A Review and Implementation of Manifold Learning Techniques on Neural Population Activity

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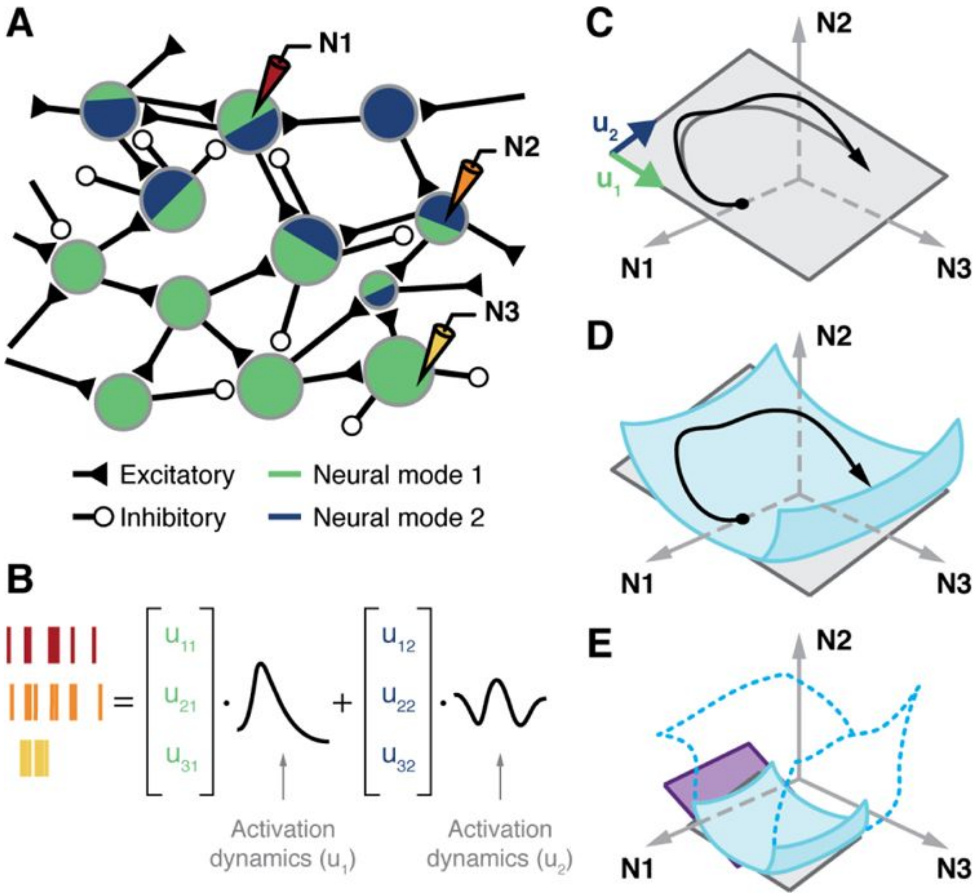
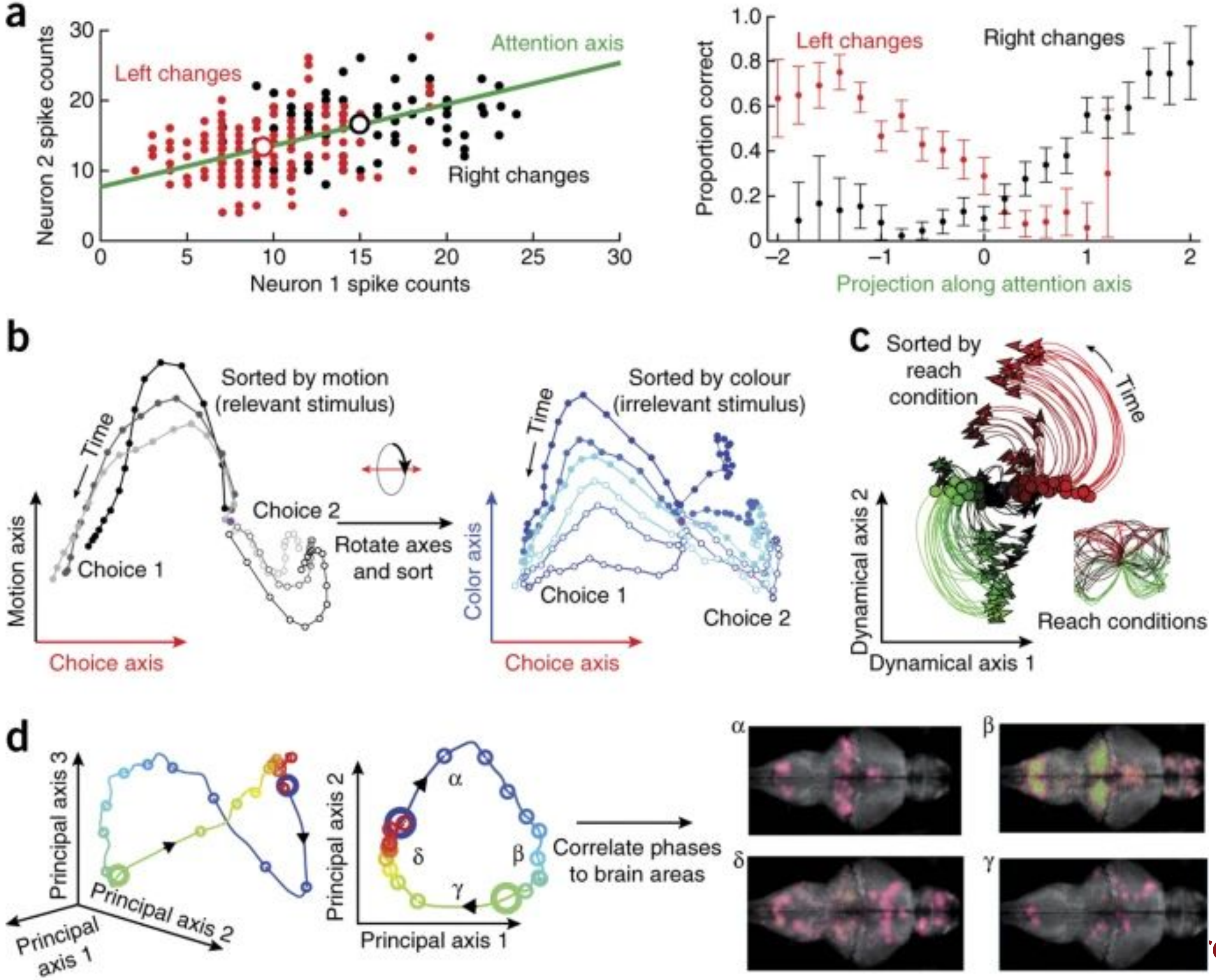
STATS 320 Poster Session

