The cocktail party problem: information theory lecture 10

COMSM0075 Information Processing and Brain

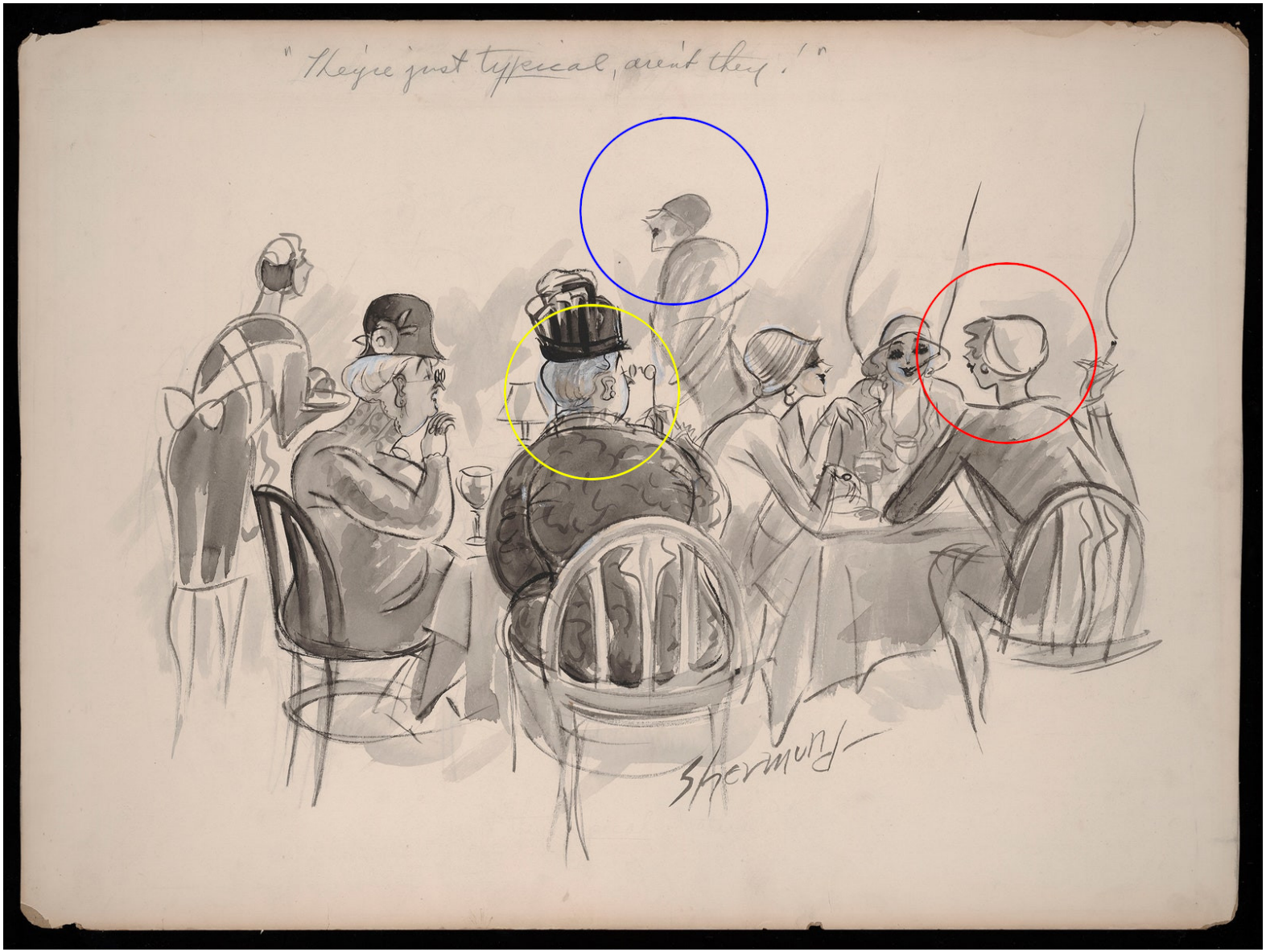
comsm0075.github.io

October 2020

The cocktail party problem

Cartoon by Barbara Shermund.

