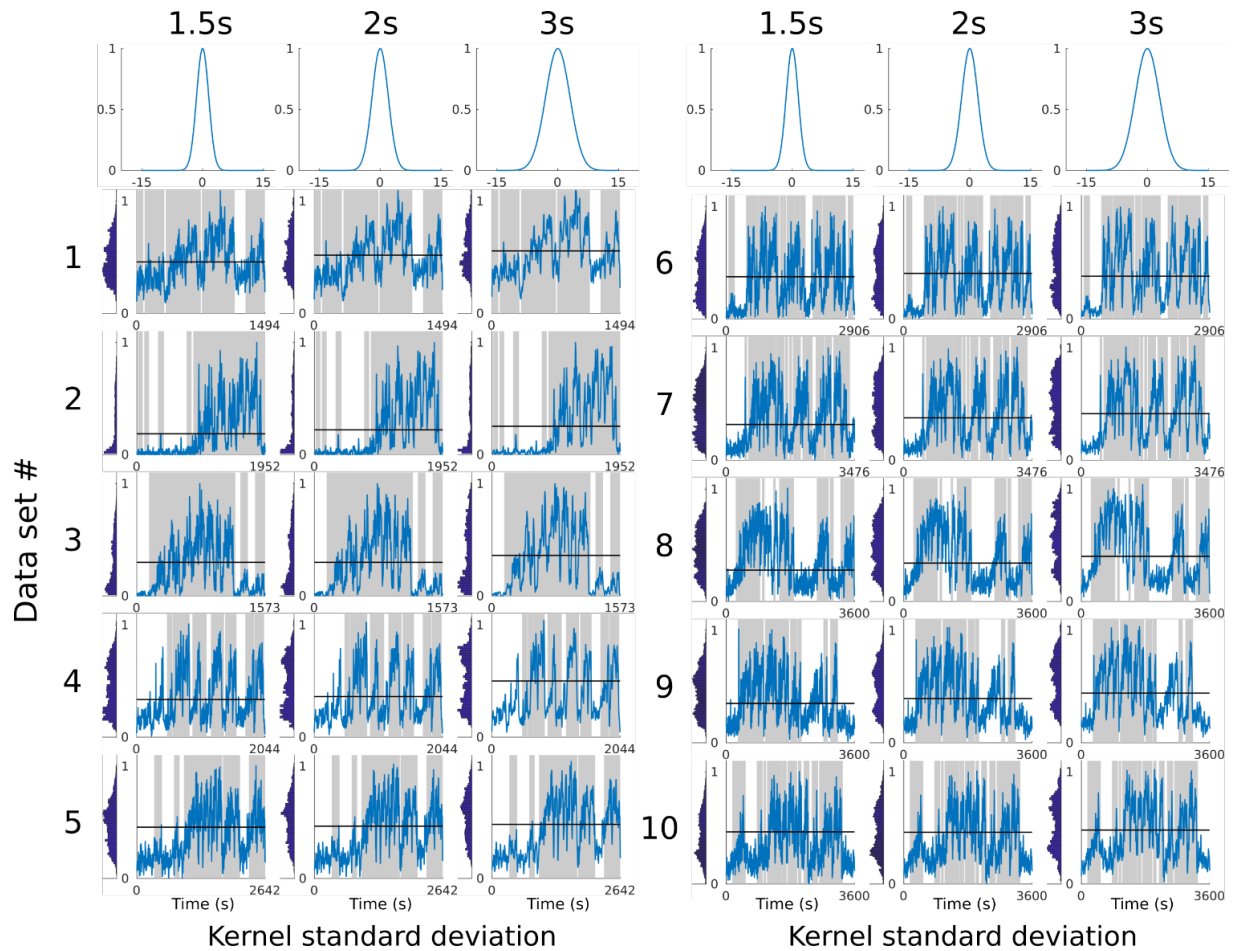
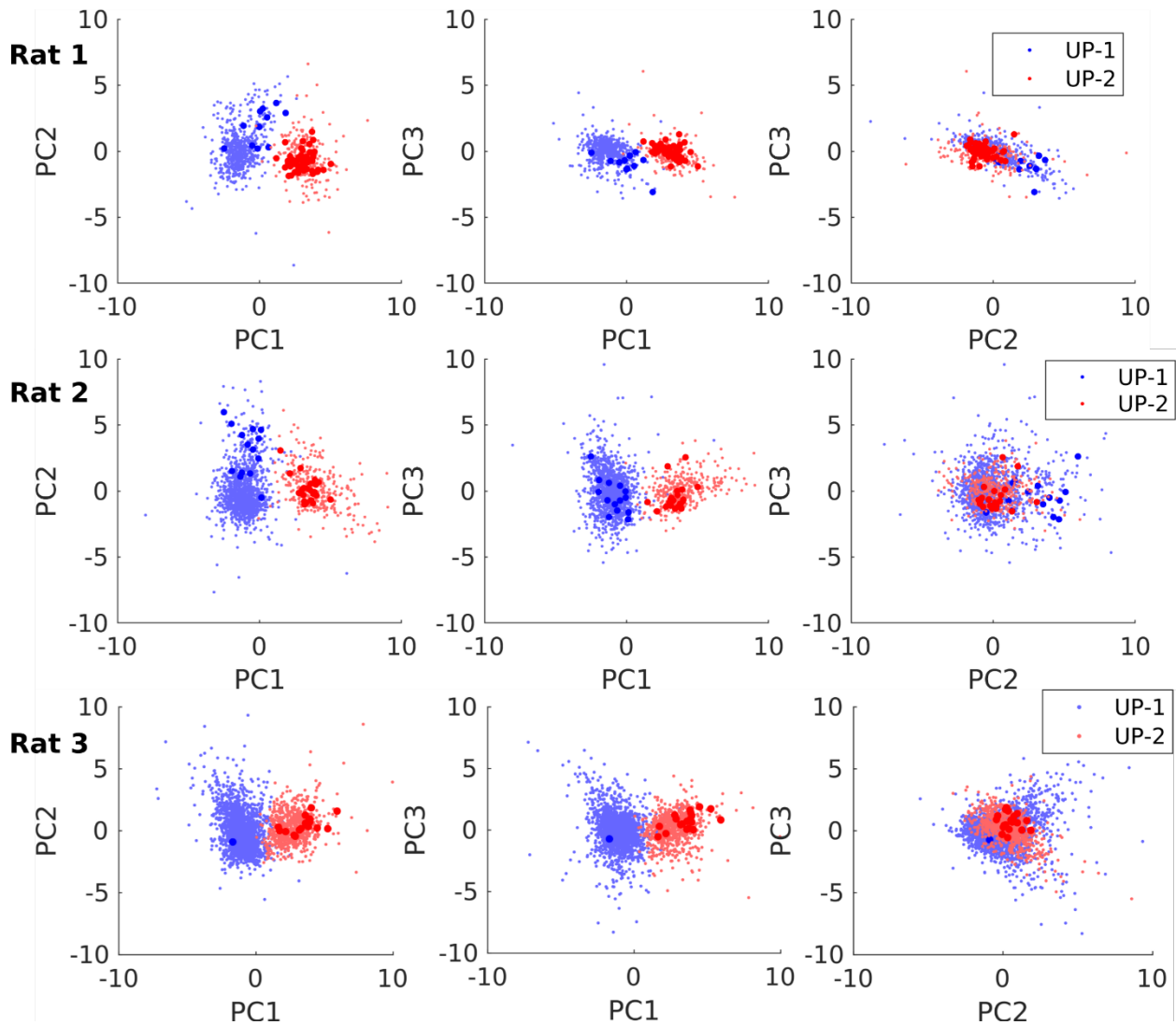


