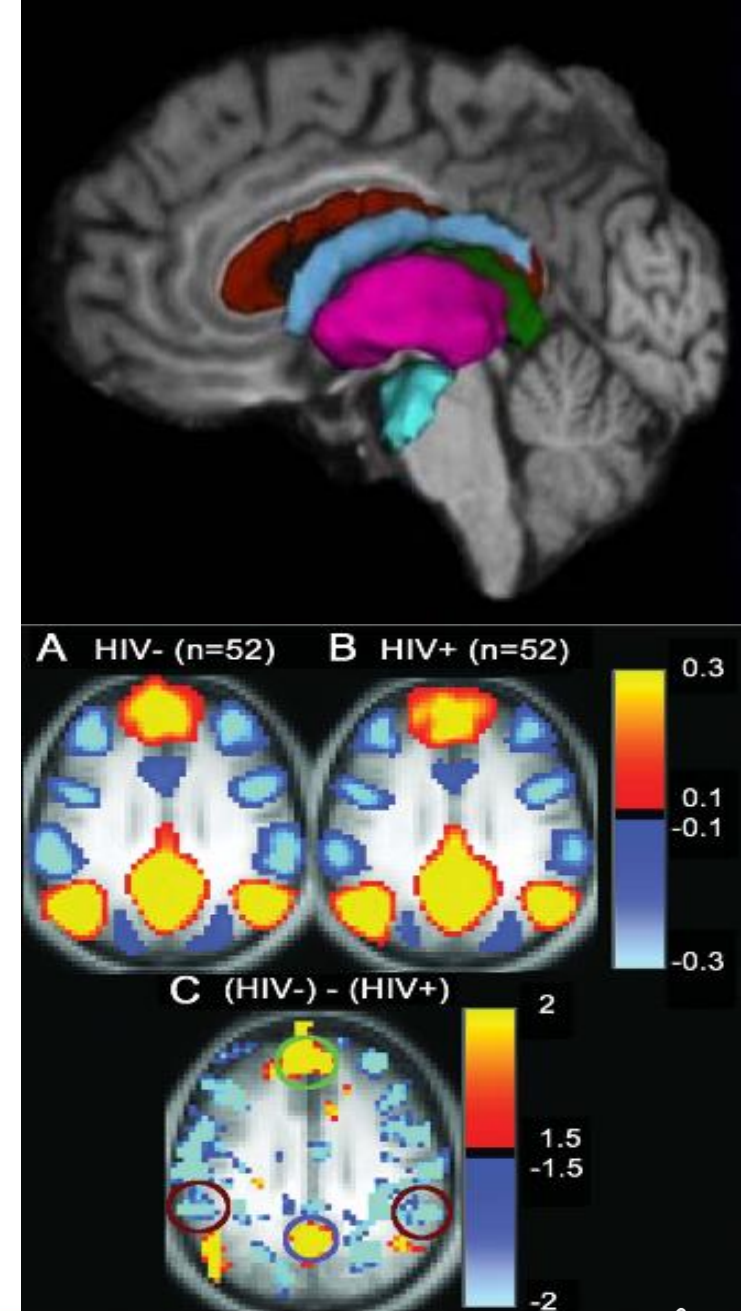


HIV

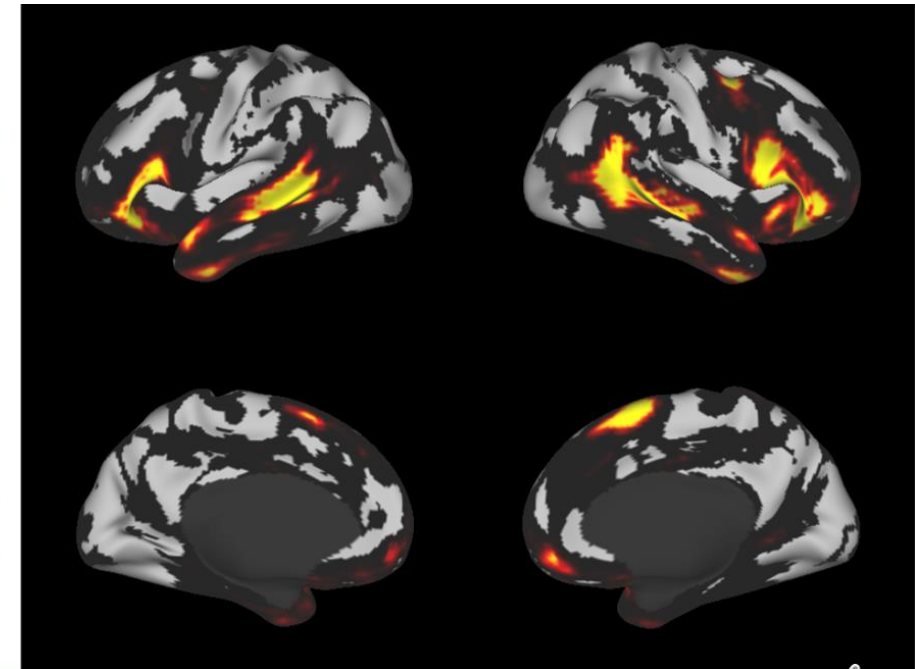
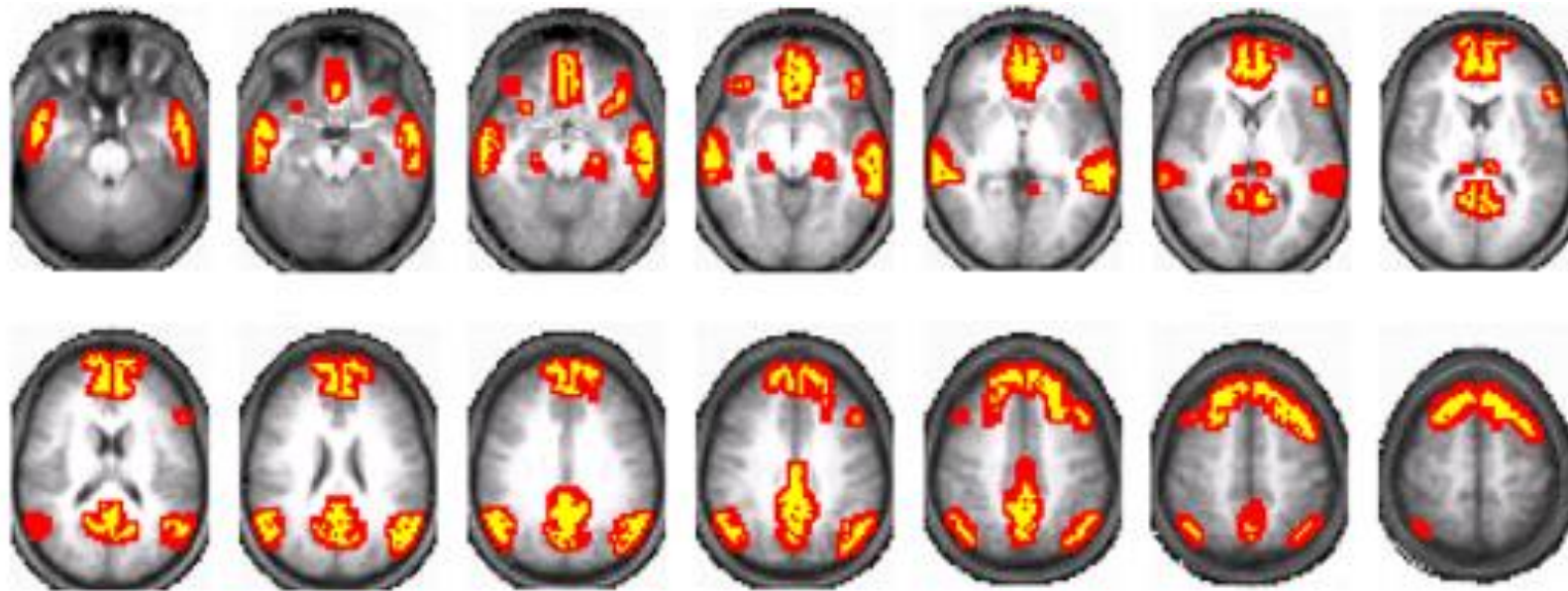
- In spite of cART, HIV associated neurological disorders (HAND) remain prevalent ($\sim 50\%$)¹
- May reflect persistent inflammation and/or viral reservoirs within the brain¹
- Neuroimaging studies show HIV effects cortical and subcortical regions
 - Structure²
 - Atrophy
 - White matter
 - Function³
 - Blood Flow
 - Connectivity

1. Heaton et. al, (2010). HIV-associated neurocognitive disorders persist in the era of potent antiretroviral therapy: Charter Study. *Neurology*.
2. Ances, Beau M., et al. "Independent effects of HIV, aging, and HAART on brain volumetric measures." *Journal of acquired immune deficiency syndromes* (1999).
3. Thomas, Jewell B., et al. "Pathways to neurodegeneration: effects of HIV and aging on resting-state functional connectivity." *Neurology* (2013).

