

Algorithms for Robust Information Embedding in Video: Progress Report 03/01/04

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Agenda

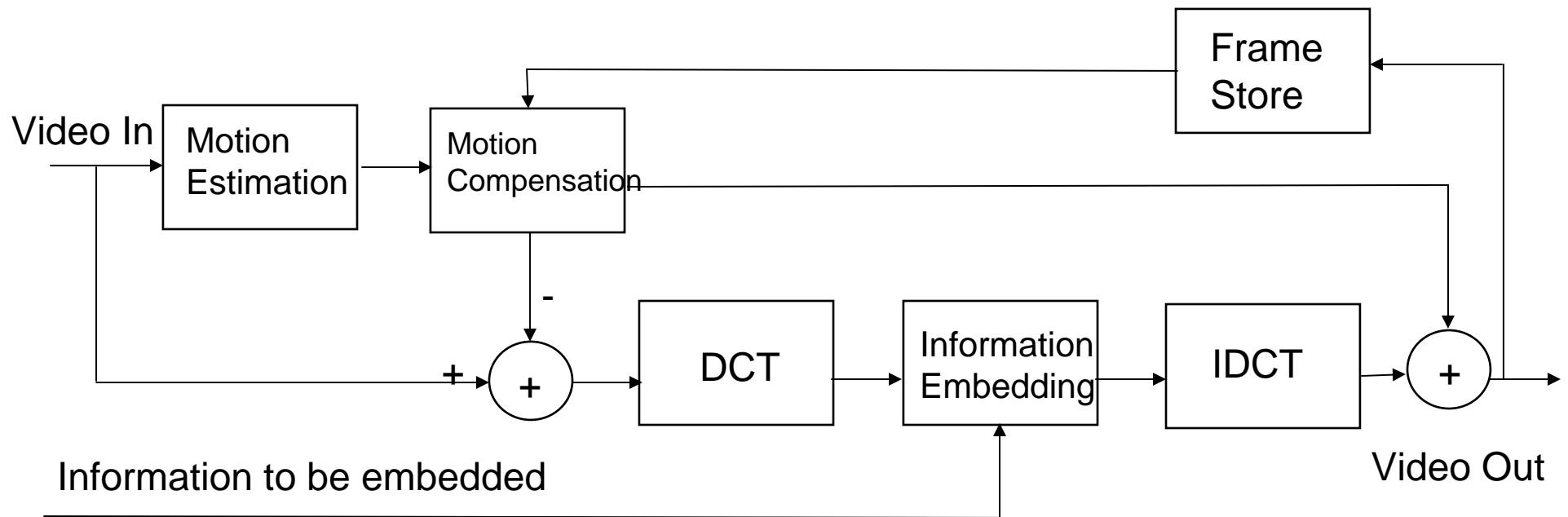
- Progress at Washington University
 - Feb. 1-29, 2004
- Block diagram discussions
- Statistical analysis
- Requests from VEIL:
 - Video before/after standard transmission
 - Further clarification of implementation issues
- Proposed Modified Timeline

Progress at Washington University

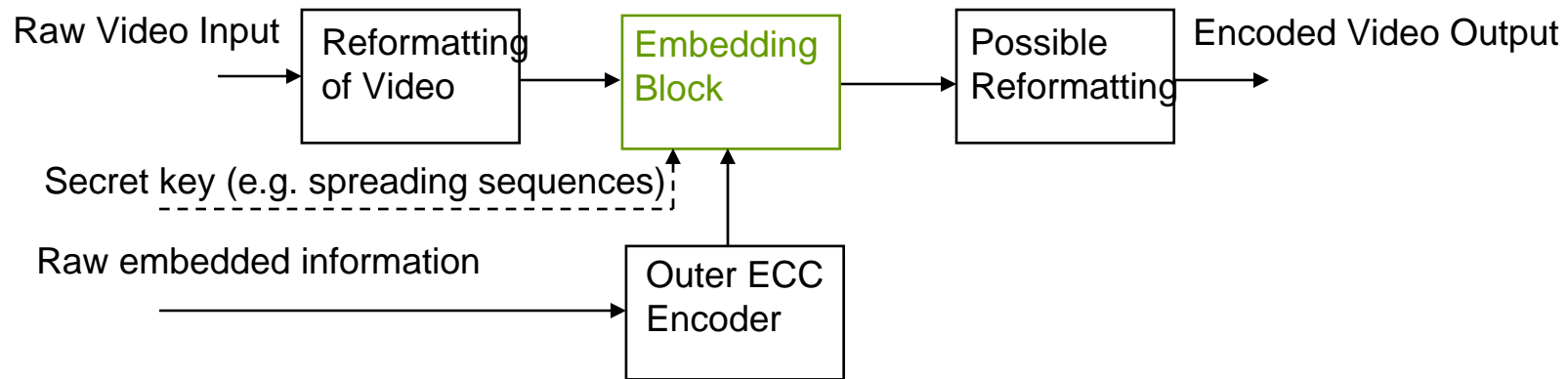
Feb. 1-29, 2004

- Builds on Jan. 30, 2004 report
- System Design Framework:
 - Progress on block diagram implementations, understanding
- Information embedding strategy outlined
- Choices in applying principles: statistical analysis
 - DCT Coefficients
 - SVD Analysis

