Soft Information based JPEG2000 Decoders

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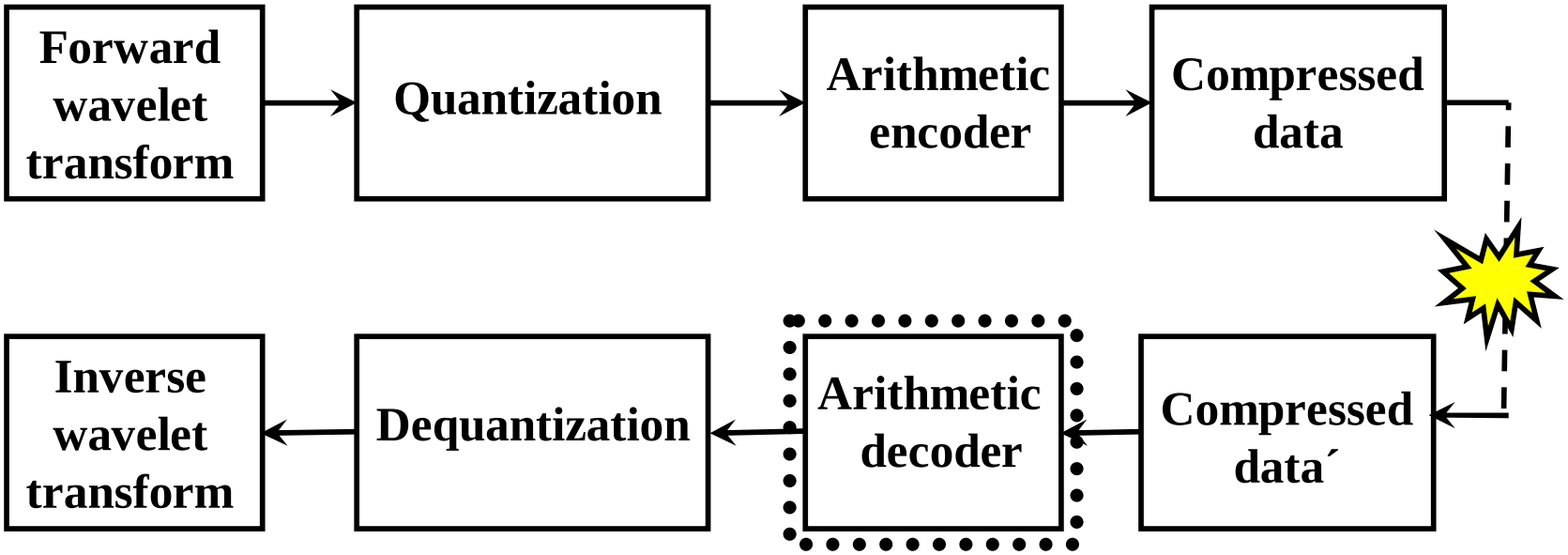
Outline

- Introduction
  - Soft information
  - Integration in JPEG2000 decoder
- Heuristic algorithm
- Optimal algorithm
- Experiment results
- Conclusions

Soft Information

- General purpose
  - Make end-points aware of channel conditions
  - Reduce retransmissions
- LLR (log likelihood ratio)
  - Soft decoding in the physical layer
  - Reliability measure for each received bit
    - Express the certainty of a bit's value to be correct

JPEG2000 & Soft Information



- Modified decoder
  - Detect bit-errors by utilizing standardized mechanisms in arithmetic codec
  - Correct bit-errors with soft information & iterative arithmetic decoding
- Purpose of an algorithm is to swap potentially erroneous bits & find new probable correct bit-sequences

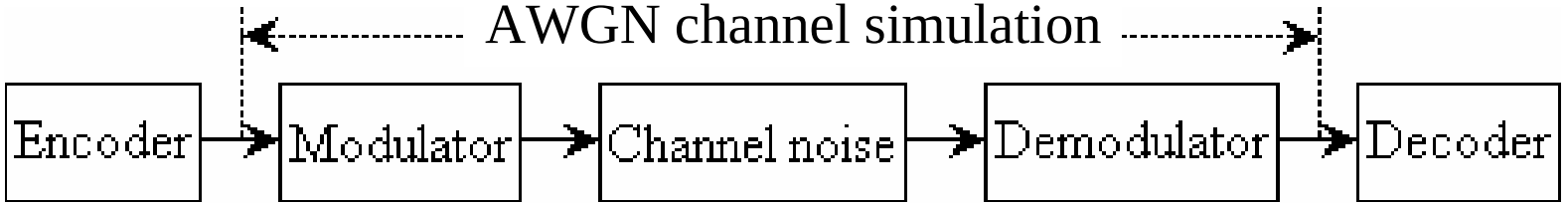
Algorithms

- Heuristic Algorithm
  - Based on simple rules it evaluates soft information and picks bits to swap
  - Produces a list of probable correct bit-sequences
    - 10 decoder iterations