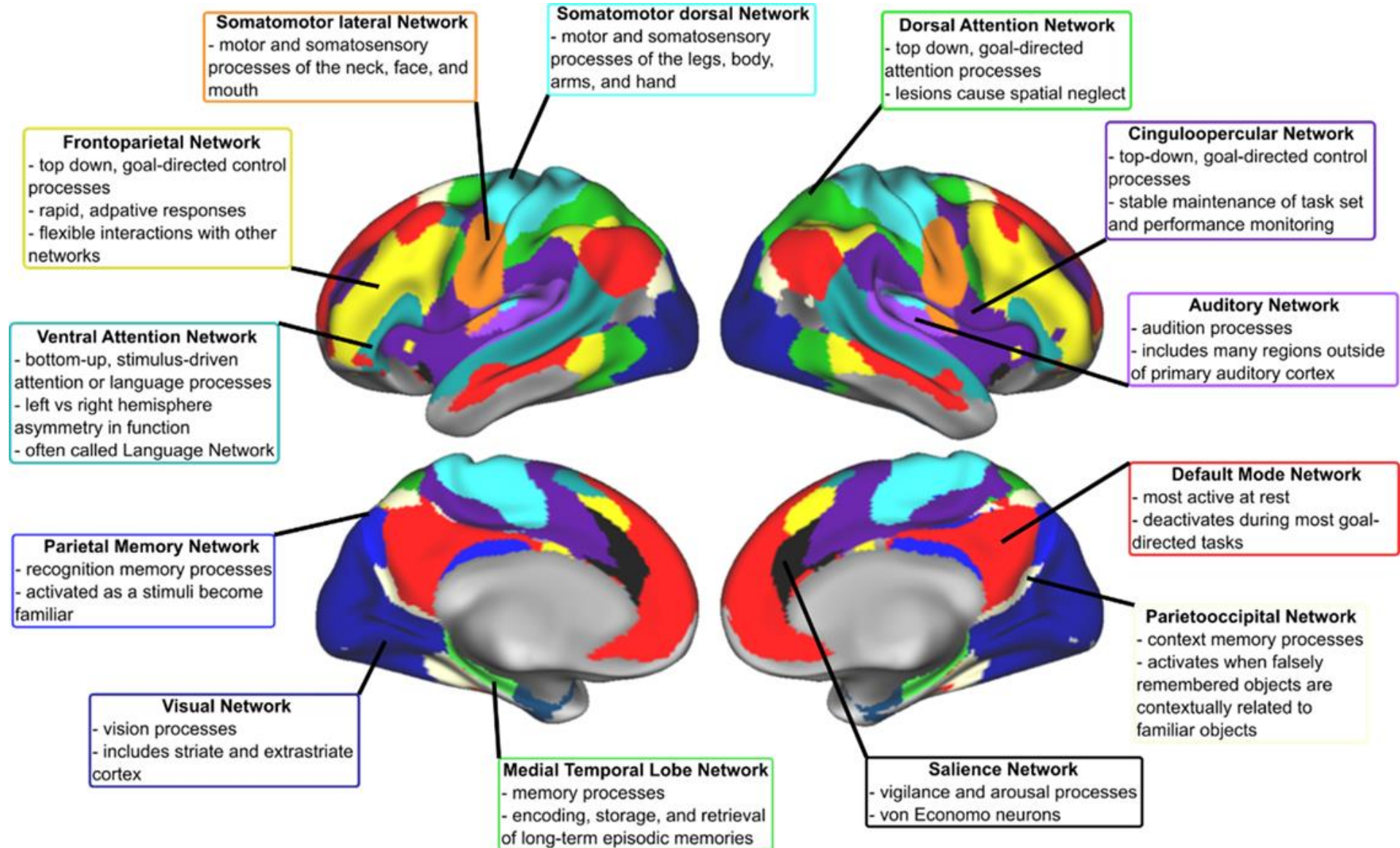


Neuroimaging

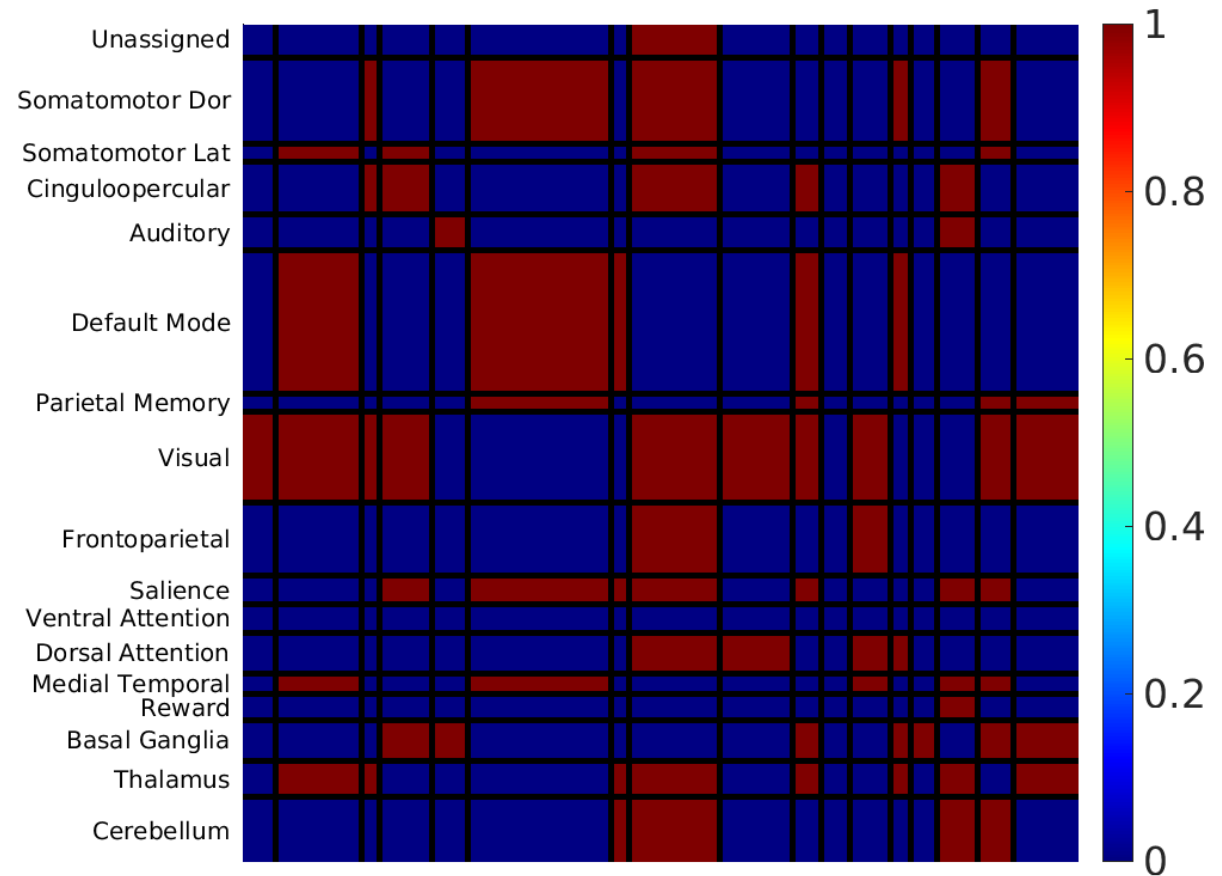
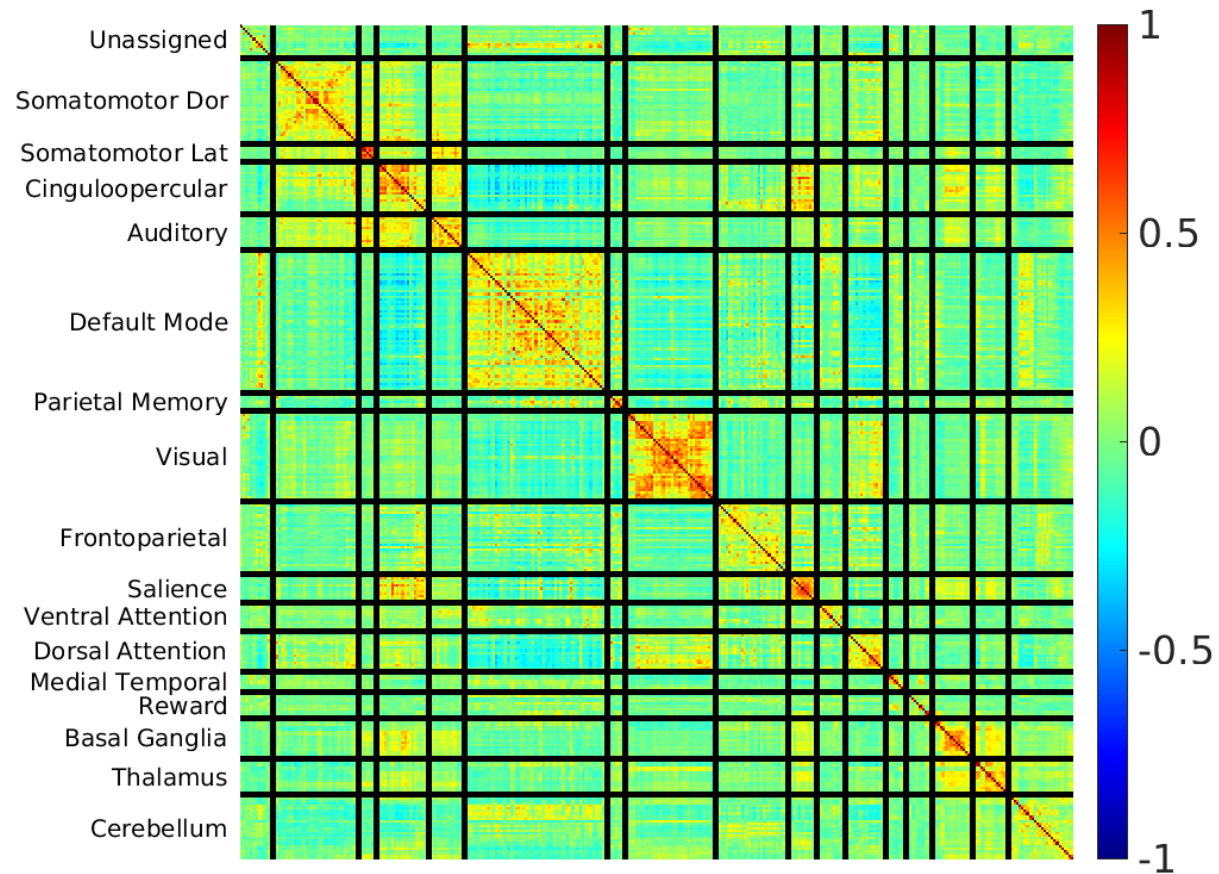
- Functional MRI (fMRI) measures brain activity by detecting changes in blood hemodynamic response
- Blood Oxygen Level Dependence
 - Measures concentration of deoxyhemoglobin to assess brain activity
- Resting State fMRI
 - Enables the evaluation of the interaction of brain regions when not performing a task



