Kandel in *Principles of Neuroscience*

"The task of neural science is to explain behavior in terms of the activities of the brain."

$$p(\text{brain activity}|\text{behavior}) \neq p(\text{behavior}|\text{brain activity})$$

Approach: Meta analysis and Bayes' theorem

neurosynth.org *beta*

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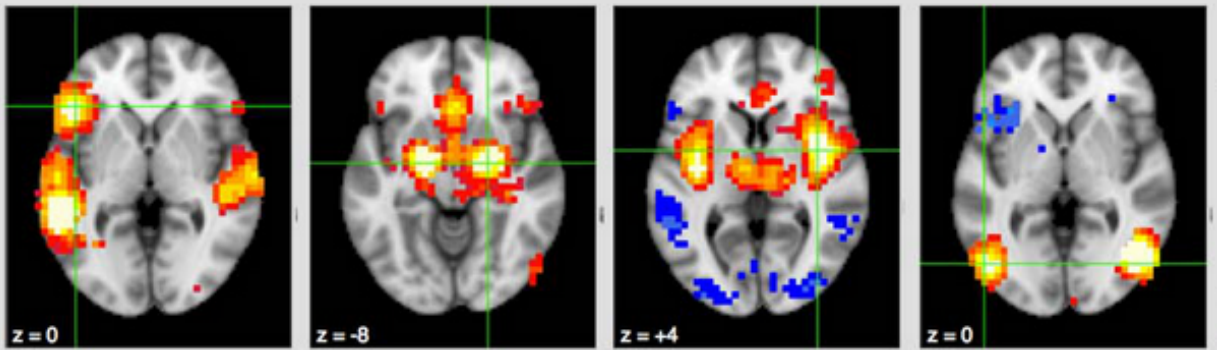
NeuroSynth is a platform for large-scale, automated synthesis of functional magnetic resonance imaging (fMRI) data extracted from published articles.

Our goal is to turn this:

Into this:

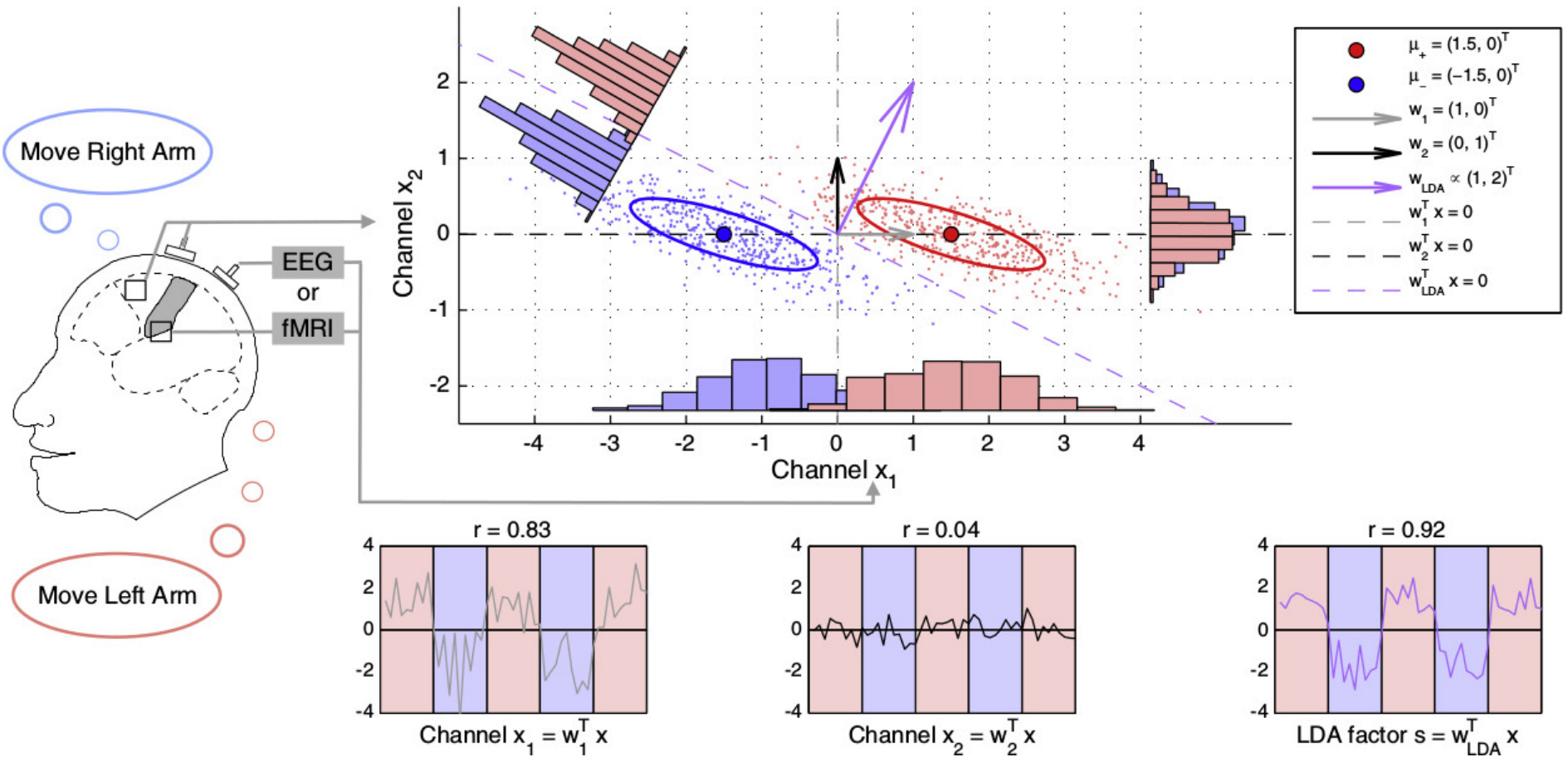


Database contents

2,047 terms
4,393 studies
147,493 activations

Yarkoni et al., Nature Methods, 2011; http://neurosynth.org

Why multivariate methods?



Haufe et al., 2014, NeuroImage

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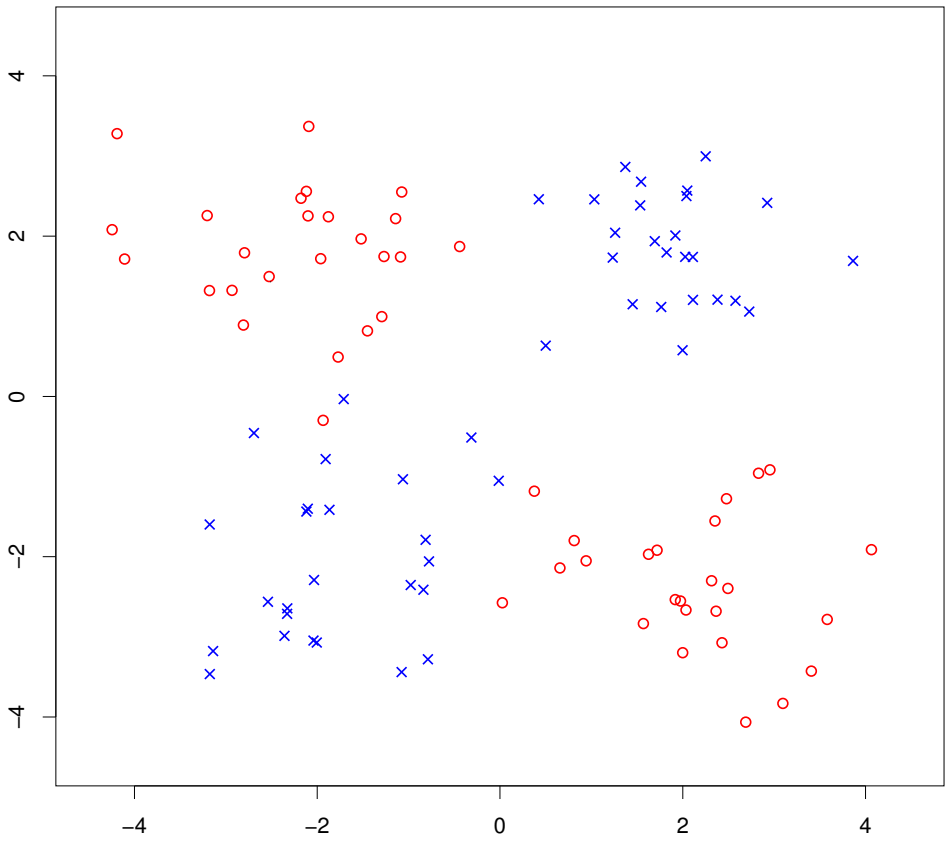