# Supplementary Figures

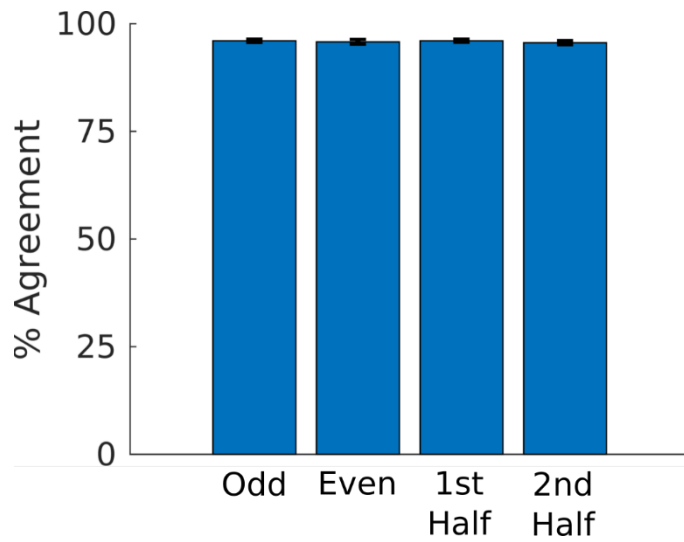
Tatsuno et al.