Manifold Discovery





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Dimensionality Reduction Techniques

Average-trial analysis: PCA, FA

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Single-trial analysis: HMM, GPFA, LDS, NLDS

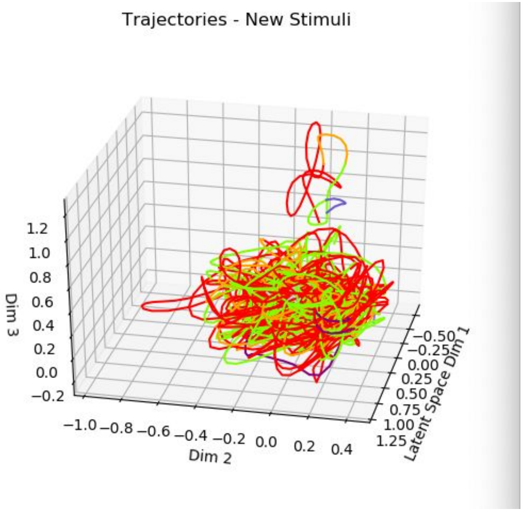
Dimensionality Reduction Techniques

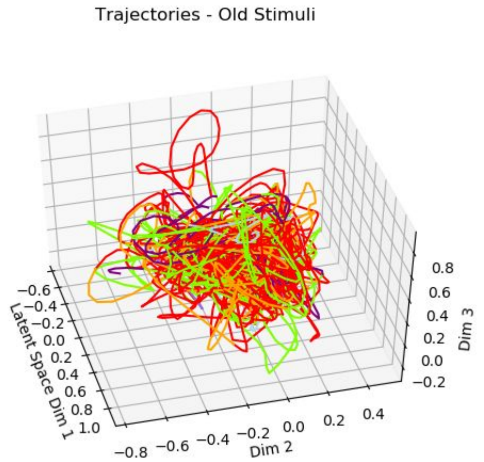
Average-trial analysis: PCA, FA

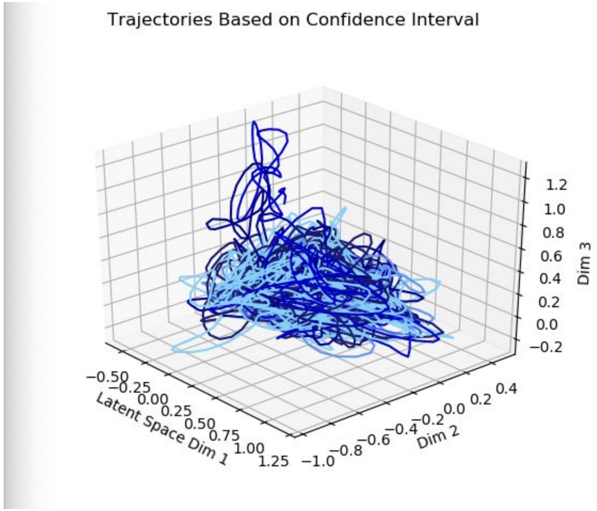
Single-trial analysis: HMM, GPFA, LDS, NLDS

Nonlinear techniques: Isomap, LLE, GPLVM

Implementation - GPFA





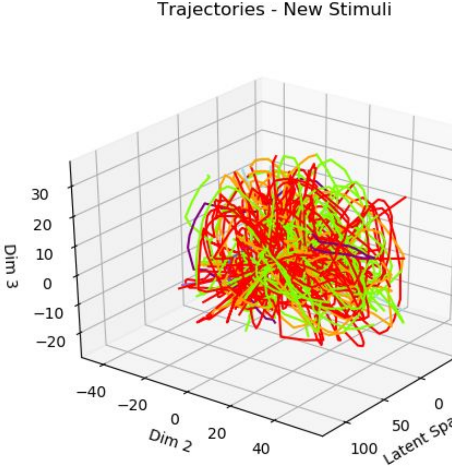


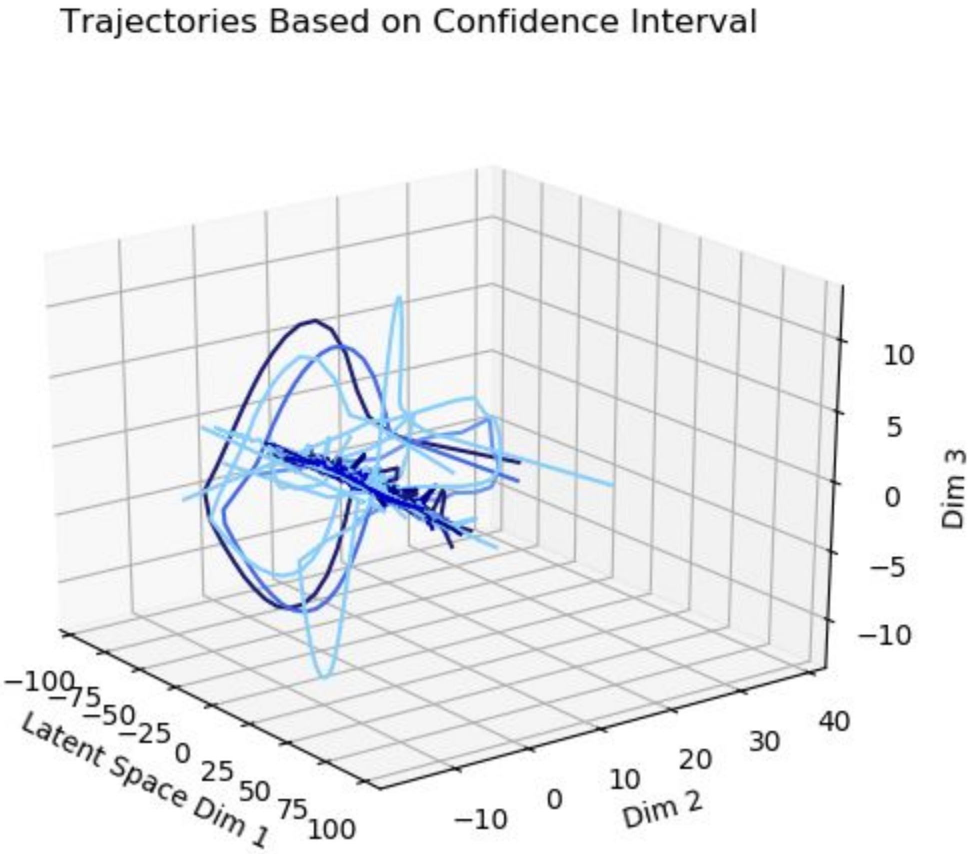
Red = Stimulus On, Orange = Stimulus Off, Green = Question Onset, Blue-Purple = Subject Gave Response, Yellow = End of Trial

