Graph-based representation for multiview images

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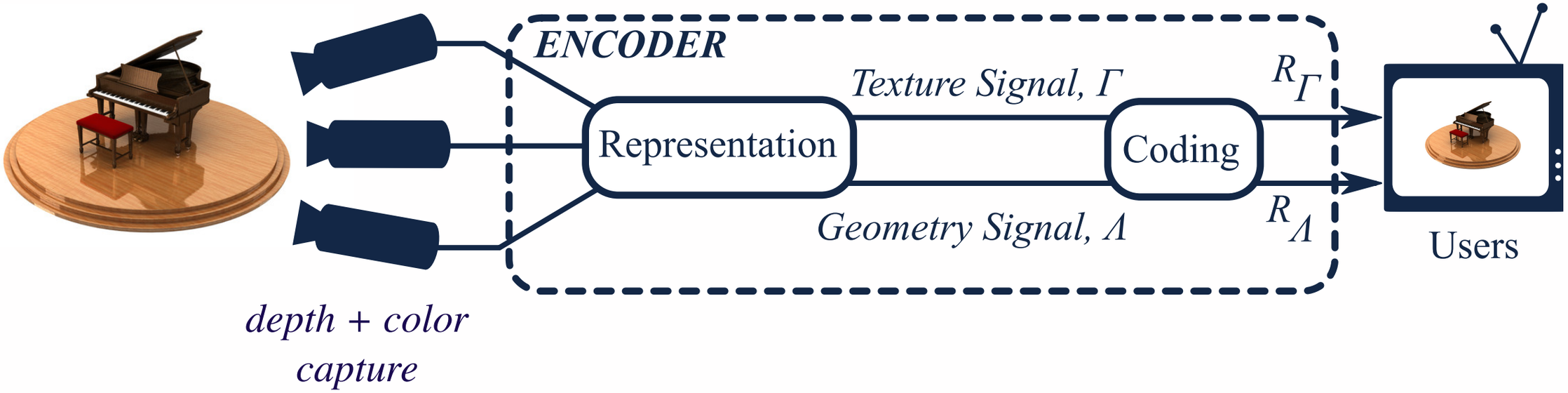
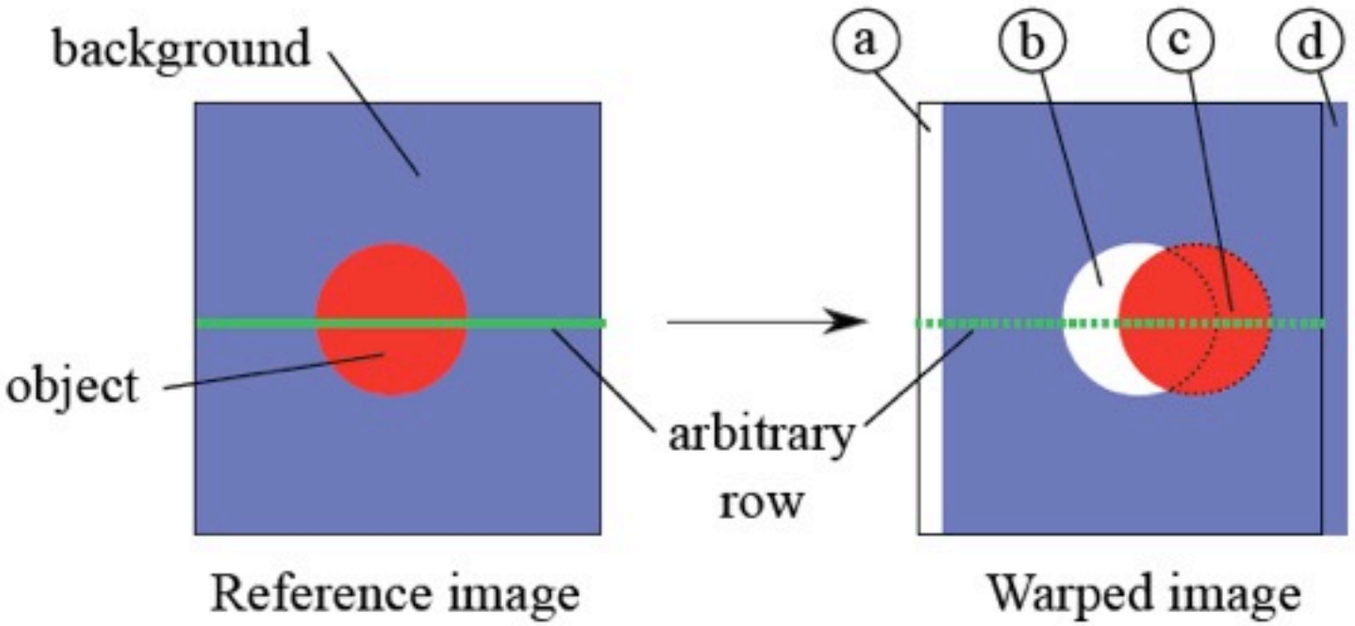
Goals