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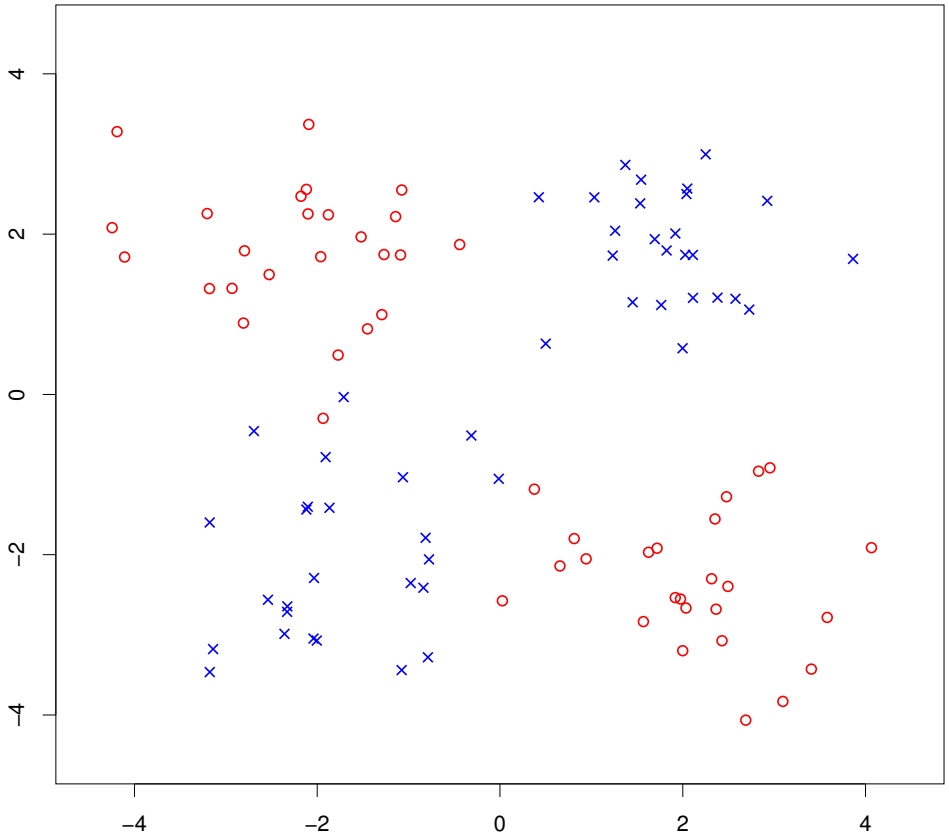
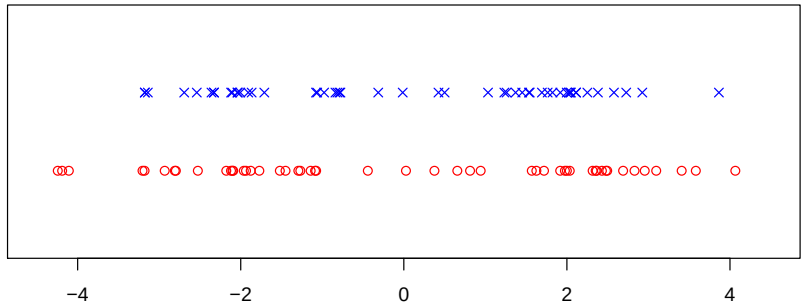
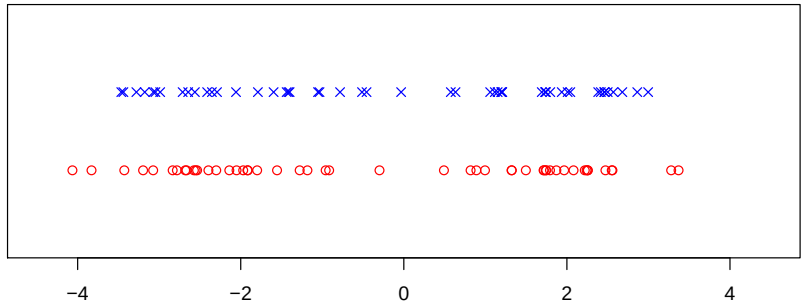
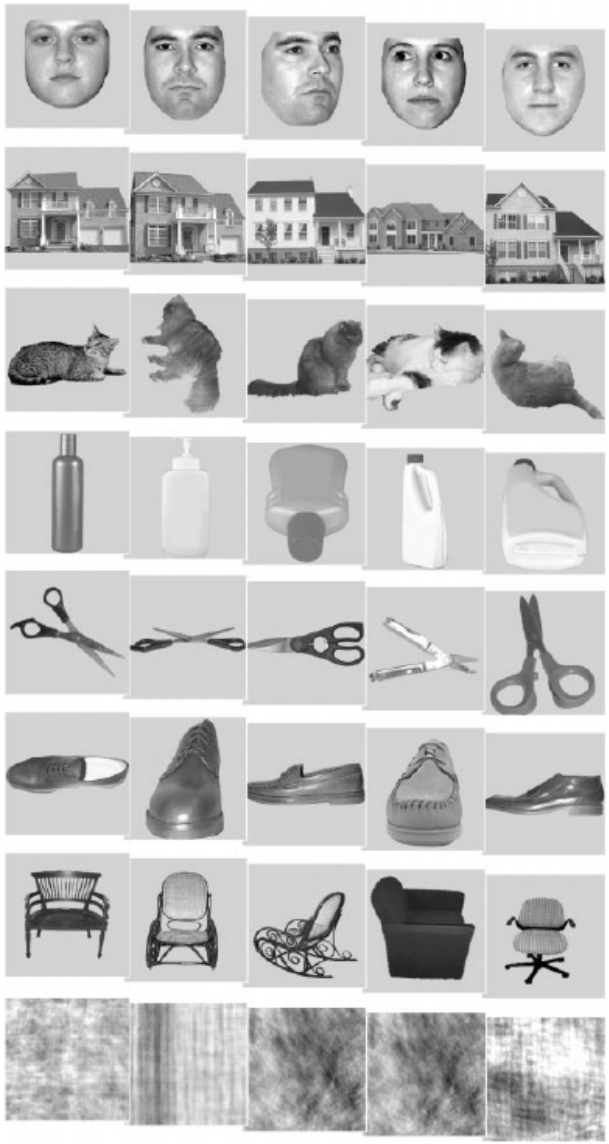
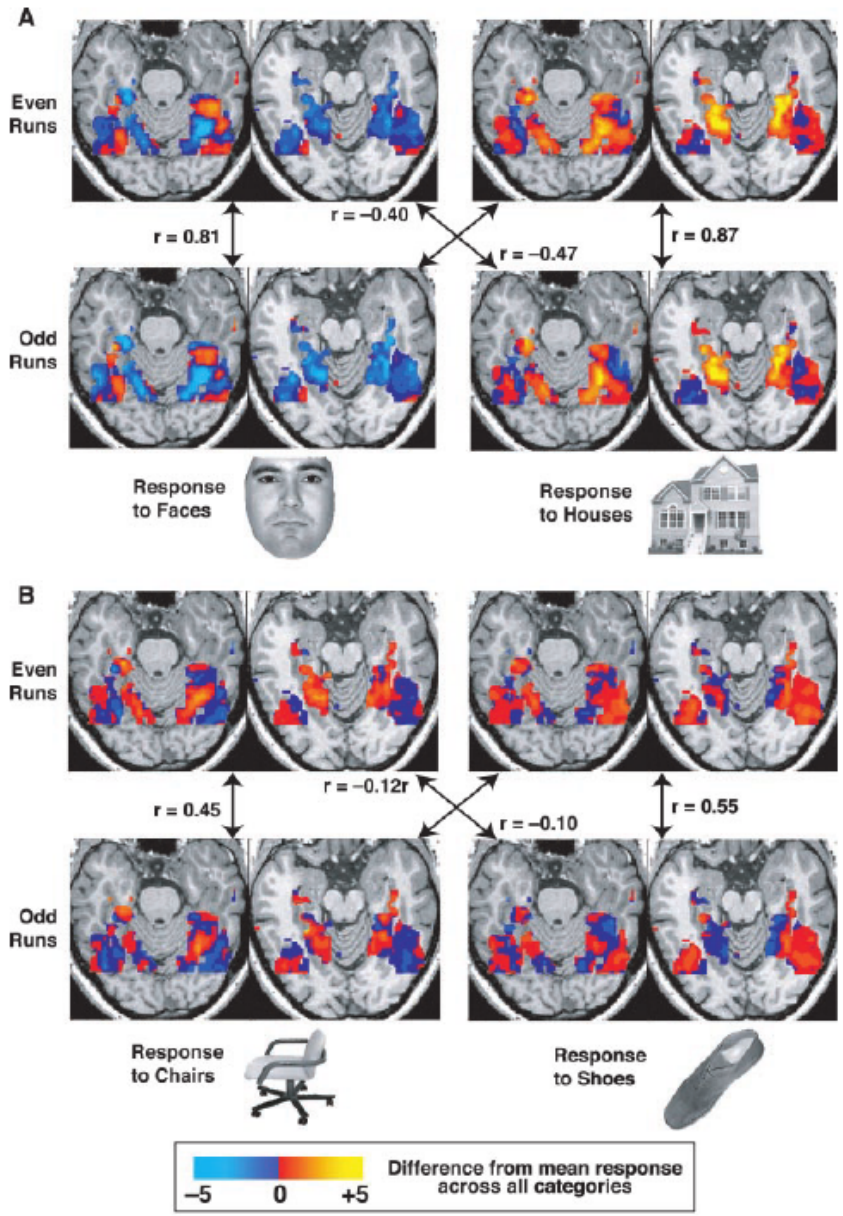