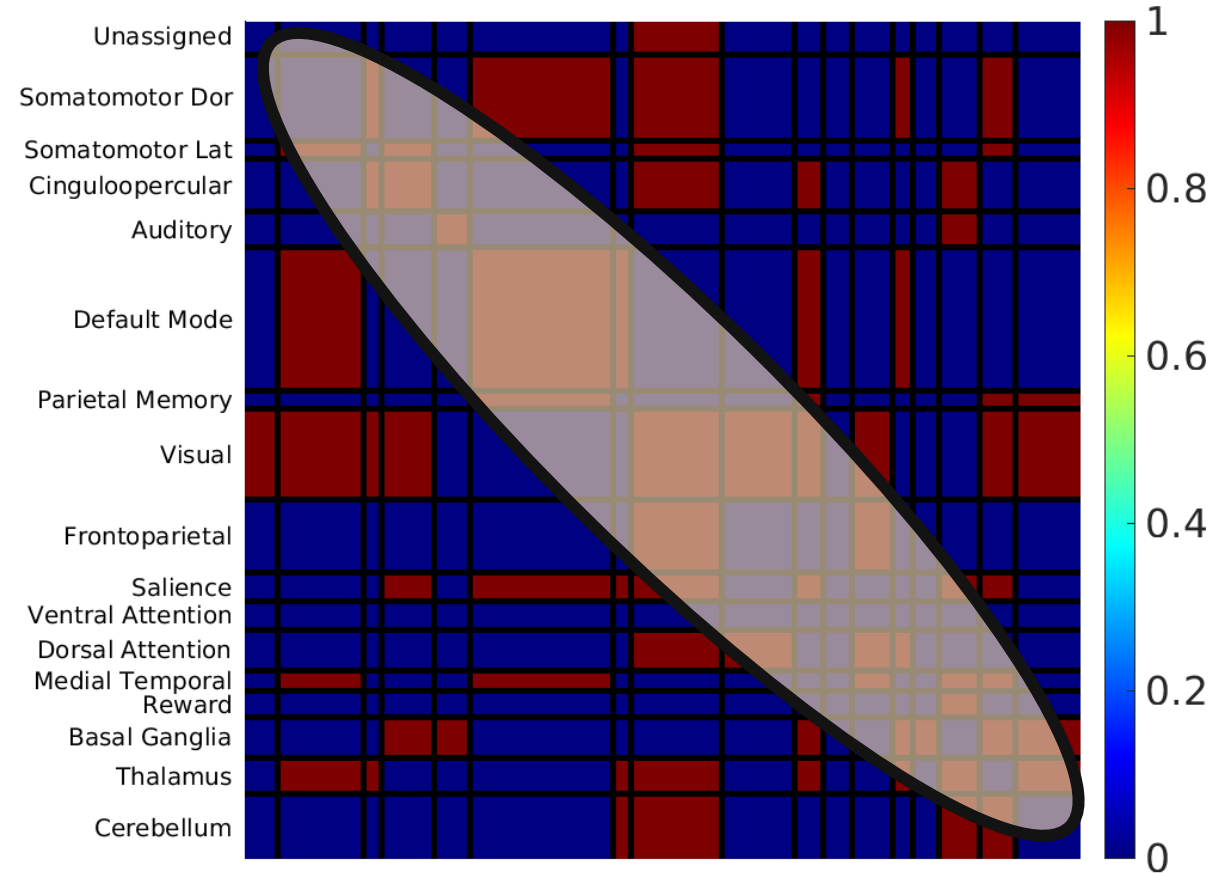
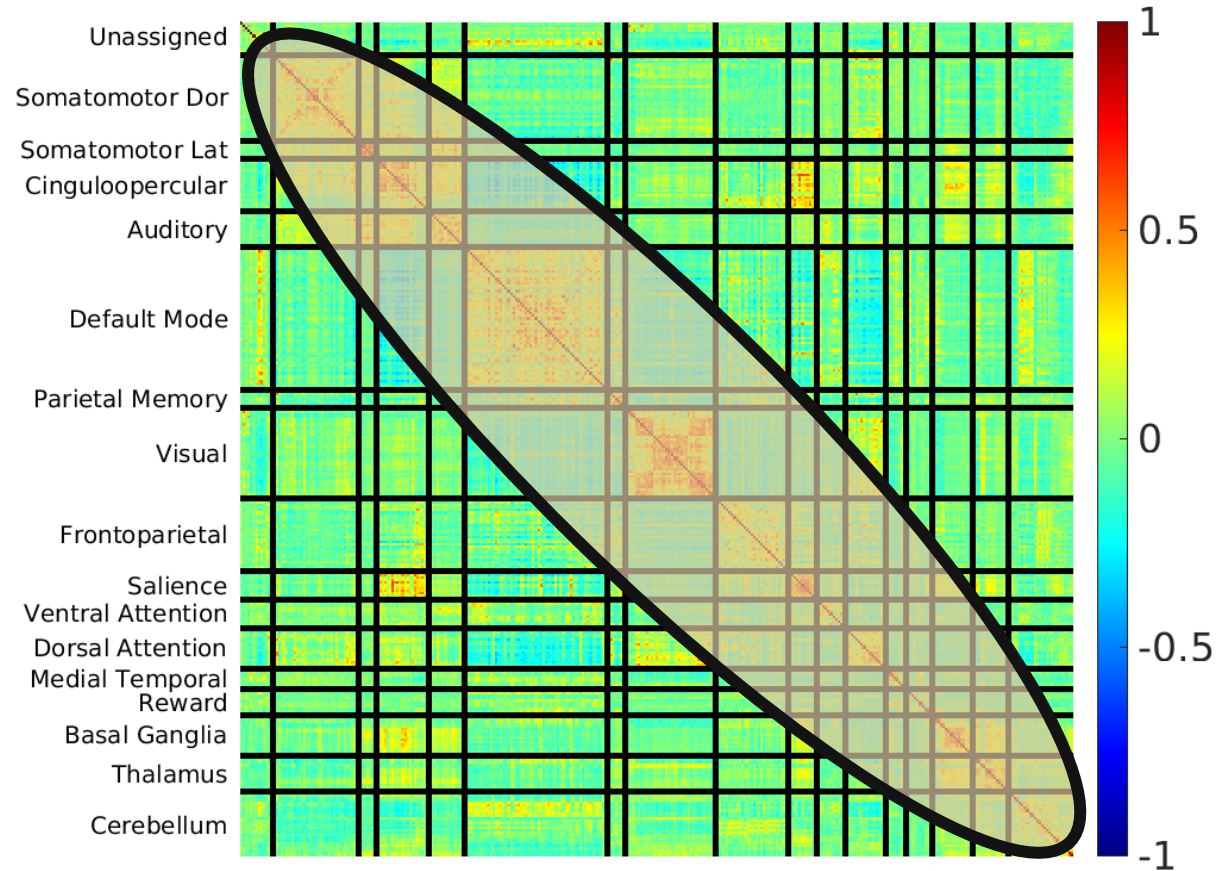
Resting State Networks



