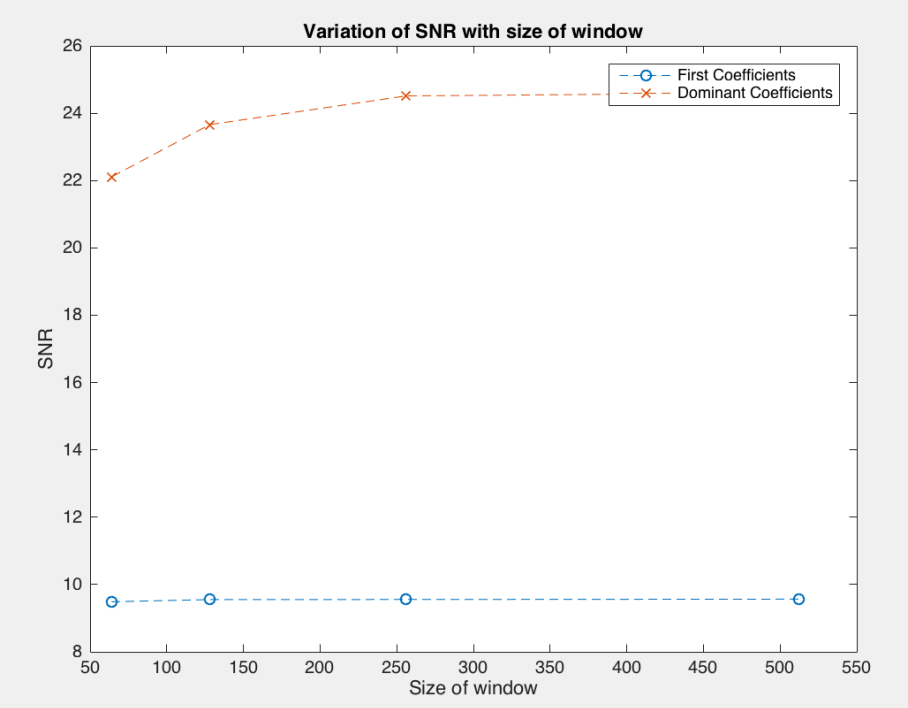
Speech Compression using Discrete Cosine Transform

Why Discrete Cosine Transform

DCT expresses a signal as a sum of cosine functions oscillating at different frequencies. It is used for audio and image compression because fewer cosine functions are needed to approximate a typical signal, whereas for differential equations the cosines express a particular choice of boundary conditions.

Relationship between Window Length and SNR

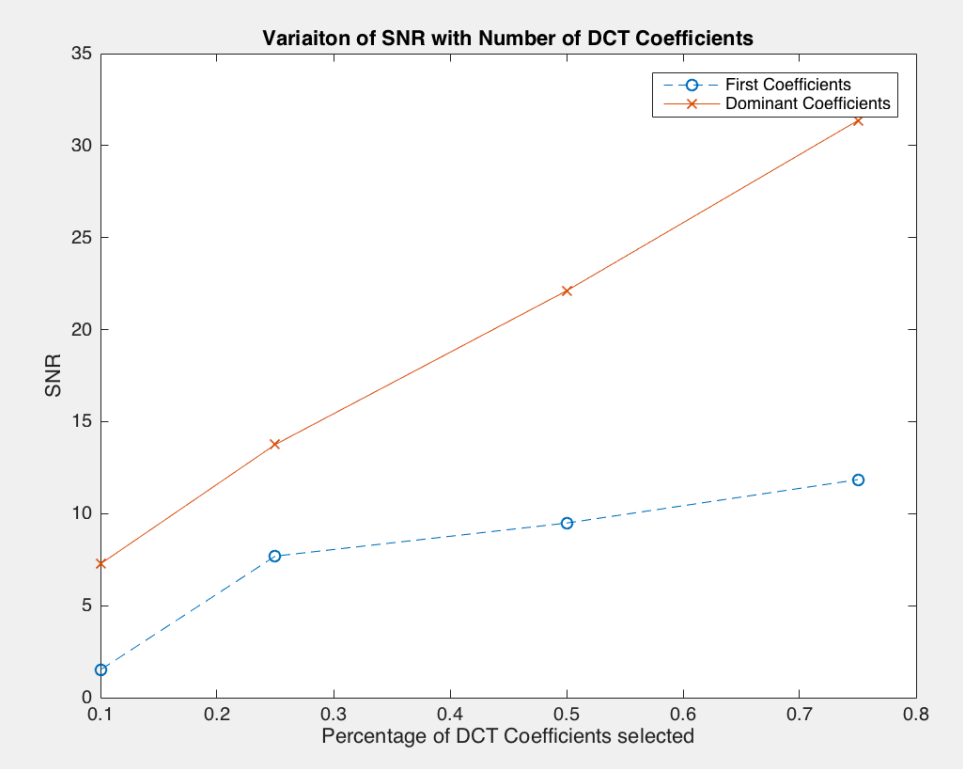
Following plot is generated for N = 64, 128, 256, 512 and 50% of DCT coefficients are picked.



