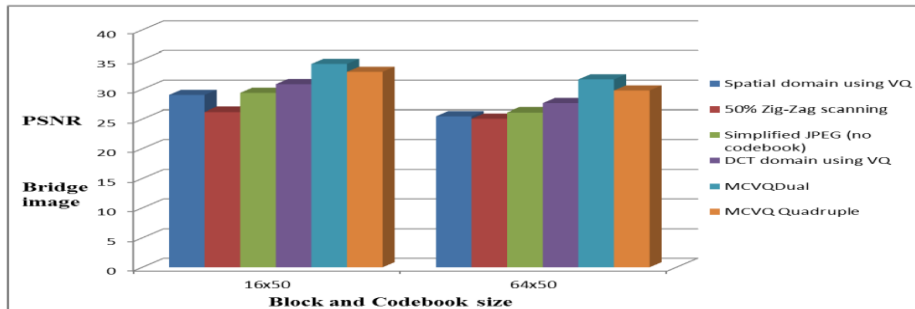# Ali Tariq Bhatti

**Dept.:** *Electrical & Computer Engineering*
**Title:** *"Advanced Vector Quantization Techniques for Image Compression in the Spatial and Frequency Domain"*
**Major Professor:** *Dr. Jung H. Kim*

## RESEARCH QUESTIONS / PROBLEMS:

- The absolute volume of data and its growth in the future are considered as the most important and key challenges in Big Data Technology.
- High quality image requires larger bandwidth and raw images need larger memory space.
- In order to resolve this problem, Advanced Vector Quantization (VQ) using Unsupervised K-Mean algorithms was the main compression optimization technique used in this research.

## METHODS:

- Various blocks for a codebook size of 25 and 50 were used.
- Advanced VQ techniques such as hybrid lossy/lossless approach to use VQ followed by Huffman coding to achieve higher PSNR number and less execution time in both spatial and DCT domain.

## RESULTS / FINDINGS:

- To maintain good-quality reconstructed image with higher PSNR and higher SNR for a given acceptable Compression Ratio, and less execution time.

## SIGNIFICANCE / IMPLICATIONS:

- This research has a significant role on saving image storage space and saving time while sending images over the network without excessively reducing the quality of the image.

PSNR comparison between all techniques for Bridge image

| Bridge Image 256x256 | 16x50 | 64x50 |
|---|---|---|
| Spatial domain using VQ | 29.029 | 25.48 |
| 50% Zig-Zag scanning | 26.1973 | 25.0741 |
| Simplified JPEG | 29.388 | 26.114 |
| DCT domain using VQ | 30.853 | 27.644 |
| MCVQ Dual | 34.291 | 31.669 |
| MCVQ Quadruple | 32.950 | 29.788 |



PSNR comparison between all techniques for Bridge image