EE 398A FINAL PROJECT

STEREO IMAGE COMPRESSION

GROUP 4

Deepa P. Sundar, Divya Elayakumar, Debabrata Sengupta

Agenda

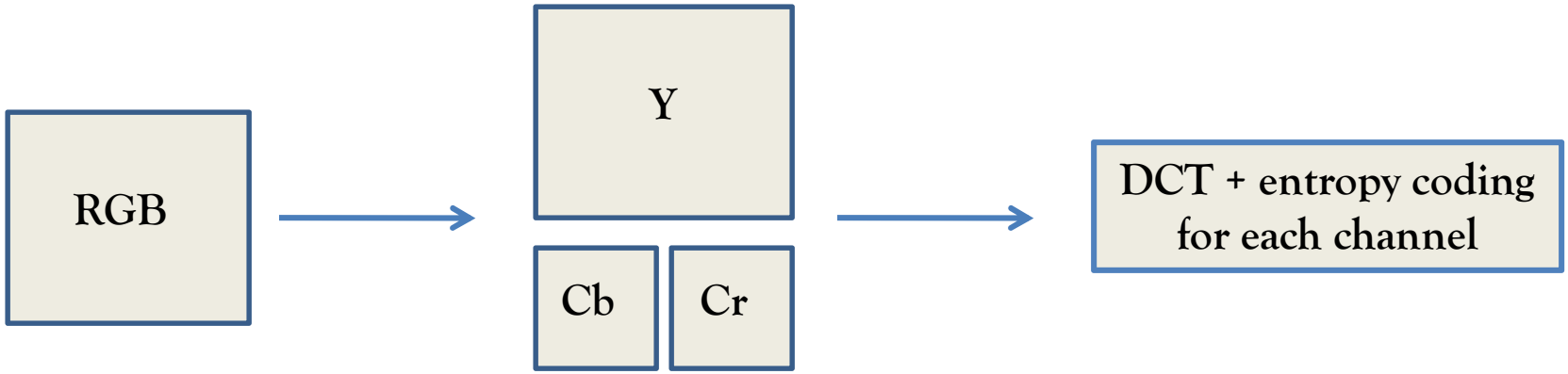
- Outline of our approach
- Encoder – Left and Right
- Decoder – Left and Right
- Results on the training set
- Conclusion

Outline of our approach

- Left Image :
  - Try to optimize for PSNR between 37 and 38 dB
- Right Image :
  - Use the above optimized reconstructed left image for block matching
- Residual Encoding
  - Compute Residual
  - Optimize such that PSNR of right image is between 37 and 38 dB

Coding of the Reference Image

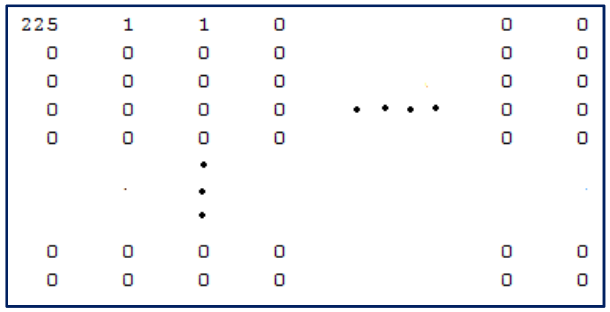
- Left image used as reference
- RGB converted to YCbCr
- Cb, Cr down-sampled by a factor of 2.
- Each channel coded separately.



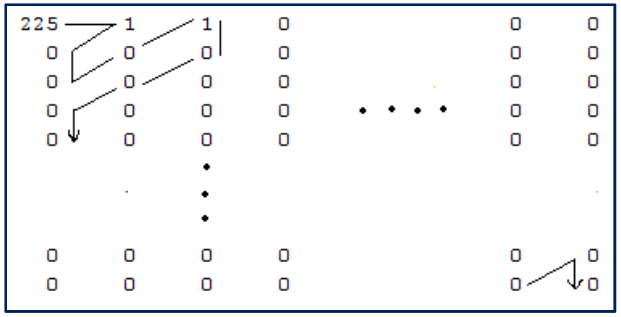
Coding of the Reference Image (2)