- Purpose: an alternative to depth-based representation
- Previous work: geometry representation and coding using ***Graph-Based Representation (GBR)***
  - describe the inter-view pixel connections as links in a **graph**
- Contribution: use of the graph for ***color compression***
  - use the graph links to exploit inter-view redundancies in the multiview signal

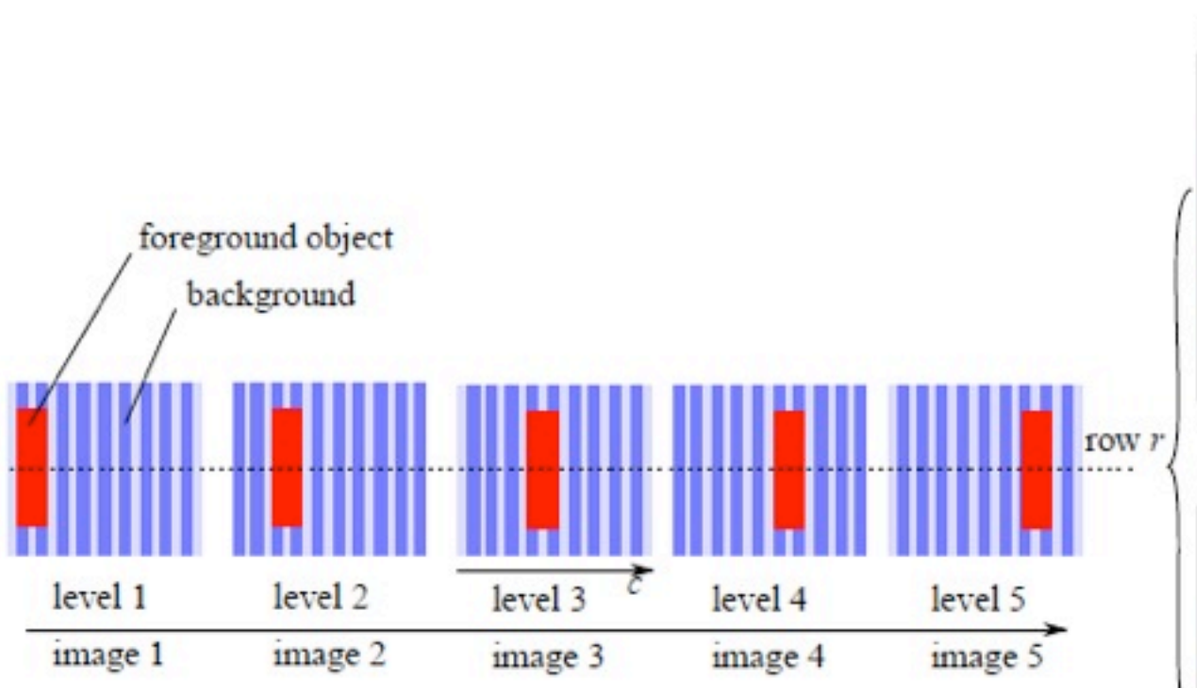
Motivation: Pixel Classification

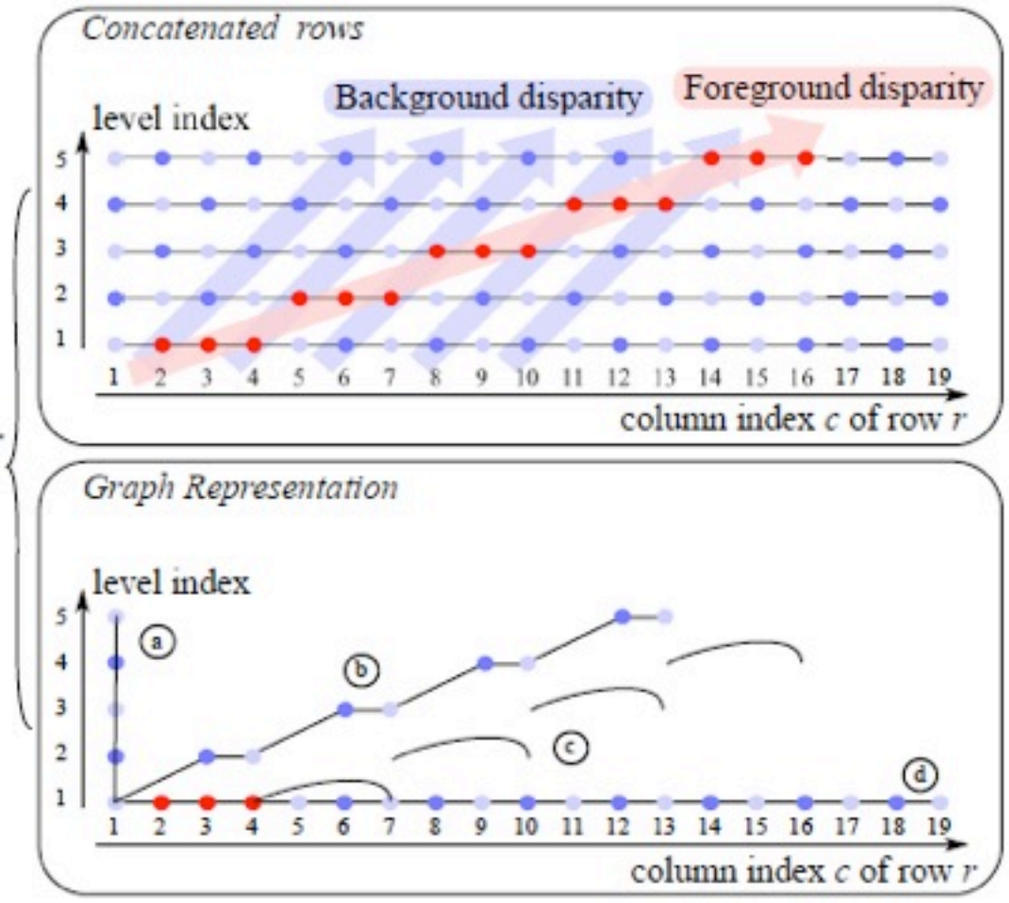


- Pixels categories
  - (a) : appearing pixels
  - (b) : disoccluded pixels
  - (c) : occluded pixels
  - (d) : disappearing pixels

