voltage vs. movement, take 1

us

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$T =$ number of time steps, x is channels, y is movement parameters. l is the number of lags. lag should be between 60 and 150 msec, or so. l can be about 10, so we add 9 different lags, ranging from 60 to 150 msec.

$x \in \mathcal{X} = \mathbb{R}_+^{96l \times T}$ $y \in \mathcal{Y} \subseteq \mathbb{R}^{k \times T}$, k can include measured stuff, plus their derivatives

things to do:

up/down-sample both x and y at 10kHz.

1. unsupervised dimensionality reduction followed by regression: Reduce dimensionality of x using sparse PCA, sparse-smooth PCA, sparse non-negative PCA. regress on y_t on x_{t-s}, where s is about 100 msec, linear, svr, MARS, GAM (generalized additive model). loss function is mse. concatenate trials by time. leave-some-out trials to estimate decoding accuracy. we can further classify into 8 choices after that if we want. can repeat with 1 to $95l$ dimensions

2. sparse CCA, free parameters: λ_x (and perhaps λ_y), and d (number of dimensions to keep). in theory, also include L_2 or structured penalty if code works (laplace penalty).

3. kalman filter: observed variable is x concatenated with y. hidden state is z:

$$\dot{z} = Az \tag{1}$$
$$w = Cz \tag{2}$$

   sparse penalty on C, connectivity matrix, which is $96l + k \times 96l + k$.

4. mixed effects assuming we have 8-alternative forced choice