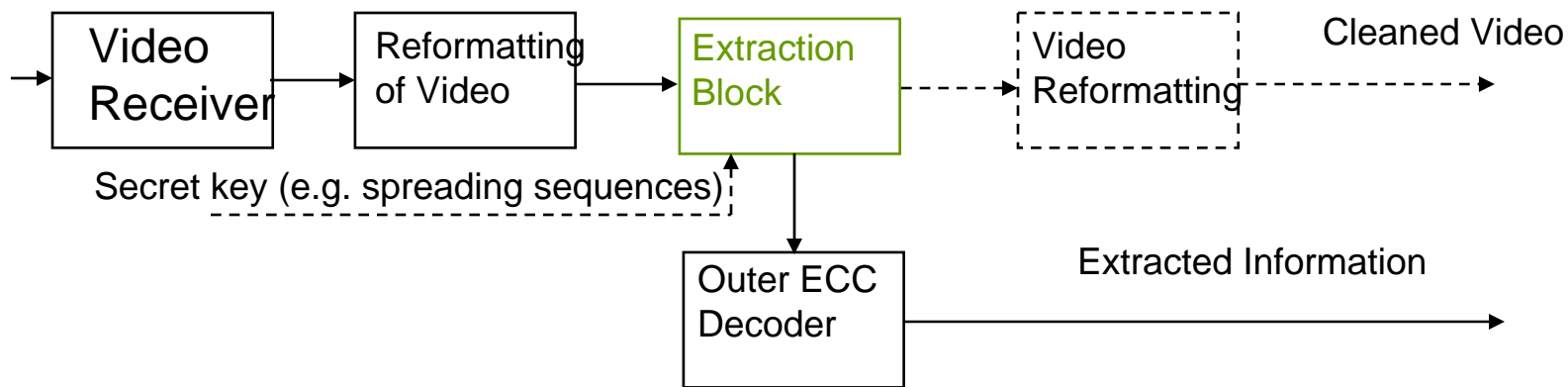
Current Instantiation of WU Embedding Block Diagram



Embedding System Design



Further Extraction System Design

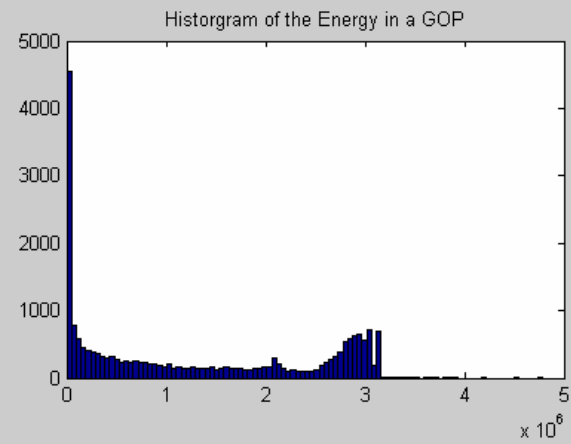
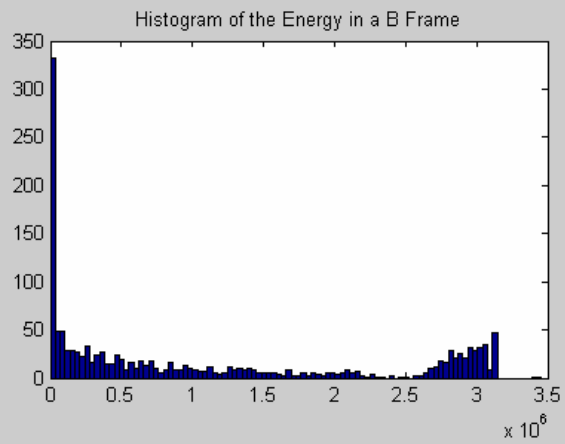
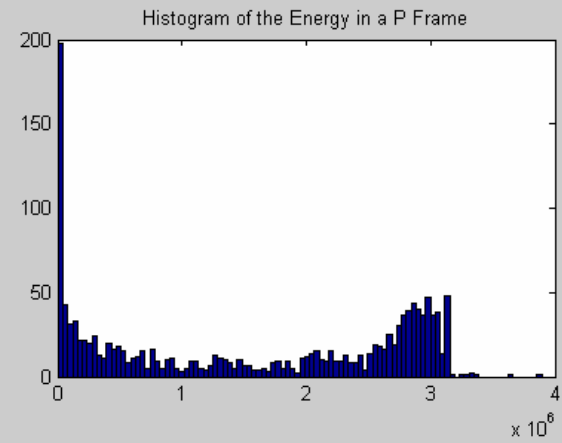
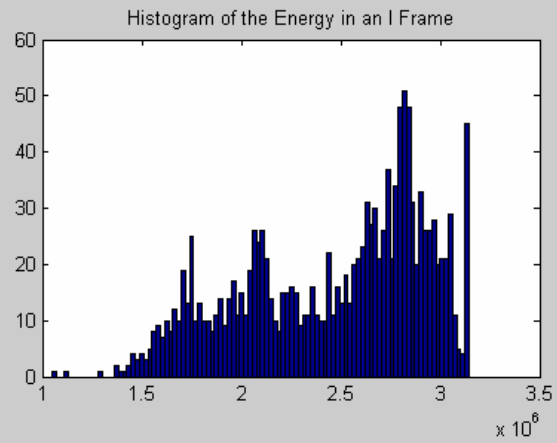