- Block based DCT (block size = 32)
- Quantization
- DC coefficients differentially encoded
- AC coefficients :
  - Run Level coding (Runs limited to 31)
  - Arithmetic coding of runs and levels

Block Diagram (Encoder)



Quantized DCT coeffs



Zig zag scanning

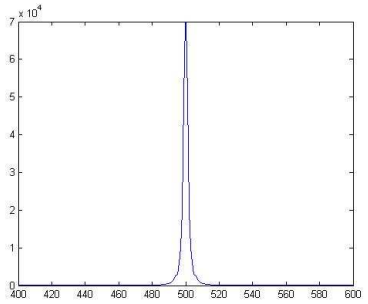
Run Level Coding of ac coeffs, **Differential encoding** of DC coeffs

Differentially encoded DC

Runs, Levels

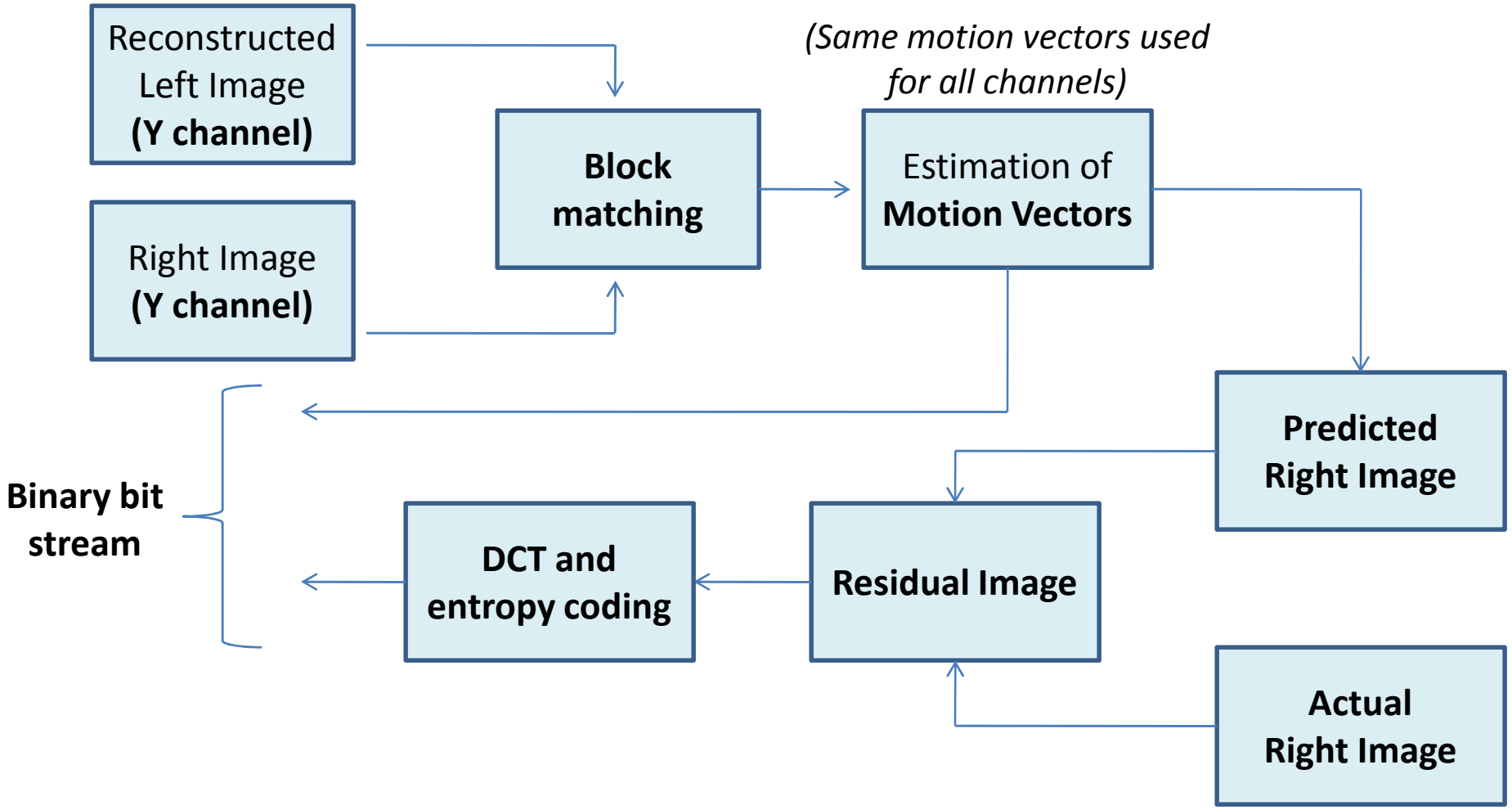
