

8X8 DCT

NxN 大小的变换公式:

$$C(u, v) = \alpha(u)\alpha(v) \sum_{x=0}^{N-1} \sum_{y=0}^{N-1} f(x, y) \cos\left[\frac{\pi(2x+1)u}{2N}\right] \cos\left[\frac{\pi(2y+1)v}{2N}\right]$$

反变换:

$$f(x, y) = \sum_{u=0}^{N-1} \sum_{v=0}^{N-1} \alpha(u)\alpha(v) C(u, v) \cos\left[\frac{\pi(2x+1)u}{2N}\right] \cos\left[\frac{\pi(2y+1)v}{2N}\right]$$

其中

$$\alpha(u) = \begin{cases} \sqrt{\frac{1}{N}} & \text{for } u = 0 \\ \sqrt{\frac{2}{N}} & \text{for } u \neq 0. \end{cases}$$

对于 8 x 8 矩阵来说, 公式如下

变换:

$$C(u, v) = \frac{1}{4} a(u) a(v) \sum_{x=0}^7 \sum_{y=0}^7 f(x, y) \cos\left[\frac{\pi(2x+1)u}{16}\right] \cos\left[\frac{\pi(2y+1)v}{16}\right]$$

反变换:

$$f(x, y) = \frac{1}{4} \sum_{u=0}^7 \sum_{v=0}^7 a(u) a(v) C(u, v) \cos\left[\frac{\pi(2x+1)u}{16}\right] \cos\left[\frac{\pi(2y+1)v}{16}\right]$$

其中:

$$a(u) = \begin{cases} 1 & u = 0 \\ \sqrt{2} & u < 8 \\ 1 & u \geq 8 \end{cases}$$

根据上述公式编写程序，第一个数据块是原始数据，第二个数据块是计算得到的结果，第三个数据块是计算反变换取得的结果：

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C:\D:\Program Files\Borland\Delphi7\Projects\dct.exe
Source:
57.00 06.00 84.00 82.00 42.00 59.00 53.00 81.00
78.00 49.00 25.00 33.00 13.00 81.00 48.00 01.00
26.00 82.00 10.00 60.00 20.00 88.00 63.00 75.00
59.00 45.00 09.00 20.00 79.00 67.00 01.00 31.00
19.00 34.00 13.00 46.00 67.00 19.00 86.00 89.00
10.00 80.00 56.00 80.00 33.00 47.00 08.00 82.00
05.00 97.00 31.00 29.00 49.00 00.00 50.00 84.00
87.00 74.00 76.00 21.00 93.00 78.00 91.00 43.00

DCT Result:
0400.50 -0029.41 0018.19 0002.24 -0002.00 -0034.19 -0016.19 -0027.09
-0019.05 -0001.09 -0008.78 0030.83 0006.03 0054.71 0046.61 -0038.49
0046.07 0025.08 0004.45 -0000.67 -0027.44 0038.04 0026.82 0031.98
-0012.73 -0016.94 -0015.15 -0086.65 0035.53 0012.52 0007.22 -0001.44
0027.25 -0015.16 -0014.99 0032.48 0032.25 0019.08 0023.26 0066.50
-0014.92 -0000.26 -0005.67 -0035.02 0021.96 -0038.69 0002.04 -0007.93
0047.21 -0013.54 -0016.93 -0030.72 -0003.52 0003.71 0025.30 -0032.49
0013.12 -0062.02 0026.93 -0043.22 0000.41 0012.52 -0047.89 0006.92

iDCT Result:
0057.00 0006.00 0084.00 0082.00 0042.00 0059.00 0053.00 0081.00
0078.00 0049.00 0025.00 0033.00 0013.00 0081.00 0048.00 0001.00
0026.00 0082.00 0010.00 0060.00 0020.00 0088.00 0063.00 0075.00
0059.00 0045.00 0009.00 0020.00 0079.00 0067.00 0001.00 0031.00
0019.00 0034.00 0013.00 0046.00 0067.00 0019.00 0086.00 0089.00
0010.00 0080.00 0056.00 0080.00 0033.00 0047.00 0008.00 0082.00
0005.00 0097.00 0031.00 0029.00 0049.00 0000.00 0050.00 0084.00
0087.00 0074.00 0076.00 0021.00 0093.00 0078.00 0091.00 0043.00

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参考：

1. 基于 DCT 算法变换的图像压缩技术研究
<http://wenku.baidu.com/view/b357841614791711cc791740.html>
2. 图象压缩(JPEG)编码算法中的 DCT 实现
<http://wenku.baidu.com/view/e7a7a7c66137ee06eff918ad.html>
3. The Discrete Cosine Transform (DCT): Theory and Application1
4. Two Dimensional DCT/IDCT Architecture