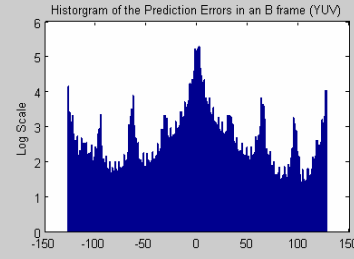
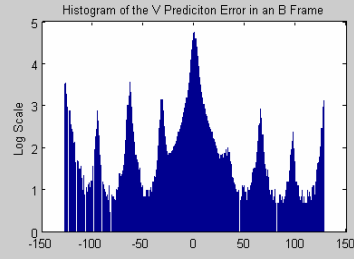
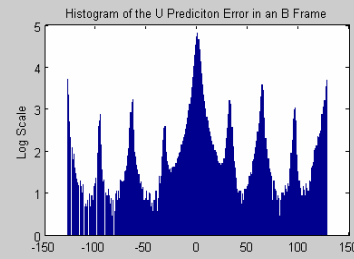
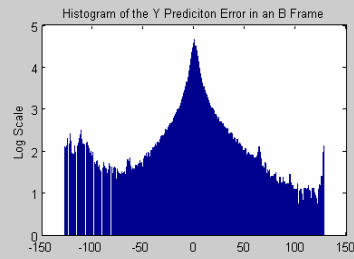
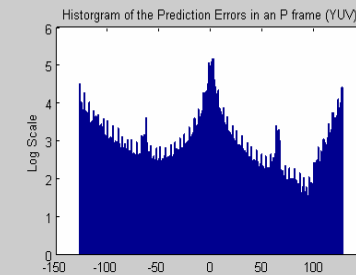
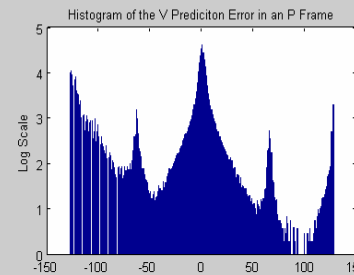
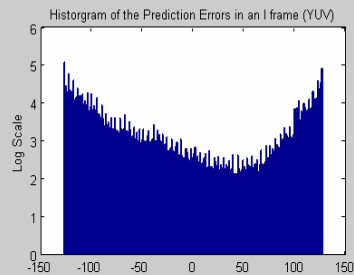
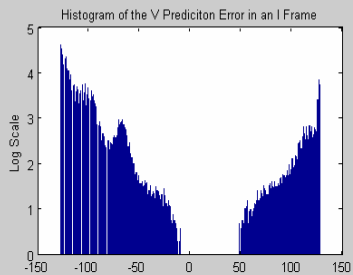
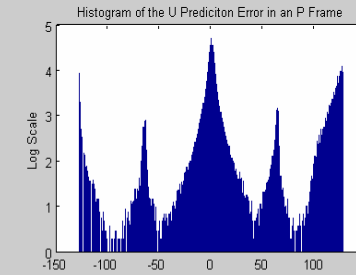
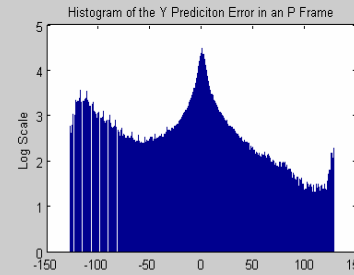
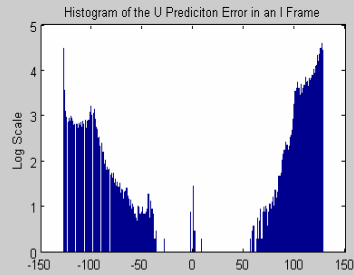
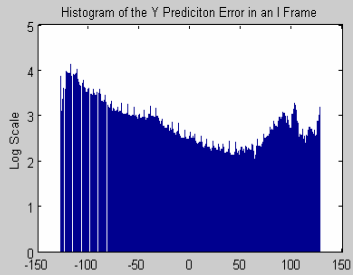
Comments:

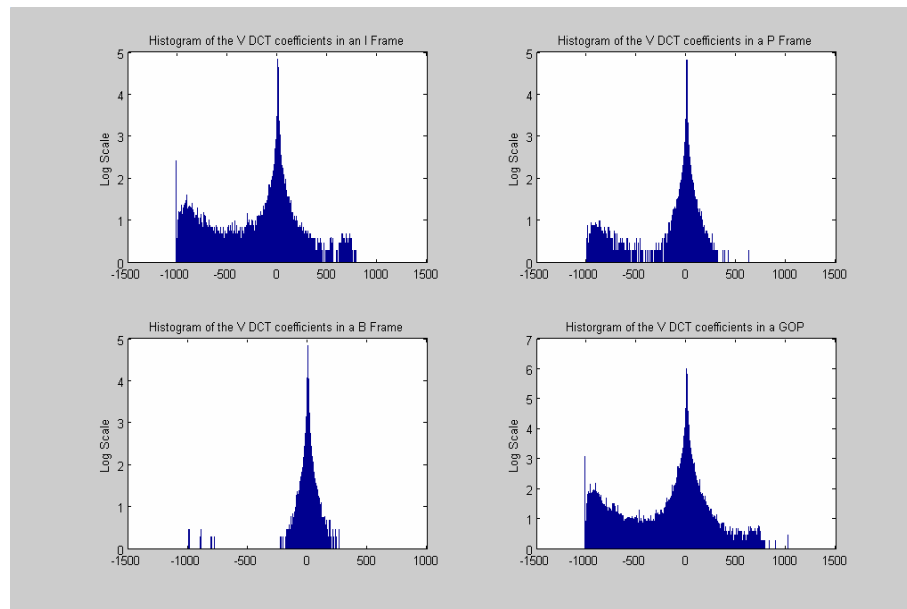
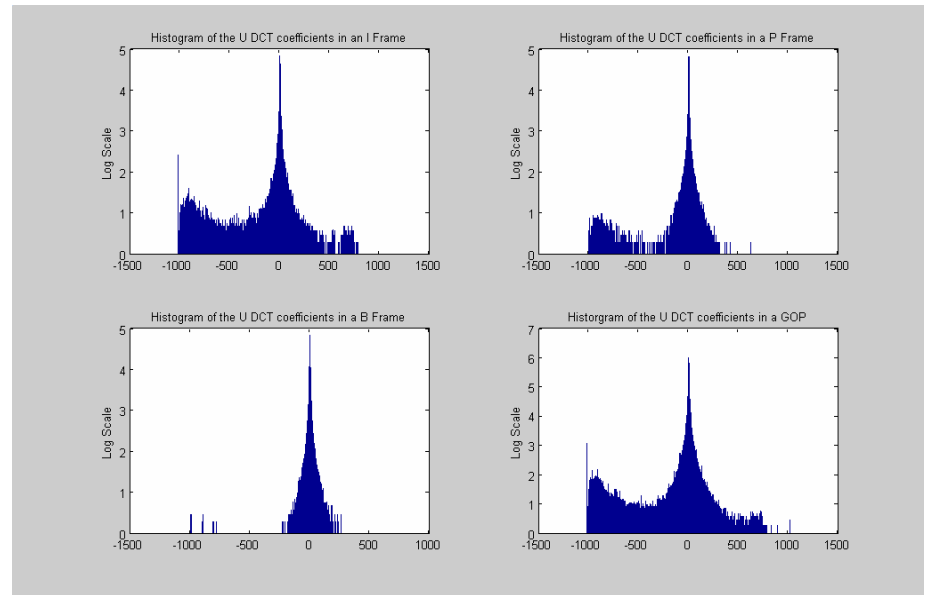
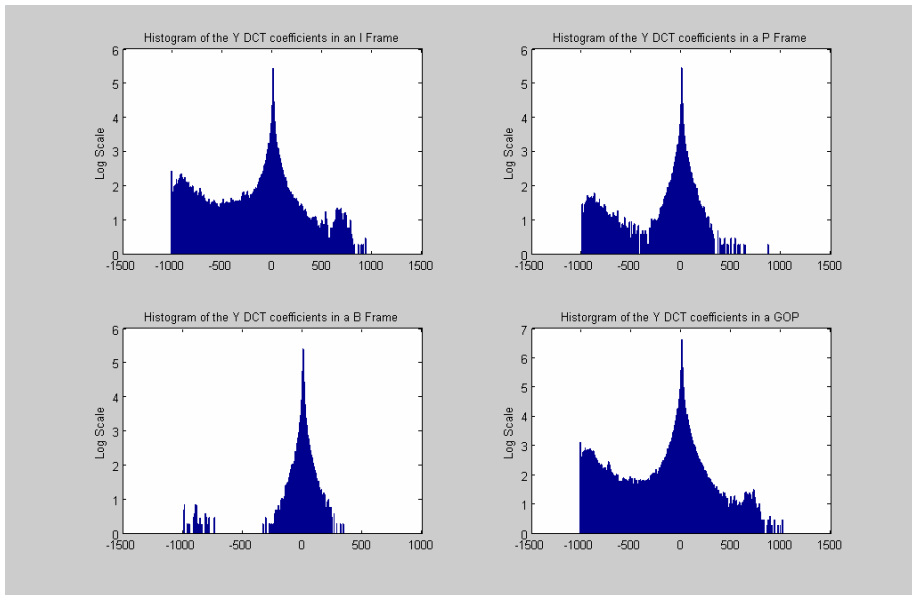
- proposed extraction block earlier
- dashed blocks are optional