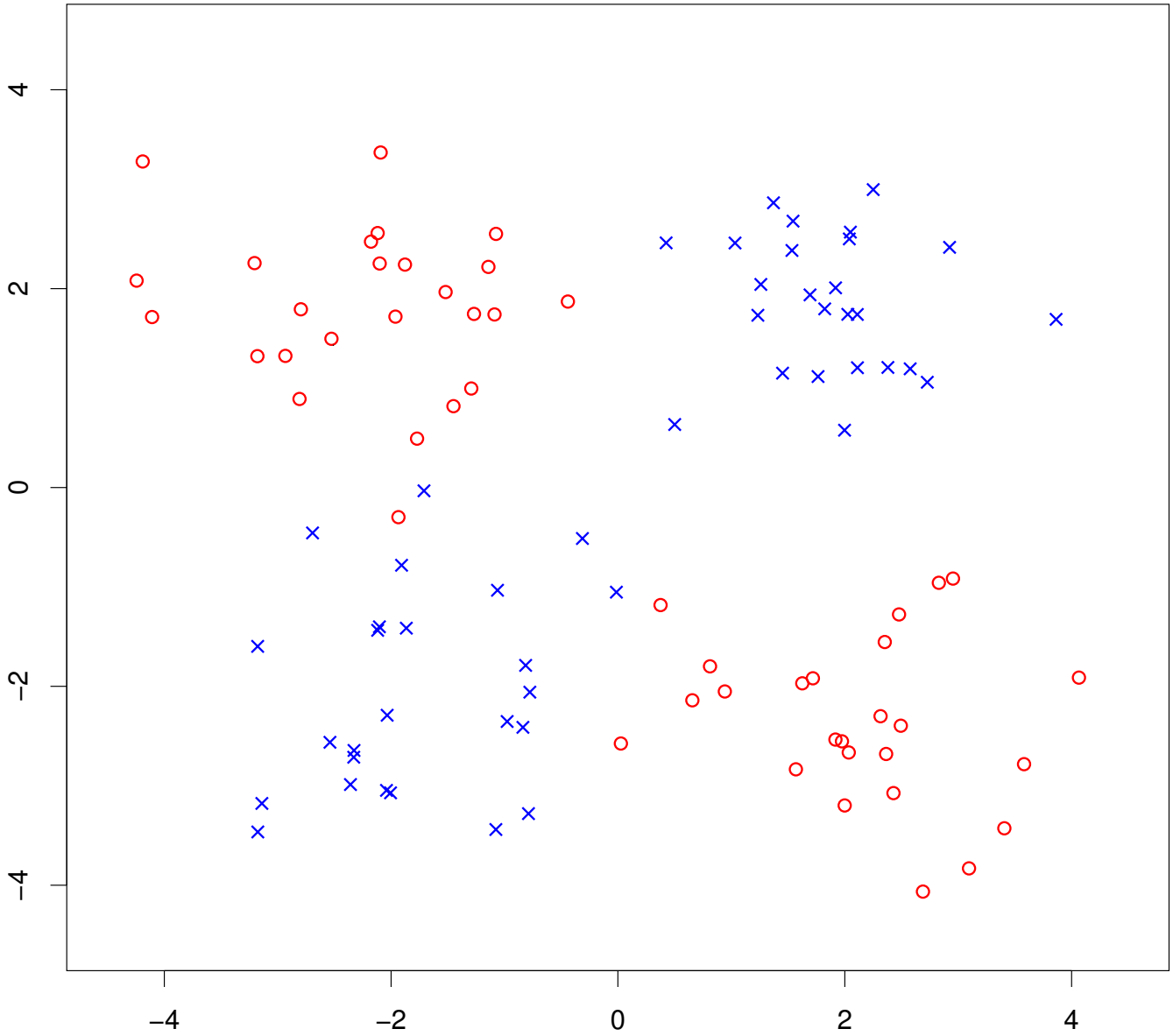
Pioneering work: visual objects





Haxby et al., Science, 2001

k-Nearest Neighbours



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