**(a)**

$$M_j^l = \{\beta_1 \cdots \beta_K\} \begin{bmatrix} a_{11} & a_{12} & \cdots \\ \vdots & \ddots & \\ a_{K1} & & a_{KK} \end{bmatrix} \left( \underbrace{\phantom{xxxxxx}}_{p_j} \star \phantom{xx} \right)$$

**Mixing signal generating row $l$ of $n$ for modality $j$**

**Rank-$K$ permutation matrix**
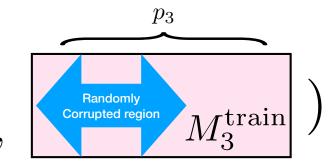
**Rank-$K$ modality-specific signal matrix**

**Modality-specific 1D or 2D smoothing kernel**

**Dimensionality Reduction**

**(b)**

$$Alg\left( \overbrace{\phantom{xxxx}}^{p_1} \text{Randomly Corrupted region } M_1^{\text{train}}, \quad M_2^{\text{train}}, \quad \overbrace{\phantom{xxxxx}}^{p_3} \text{Randomly Corrupted region } M_3^{\text{train}} \right)$$

**Supervision: 80/20 split**

$$lm(\vec{\beta}_1^{\text{train}} \approx \{M_j^{\text{train}} \times V_j\})$$

**(c)**

**Prediction & Evaluation**

$$lm(\{M_j^{\text{test}} \times V_j\}) \xleftrightarrow{R^2} \vec{\beta}_1^{\text{test}}$$

**(d)** **Noise level & R-squared signal recovery across methods**