Statistical Analysis

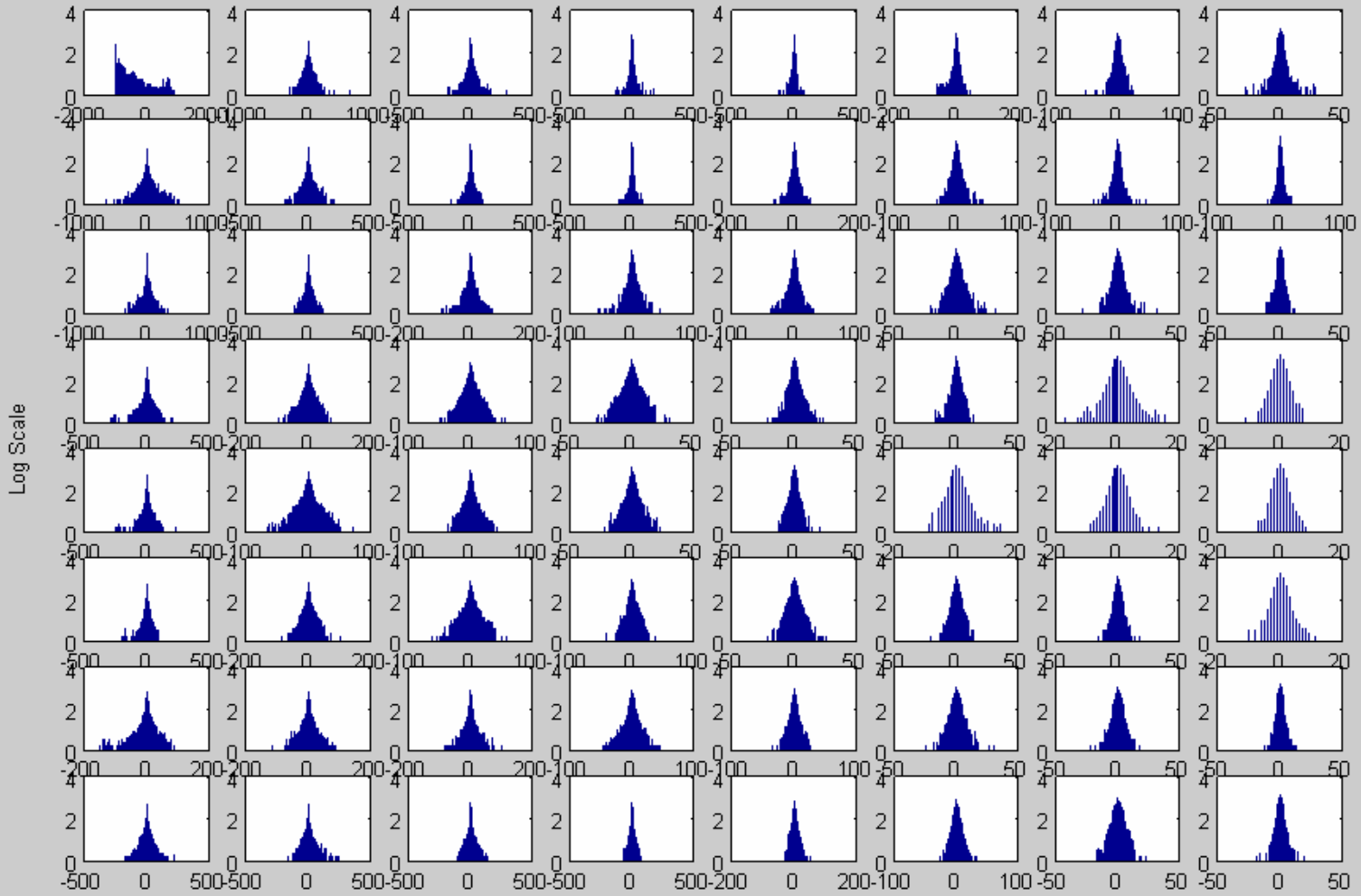
- Distribution of the Energy in I, P, B, & GOP
- Distribution of the Prediction Errors in I, P, B Frames
- Distribution of DCT Coefficients I, P, B Frames
- Distribution of Individual Y DCT Coefficients I Frame
- Singular Value Decomposition Analysis
- Distribution of Correlation Values I, P, B Frames