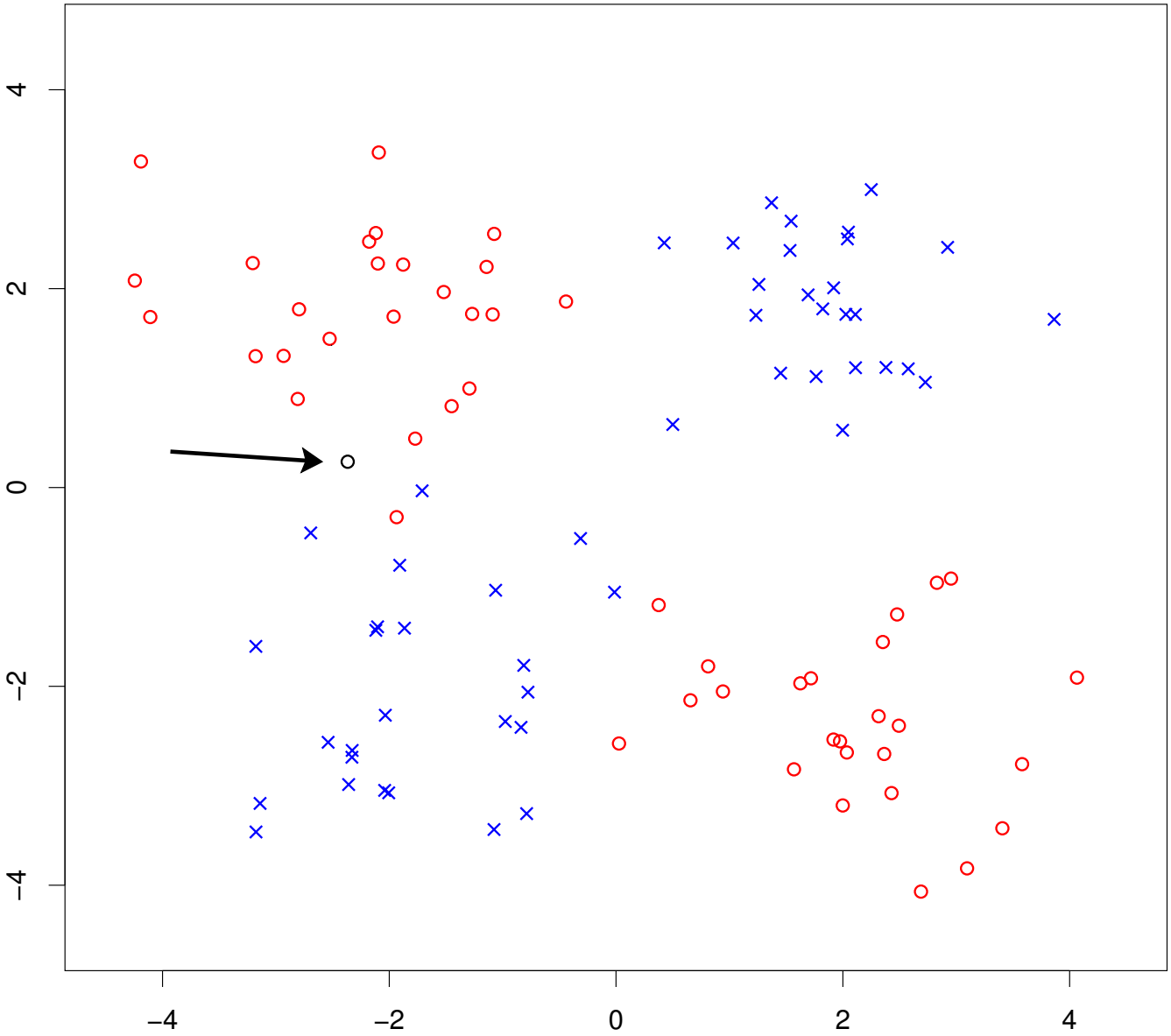

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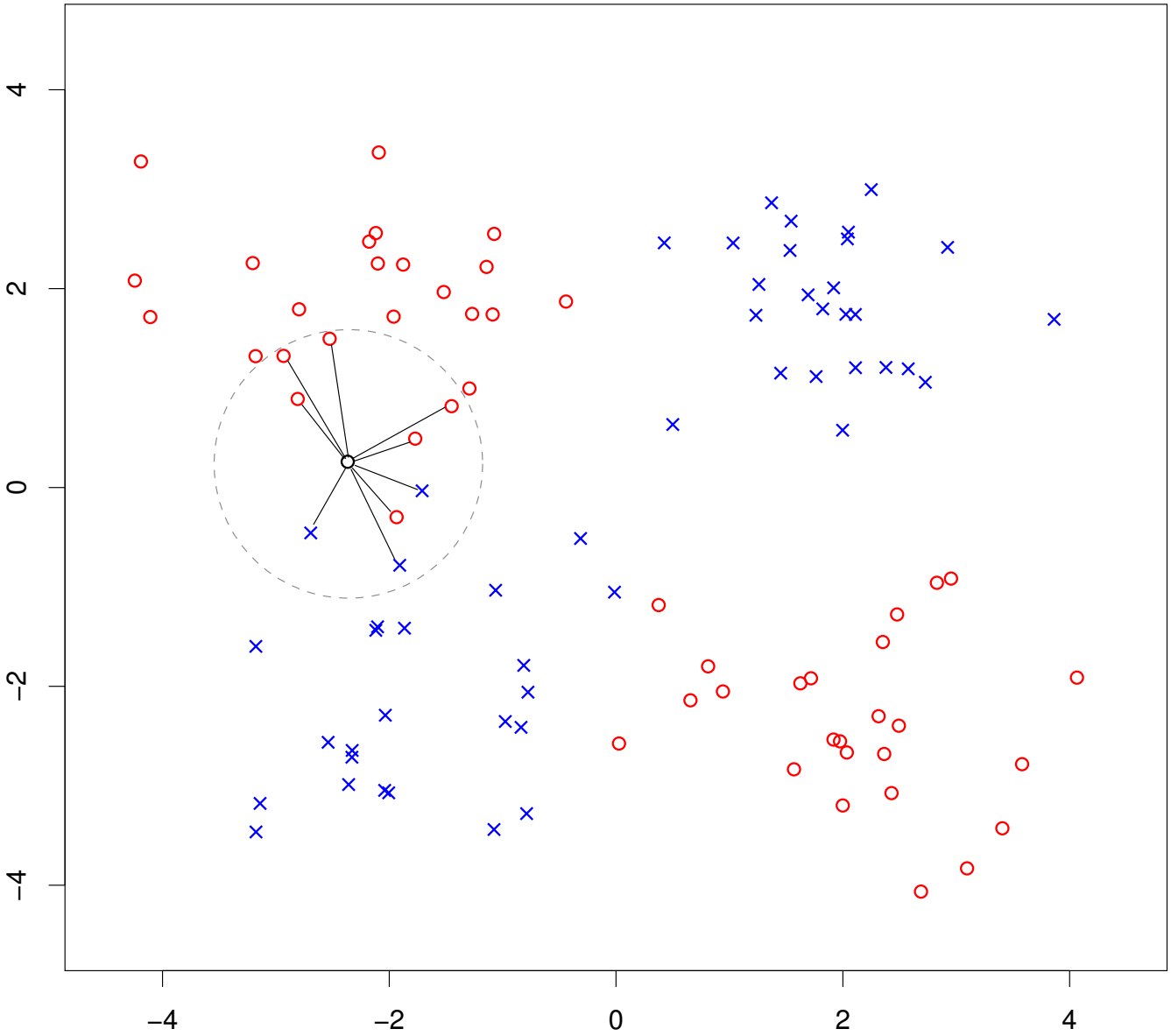

