KL-Evidence: A Novel Multivariate Neurofeedback Method for Differentiating Representations

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Abstract Multidimensional STIMULUS SPACE

real-world objects feature difficult to control decades of experience changes too transient?

Artificial object space full parametric control no extant category bias simple, but still ‘objects’

Categorical Perception of Space

Inducing and Measuring PERCEPTUAL CHANGES

Categorical Perception of Space

2 AFC between line endpoints | 10 lines

Prediction sharper category boundaries (steeper psychometric function) for feedback dimension versus untrained dimension

No explicit top-down learning signal

Hypothesis

Reinforcing differential neural activity patterns in ventral temporal cortex for visually similar shapes will drive apart their neural representations and reduce perceptual similarity trial-level fast timescale access neural pattern change neural representation

real-time fMRI neurofeedback below threshold of awareness

NEUROFEEDBACK: KL-Evidence Model & Training

if two shapes become more similar neurally, they may be perceived similarly

Drive neural activity for shapes near category boundary towards category prototypes

Feedback based on standard MVPA may drive activity away from boundary in arbitrary directions

KL-Evidence may shift patterns towards neural prototypes more accurately

Shape oscillates with variable radius, centered randomly Task

Push neural pattern of shape towards prototype Goal

Make the shape stop oscillating! Instructions

Radius R Neurofeedback Manipulation

Positive feedback: decrease R Negative feedback: increase R

Parametric Shape Localizer

average 6 lines | n=8 | anatomical ROI

Feedback Training ROI Searchlight for parametric regions: r > 0.50

KL-Evidence - Category 1 SVM Evidence - Category 1

KL Evidence • SVM Evidence - Category 1

Categories

KL Evidence • Category 1

SVM Evidence - Category 1

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