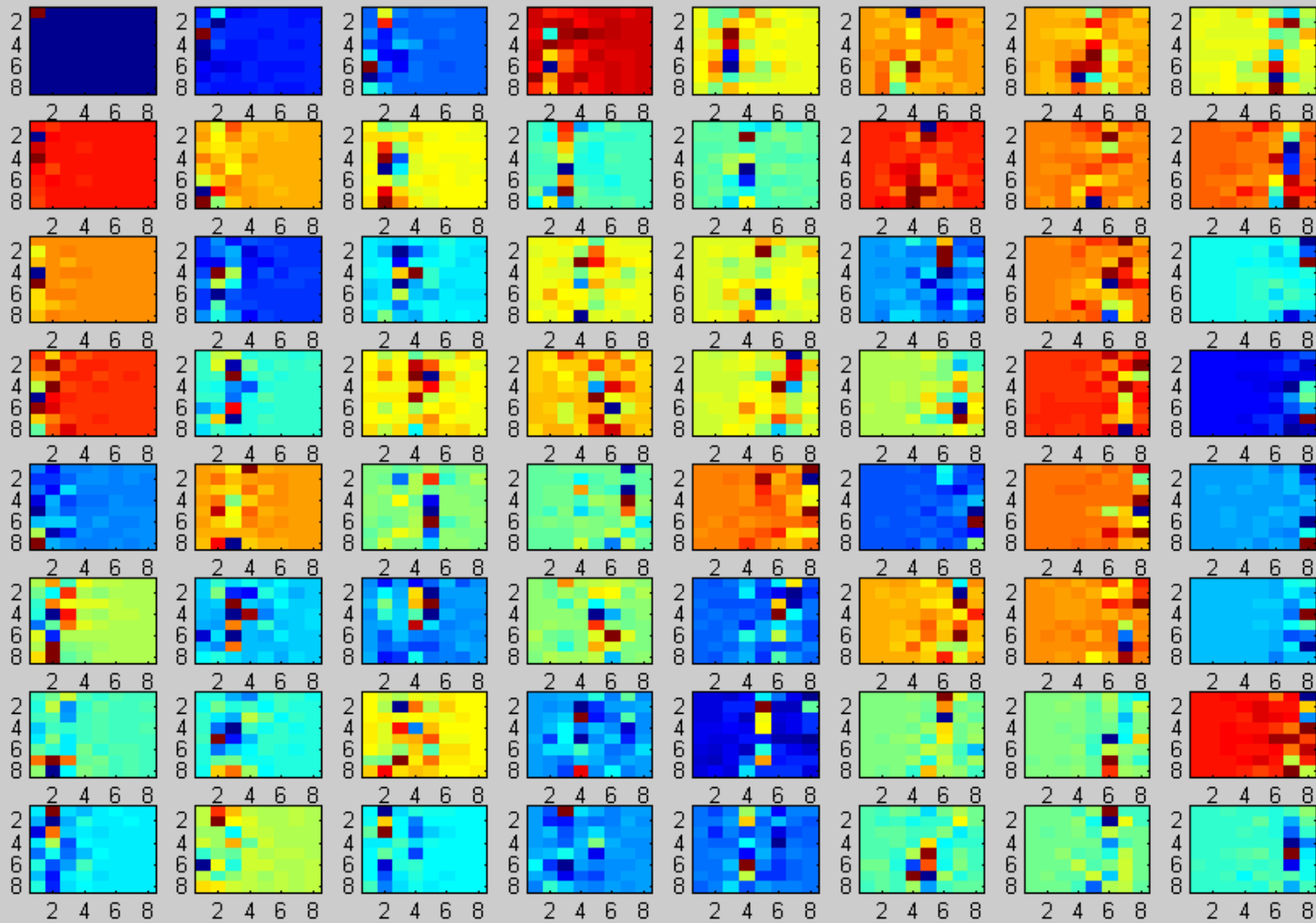


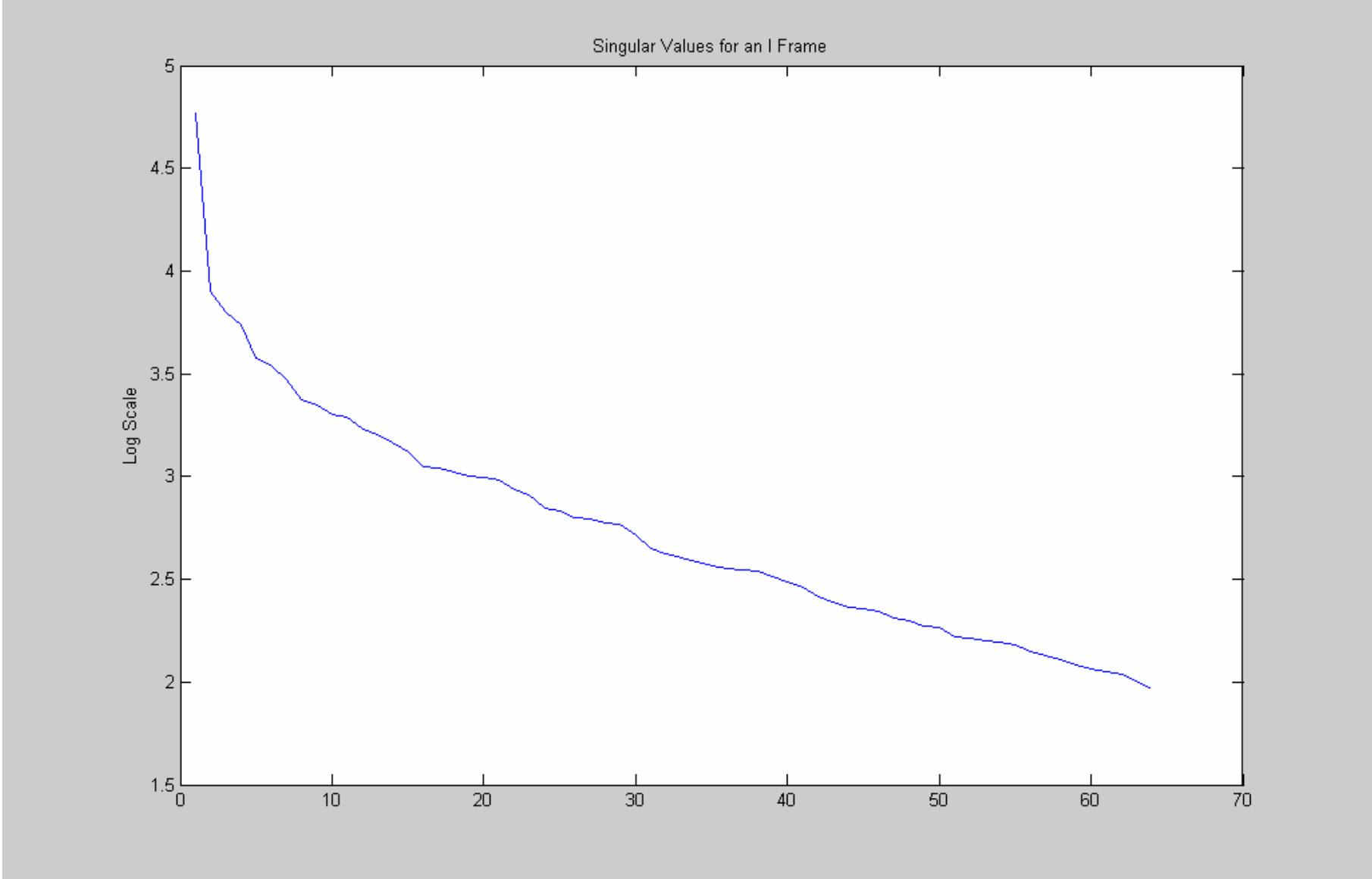


Histograms of Each Y DCT Component of an I Frame