- Optimal Algorithm
  - Soft information values are additive
    - Sum of soft information values corresponds to the probability for the bit-sequence to be correct
  - Produces an optimal ordered list of most probable correct bit-sequences
    - Decoder iterations varied 5,10 & 15

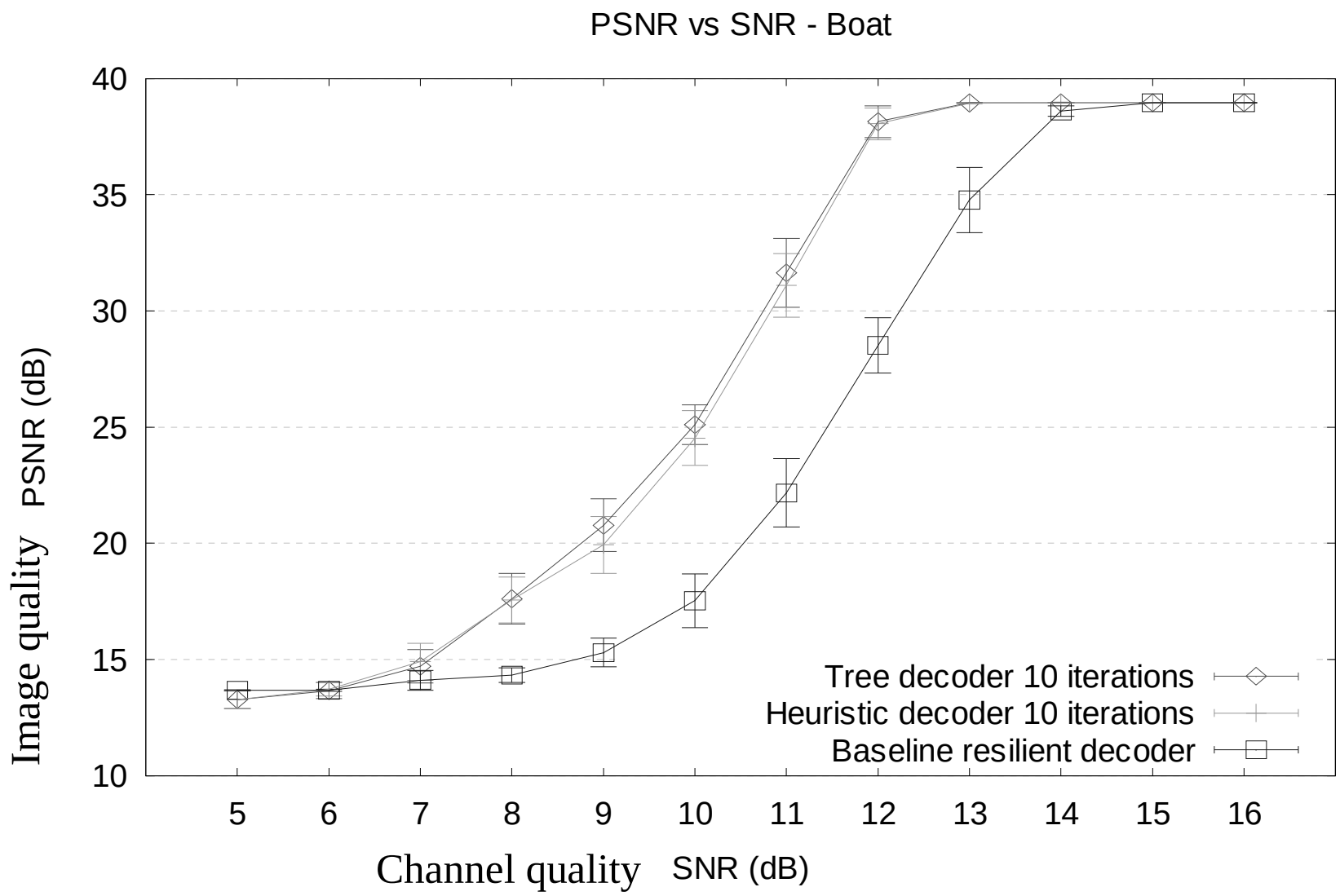
Experiment Set-up



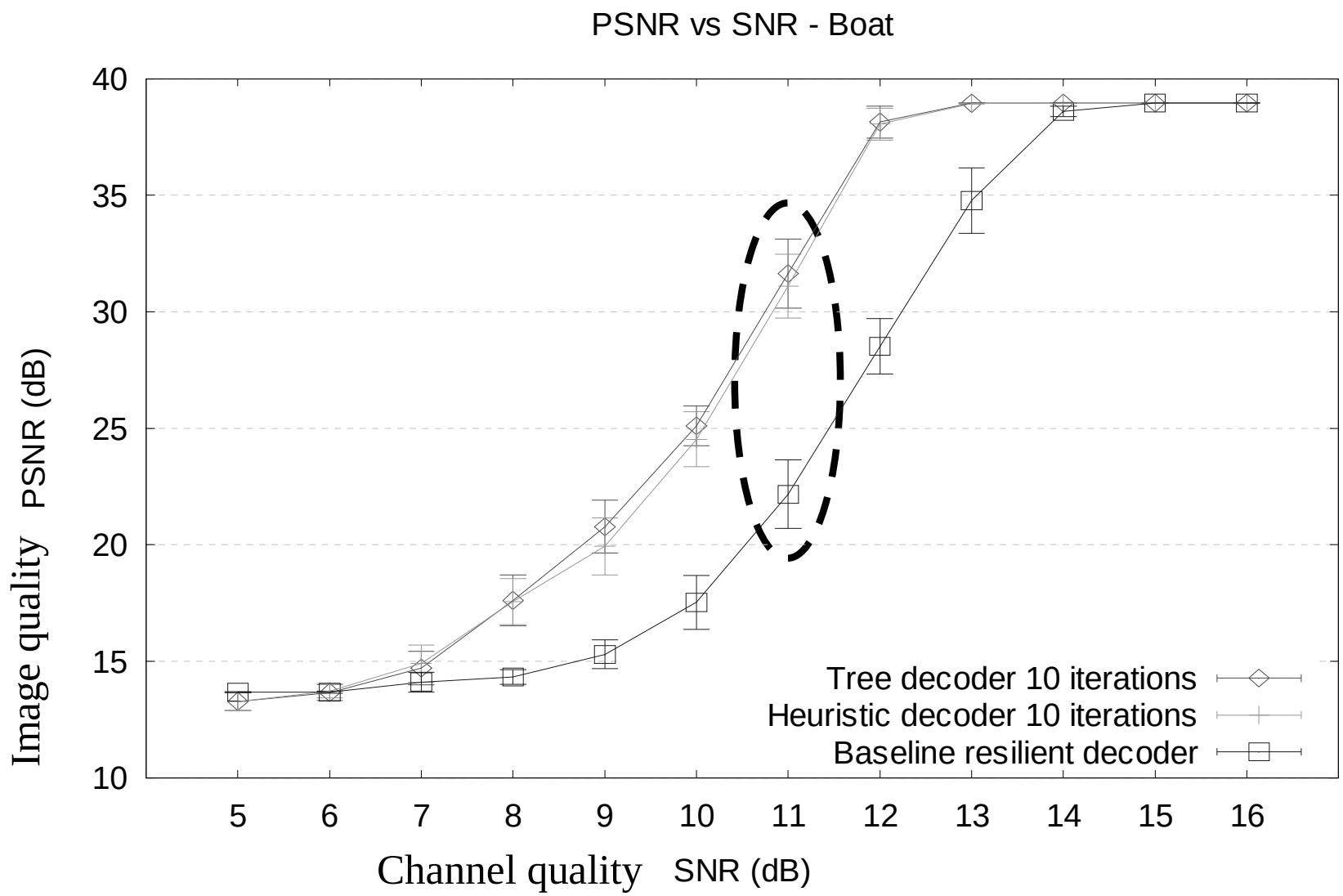



- Images transmitted over AWGN-channel
- 16-QAM modulation
- Signal to Noise power Ratio 5-16 dB
- Demodulator software generated soft information
- Received images decoded with different decoders