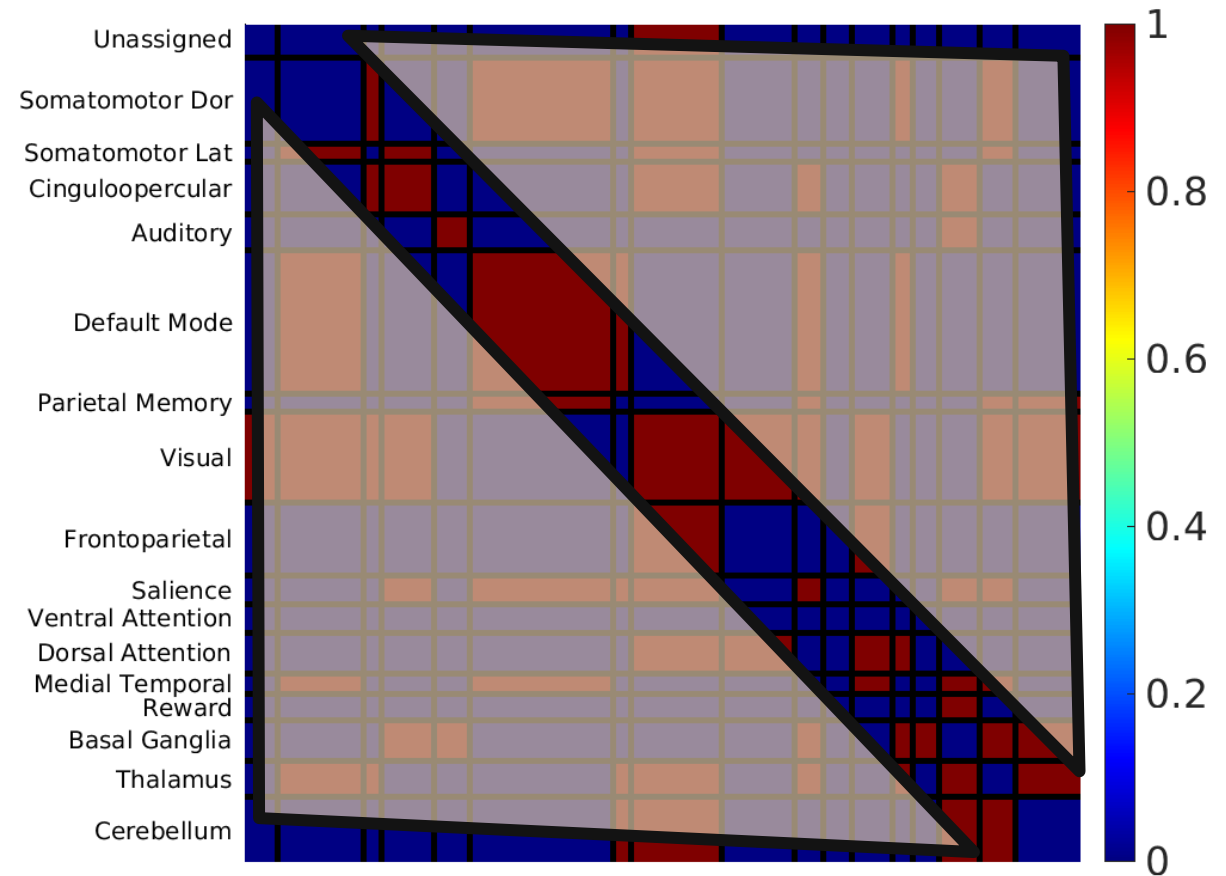
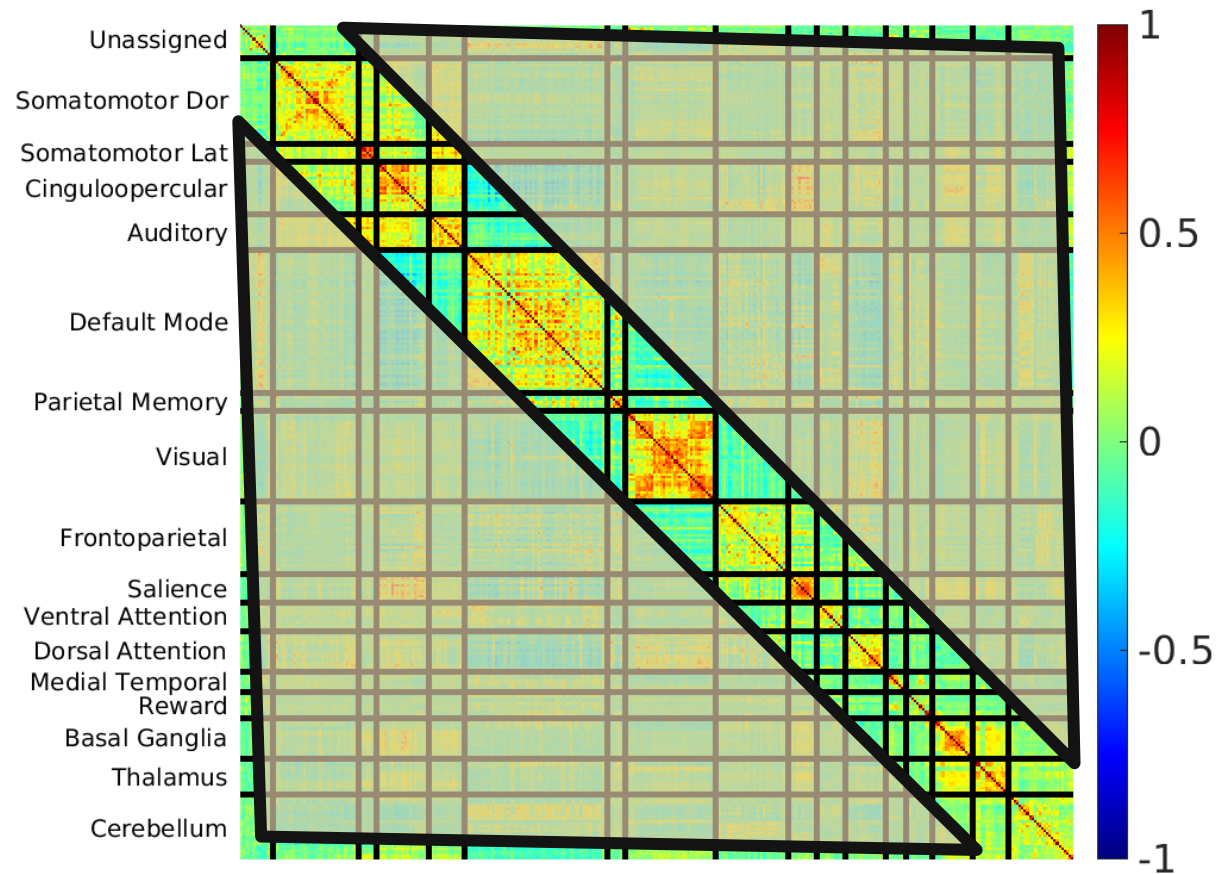
Network Similarity



Within Network Similarity



Between Network Similarity



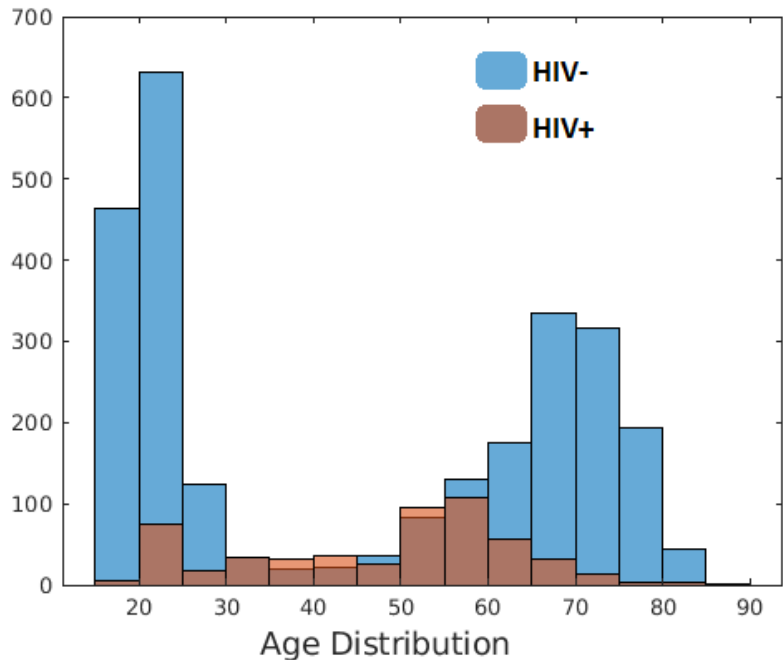
Aims

- Investigate a large cohort of PLWH and HIV- controls to
 - Use feature selection to identify functional brain networks most affected by HIV
 - Use feature selection to identify functional brain networks most affected by age in specific age bins
 - Model the temporal dynamics of network strength as a function of aging in both groups
 - Compare the trajectories of network strength to identify the effect of HIV on the aging brain in relation to functional organization