Binary bit stream

Arithmetic Coding Block



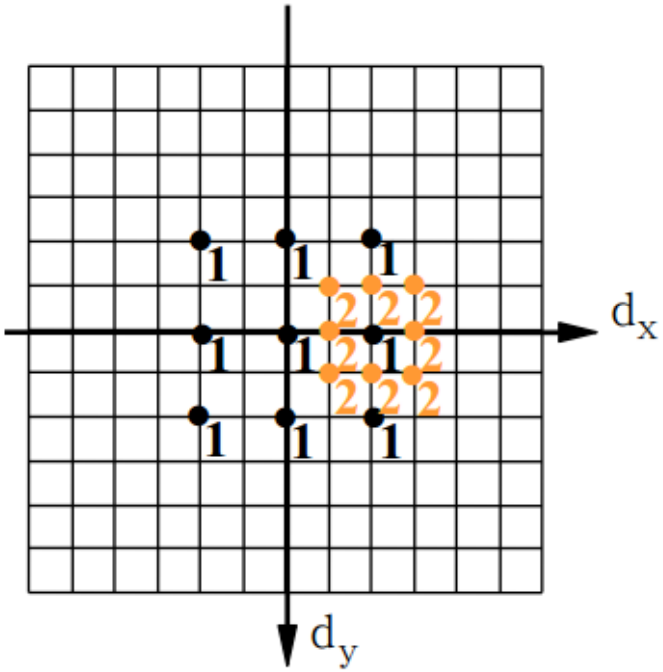
Trained probability tables

Block Diagram (Encoding the Right Image)



Block Matching

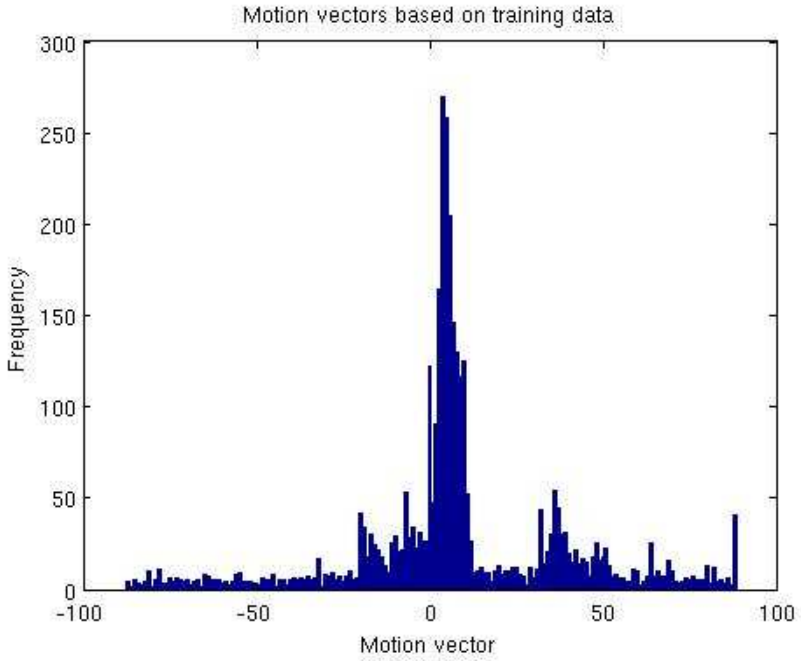
- Reconstructed left image is used for block matching.
- Block size of 32 x 32
- Coarse to fine search in 3 levels
  - First two coarse searches
  - Last level is a fine search
- Metric used : Sum of Absolute Differences



