Discrete Cosine Transformation

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1 Discrete Cosine Transformation:

$$\tilde{X}^{c2}[k] = \sqrt{\frac{2}{N}} \tilde{\beta}[k] \sum_{n=0}^{N-1} x[n] \cos\left(\frac{\pi k (2n+1)}{2N}\right), \qquad k = 0, 1, ..., N-1.$$

where, $[k] = \begin{cases} \frac{1}{\sqrt{2}}, & k = 0, \\ 1, & k = 1, 2, ..., N-1. \end{cases}$

With scaling factor,

$$c2[k] = \omega[k] \sum_{n=0}^{N-1} x[n] \cos\left(\frac{\pi k(2n+1)}{2N}\right), \qquad k = 0, 1, ..., N-1.$$

where,

$$\omega[k] = \begin{cases} \frac{1}{\sqrt{N}}, & k = 0, \\ \sqrt{\frac{2}{N}}, & k = 1, 2, ..., N-1. \end{cases} \tag{1}$$

2 Inverse Discrete Cosine Transform:

$$x[n] = \sqrt{\frac{2}{N}} \sum_{n=0}^{N-1} \tilde{\beta}[k] \tilde{X}^{c2} \cos\left(\frac{\pi k(2n+1)}{2N}\right), \qquad 0 \le n \le N-1,$$

where,

$[k] = \begin{cases} \frac{1}{\sqrt{2}}, & k = 0, \\ 1, & k = 1, 2, ..., N-1. \end{cases}$

With scaling factor,

$$x[n] = \omega[k] \sum_{n=0}^{N-1} \tilde{X}^{c2}[k] \cos\left(\frac{\pi k(2n+1)}{2N}\right), \qquad 0 \le n \le N-1,$$

where,

$$\omega[k] = \begin{cases} \frac{1}{\sqrt{N}}, & k = 0, \\ \\ \sqrt{\frac{2}{N}}, & k = 1, 2, ..., N - 1 \end{cases} \tag{2}$$