Notebook1

March 5, 2018

Contents

1 Mathematical Description of the Discrete Cosine Transform

1. Brief Overview

   - The Discrete cosine transform can represent an image as a sum of sinusoids with frequencies and magnitudes that differ.
   - The Cosine transform has the property that most of the important bits of information with an image (or even an audio wave) is concentrated (Notebook 2 will expand on this idea).
   - Due to this property, the DCT (or the Modified discrete cosine transofrm) is used to MP3 compression and for JPG compression.

2. The Equation

   - The Two dimensional DCT of an M-by-N matrix can be expressed as follows.
     $C_{pq} = \alpha_p \alpha_q \sum_{m=0}^{M-n} \sum_{n=0}^{N-1} A_{mn} \cos \frac{\pi(2m+1)p}{2M} \cos \frac{\pi(2n+1)q}{2N}$
     where
     $0 \leq p \leq M - 1$
     $0 \leq q \leq N - 1$
     $$\alpha_p = \begin{cases} 1/\sqrt{M} & p = 0 \\ \sqrt{2/M} & 1 \leq p \leq M-1 \end{cases}$$
     $$\alpha_q = \begin{cases} 1/\sqrt{N} & p = 0 \\ \sqrt{2/N} & 1 \leq q \leq N-1 \end{cases}$$
   - We can note that if we assign p = n and q = n, they both fit the domain of p and q, and I will be using this for the program