Graph-based representation

T. Maugey, A. Ortega°, P. Frossard*, ICASSP 2013, MMSP 2013, submitted TIP 2014*





Graph-based representation

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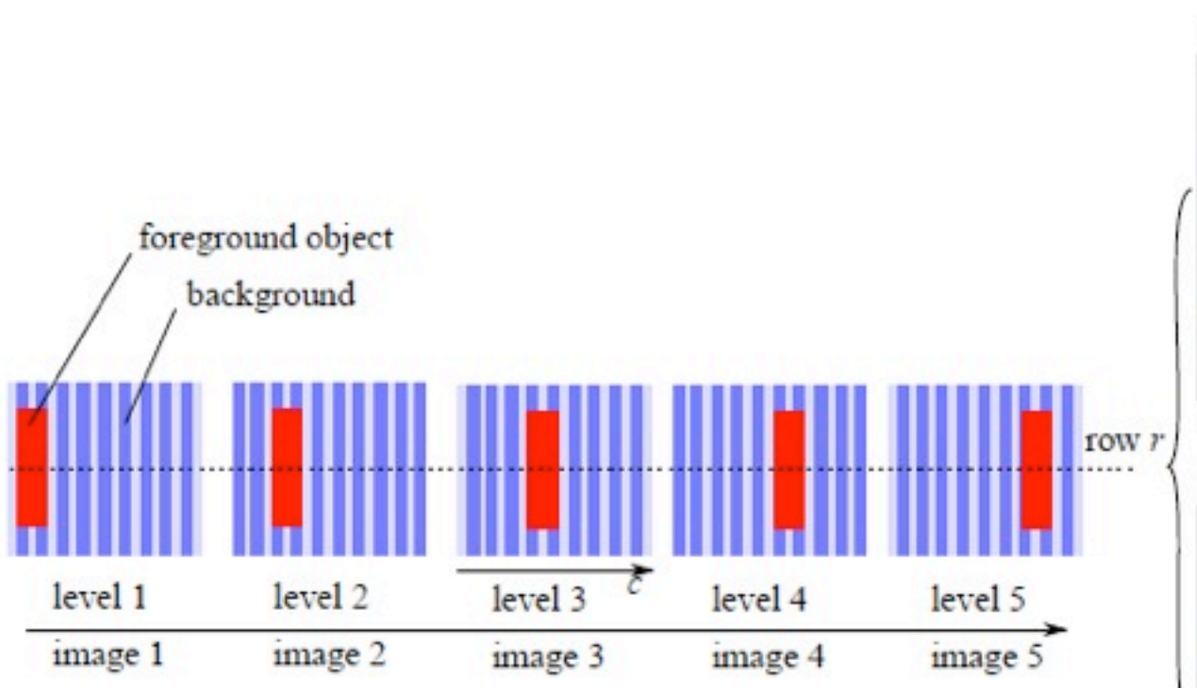
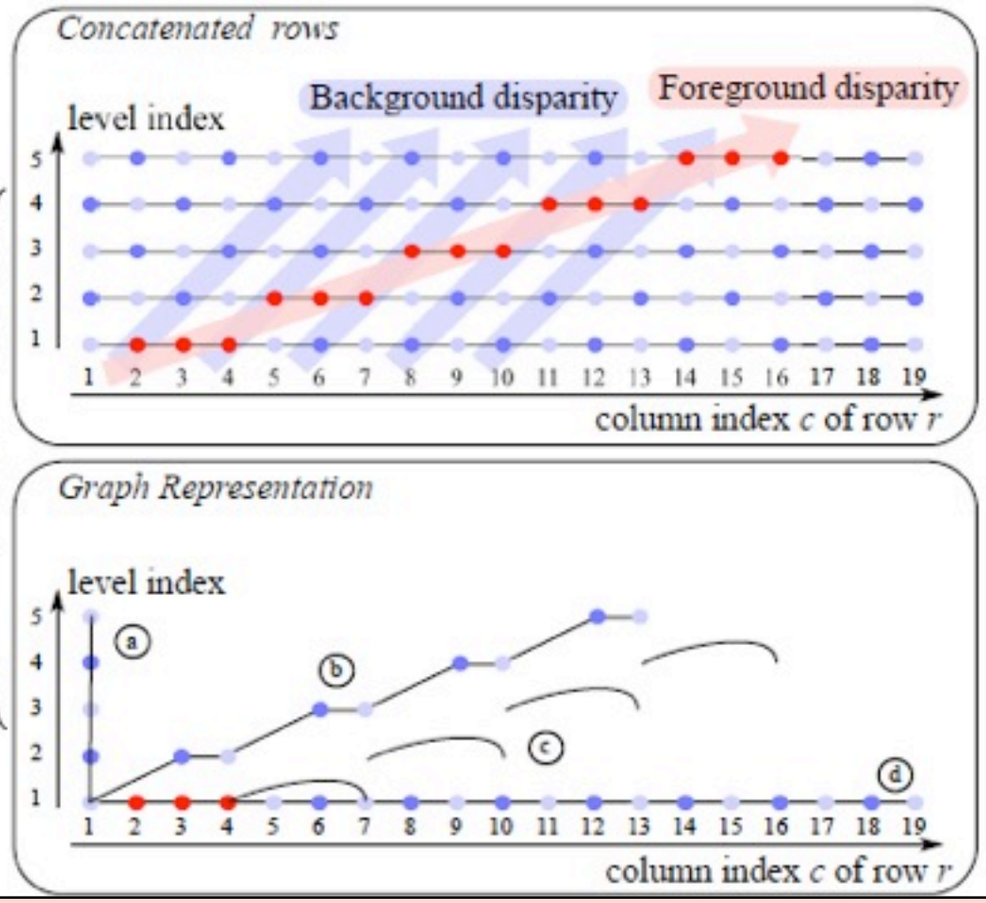
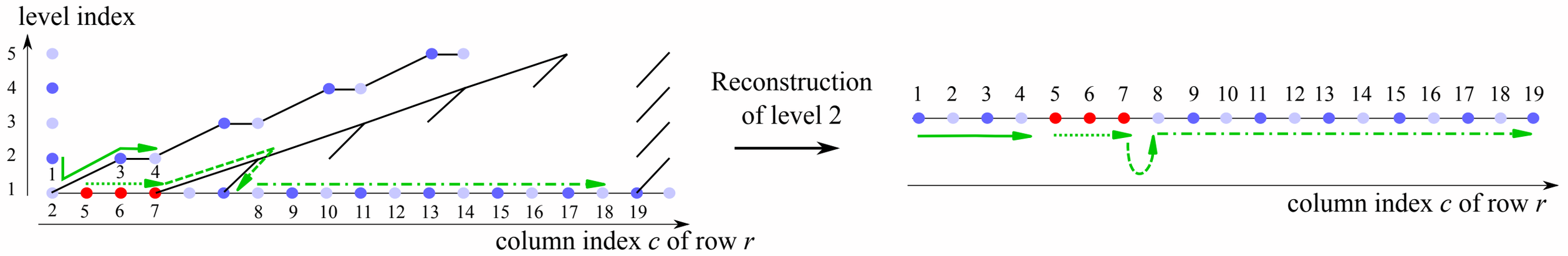