Picture courtesy : Prof Girod/ Prof. Wiegand

Search Window

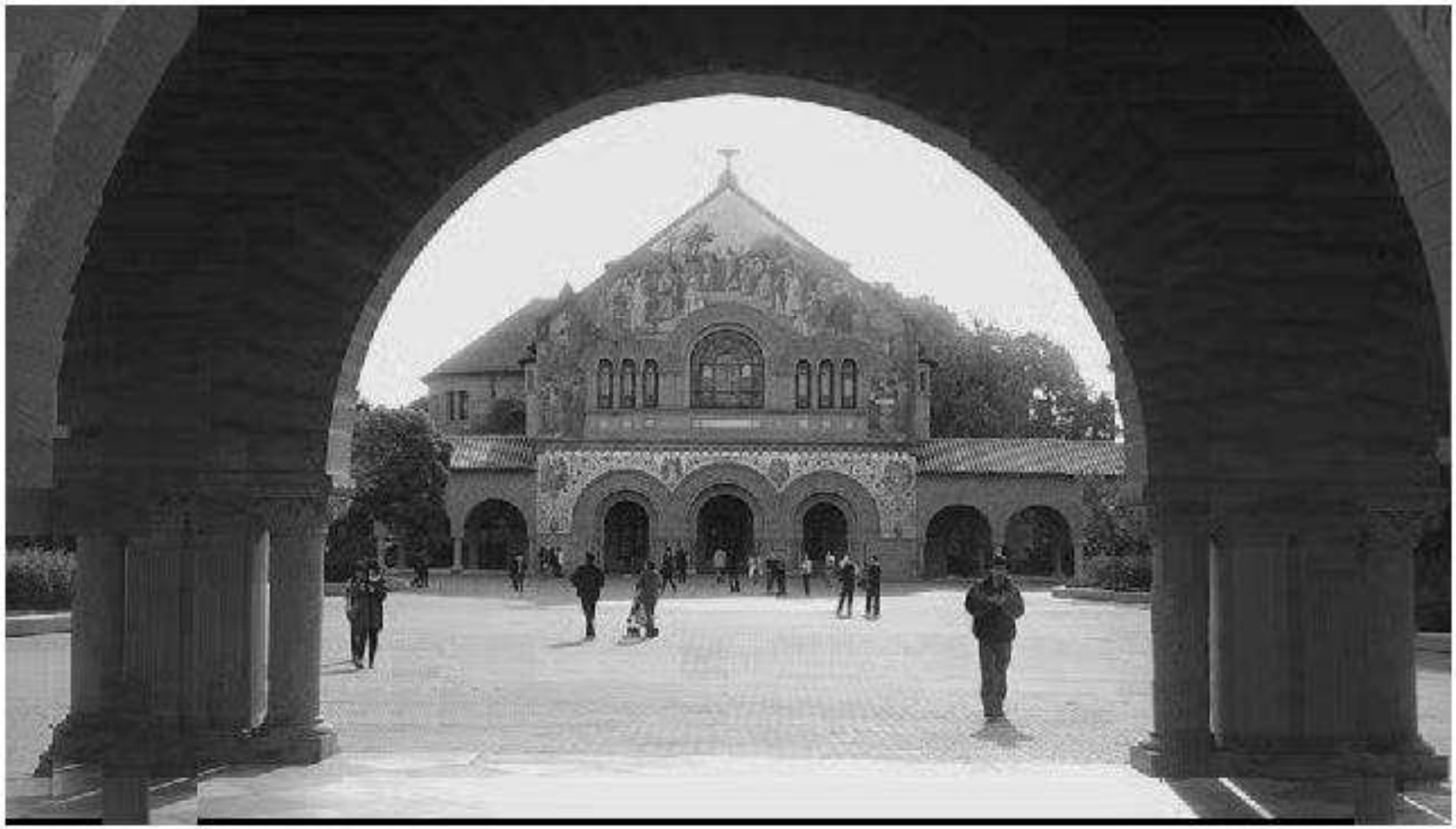
- We used 7 images for training
  - Both x and y disparity recorded
- Search window implemented based on training data



