(10) Distance Transform

甲、摘要

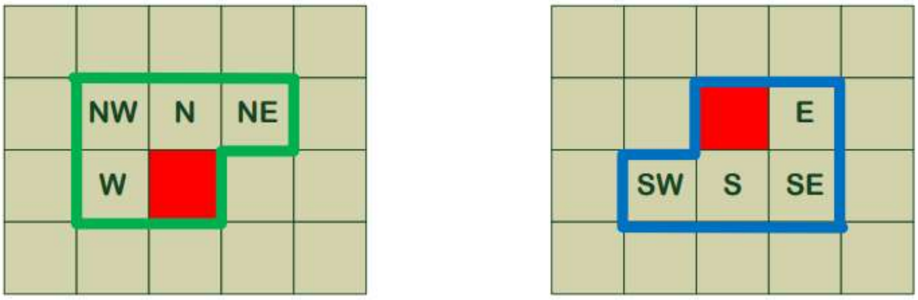
設計 Distance Transform 電路能使輸入的二值化影像能產生出一灰階圖像，其強度非亮度值而是物件內部每一點與物件邊緣的距離。

乙、想法

Distance transform 演算法:

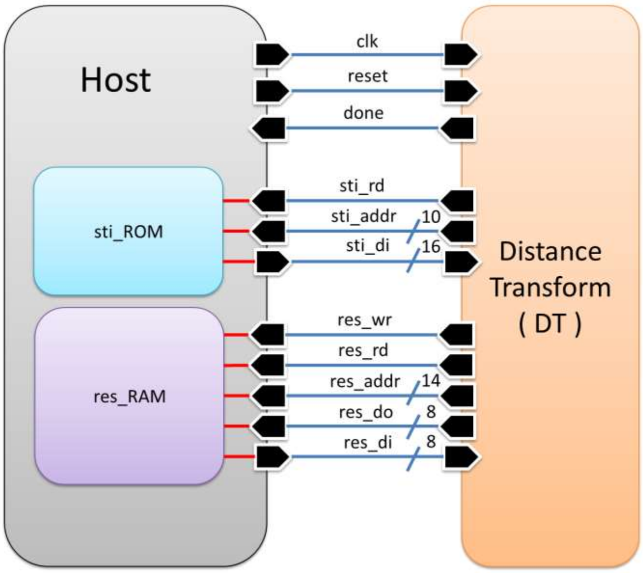
利用 Chessboard distance 量測距離 $D(p_1,p_2)=\max(|x_1-x_2|,|y_1-y_2|)$假設二值化影像資料 0 代表背景，1 代表物件，則上述量測距離公式可看成對於每一物件區域的像素，計算其與最近的背景像素的距離，並以此距離值來取代原物件像素值。

而上述演算法可簡化成 8-distance transform 方式進行，利用 Forward pass 及 Backward pass 兩個步驟達到相同成果。Forward pass 從影像左上到右下去掃 window，若為物件則進行 $P=\min(P_W,P_{NW},P_N,P_{NE})+1$；而 backward pass 剛好相反，由右下到左上，若為物件則進行 $P=\min(P_W+1,P_{NW}+1,P_N+1,P_{NE}+1)$。



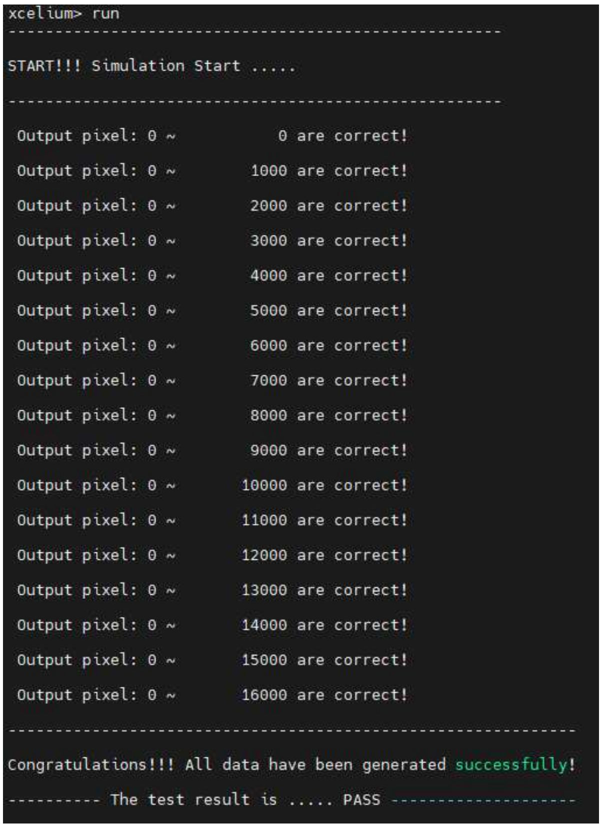
Forward pass window　　Backward pass window

圖一、Forward pass window 及 Backward pass window



圖二、系統方塊圖

丙、結果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xcelium> run
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START!!! Simulation Start .....

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 Output pixel: 0 ~          0 are correct!

 Output pixel: 0 ~       1000 are correct!

 Output pixel: 0 ~       2000 are correct!

 Output pixel: 0 ~       3000 are correct!

 Output pixel: 0 ~       4000 are correct!

 Output pixel: 0 ~       5000 are correct!

 Output pixel: 0 ~       6000 are correct!

 Output pixel: 0 ~       7000 are correct!

 Output pixel: 0 ~       8000 are correct!

 Output pixel: 0 ~       9000 are correct!

 Output pixel: 0 ~      10000 are correct!

 Output pixel: 0 ~      11000 are correct!

 Output pixel: 0 ~      12000 are correct!

 Output pixel: 0 ~      13000 are correct!

 Output pixel: 0 ~      14000 are correct!

 Output pixel: 0 ~      15000 are correct!

 Output pixel: 0 ~      16000 are correct!

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Congratulations!!! All data have been generated successfully!

---------- The test result is ..... PASS --------------------
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圖三、驗證結果正確且達 Rank A