Data

- 3329 Scans
- 4 studies
 - HIV
 - ADRC
 - DIAN
 - GSP¹
- Age range 18-74

	HIV+ N = 538	Controls N = 2791	P
Age (years)	47.2 ± 15.1	44.5 ± 22.9	.003
Sex (% Male)	69%	42%	< .0001
Education	13.4 ± 2.5	15.03 ± 2.4	< .0001
Race (% AA)	64%	31%	< .0001
Duration of HIV infection	12.8 ± 9.4	-	
Recent Viral Load, med (IQR)	32 (0)	-	
Current CD4 cells/μl, med (IQR)	647 (609)	-	
cART	95%	-	

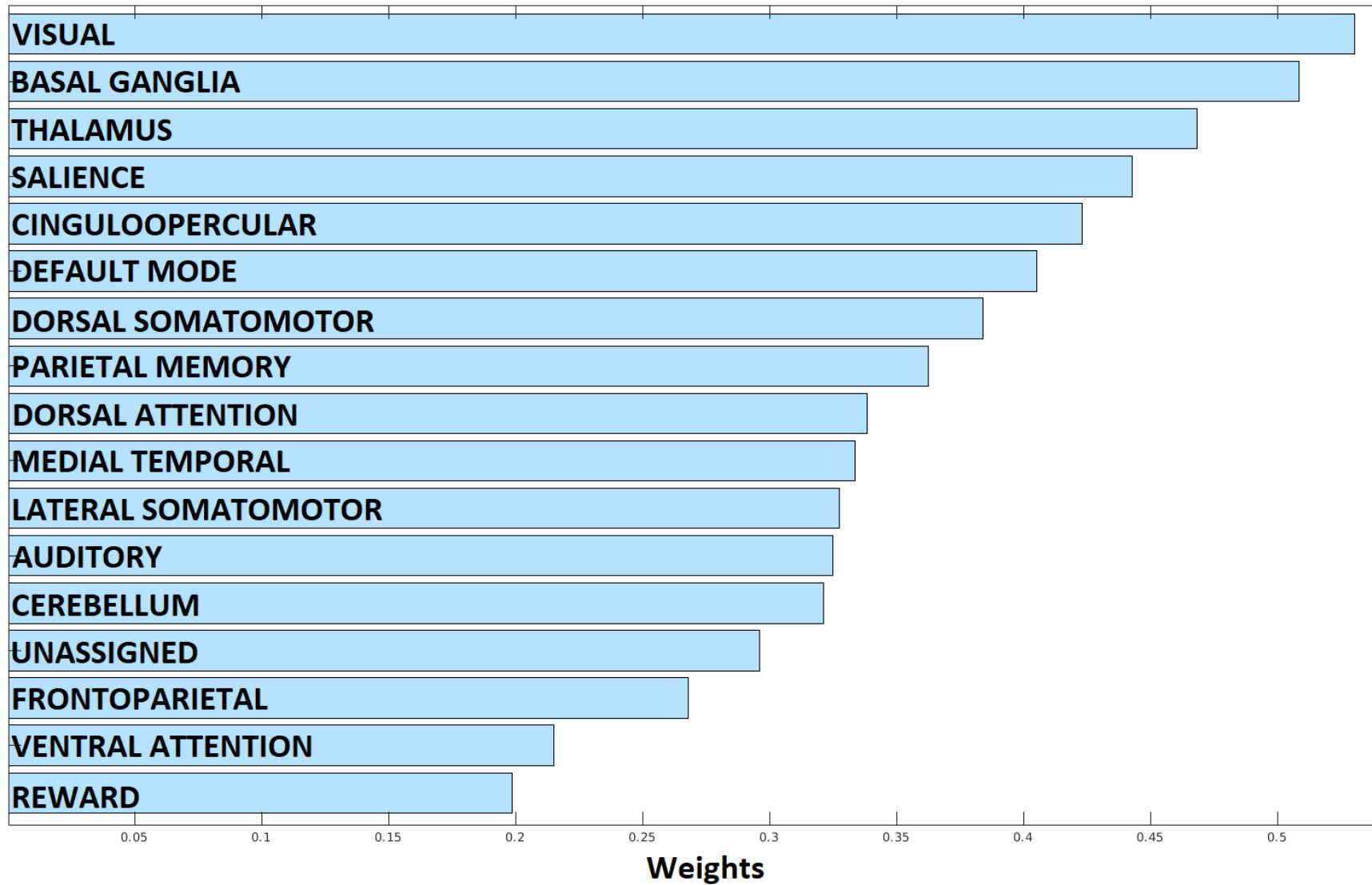


1. Buckner; Roffman; Smoller, 2014, "Brain Genomics Superstruct Project (GSP)", Harvard Dataverse, V10

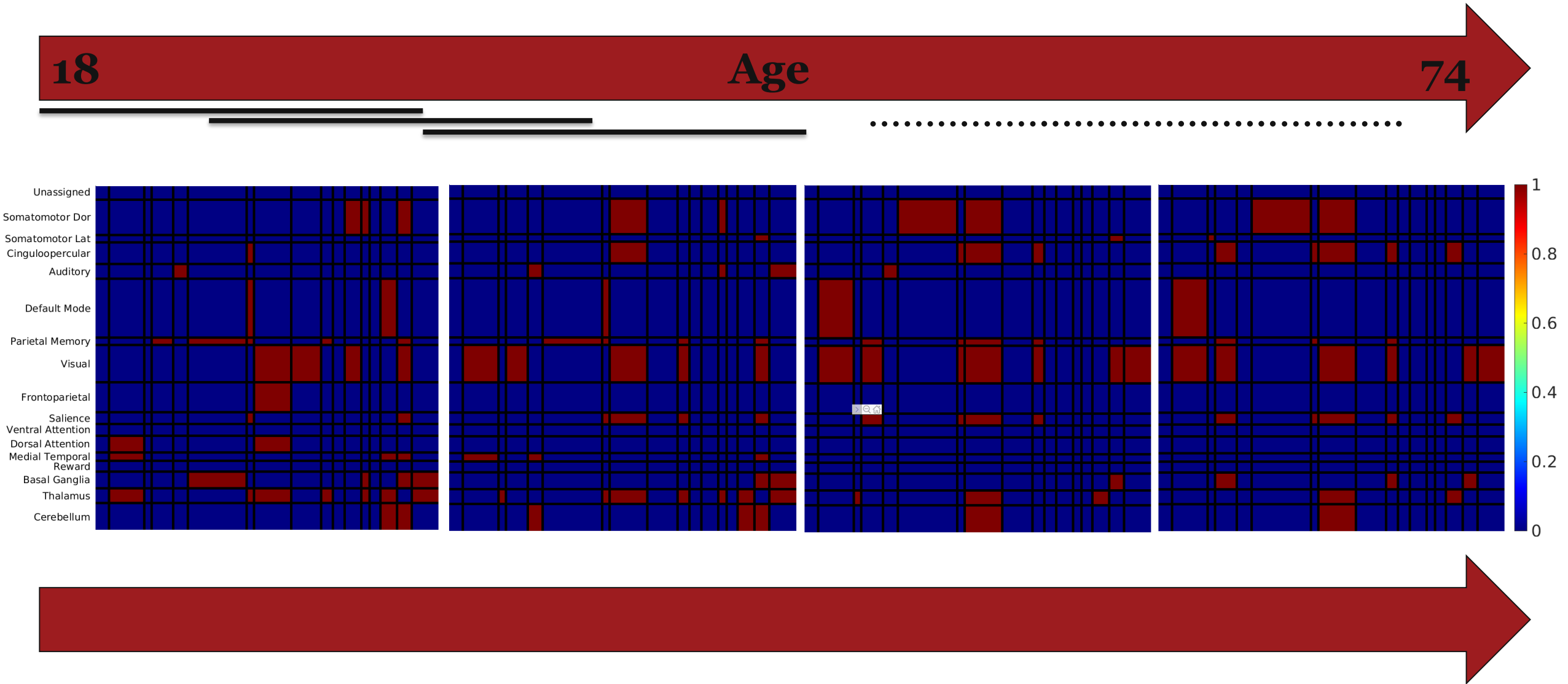
Methods: Feature Selection

- Feature Selection
 - Regions most affected by HIV
 - Relief Algorithm
 - Detect conditional dependencies between attributes and ranks importance using KNN approach
 - Full data set
 - Age bins