The cocktail party problem

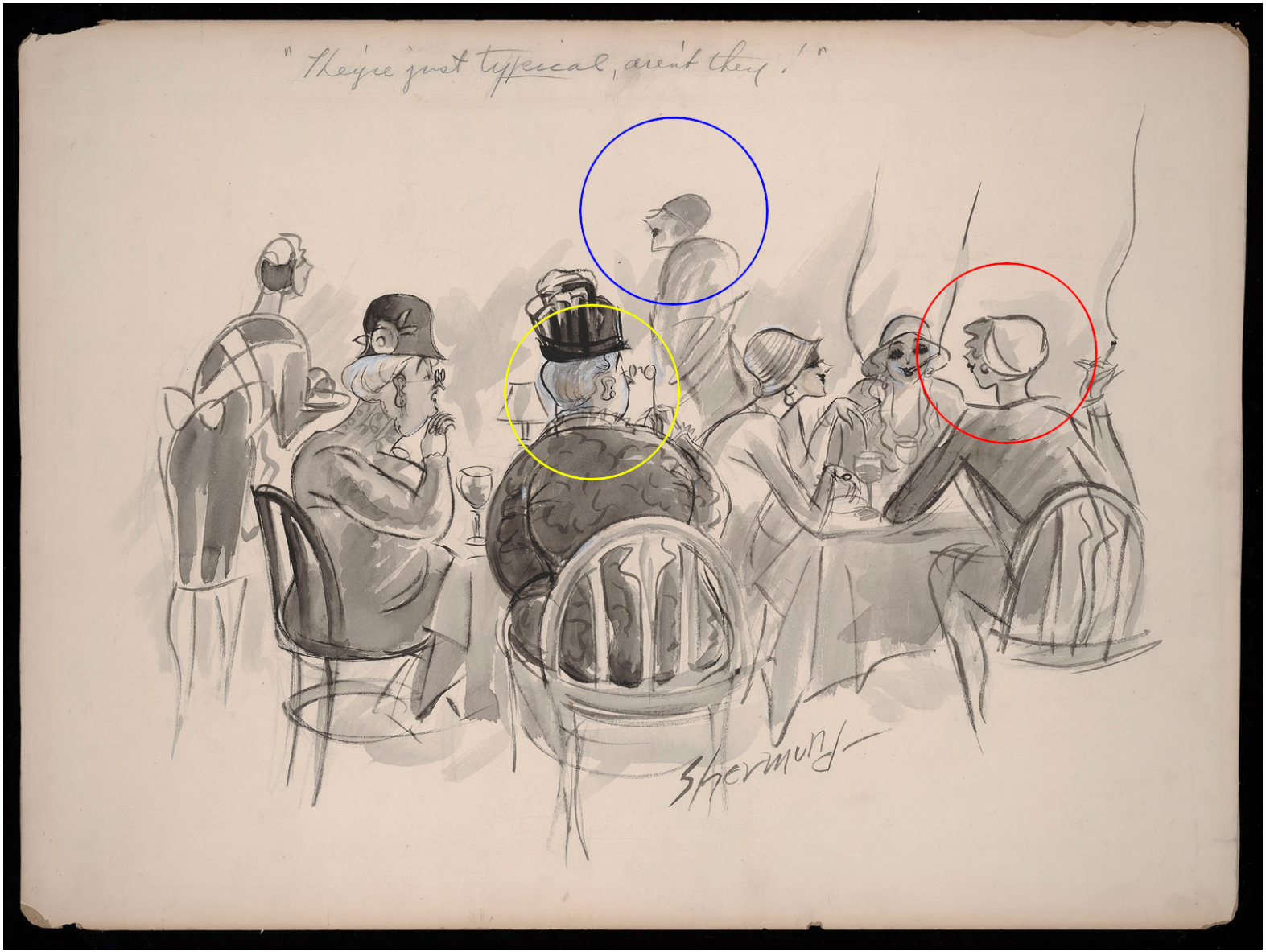


Cartoon by Barbara Shermund.

The cocktail party problem

Image from wikipedia.

