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Representation of Problems

I/O dimension	$d = (n, i, o)$	(length, input stride, output stride)
I/O tensor	$t = (d_1, d_2, \dots, d_\rho)$	A set of I/O dimensions
Rank	$\rho = t $	

$$d = (n, i, o)$$

DFT (1)

$$Y[k] = \sum_{j=0}^{n-1} X[j] \omega_n^{jk} \quad \omega_n = e^{-j2\pi/n} \quad n = n_1 n_2 \quad 0 \leq k < n \quad 0 \leq j < n$$

$$k = k_1 + k_2 n_1 \quad 0 \leq k_1 < n_1 \quad 0 \leq k_2 < n_2$$

$$j = j_1 n_2 + j_2 \quad 0 \leq j_1 < n_1 \quad 0 \leq j_2 < n_2$$

$$Y[k_1 + k_2 n_1] = \sum_{j_2=0}^{n_2-1} \sum_{j_1=0}^{n_1-1} X[j_1 n_2 + j_2] \omega_{n_1 n_2}^{(k_1 + k_2 n_1)(j_1 n_2 + j_2)}$$

$$(k_1 + k_2 n_1)(j_1 n_2 + j_2) = k_1 j_1 n_2 + k_2 j_1 n_1 n_2 + k_1 j_2 + k_2 j_2 n_1$$

$$\omega_{n_1 n_2}^{(k_1 + k_2 n_1)(j_1 n_2 + j_2)} = \omega_{n_1 n_2}^{k_1 j_1 n_2} \cdot \omega_{n_1 n_2}^{k_2 j_1 n_1 n_2} \cdot \omega_{n_1 n_2}^{k_1 j_2} \cdot \omega_{n_1 n_2}^{k_2 j_2 n_1}$$

$$= \omega_{n_1}^{k_1 j_1} \cdot 1 \cdot \omega_n^{k_1 j_2} \cdot \omega_{n_2}^{k_2 j_2}$$

$$Y[k_1 + k_2 n_1] = \sum_{j_2=0}^{n_2-1} \left[\left(\sum_{j_1=0}^{n_1-1} X[j_1 n_2 + j_2] \omega_{n_1}^{k_1 j_1} \right) \omega_n^{k_1 j_2} \right] \omega_{n_2}^{k_2 j_2}$$

DFT (2)

$$Y[k_1 + k_2 n_1] = \sum_{j_2=0}^{n_2-1} \left[\left(\sum_{j_1=0}^{n_1-1} X[j_1 n_2 + j_2] \omega_{n_1}^{k_1 j_1} \right) \omega_n^{k_1 j_2} \right] \omega_{n_2}^{k_2 j_2}$$

n_2 DFT of size n_1 n_1 DFT of size n_2

Message Aggregation

References

- [1] <http://en.wikipedia.org/>
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- [6] <http://www.mpi-forum.org/docs/mpi-11-html>