This implies that changing size of the window doesn't have any significant affect on on the SNR value and thus the quality of compression. The reason being almost same coefficients are picked no matter the size of window.

Relationship between Percentage of Coefficients picked and SNR

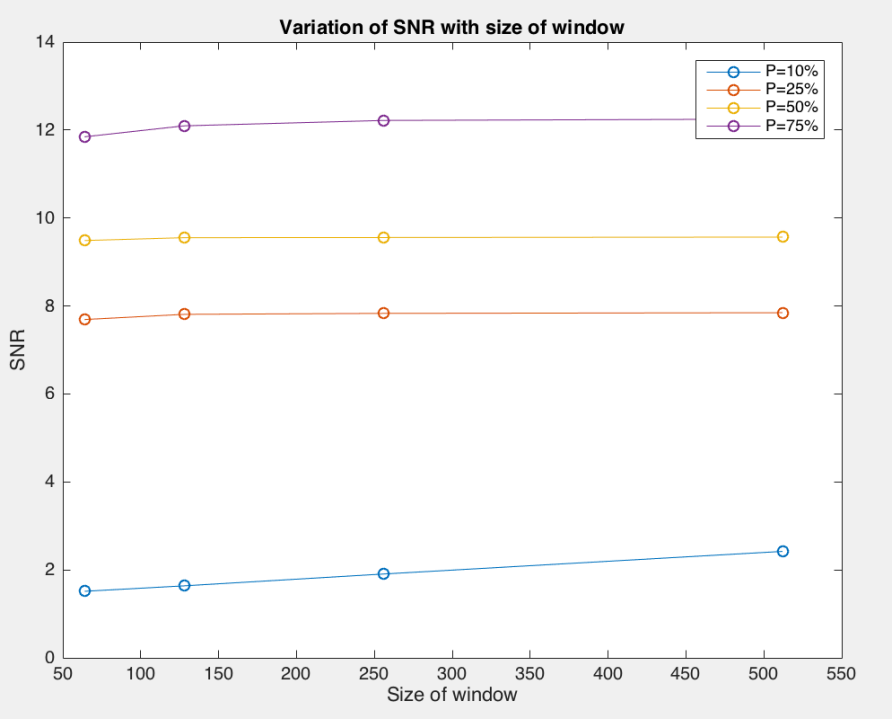
Following plot is generated for picked DCT coefficients as 10%, 25%, 50%, 75% and window size = 64