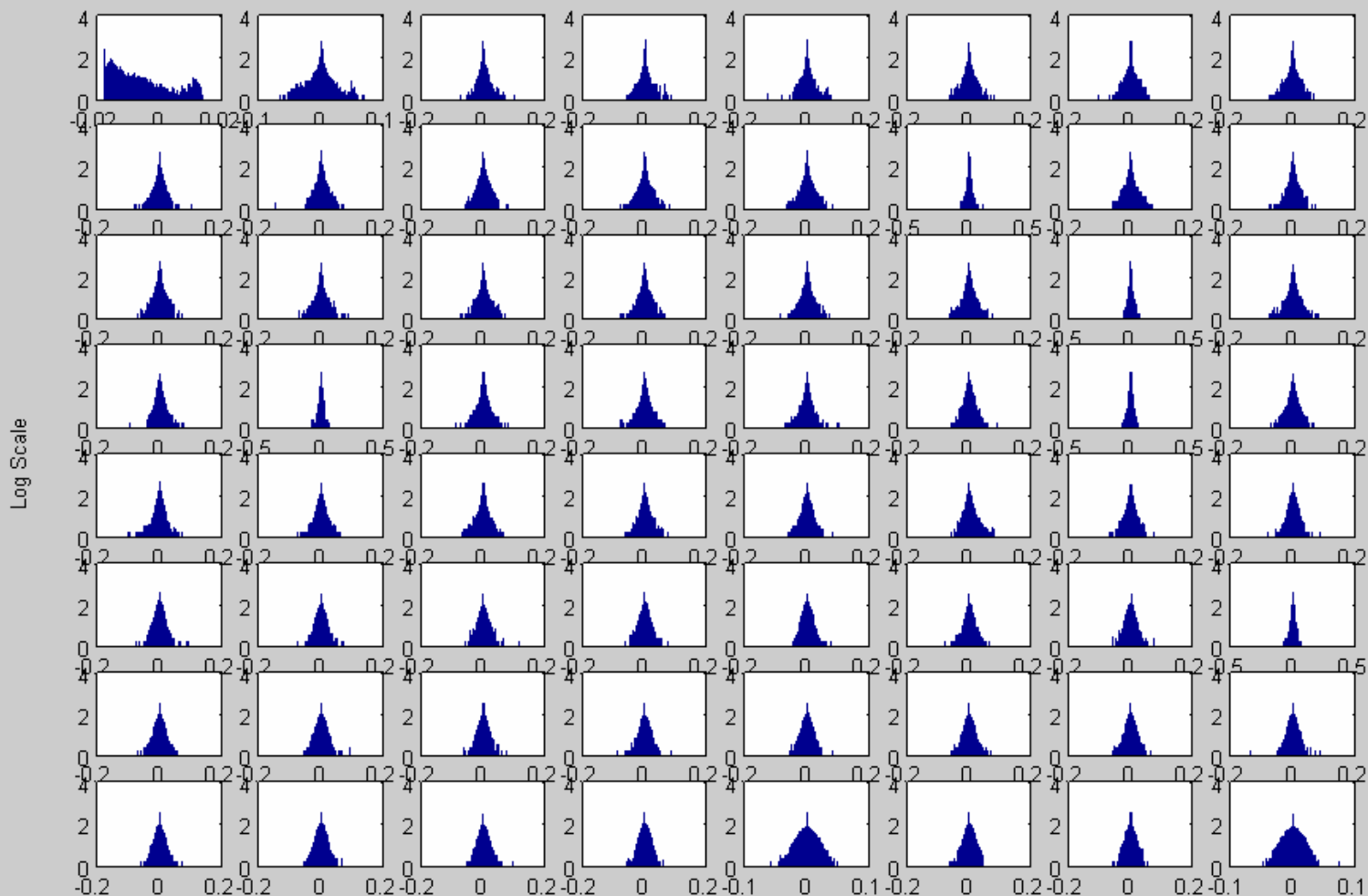


Singular Value Decomposition: Images of Eigenvectors of $Y^T Y$ for the Y values of an I Frame

