

25/06/20

Anika Fuchs: 2580781

Arkit Agrawal: 2581532

Akshay Joshi: 2581346

IPCV Assignment 7

Morphology

Given:

- $A_B(f) = (f \oplus B) - f$
- $B_B(f) = f - (f \ominus B)$
- $C_B(f) = (f \oplus B) - (f \ominus B)$
- $D_B(f) = A_B(f) - B_B(f)$

Q 1-D signal $f = (\dots, 0, 0, 0, 0, 1, 1, 1, 1, \dots)^T$

Also the structuring element is of size 3

i) $A_B(f) = (f \oplus B) - f$

$$\rightarrow A_B(f) = (\dots, 0, 0, 0, 1, 1, 1, 1, \dots)^T - (\dots, 0, 0, 0, 1, 1, 1, 1, \dots)^T$$

$$= (\dots, 0, 0, 0, 1, 0, 0, 0, \dots)^T$$

ii) $B_B(f) = f - (f \ominus B)$

\rightarrow substitute values of f & $f \ominus B$

$$B_B(f) = (\dots, 0, 0, 0, 0, 1, 1, 1, 1, \dots)^T - (\dots, 0, 0, 0, 0, 1, 1, 1, 1, \dots)^T$$

$$= (\dots, 0, 0, 0, 0, 1, 0, 0, 0, \dots)^T$$

iii) $C_B(f) = (f \oplus B) - (f \ominus B)$

$$C_B(f) = (\dots, 0, 0, 0, 1, 1, 1, 1, \dots)^T - (\dots, 0, 0, 0, 0, 1, 1, 1, 1, \dots)^T$$

$$= (\dots, 0, 0, 0, 1, 1, 0, 0, 0, \dots)^T$$

$$iv) D_B(f) = A_B(f) - B_B(f)$$

$$\begin{aligned} \rightarrow D_B(f) &= ((f \oplus B) - f) - (f - (f \ominus B)) \\ &= (f \oplus B) - 2f + (f \ominus B) \\ &= (\dots, 0, 0, 0, 1, 1, 1, 1, 1, \dots)^T - 2(\dots, 0, 0, 0, 0, 0, 0, 0, 0, \dots)^T \\ &\quad + (\dots, 1, 1, 1, 1, \dots)^T + (\dots, 0, 0, 0, 0, 0, 1, 1, 1, \dots)^T \\ &= (\dots, 0, 0, 0, 1, \underline{-1}, 0, 0, 0, \dots)^T \end{aligned}$$

⑤ Applying ^{state} linear shift-invariant filter \otimes on A_B, B_B, C_B, D_B

→ FOR A_B we can apply 'schwartzky cylinder hat' which extracts small dark structures
i.e. $f \cdot B - f$

• B_B : we can use 'white top hat' to extract small bright structures
 $f - (f \circ B)$

• C_B : we can apply 'self dual top hat'
i.e. $(f \cdot B) - (f \circ B)$
[extract both bright & dark details]

• D_B : We would have to ^{take difference} ~~combine~~ both 'black top' & 'white top hat'
i.e. $((f \cdot B) - f) - (f - (f \ominus B))$
 $= (f \cdot B) - 2f + (f \ominus B)$

1] Structure Tensor Analysis:

→ ⑤ Since the tensor/second moment matrix is derived from the gradient of a function, we can't detect corners when $P=0$, since it ~~is~~ invariantly means applying gaussian smoothing over the tensor