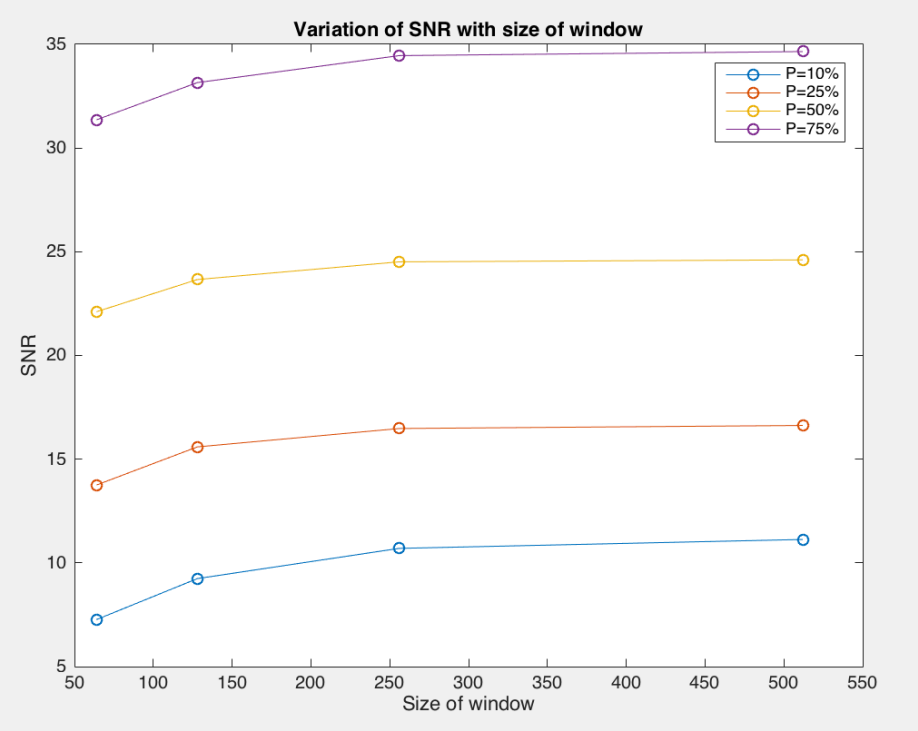
Thus, as we pick greater number of DCT Coefficients, there is clear improvement is SNR. Moreover, the SNR for dominant coefficients is greater than that for first coefficients.

Variation of SNR with Window Size for Different Percentage of DCT Coefficients

For the case of First P% Coefficients picked



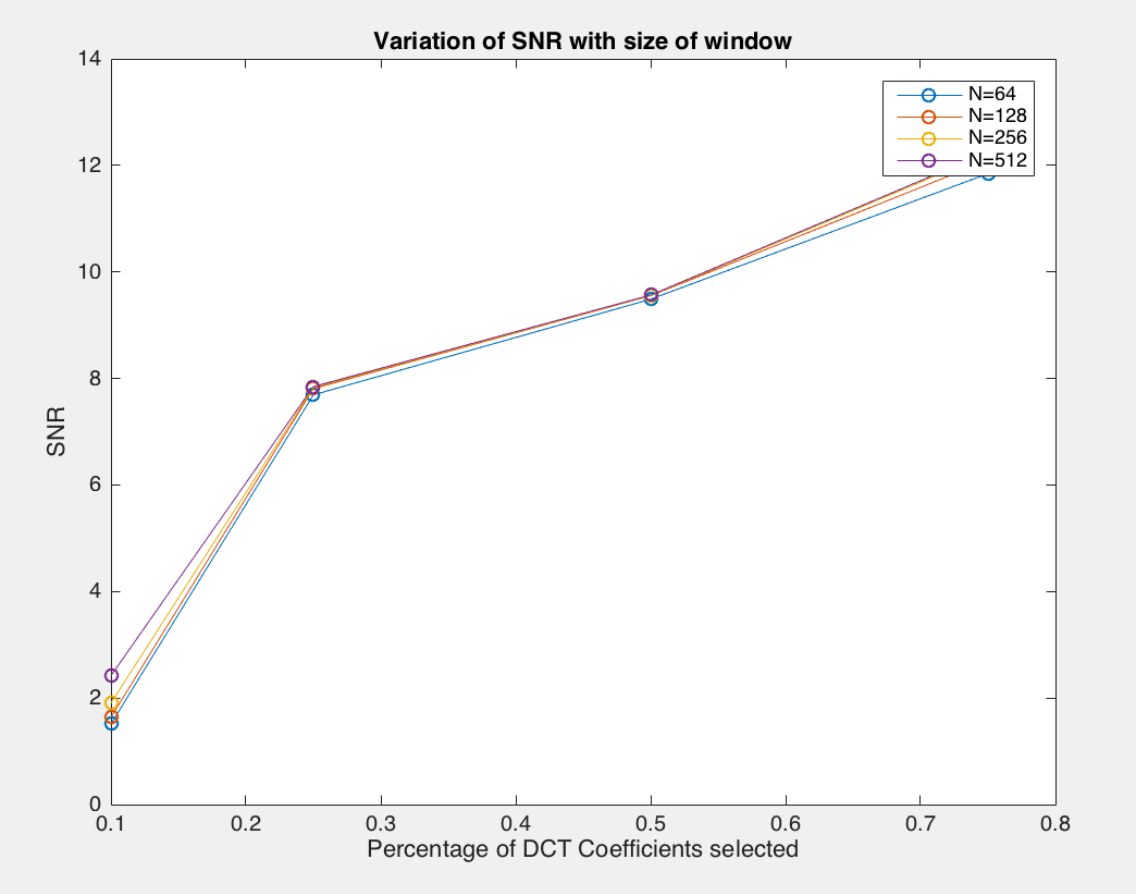
For the case of dominant P% Coefficients picked



