Ass #1: Return today
Ass #2: Out Friday due after reading week.
Project: Replies by Friday (e-mail)
Books: "cs 481" Davis Lib

GS 50r 1946 Spatial vs Frequency Rep'n

Time only

??

[Graphs and diagrams]

Time

Short Time Fourier Transform (STFT)

Each box is a complex #/Phase & Magnitude

Gaussian weighted cosine

Gaussian weighted sine

Output = cosθ + isinθ
\[ \mathcal{N}(\bar{X}, \bar{\sigma}^2) = e^{-\frac{(\mathbf{x} - \bar{X})^2}{2\sigma^2}} \leq \text{Gaussian Normal} \]

\[ \mathbf{x} = (x_1, x_2, \ldots, x_n) \]

\[ \bar{X} = \frac{1}{n} \sum_{i=1}^{n} x_i \]

\[ \bar{\sigma}^2 = \frac{1}{n} \sum_{i=1}^{n} (x_i - \bar{X})^2 \]

\[ \mathbf{Z} = (z_1, z_2, \ldots, z_n) \]

\[ \text{Sampled from Gaussian } \mathcal{N}(\bar{X}, \bar{\sigma}^2) \]

\[ \mathbf{v}_i \quad \mathbf{r}_i \quad \mathbf{r}_i \]

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From slides: Dougman 1989
Olshausen and Field
Mellon and Burr
Edge Detection

"Ideal edges" \(\rightarrow\) \(\times\) \(\rightarrow\) ext

"Root edge"

"Rise"

"5c"

Edge Detection

Edges: Collections of edges that make curves, lines, segments, etc.

Problem

1. Detect edges
2. Grouping edges
3. Interpretation: Cause/meaning of edge
OPTIMAL EDGE DETECTION (Conry) IEEE PAMI 8 (6), 1986

White noise \( \sim \mathcal{N}(0, \sigma) \)

What is the optimal filter to detect this edge?


“Difference of boxers”


All you need to know:

1. Blur image
   \[ \hat{J} \leftarrow \text{blur}(I) \]
   \[ \frac{1}{[1 - 1 0]} \]

2. Compute
   \[ \nabla J = \left( \frac{\partial J}{\partial x}, \frac{\partial J}{\partial y} \right) \]
   \[ \left( \frac{\partial}{\partial x}, \frac{\partial}{\partial y} \right) \]
   \[ \frac{5}{5} \]
   \[ 0 \]
   \[ 0 \]
   \[ 0 \]
3. Edges

\[ e_s(i,j) = \|\nabla x\| = \|\nabla (x \cdot \hat{r})\| = \sqrt{x_i^2 + y_j^2} \]

\[ e_\theta(i,j) = \text{atan} \left( \frac{x_i}{y_j} \right) \]

4. Non maximum edge suppression

5. Still in edges

6. Grouping - e.g. sitting lines are not smooth curves.