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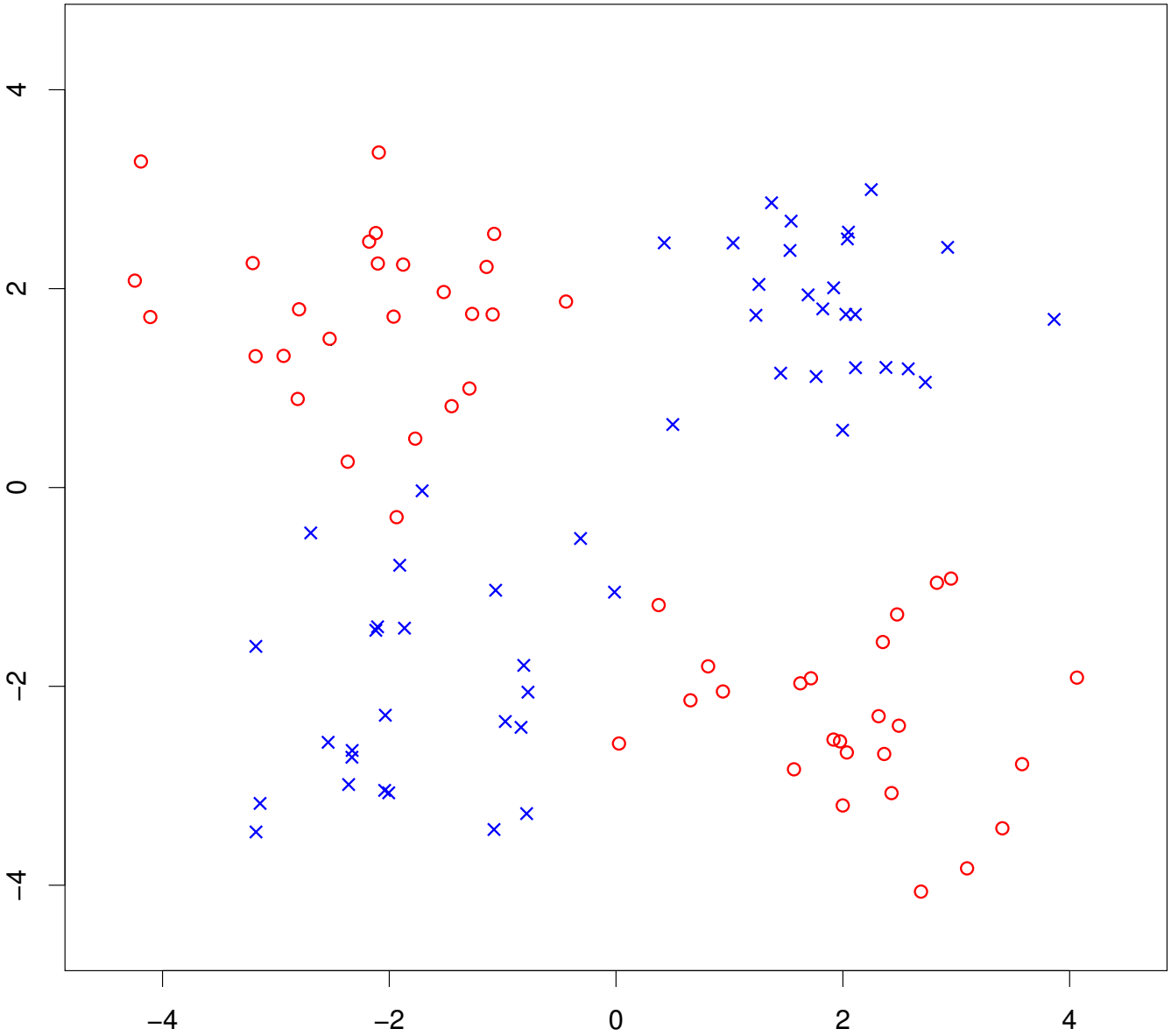