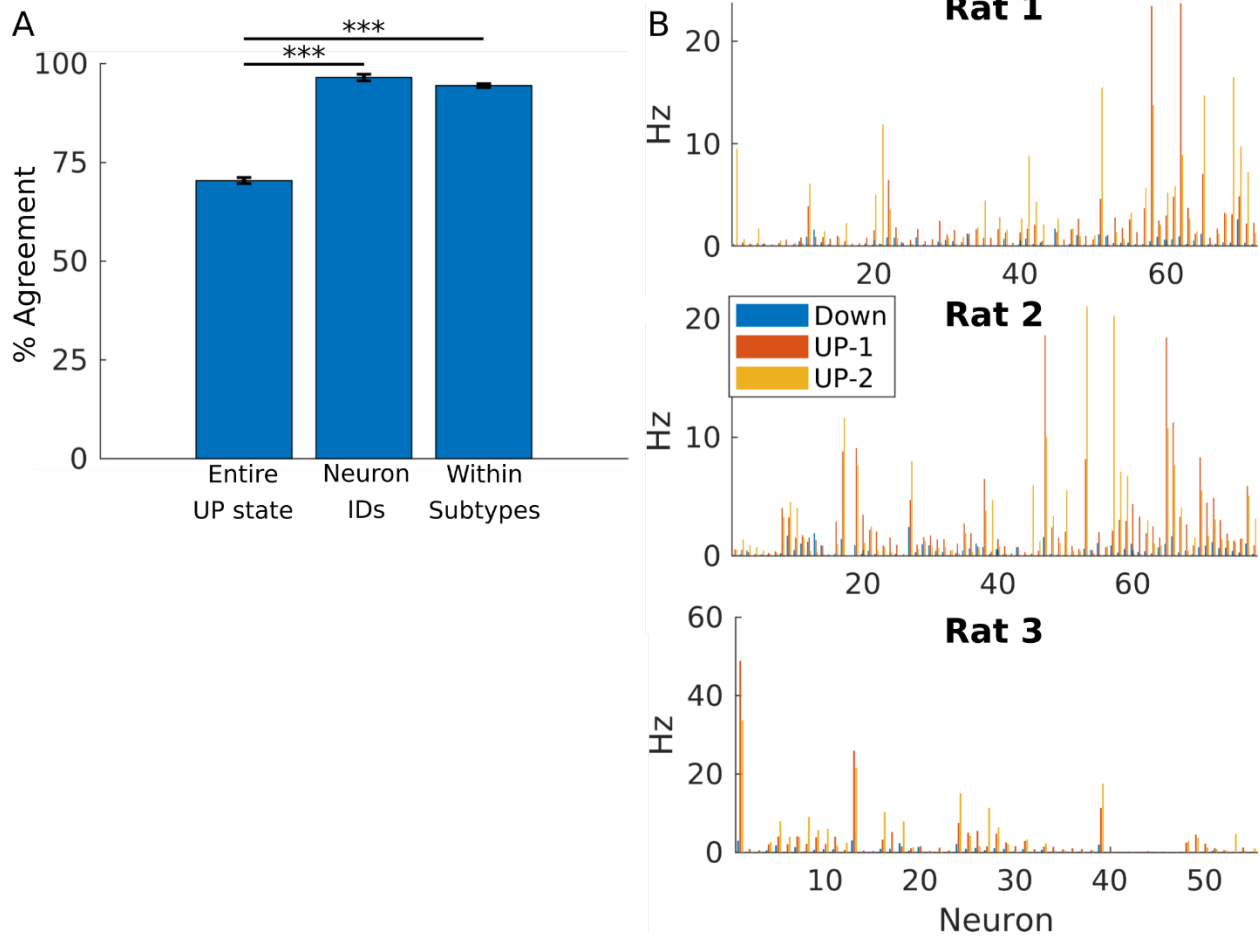
**Supplementary Figure 1. Epoch Threshold Determination.** Population firing rate for each data set using 20 ms bins was used to find time points when the firing rate equaled zero. The position of the zero bins were used to create a binary vector which was then convolved with a Gaussian kernel with a standard deviation of 1.5, 2 and 3 seconds. The corresponding convolved trace and the histogram of values from motionless periods (gray patches behind the convolved trace) is shown for each data set. The histogram was used to find a valley at which a threshold (black line) was set.



**Supplementary Figure 2. Comparison of Principal Component Projections.** Three different principal component projections for three data sets using the first three principal components. For Rat 1, 1.77% of UP-1 states had detected reactivation while 21% of UP-2 states had reactivation. For Rat 2, 1.11% of UP-1 states had reactivation and 6.45% of UP-2 states had reactivation. For Rat 3, 0.05% of UP-1 states had reactivation, and 2.55% of UP-2 states had reactivation.



**Supplementary Figure 3. Consistency of HMM Using Partial Data.** Each UP state was paired with its preceding DOWN state. Four different subsets were generated from the original data set. The first subset was odd-numbered DOWN-UP pairs (odd), the second subset was even-numbered DOWN-UP pairs (even), the third subset was the first half of the original data set (1st half) and the fourth subset was the second half of the original data set (2nd half). Then, an HMM was trained using each of four different subsets. The state sequences from these models was compared to the state sequence from the original HMM. Percent agreement was found using data from UP states where a transition between UP-1 and UP-2 occurred, and the preceding down state. Percent agreement across data sets is shown (mean  $\pm$  sem).



**Supplementary Figure 4. A. Percent Agreement for Shuffled HMM.** Percent agreement between the original model and shuffled models using 3 different shuffling methods: Unidimensional input data was shuffled within the entire UP state, within subtypes, or neuron IDs were randomly shuffled. Only UP states which contain a transition between the UP-1 and UP-2 and the preceding DOWN state were used. Results were averaged across each of the 10 shuffles and across data sets (mean  $\pm$  sem). (\*\*\*) =  $p < 0.001$ ). **B. Average Firing Rate of each Neuron in DOWN, UP-1 and UP-2 states.** Mean firing rate of each neuron in each state event (DOWN, UP-1 and UP-2) was averaged across all events. Three representative data sets are shown.