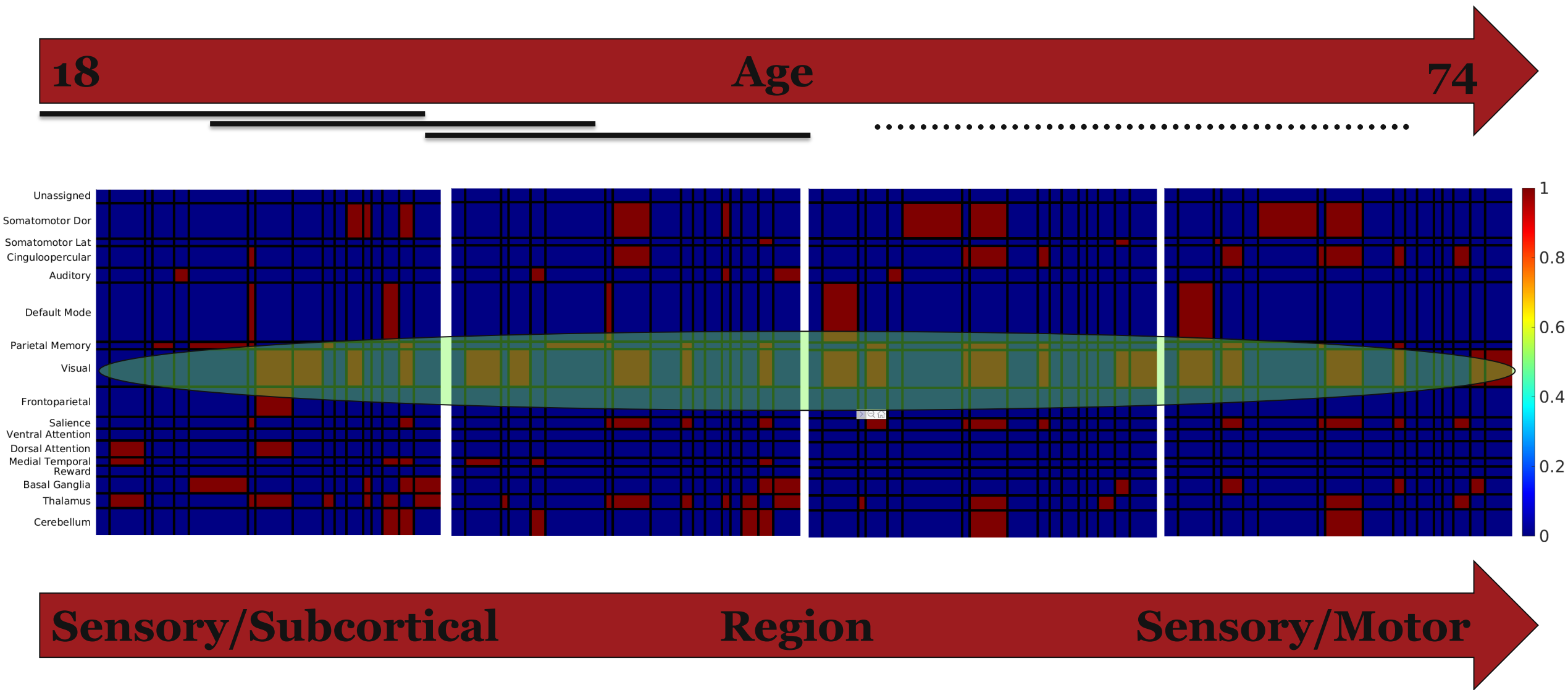
Feature Selection



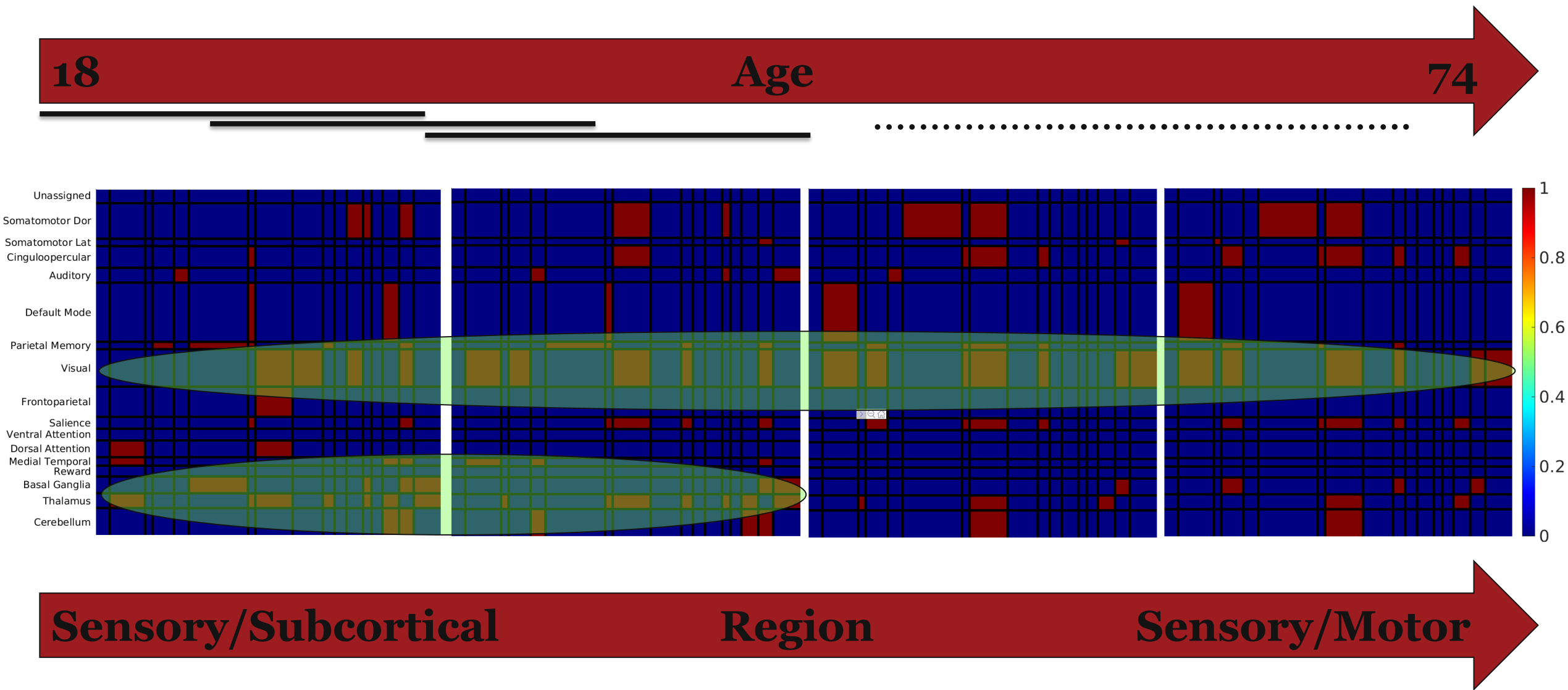
Methods: Sliding Window Feature Selection