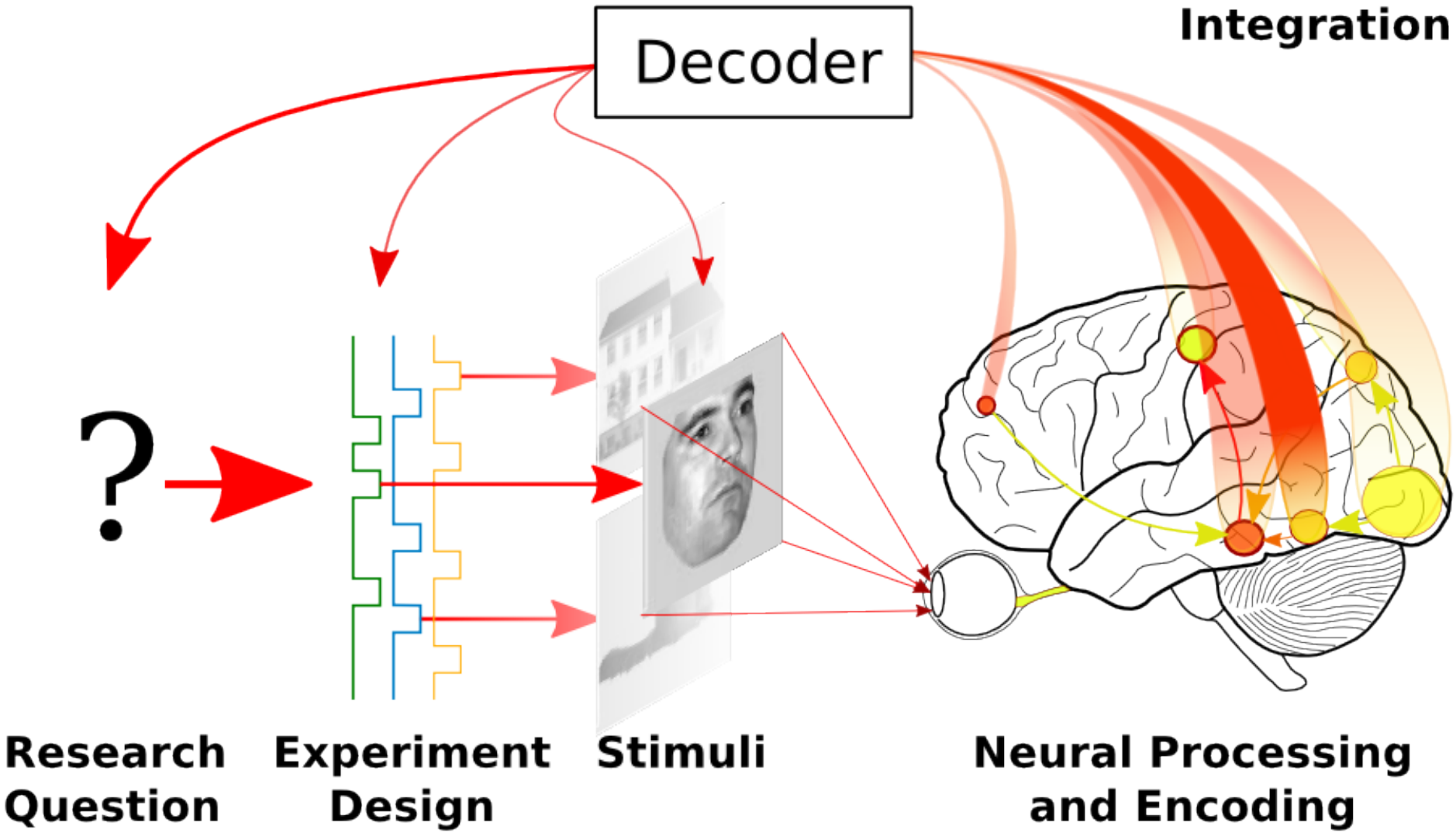
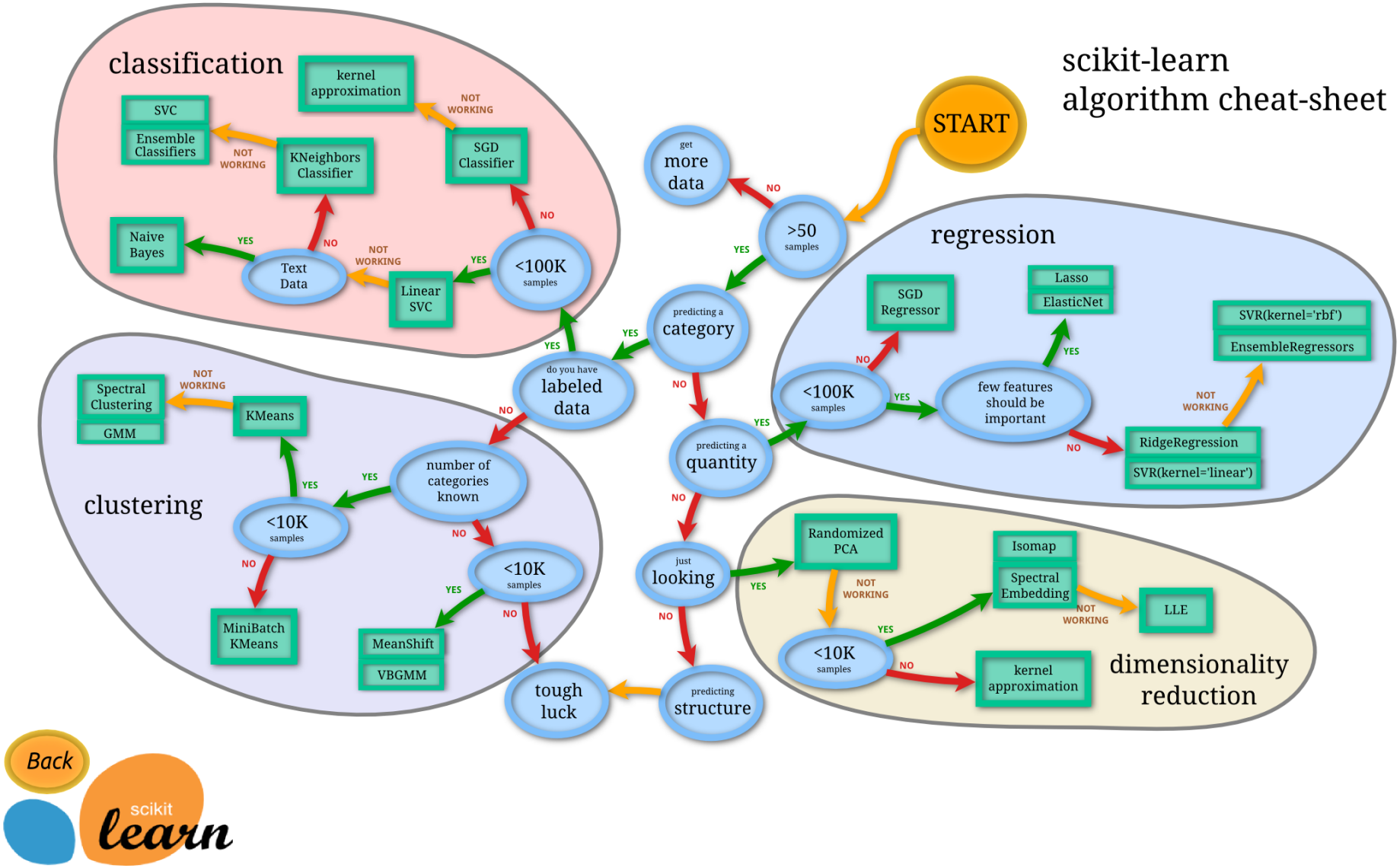


