Re: Query DCT and DFT

Source: http://sci.tech−archive.net/Archive/sci.image.processing/2005−04/msg00164.html

- *From*: stevenj@xxxxxxxxxxx
- *Date*: 25 Apr 2005 12:53:10 −0700

Thomas Richter wrote:
> > > DCT is better for lossy compression. To see that, you need to recall
> > > that both DCT and DFT stem from fourier series that analyze functions
> > > mapping from R −>R and are periodic. The input of DCT and DFT, however,
> > > is finite sequence of samples. So to compute the fourier series, it is
> > > necessary to continue the function onto R by assuming what the values
> > > outside the given range are. For DFT, the assumption is thath the finite
> > > sequence repeats. For DCT, the sequence is mirrored and then repeated.
>
> /* snip */
>
> This is exactly the same as saying "DCT is real−valued". A fourier
> transformed signal that is real−valued necessarely has an original signal
> that is symmetric. (−;

Not quite. A DCT is essentially equivalent to a DFT of real and even data (modulo half−sample shifts), which is a stronger condition than simply requiring real inputs.

In particular, a DCT of type II (the most common for compression applications) or of type−I corresponds to even boundary conditions at *both* ends of the data, which ensures that the data are implicitly continuous at the boundaries (although their slopes may be dicontinuous).

On the other hand, a DFT of purely real data has implicit periodic boundary conditions, which may imply a discontinuity at the boundary if the inputs don't match up at the "ends", causing slower convergence (weaker energy compaction) in Fourier space.

(The boundary conditions in Fourier space are less pertinent, because

one specifies the inputs and cares about the compaction in Fourier space, not vice versa).

Cordially,
Steven G. Johnson

PS. Types III and IV of the DCT are even at one end and odd at the other. This means that they can have implicit discontinuities if their input data don't go to zero at the odd end. On the other hand, this makes them ideal for the MDCT, where one uses inputs of twice the "natural" length to induce time−domain aliasing cancellation (TDAC) for lapped transforms.

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- ***References***:
  - ♦ ***Query DCT and DFT***
    - ◊ *From:* MJ
  - ♦ ***Re: Query DCT and DFT***
    - ◊ *From:* Thomas Richter
  - ♦ ***Re: Query DCT and DFT***
    - ◊ *From:* MJ
  - ♦ ***Re: Query DCT and DFT***
    - ◊ *From:* Christian Gollwitzer
  - ♦ ***Re: Query DCT and DFT***
    - ◊ *From:* Sharat Chikkerur
  - ♦ ***Re: Query DCT and DFT***
    - ◊ *From:* Thomas Richter

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