

Project #12 HINT

See section 7.5, pp. 172–173. Apply HINT (Hierarchical INTERpolation) method to Sena test image (8 bpp gray scale). Figure 7.2, p. 173, shows HINT scheme for 4×4 block structure.

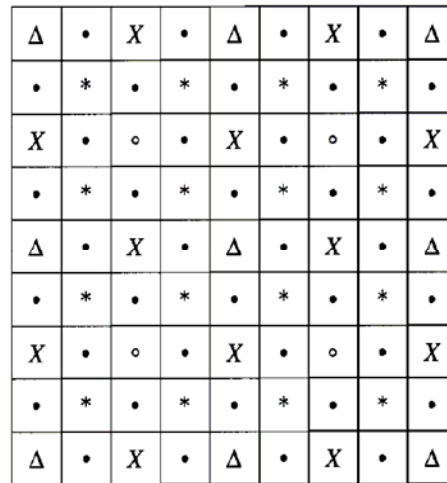
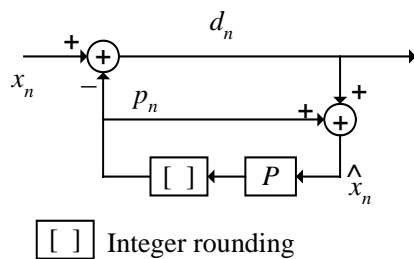


Figure 7.2, p. 173 [K. Sayood, *Introduction to Data Compression–3rd Edition*. San Francisco, CA: Morgan Kaufmann, 2006.]

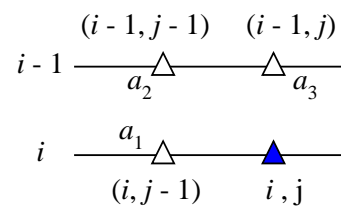
(Step 1) Down sampling of original image by 1:4 to get the low-resolution image with pixels labeled Δ. Apply DPCM (without quantizer) with the 3-tap predictor of the form,

$$\hat{x}_{i,j} = a_1x_{i,j-1} + a_2x_{i-1,j-1} + a_3x_{i-1,j} \text{ where } x \text{ is in the sub-sampled } \Delta \text{ pixels.}$$

$$\{a_1, a_2, a_3\} = \left\{ \frac{7}{8}, -\frac{5}{8}, \frac{3}{4} \right\}. \text{ Use zeros for unavailable predicted pixels.}$$

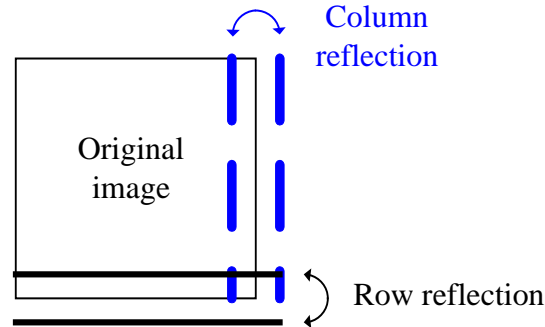


DPCM block diagram in Step 1.



Prediction scheme of Δ pixel at *i,j* location.

(Step 2) Use full-resolution Sena and replace the original  $\Delta$  pixels with the reconstructed  $\Delta$  pixels ( $\hat{x}_n$  in Step 1). The pixels labeled o are estimated from four surrounding  $\Delta$  pixels by  $\frac{1}{4} \sum_{k=1}^4 \Delta_k$  (linear interpolation). Use reflection of rows and columns at the image boundary for the o pixel locations where  $\Delta$  pixels are missing. Rounding the estimates to the nearest integer. Subtract the rounded estimates from the current  $\Delta$  pixel. Show 1-D histogram of the error (residual) and calculate the entropy based on the histogram.



Row and column reflections at the image boundary in Step 2

(Step 3) The pixels labeled X are estimated from four surrounding  $\Delta$  and o by  $\frac{1}{4} \sum_{k=1}^2 (\Delta_k + o_k)$ . Use reflection of rows and columns at the image boundary for the X pixel locations where  $\Delta$  and o pixels are missing. Rounding the estimates to the nearest integer. Subtract the rounded estimates from the current X pixel. Show 1-D histogram of the error (residual) and calculate the entropy based on the histogram.

(Step 4) The pixels labeled \* are estimated from  $\Delta$ , X, and o pixels. Perform rounding and subtracting similar to (Step 3). Show 1-D histogram of the error (residual of \* pixels) and calculate the entropy based on the histogram.

(Step 5) The pixels labeled • are estimated from known neighboring pixels ( $\Delta$ , X, o, \*). Perform rounding and subtracting similar to (Step 3). Show 1-D histogram of the error (residual of • pixels) and calculate the entropy based on the histogram.

Show 1-D histogram of Sena image, calculate entropy of Sena image and compare the results from Steps 1–5.