Corrections to "An Algorithm for Calculation of the Discrete Cosine Transform by Paired Transform"

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The following typo-errors have been found in article [1] devoted to the splitting of the 1-D N-point DCT, where $N = 2^r$, $r > 1$, by the paired transform.

1. Components $f_{p,t}$ of the paired transform, χ'_N, of the sequence f_n, $n = 0 : (N-1)$, are defined as

$$f_{p,t} = \bar{f}_{p,t} - \bar{f}_{p,t+N} = \sum_{n \in V_{p,t}} f_n - \sum_{n \in V_{p,t+N}} f_n \qquad (1)$$
$$t = 0 : (N-1),$$

where

$$V_{p,t} = \left\{ n; \left(n + \frac{1}{2}\right) p = t \bmod 2N, n = 0 : (N-1) \right\} \qquad (2)$$

The set $V_{p,t}$ is the union of points n satisfying the condition in (2) by modulo $2N$ not N. However, by mistake, the values of t in the first table of Example 1 have been counted by modulo $N = 8$. Therefore, the table and the two following sentences of Example 1 should be corrected as follows:

n	0	1	2	3	4	5	6	7
t	1.5	4.5	7.5	10.5	13.5	0.5	3.5	6.5

Therefore

$$f_{3,n+0.5} = \bar{f}_{3,n+0.5} - \bar{f}_{3,n+8.5} = \pm f_{3n+5 \bmod 8}, \;\; n = 0 : 7,$$

and $f_{3,t} = 0$ for other numbers t from the set Y. For instance, $f_{3,0.5} = f_5$, $f_{3,1.5} = f_0$ and $f_{3,2.5} = -f_3$, $f_{3,2} = 0$.

2. In (5), the parameter t runs as $t = 0 : 0.5 : (N - 0.5)$. In the last equation in the 1st column and two next equations in the 2nd column of page 267, the index t runs as $t = 0 : 0.5 : (N-1)/2$. In the last equation on page 268, the upper limit of the sum of C_{2m+1} should be $N/2 - 1$. In the first two equations on page 269, the upper limit of the sums of $C_{(2m+1)2}$ should be $N/4 - 1$.

3. The N-point paired transformation should be written as χ'_N instead of χ'_8 in the equation located between (17) and (18) on page 271.

4. Characteristic functions $\chi_{p,t}$ of sets $V_{p,t}$ are defined as

$$\chi_{p,t}(n) = \begin{cases} 1; & \left(n + \frac{1}{2}\right) p = t \bmod 2N \\ 0; & \text{otherwise} \end{cases} \qquad (22)$$
$$n = 0 : (N-1).$$

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The product of p with $n + 1/2$ not n is considered in this definition. Therefore, in Definition I of the paired function, the product np in the equation located between (23) and (24) should be changed by $(n + \frac{1}{2})p$. The paired function is thus defined as

$$\begin{aligned} \chi'_{p,t}(n) &= \chi_{p,t}(n) - \chi_{p,t+N}(n) \\ &\quad -\chi_{p,N-t}(n) + \chi_{p,2N-t}(n) \qquad (23) \\ &= \begin{cases} 1; & (n + \frac{1}{2})p = t \text{ or } (2N - t) \bmod 2N \\ -1; & (n + \frac{1}{2})p = (N - t) \text{ or } (t + N) \bmod 2N \\ 0; & \text{otherwise} \end{cases} \\ &\quad n = 0 : (N-1). \qquad (24) \end{aligned}$$

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References

[1] A.M. Grigoryan, "An algorithm for calculation of the discrete cosine transform by paired transform," *IEEE Trans. on Signal Processing,* vol. 53, no. 1, pp. 265-273, Jan. 2005.