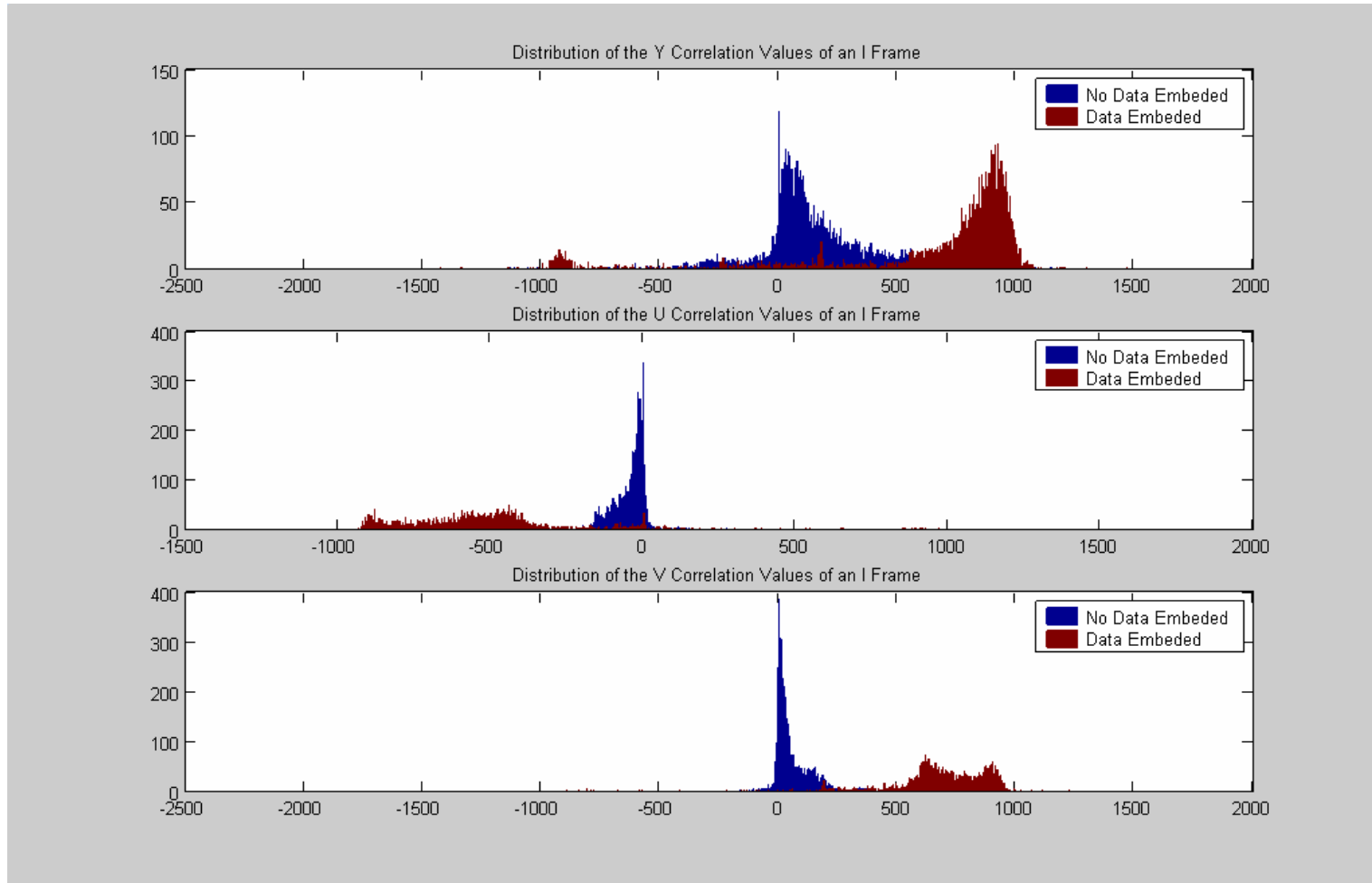




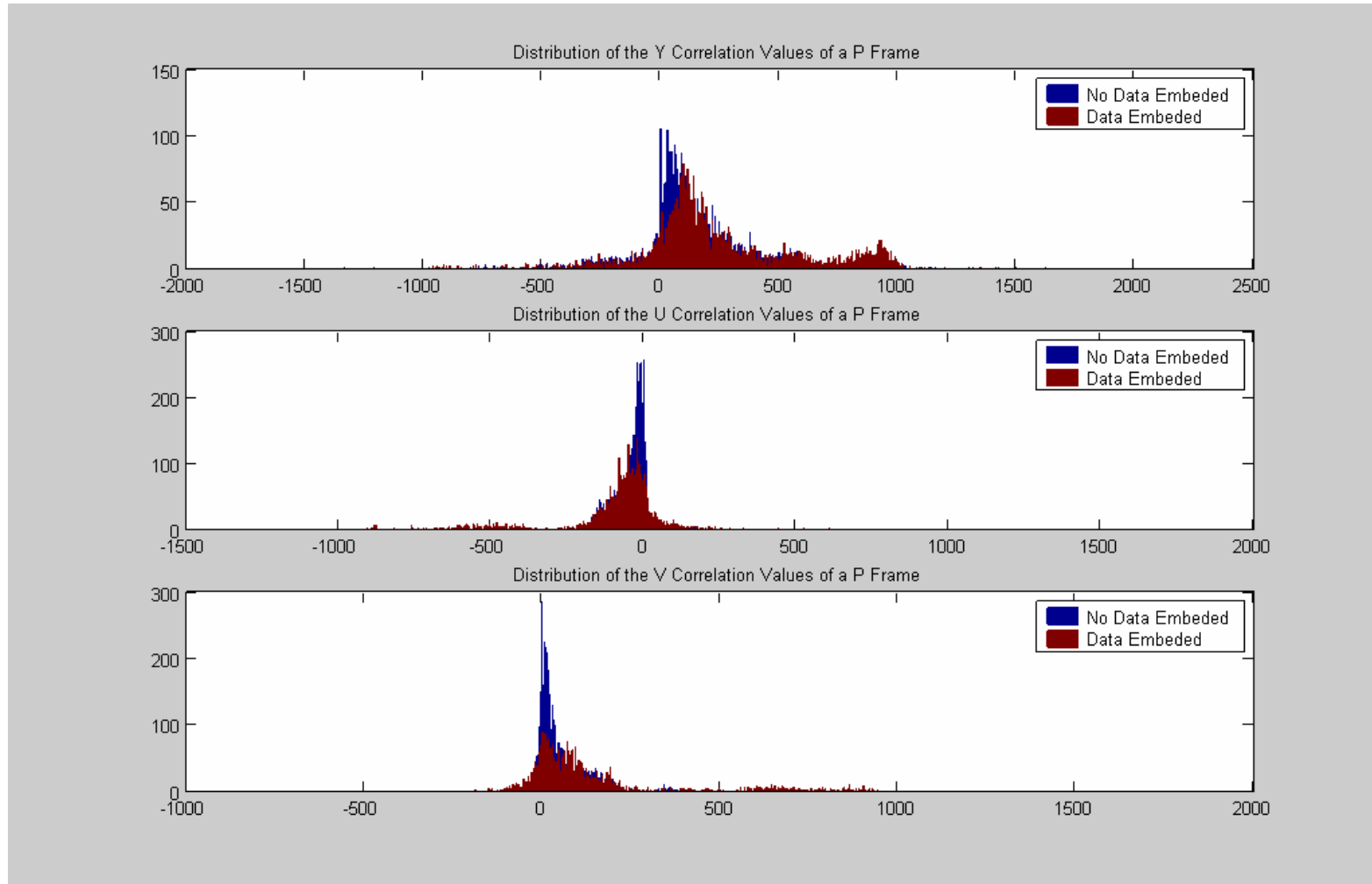
Singular Value Decomposition: Histograms of the Eigenvectors of YY^T for the Y DCT Components of and I Frame