The cocktail party problem



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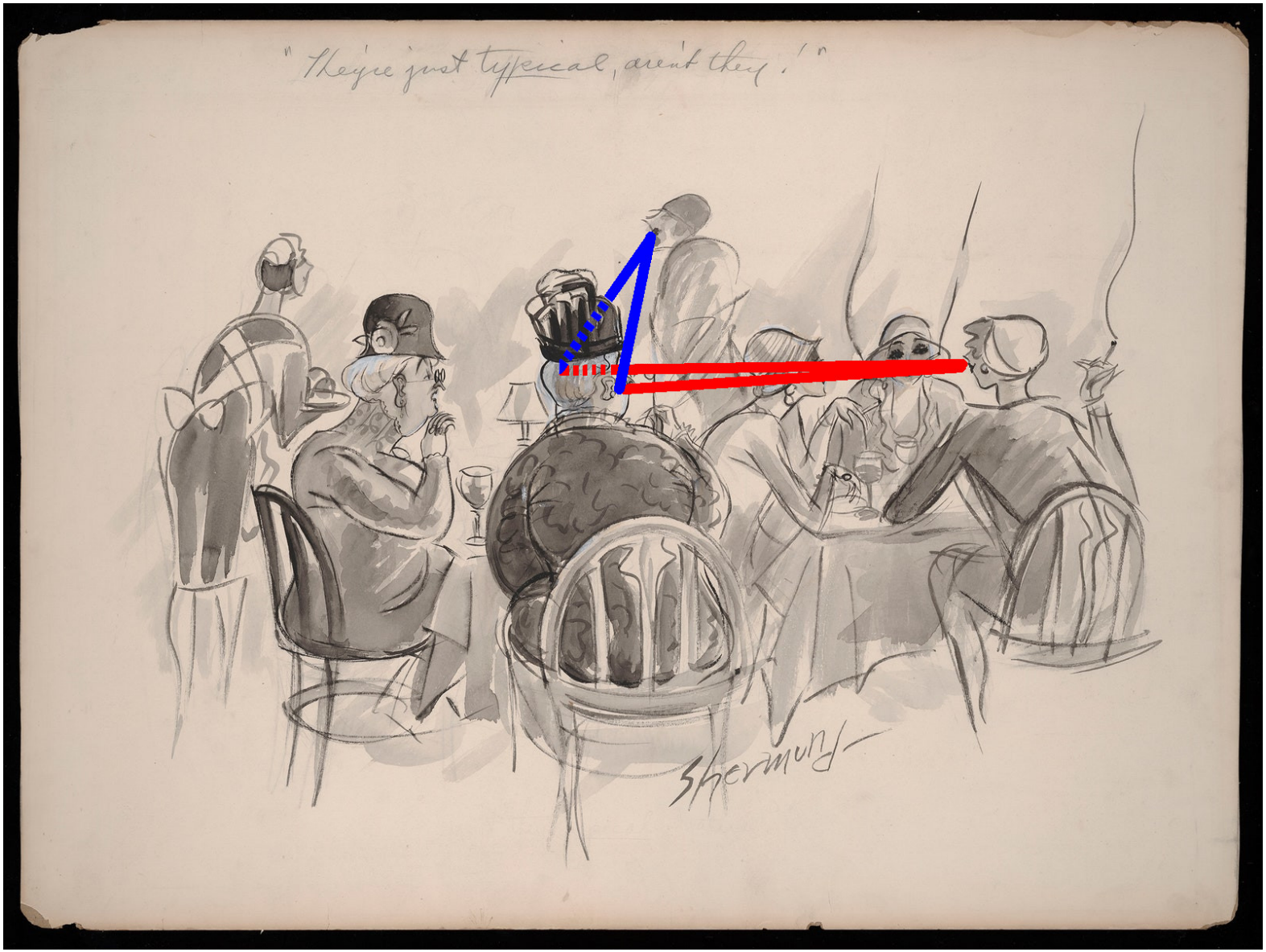

