Basis Functions

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Basis Representation

- Every point can described as a linear combination of Orthoginal Basis vectors
- Standard Basis for an Image will be set of unit vectors corresponding to each pixel.

  Example:

- I = $\begin{bmatrix} 5 & 6 \\ 2 & 8 \end{bmatrix} = 5\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix} + 6\begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} + 2\begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix} + 8\begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$

Fourier Transform Basis

- The basis functions here are complex sinusoidal functions.

  For 2x2 Image/patch Basis will be

$$\begin{bmatrix}1 & 1\\ 1 & 1\end{bmatrix}, \begin{bmatrix}1 & -1\\ 1 & -1\end{bmatrix}, \begin{bmatrix}1 & 1\\ -1 & -1\end{bmatrix}, \begin{bmatrix}1 & -1\\ -1 & 1\end{bmatrix}$$

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$$I = \begin{bmatrix}5 & 6\\ 3 & 6\end{bmatrix} = \frac{20}{4}\begin{bmatrix}1 & 1\\ 1 & 1\end{bmatrix} + \frac{-4}{4}\begin{bmatrix}1 & -1\\ 1 & -1\end{bmatrix} + \frac{2}{4}\begin{bmatrix}1 & 1\\ -1 & -1\end{bmatrix} + \frac{2}{4}\begin{bmatrix}1 & -1\\ -1 & 1\end{bmatrix}$$

References

- http://nptel.ac.in/courses/117104069/chapter_7/7_10.html
- http://www.serc.iisc.ernet.in/~venky/SE263/slides/FreqDomain.pdf