Sliding Window Feature Selection



Sliding Window Feature Selection

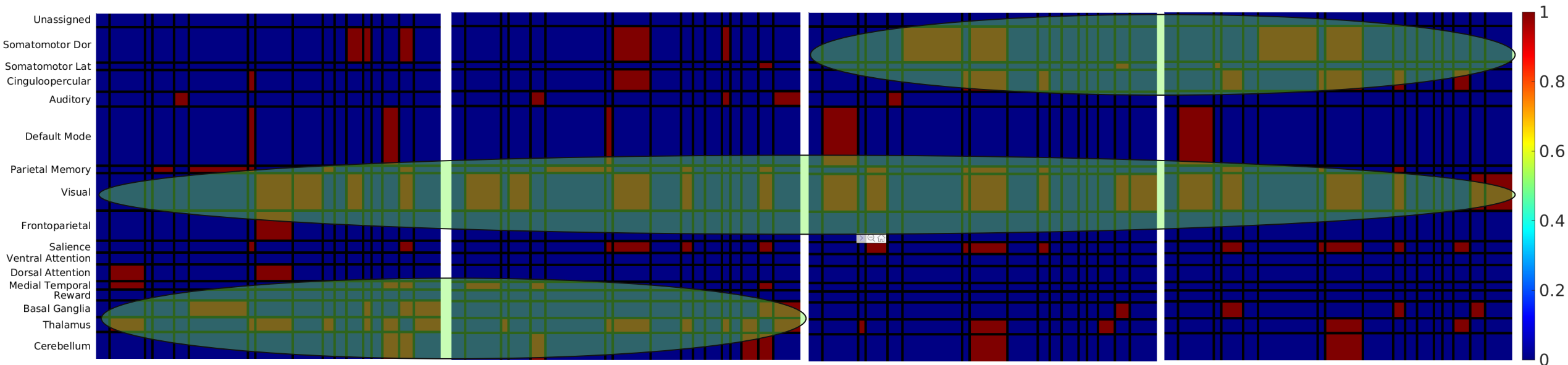


Sliding Window Feature Selection

18

Age

74



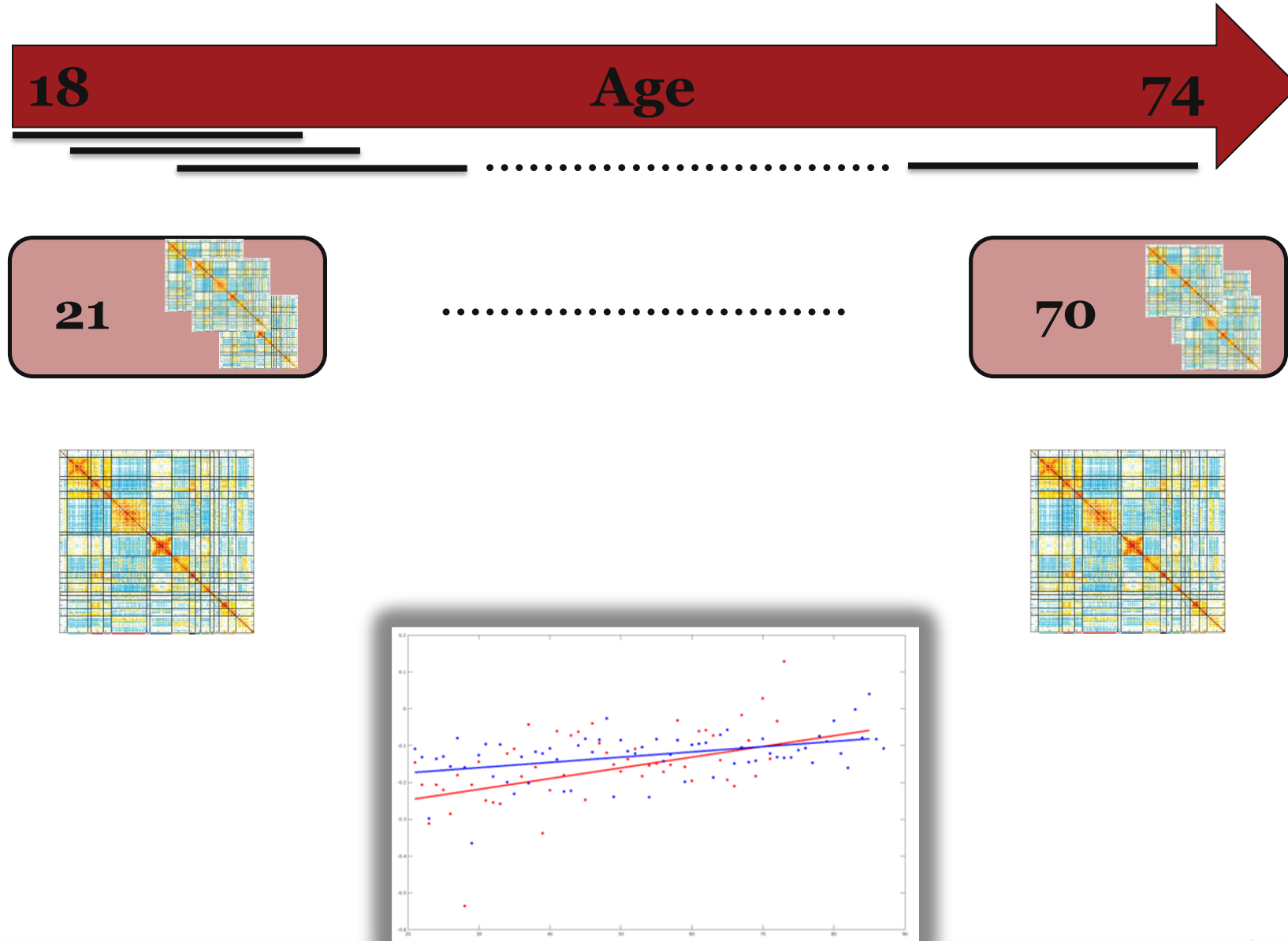
Sensory/Subcortical

Region

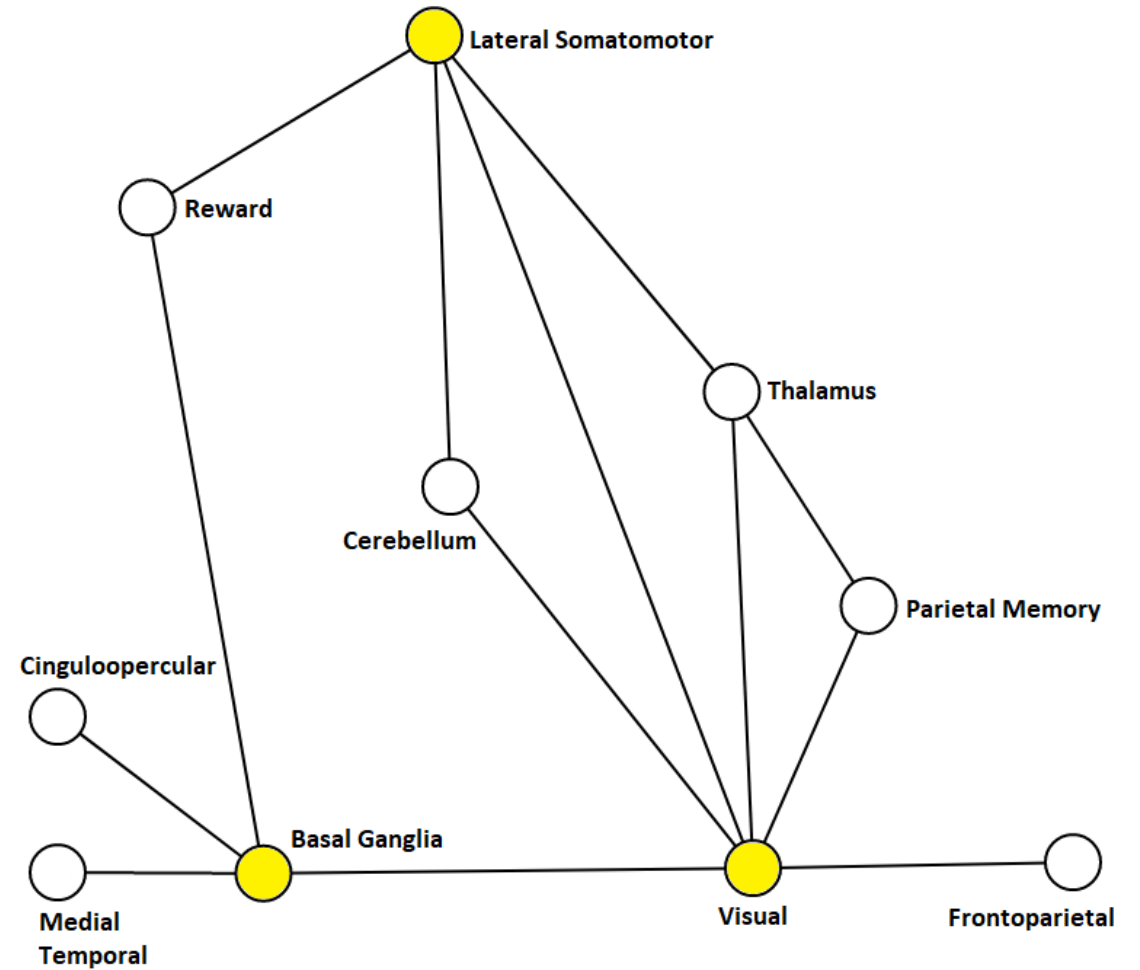
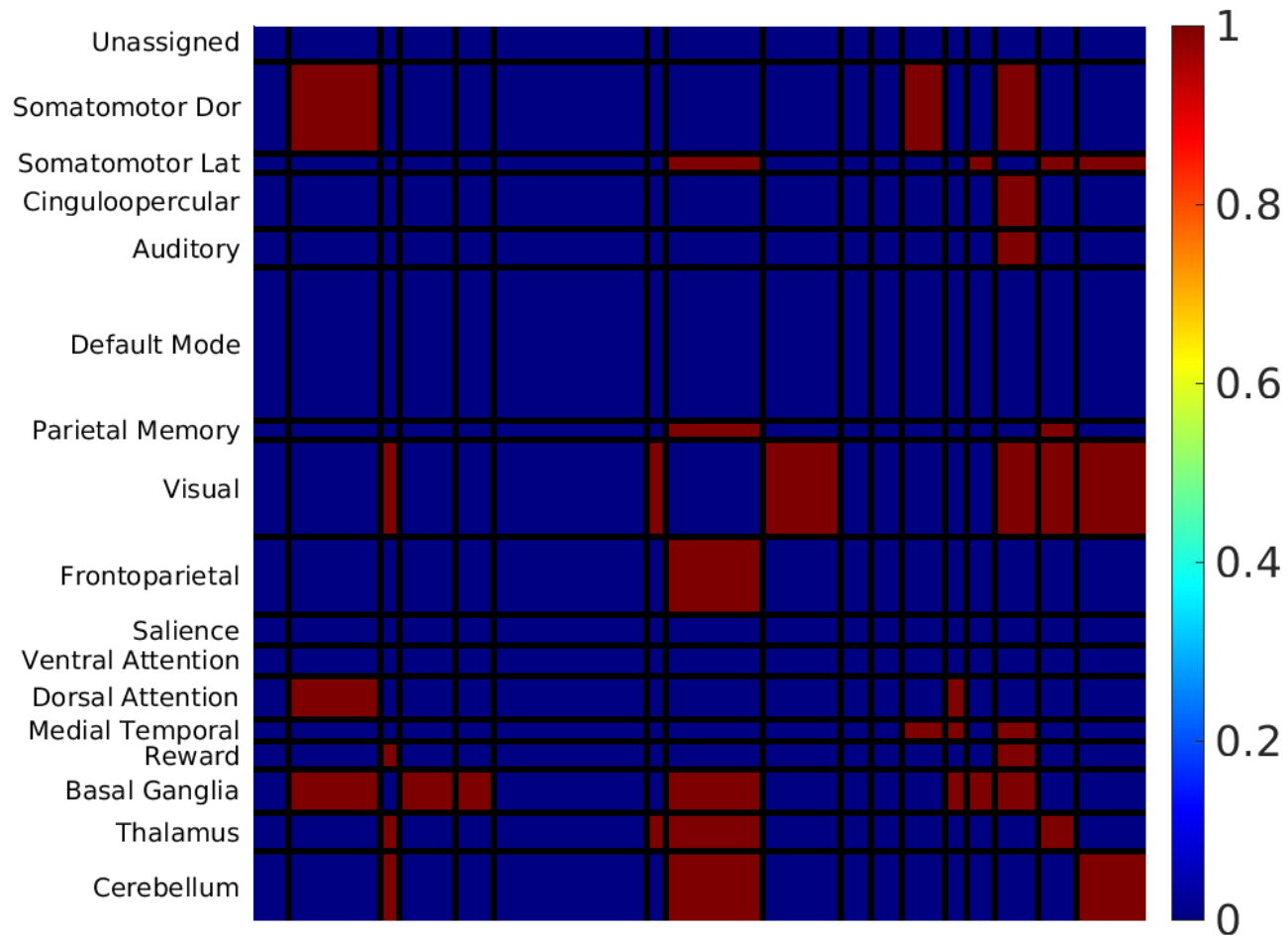
Sensory/Motor