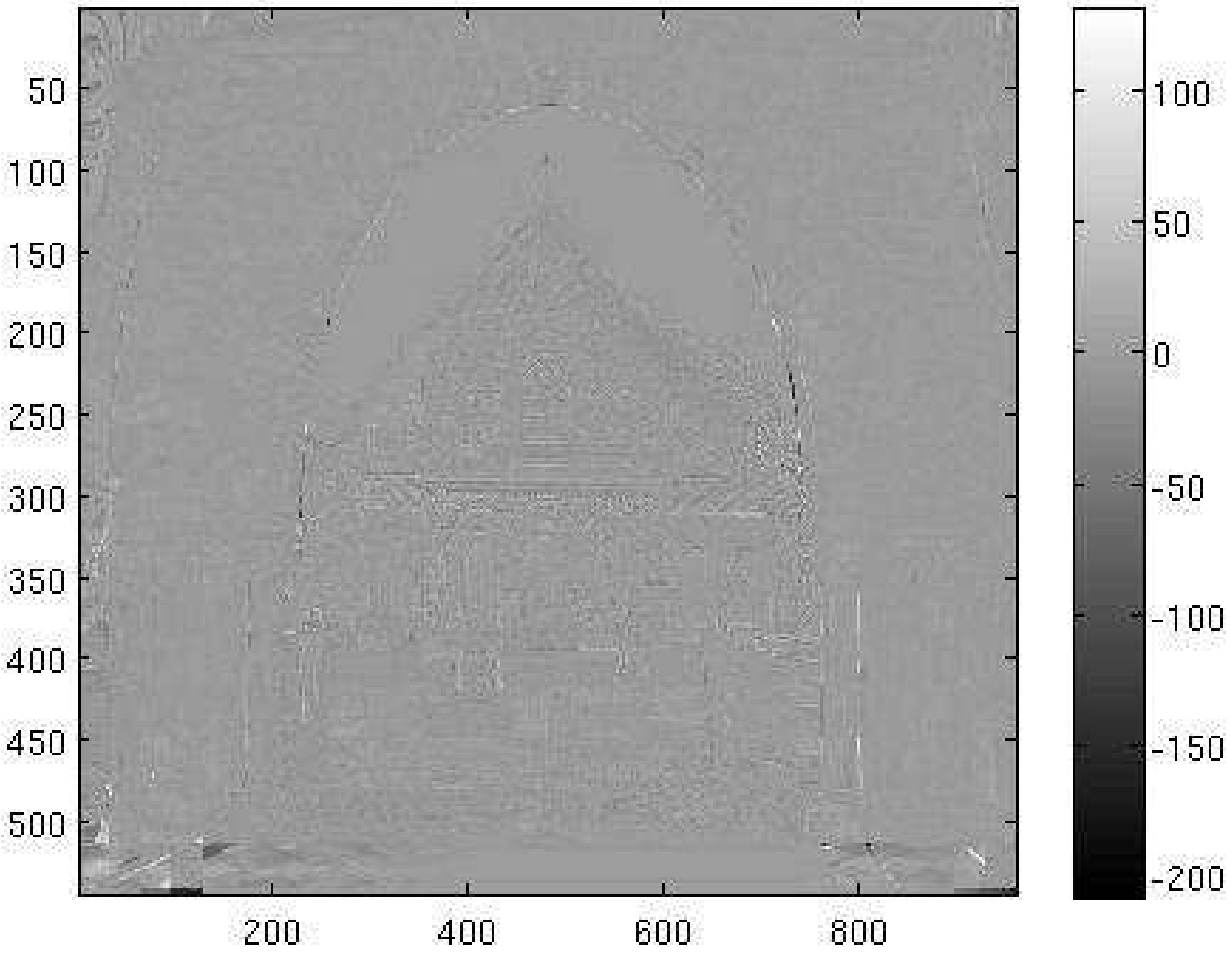
Residual Computation

- We obtain the motion compensated right image for all three channels.
- We use the same motion vectors (also scaled by a factor of 2) to predict the Cb, Cr channels.
- The residual images are obtained by subtracting the motion compensated right image from the original image.