MVPA approach: Reverse the flow!

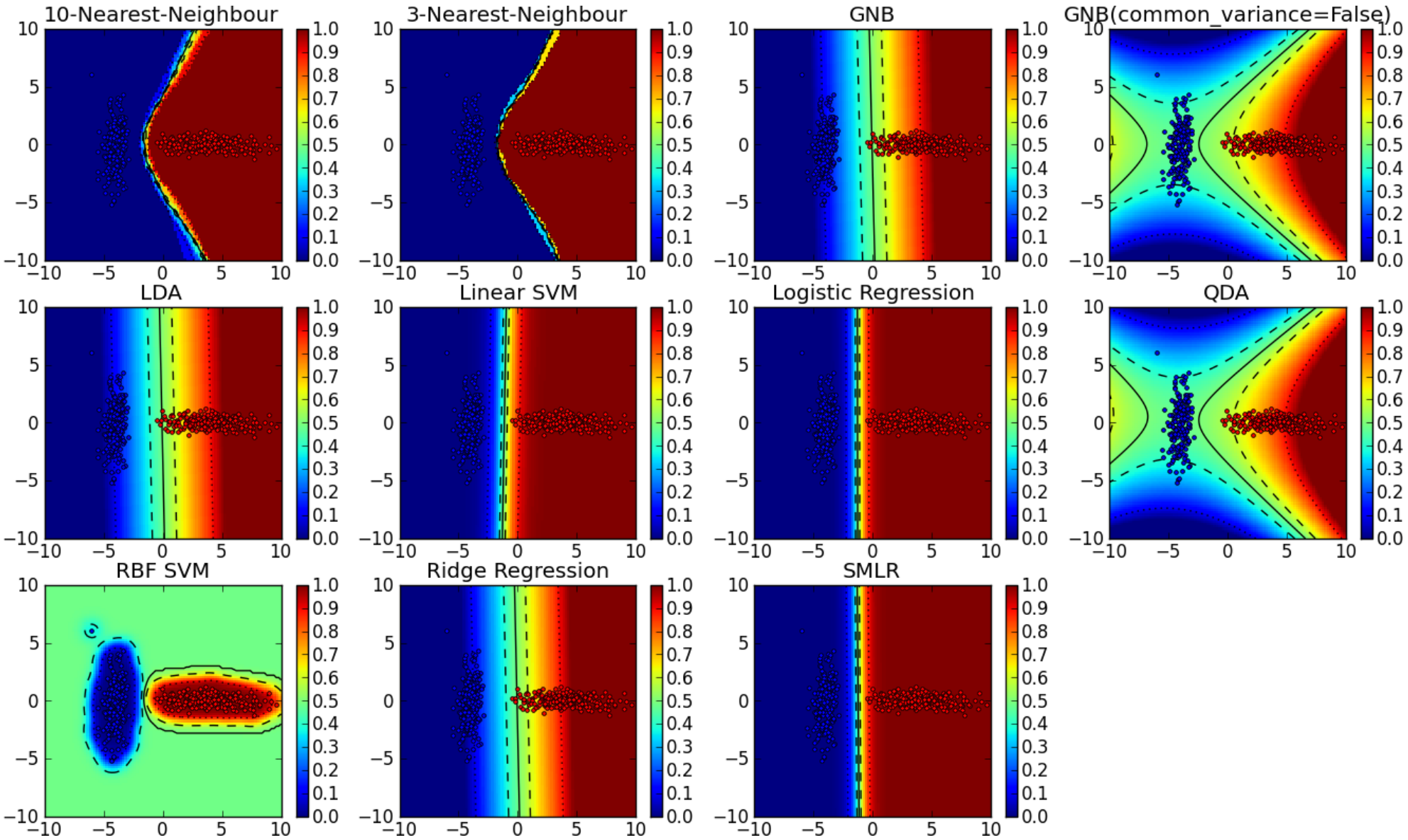


$p(\text{behavior}|\text{brain activity})$

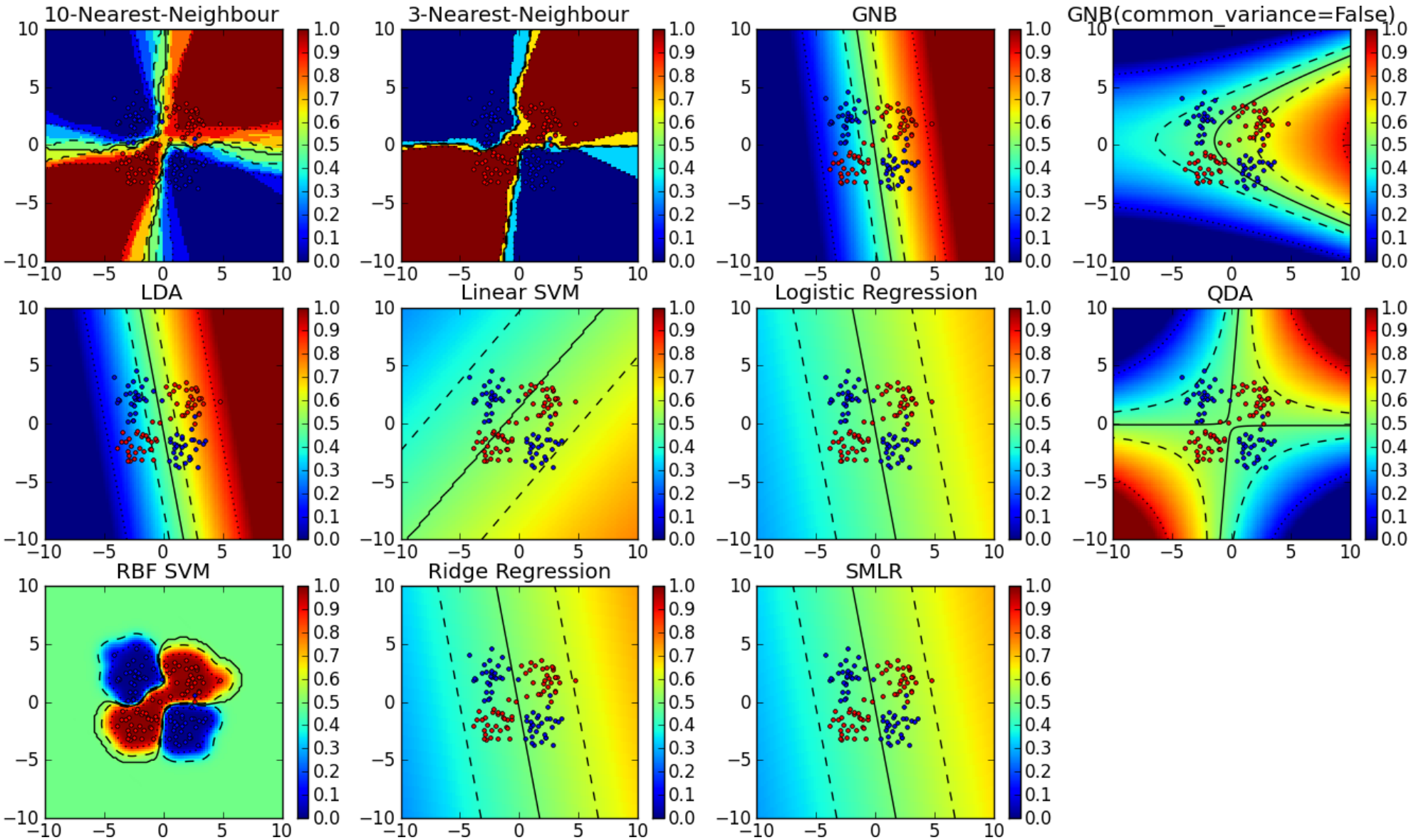
Which classifier?