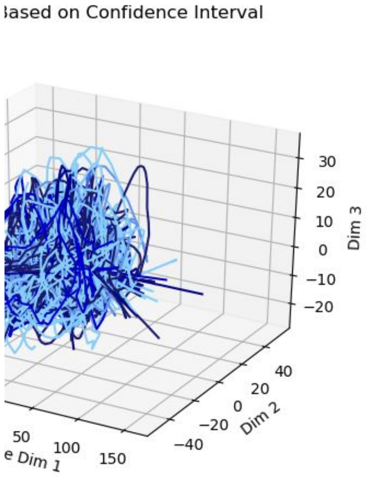
Deeper blue = More confident that the subject had seen the image before

Stanford University

Implementation - Isomap



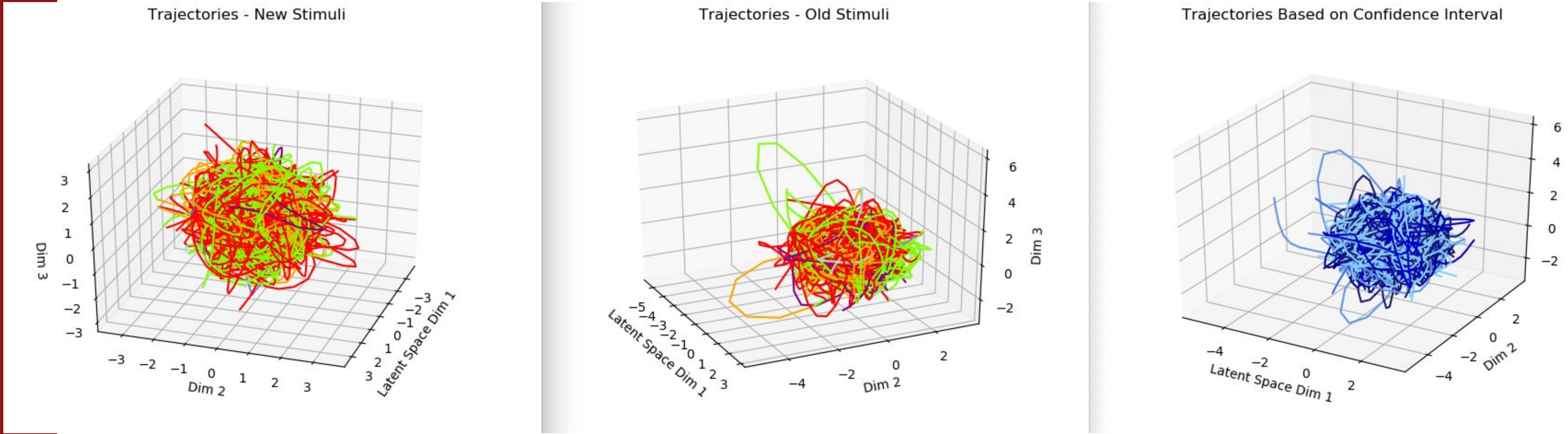




Red = Stimulus O … = Subject
Gave Response, …

Deeper blue = Mo

Implementation - Bayesian-GPLVM



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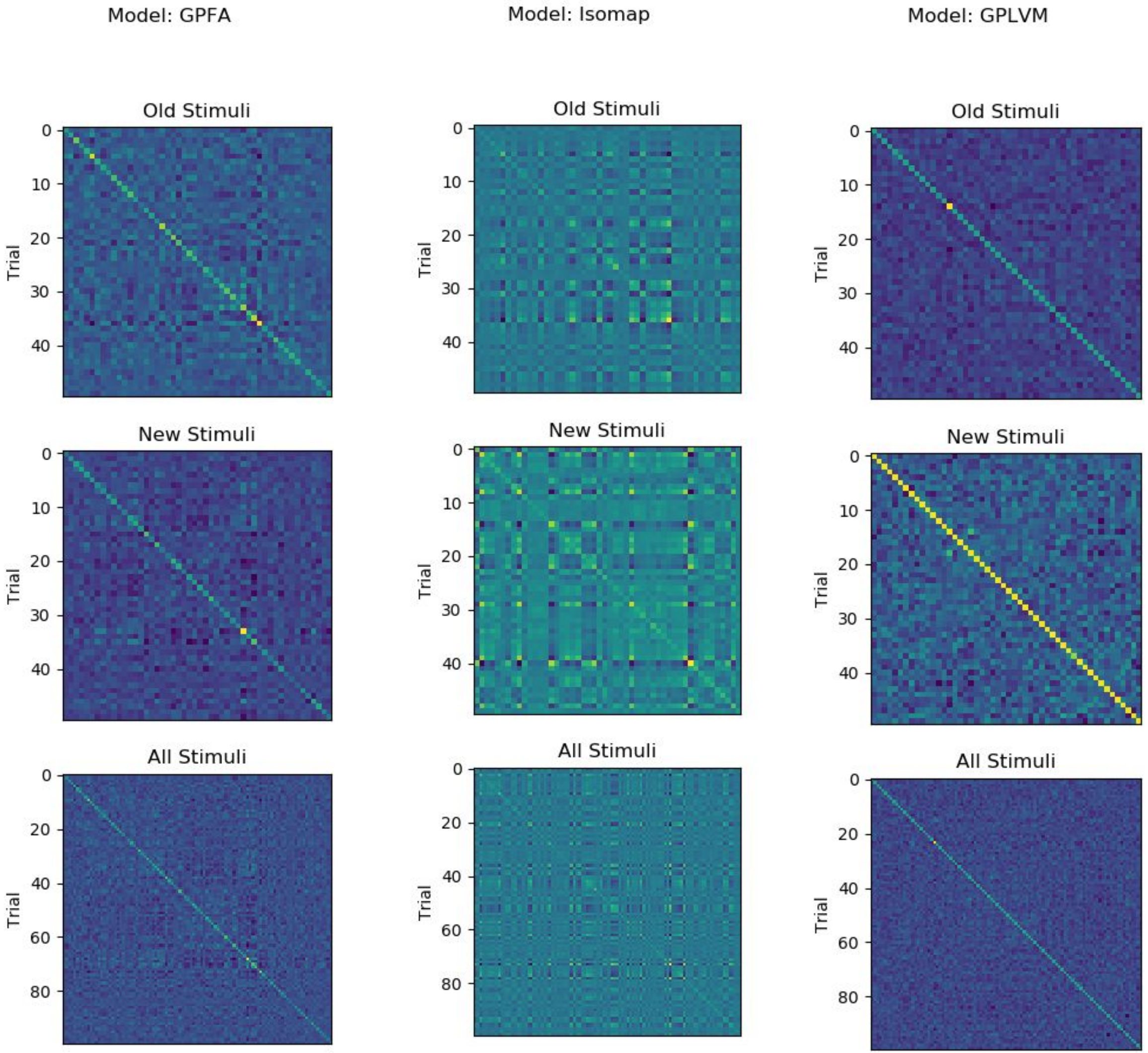
Covariance


Model: GPFA
Model: Isomap
Model: GPLVM
Old Stimuli
New Stimuli
All Stimuli
Trial
0
10
20
30
40
60
80

Limitations and Future Directions

- Perform this analysis on synthetic data first.

- Expand the data used by combining all files and subjects to determine if there is an underlying architecture of memory recall.

- Use a hidden Markov Model to detect event changes throughout trials.

- Spatiotemporal dynamics of memory recall may be too difficult to untangle and display in 3 dimensions.

References

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