

EECS 16A ##12.5 LECTURE 27##

* LAST LECTURE *

OMP FOR IMAGING

100x100 image. In Module 1, this took 10000 measures.

What if we know it's a sparse image? Most pixels black.

ex.
$$\begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_{10} \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 0 \\ 1 \end{bmatrix}$$

Only 4 measures, but given that only 2/10 pixels are nonzero

$= \tau_1 x_1 + \tau_2 x_2 + \dots + \tau_{10} x_{10} = \vec{r}$

$\langle \vec{r}, \tau_5 \rangle$ is greatest. $\hat{x}_5 = (\text{proj}_{\tau_5} \vec{r}) / \tau_5 = 1.5$

$\vec{r}_1 = \vec{r} - 1.5 \tau_5 = \begin{bmatrix} -0.5 \\ 0.5 \\ 0 \\ 1 \end{bmatrix}$

$\langle \vec{r}_1, \tau_7 \rangle$ is greatest. $\begin{bmatrix} \hat{x}_5 \\ \hat{x}_7 \end{bmatrix} = (S^T S)^{-1} S^T \vec{r} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$

$\hookrightarrow S = [\tau_5 \ \tau_7]$

VALIDATION

Let's go back to devices.



real gold codes

\vec{r} : microphone 1



ghost codes

not assigned to any device

When do we stop OMP?

Validation set: \vec{r}_{primary}

When you pick a ghost code!

$\vec{r}_{\text{validation}}$

strongest signals will reach both

Central Question: How do I know my model is any good?

Train on some data, validate cost on other data. This will help avoid overfitting.

* END OF COURSE *