- Only new pixels appear in higher levels
- Connections link these pixels with their neighbor in the previous level
  - The (a) appearing and (b) occluded pixels are described *in the first image/level they appear*
  - The (c) disoccluded and (d) disappearing pixels are represented in the graph *by connections with no luminance values*

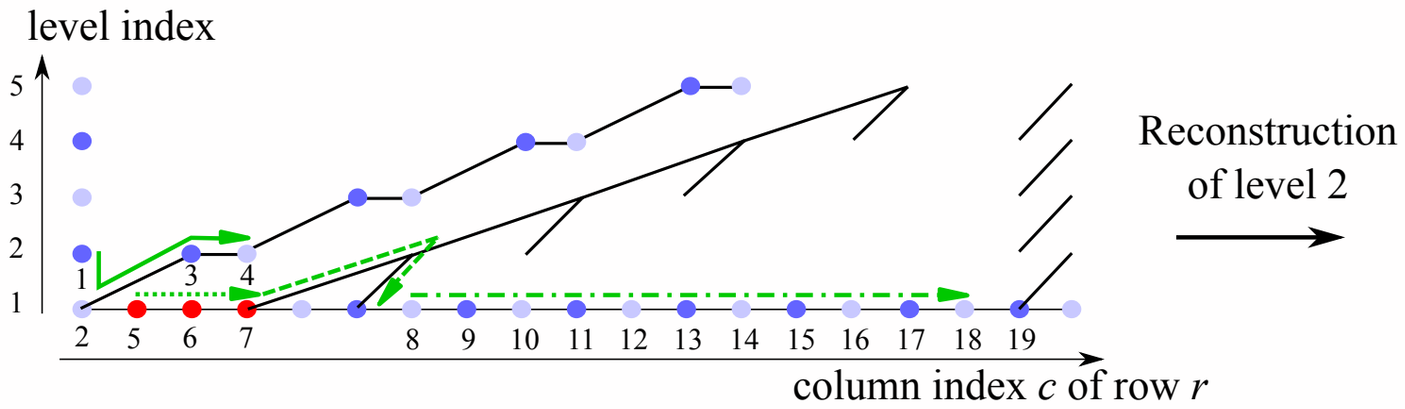
View reconstruction



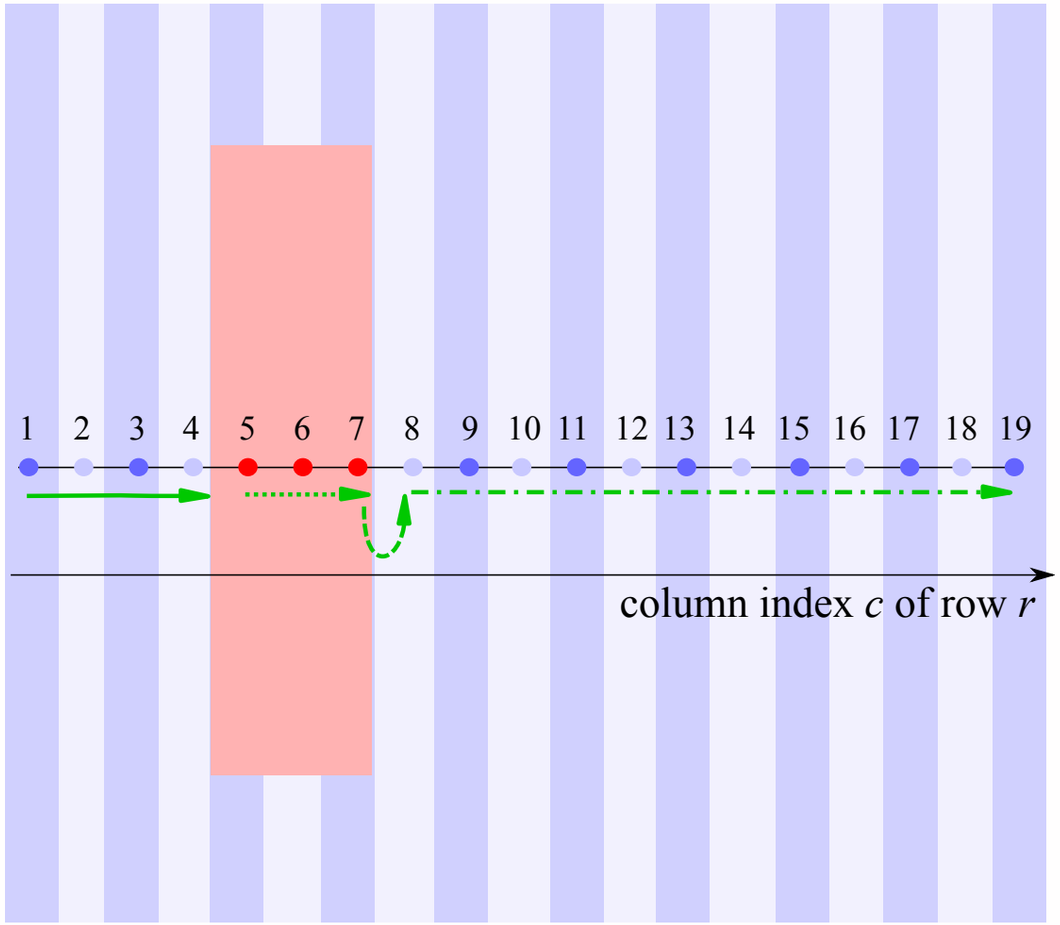
Reconstruction policy:

- start at the level that is to be reconstructed and to fill all the appearing pixels
- follow the connections to upper levels when they occur
- go down to lower level when it is not possible to continue in the current level

View reconstruction



Reconstruction of level 2



Reconstruction policy:

- start at the level that is to be reconstructed and to fill all the appearing pixels
- follow the connections to upper levels when they occur
- go down to lower level when it is not possible to continue in the current level