Heuristic vs. Optimal Algorithm (10 Iterations)



Heuristic vs. Optimal Algorithm (10 Iterations)



SNR 11 dB

Baseline error resilient
decoder PSNR 23.301 dB

SNR 11 dB

Baseline error resilient
decoder PSNR 23.301 dB

Heuristic decoder
PSNR 30.6885 dB

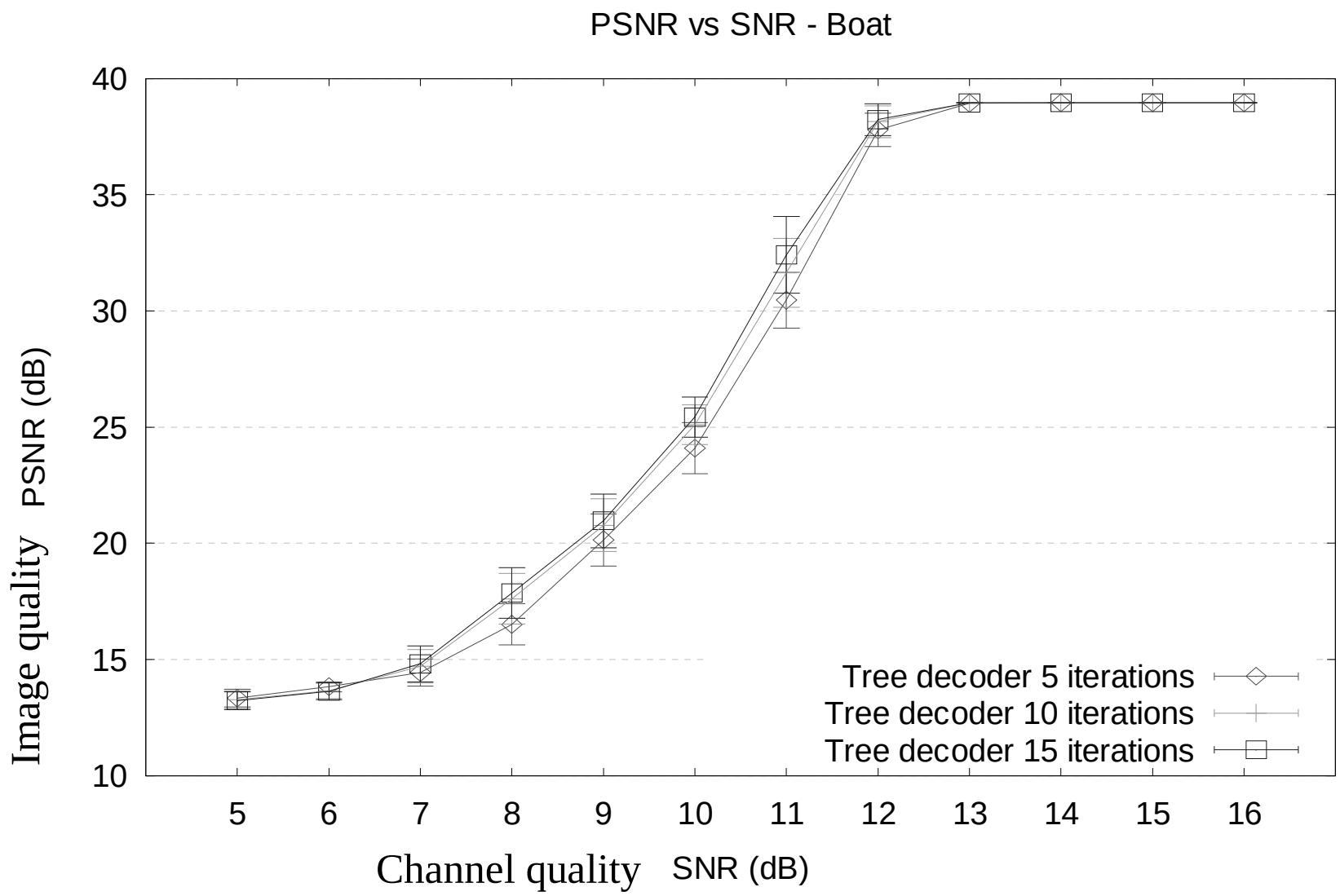
SNR 11 dB

Baseline error resilient decoder PSNR 23.301 dB