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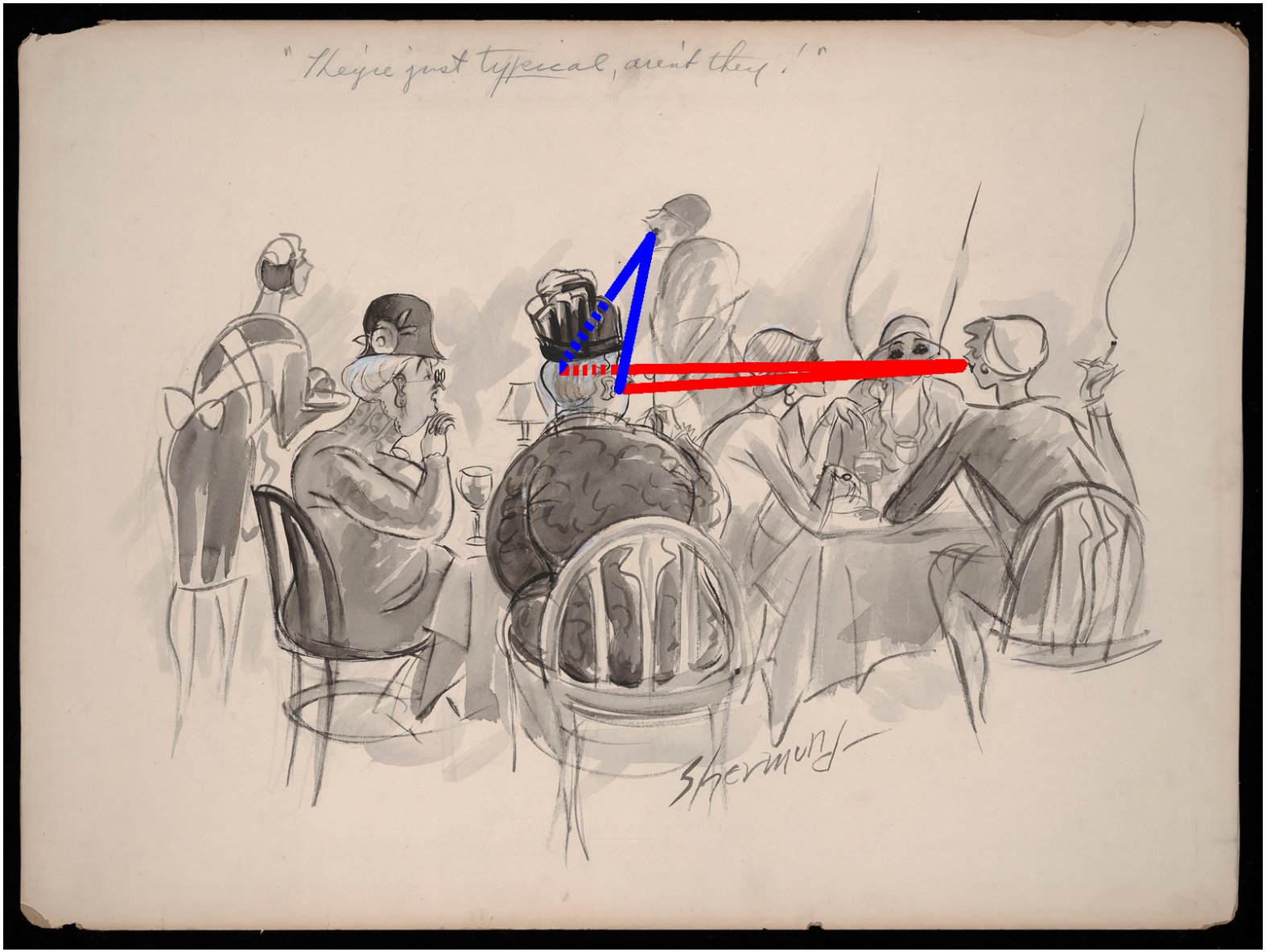
The cocktail party problem

Image from wikipedia.

The cocktail party problem - simple version



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The simple version

$$\mathrm{r}(t) = M\mathrm{s}(t)$$

with

- $\mathrm{r}(t)$ recordings
- $\mathrm{s}(t)$ sources
- M mixing matrix

Assume

$$p_{S_1,S_2}(s_1, s_2) = p_{S_1}(s_1)p_{S_2}(s_2)$$

Source separation

$$\mathrm{x}(t) = W\mathrm{r}(t)$$

so that $\mathrm{x}(t)$ is more-or-less $\mathrm{s}(t)$ - some rescaling and shuffling may occur. In this two-to-two example, that means

$$MW = \mathrm{diag}\,(d_1, d_2)$$

or

$$MW = \begin{pmatrix} 0 & d_1 \\ d_2 & 0 \end{pmatrix}$$

Source separation

$$\mathsf{s} \overset{\text{mixing}}{\longrightarrow} \mathsf{r} = M\mathsf{s} \overset{\text{unmixing}}{\longrightarrow} \mathsf{x} = W\mathsf{r}$$

Two approaches

- `fastICA`
- Infomax

fastICA

`FastICA` maximizes the non-Gaußianity of the components of x.