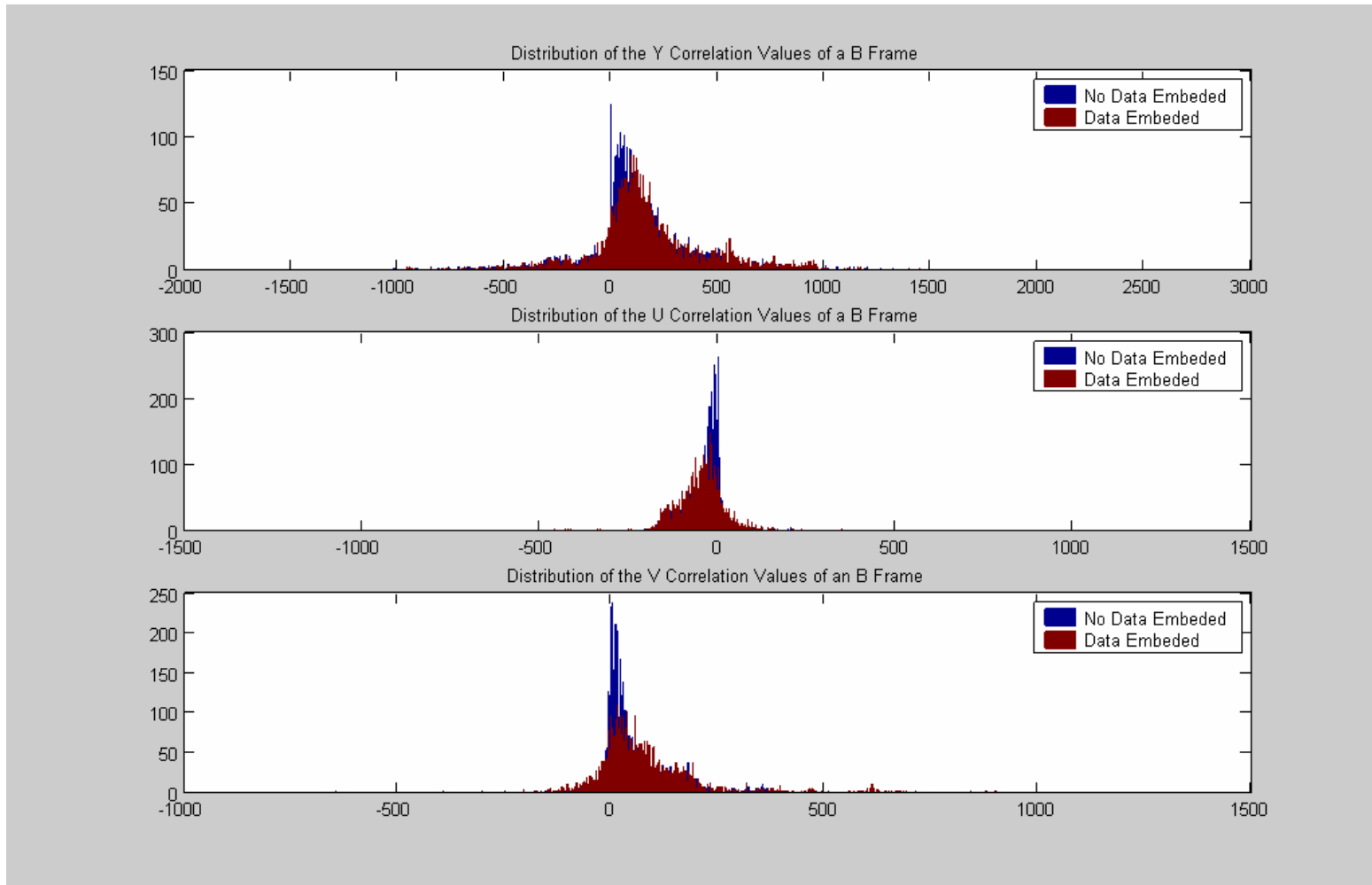
Spread spectrum embedding, watermark visible



Spread spectrum embedding, watermark visible



Spread spectrum embedding, watermark visible



Modified Proposed Timeline

- Acquire new PC for project: Mar. 5
- Continuing development of WU block diagram for information embedding/extraction
 - spread spectrum, QIM, DC-QIM, combination
 - choice of transforms
 - analysis of distributions of coefficients before and after transmission
- Demonstration of MPEG blocks: March 12
- Demonstration of information embedding/extraction blocks: April 2
- Demonstration of MPEG blocks together with information embedding/extraction blocks: April 30

Current Requests from VEIL

- Data for analysis of transmission statistics:
 - Video before/after transmission
 - Assistance with reformatting data analysis
- Blackfin processor issues
 - Number of bits in DCT coefficient domain → greater understanding of numerical implementation issues