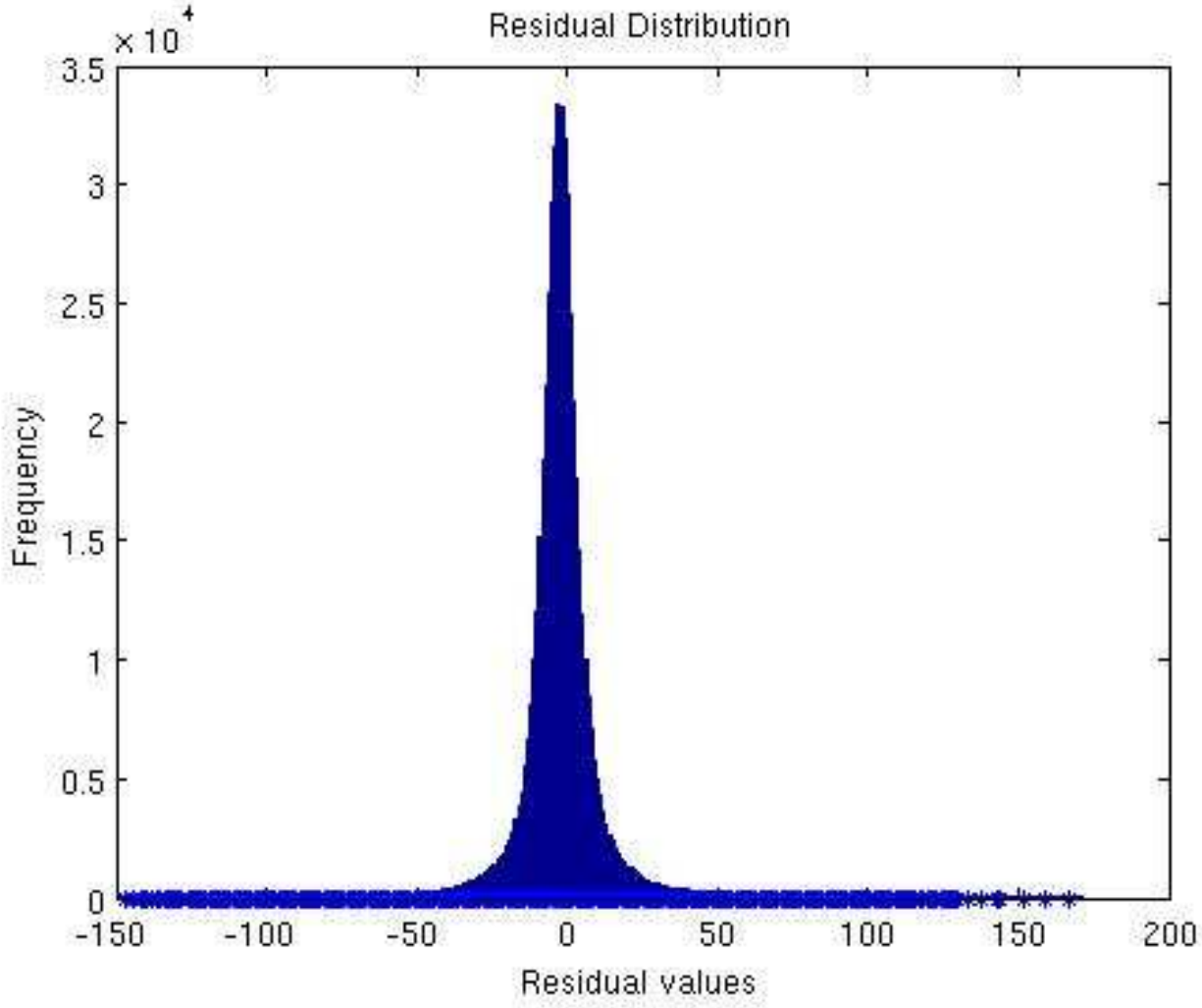
Motion Compensated Right Image



Residual Image



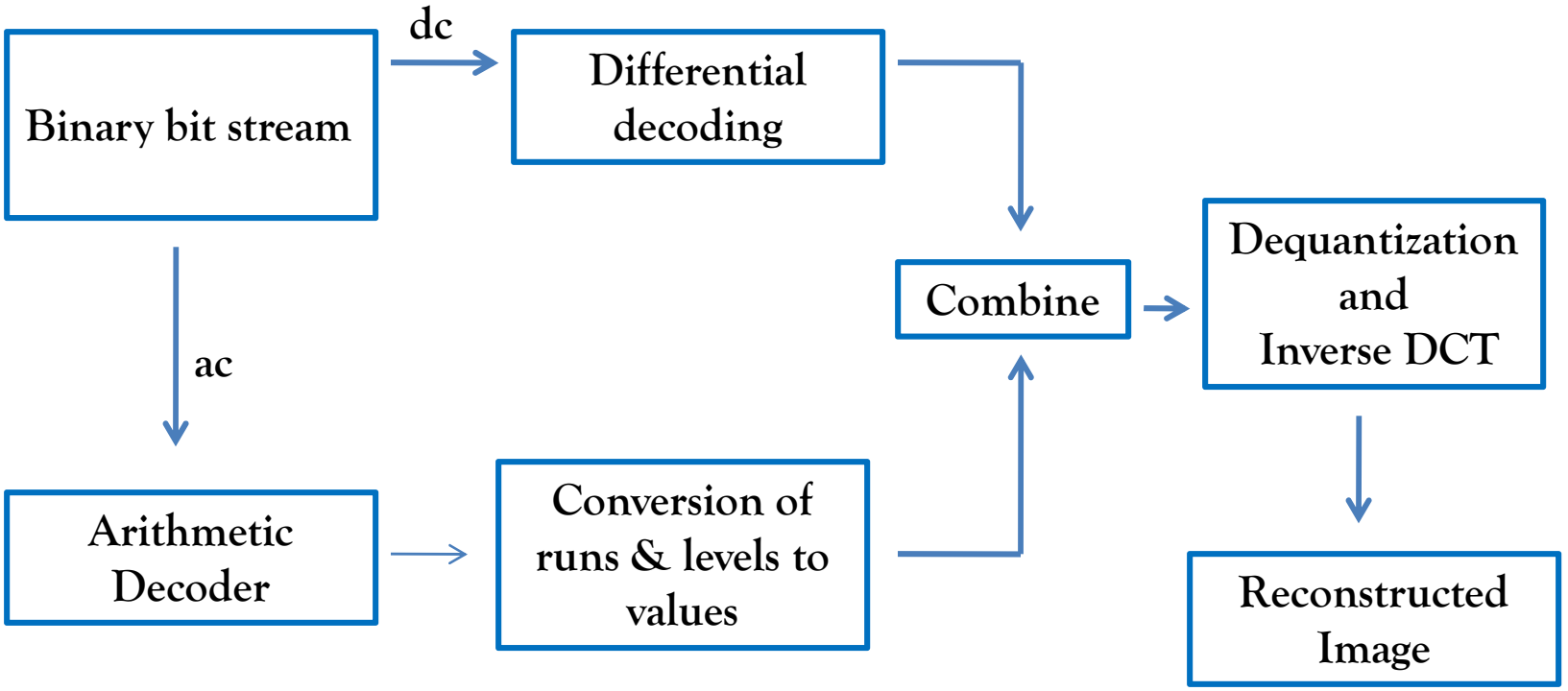
Distribution of the Residuals



Decoding of the Reference Image

- Use an arithmetic decoder to decode the ac coefficients . It has a probability table pre-trained and hard-coded.
- Decode the DC coefficients using a differential decoder
- De-quantize
- Inverse DCT

Block Diagram (Decoder)



Results

Images	Our compression		Jpeg compression
	PSNR	Bit rate	Bit rate
1	37.5	1.6204	1.5883
2	37.6	0.5718	0.5624
3	37.8	0.1445	0.1613
4	37.3	0.4063	0.3355
5	37.5	0.5734	0.5338
6	37.6	0.8809	0.8081
7	37.5	1.2987	1.3027
8	37.1	1.0815	1.0821
9	37.6	0.3959	0.3401
10	37.3	1.1752	1.1739
11	37.7	0.6881	0.6313
12	37.8	0.3605	0.3175
13	37.5	1.3454	1.583
14	37.8	1.8092	2.1229

Conclusion

- Average bit rate for 14 training images : **0.8 bpp**
- Average PSNR for 14 images : **37.57 dB**

- Block DCT + Run Level coding + Arithmetic coding performs quite well (slightly better than jpeg in most cases)