Methods- Trajectories

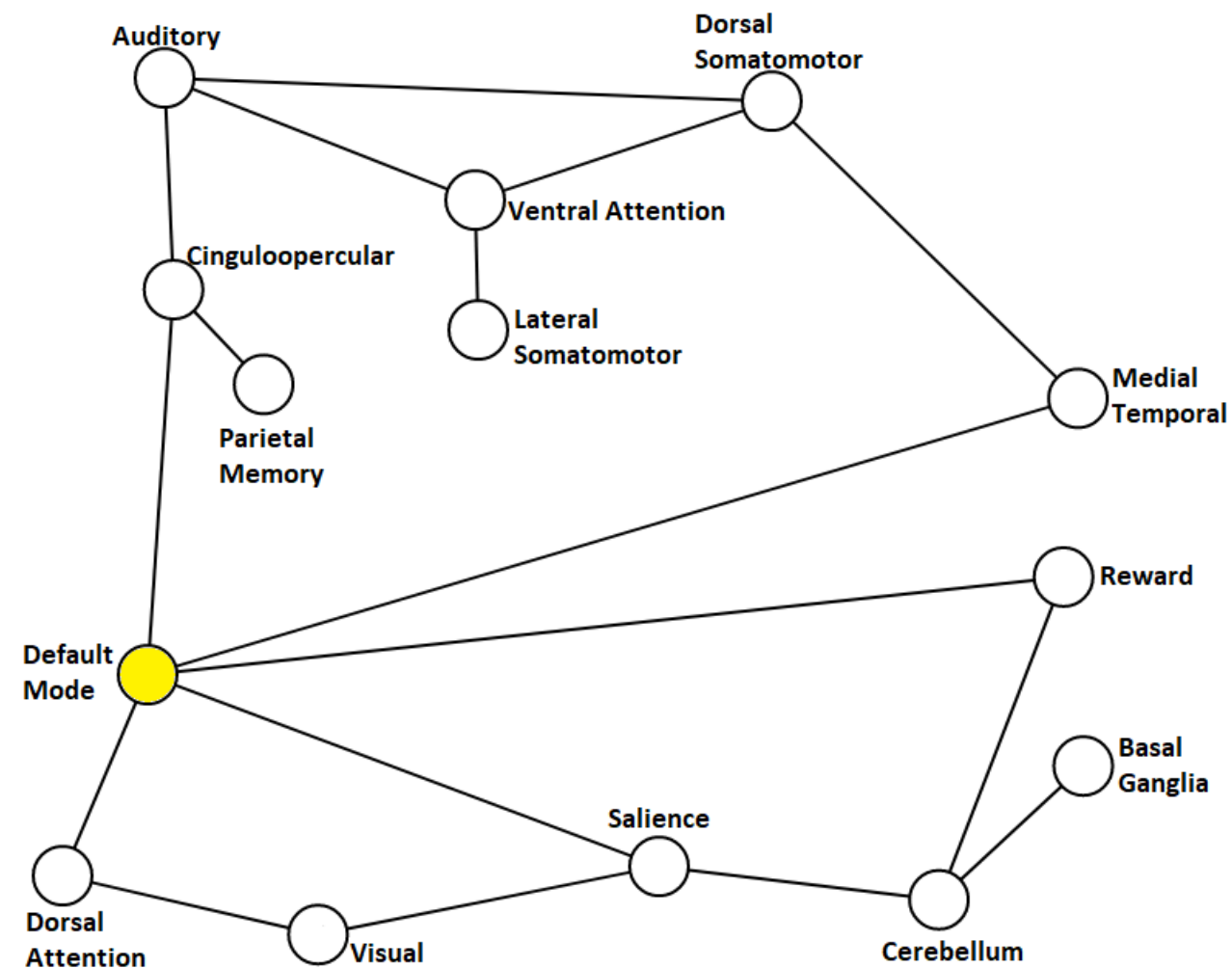
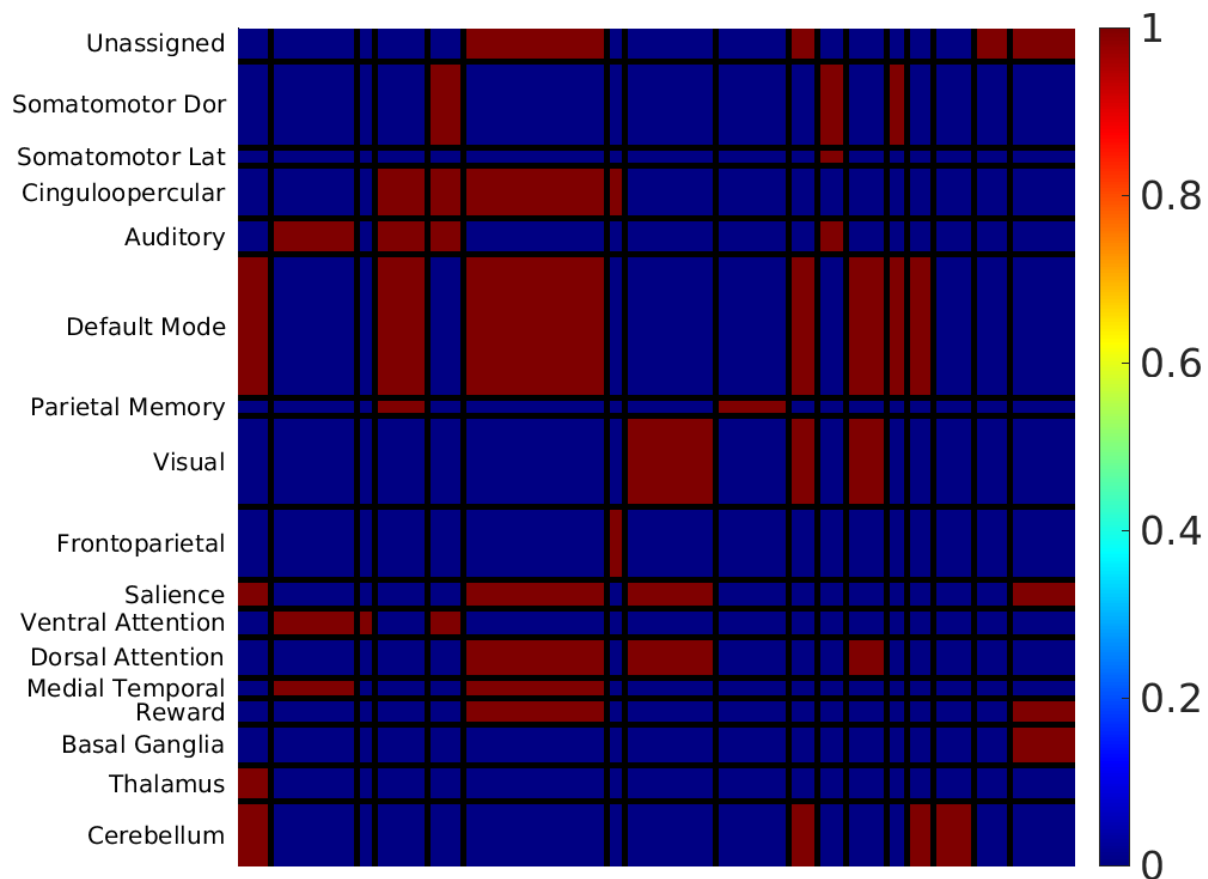
- Trajectory Modeling
 - Trajectories most affected by HIV
 - Average correlation strength for each age
 - Polynomial Curve Fitting
 - Similarity of trajectory
 - Correlations



Trajectories Most Affected



Trajectories Least Affected



Summary

- Strongest predictive regions of HIV status
 - Visual
 - Basal Ganglia
 - Salience
 - Cinguloopercular
 - Default Mode
- Subcortical/sensory regions affected first, followed by sensory/motor cortical regions
- Regional trajectories that showed the most dissimilarity
 - Vision
 - Basal ganglia
 - Somatomotor
- Regional trajectories that showed the least dissimilarity
 - Hubs involving the default mode

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