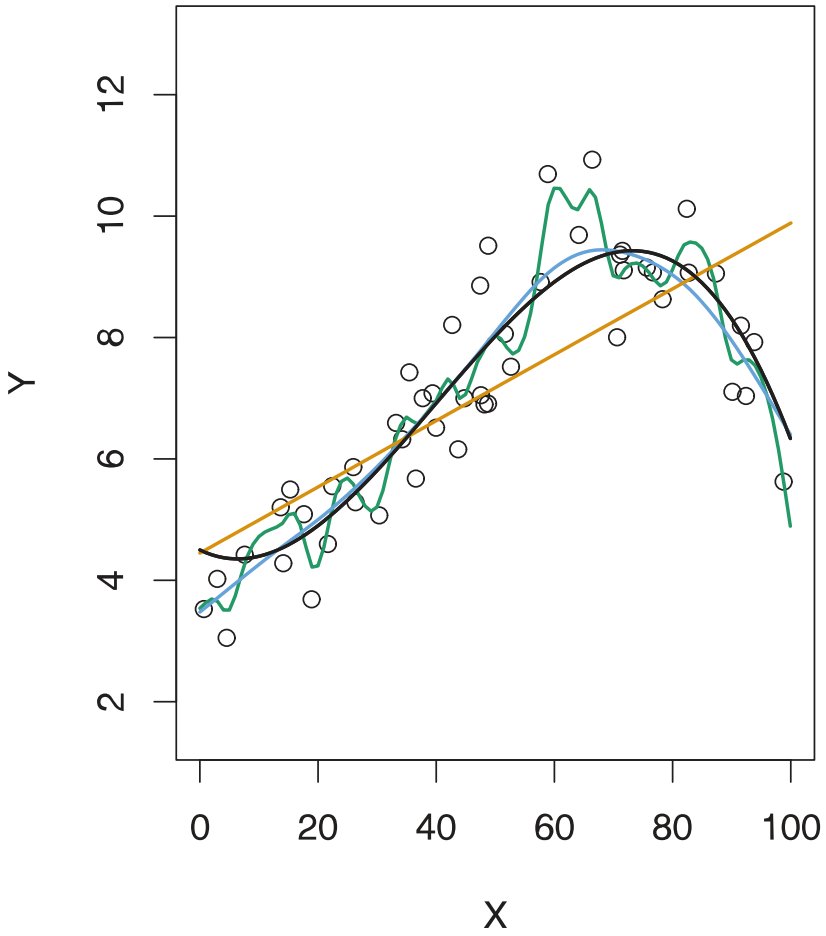
Decision models – linear problem

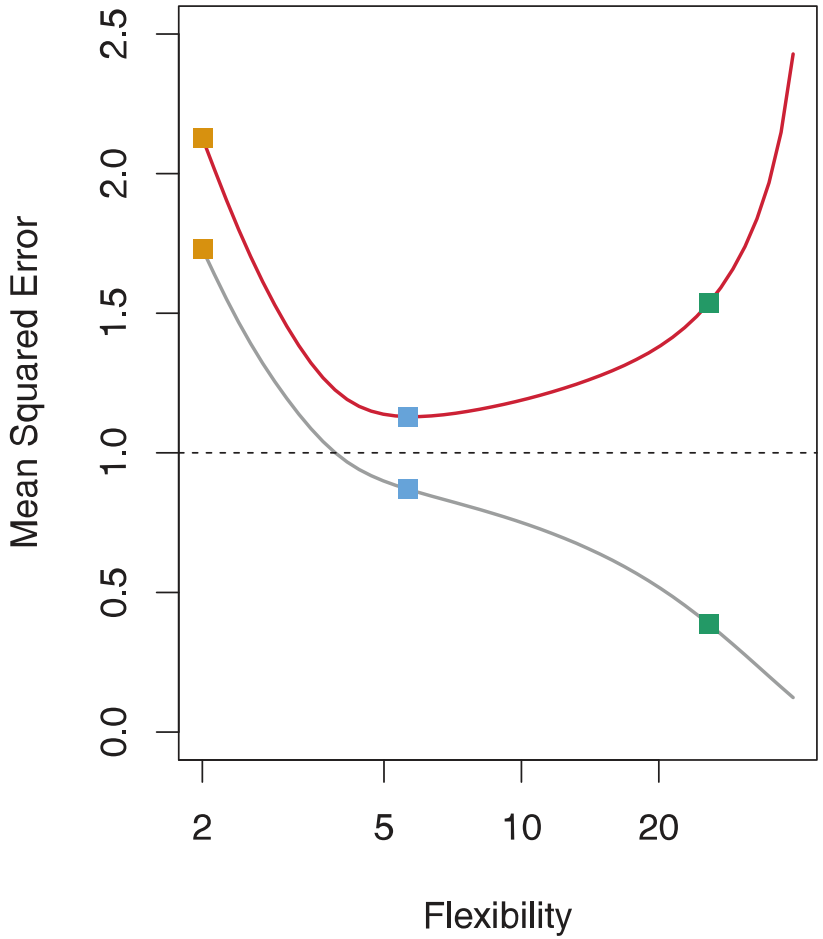


Decision models – non-linear problem



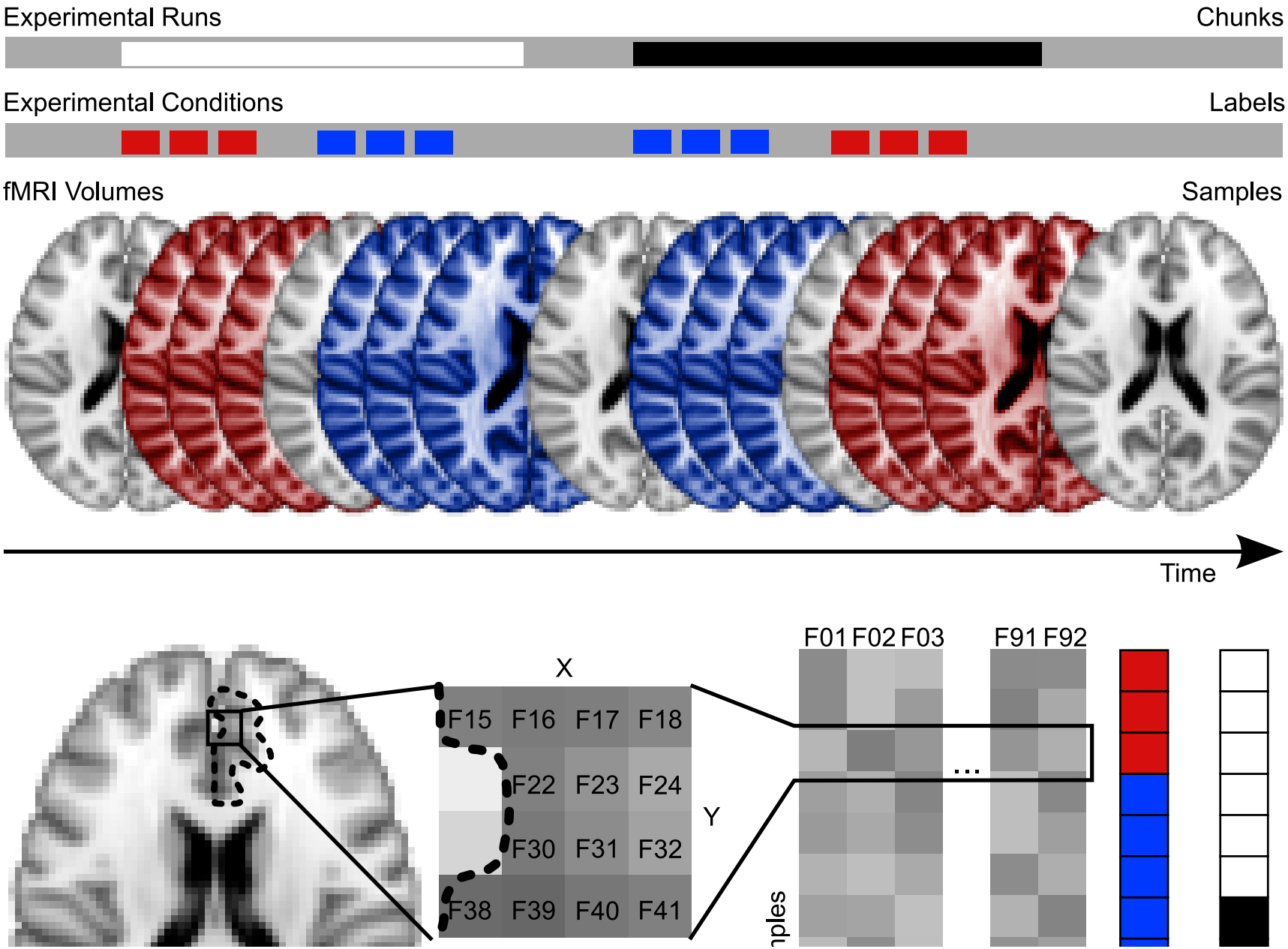
Model appropriateness





James, G., Witten, D., Hastie, T., and Tibshirani, R. (2013). *An Introduction to Statistical Learning: with Applications in R*. Springer Texts in Statistics. Springer. (free PDF copy)

Data representation – classification



Enough said. . . (for now)

Let's see how we can do this. . .

References

James, G., Witten, D., Hastie, T., and Tibshirani, R. (2013). *An Introduction to Statistical Learning: with Applications in R*. Springer Texts in Statistics. Springer. (free PDF copy).