

Feb. 5, 2013

Lexicographic order.

* data cube of $512 \times 512 \times 512$ sampling points.

For the point of $P(200, 150, 300)$, what is the 1-D index in Lexicographic order? $P(i) = P(n_1, n_2, n_3)$

$$i = n_1 + \sum_{k=2}^d \left(n_k \prod_{l=1}^{k-1} N_l \right)$$

For $d=3$

$$i = n_1 + n_2 N_1 + n_3 N_1 N_2$$

For this example, $N_1 = N_2 = N_3 = 512$ (dimension size)

the 3-D indices, $n_1 = 200, n_2 = 150, n_3 = 300$

$$i = 200 + 150 \times 512 + 300 \times 512 \times 512$$

$$i = 78720200$$

$$P(78720200) = P(200, 150, 300)$$

* For the same data cube, if the 1-D Lexicographic-order index is 15,001,123, what is the 3-D indices?

$$P(n_1, n_2, n_3)$$

$$\text{From } i = n_1 + n_2 N_1 + n_3 N_1 N_2$$

$$n_3 = i / N_1 N_2 = 57 \Rightarrow n_3 \text{ (the integer quotient)}$$

$$n_1 + n_2 N_1 = i \bmod N_1 N_2 \quad \text{(the remainder) } \underline{R}$$

$$\Rightarrow n_2 = \underline{R} / N_1 \Rightarrow n_2$$

$$\Rightarrow n_1 = R \bmod N_1 \Rightarrow n_1$$

$$n_3 = 15001123 / (512 \times 512) = 57; \quad R = 15001123 - 57 \times 512 \times 512$$

$$R = 15001123 \bmod (512 \times 512) = 58915; \quad n_2 = 115; \quad n_3 = 35$$