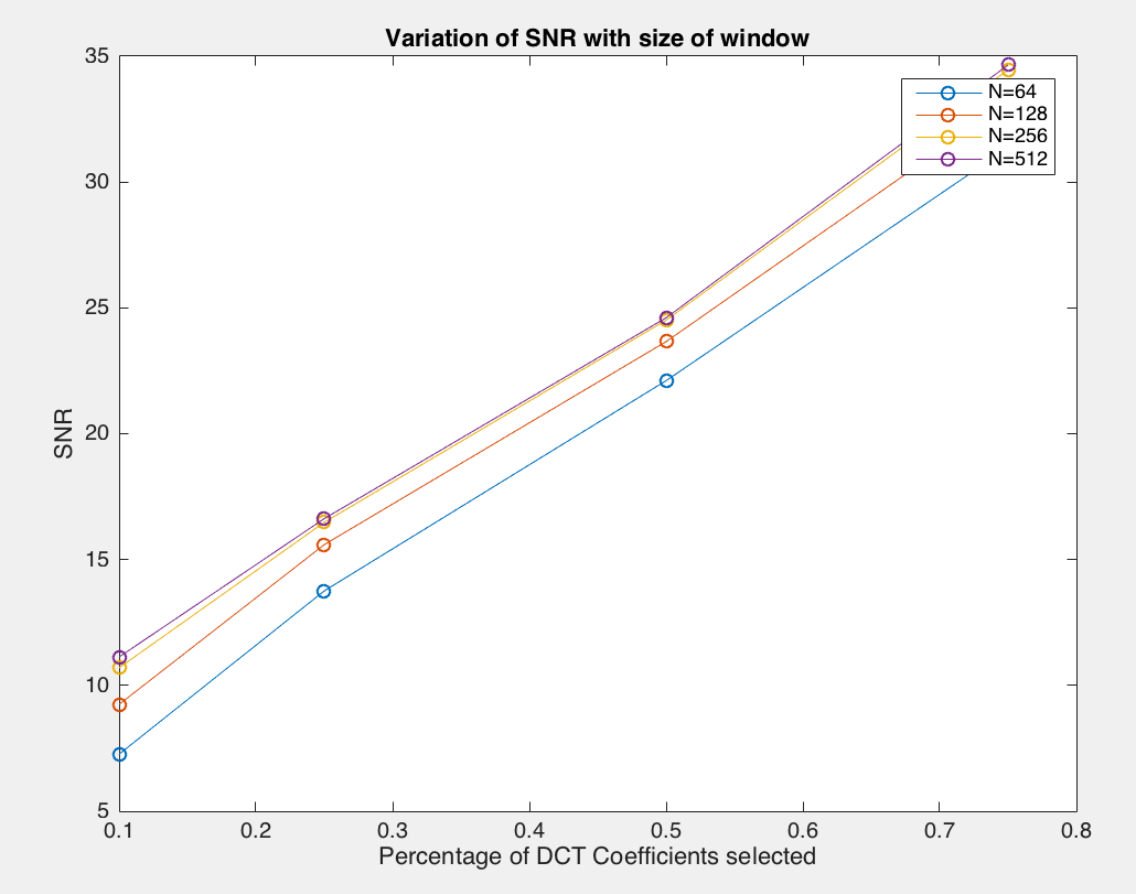
This again proves that as we pick greater number of DCT Coefficients, there is clear improvement is SNR.

Variation of SNR with Percentage of DCT Coefficients for Different Window Sizes

For the case of First P% Coefficients picked



For the case of Dominant P% Coefficients picked



Thus Window size has a minor affect on the SNR

Conclusion

Picking the dominant coefficients yields better SNR and hence is more suitable for audio compression. However, since we have to save the index matrix as well, there is a memory overhead if we ignore less that 50% DCT coefficients.