#### Supplementary Materials

#### Canonical-correlation analysis (CCA) method

Given two column vectors and of random variables, CCA finds optimal weighting vectors *WY* and such that the correlation between *WYY* and *W* is maximized, subject to linear constraints [(Yanai and Takane, 1992)](https://paperpile.com/c/Jc9ZDg/VErB). It has been shown that the canonical vectors, *WY* and *WŶ* are the eigenvectors corresponding to the largest eigenvalues of the matrices and , respectively, where and are the within set covariance matrices and and are the cross-covariance matrices of the vectors in the Y and column vectors. Here we define *Y* as the vector of BOLD signal measurements (BOLD(*t*)), and is the column vector of the convolutions between the assumed . here is assumed to be a single Gamma function

(A1)

where σ represents the width of the peak (dispersion) and τ its location. The temporal derivatives of and the stimulus pattern (e.g., PETCO2(t)), and is the initialization for :

(A2)

As mentioned, CCA finds the optimal weighting vectors ( and ) that maximize the correlation between column vectors Y and ,

(A3)

(A4)