Heuristic decoder PSNR 30.6885 dB

Tree decoder PSNR 31.4318 dB

Optimal Algorithm - Impact of Number of Iterations



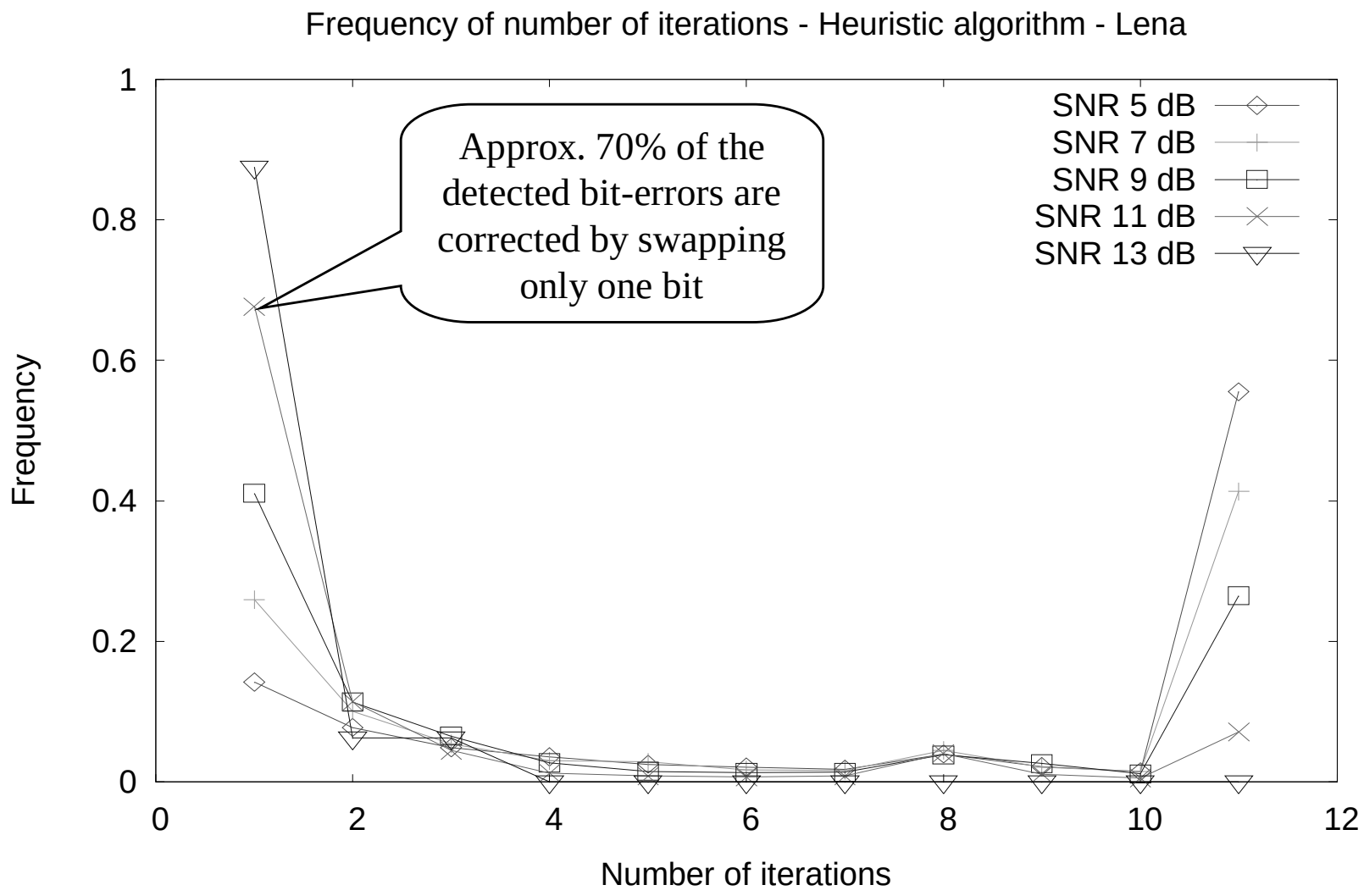
SNR 11 dB

Tree decoder 5 iterations
PSNR 30.3724 dB

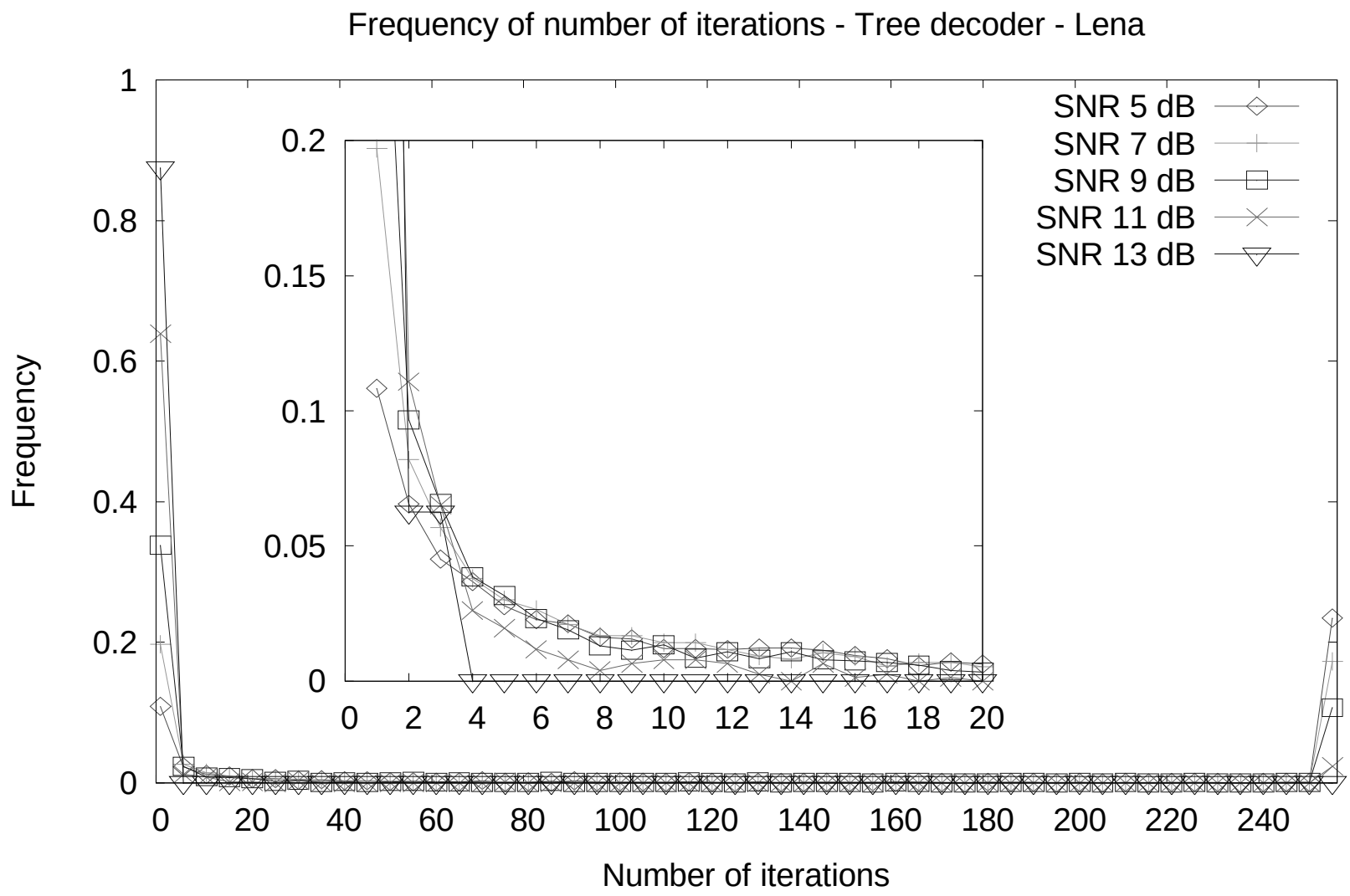
Tree decoder 10 iterations
PSNR 31.4318 dB

Tree decoder 15 iterations
PSNR 31.4461 dB

Heuristic Algorithm - Frequency of Number of Iterations



Optimal Algorithm - Frequency of Number of Iterations



Conclusion

- High gain possible with soft information
- Heuristic algorithm performs well
- Marginal gains observed with optimal algorithm

- Low number of iterations is sufficient given the robustness of the error detecting mechanisms

- Decoder behaviour similar independent of motif