Graph example

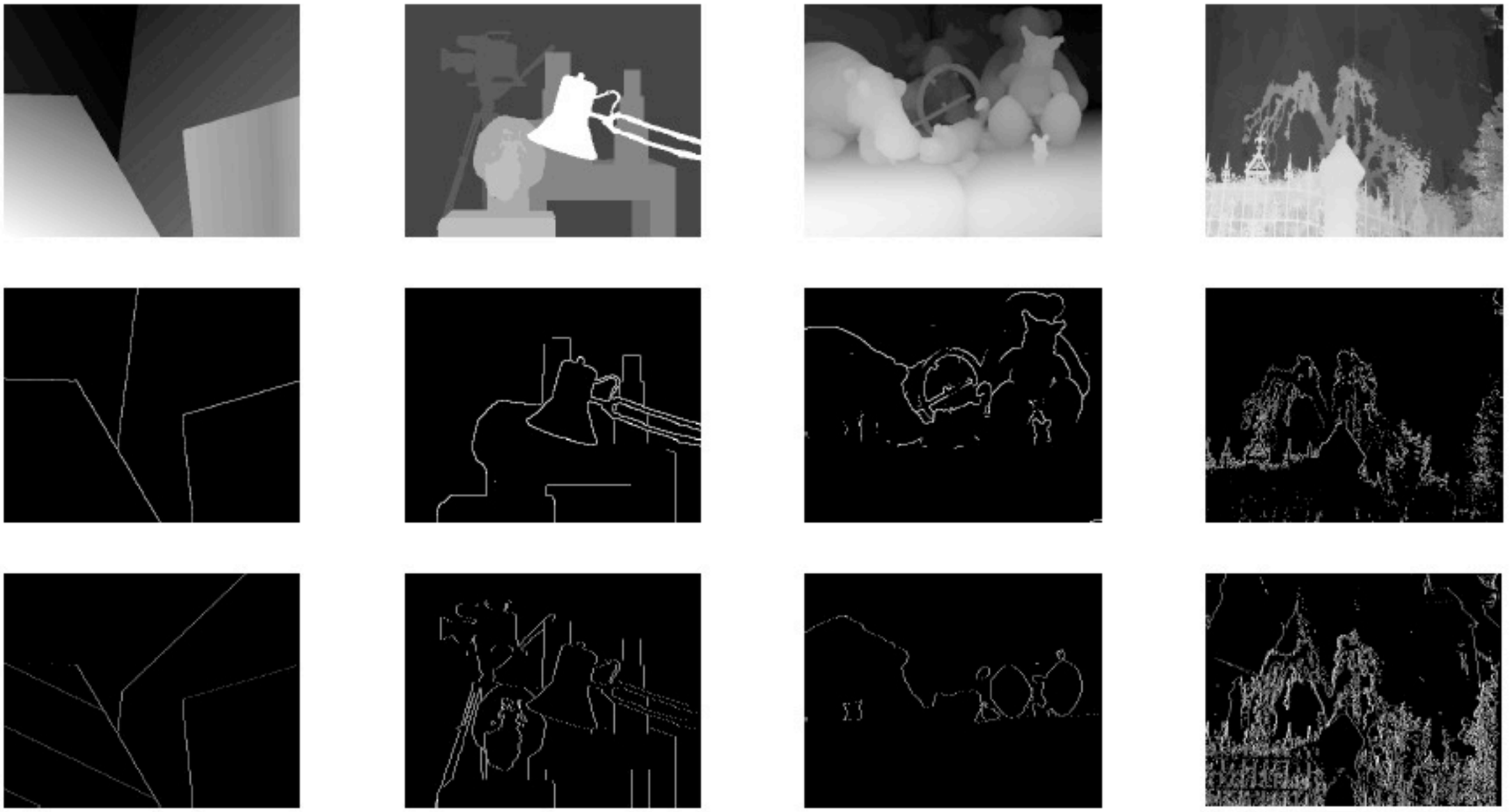


Fig. 11: Illustration of depth images (first row), depth edges preserved by depth coding algorithm (second row), and GBR connection positions (third row), for the "Venus", "Tsukuba", "Couch" and "Mansion" multiview datasets of Table I.

Retrieved disparity from GBR

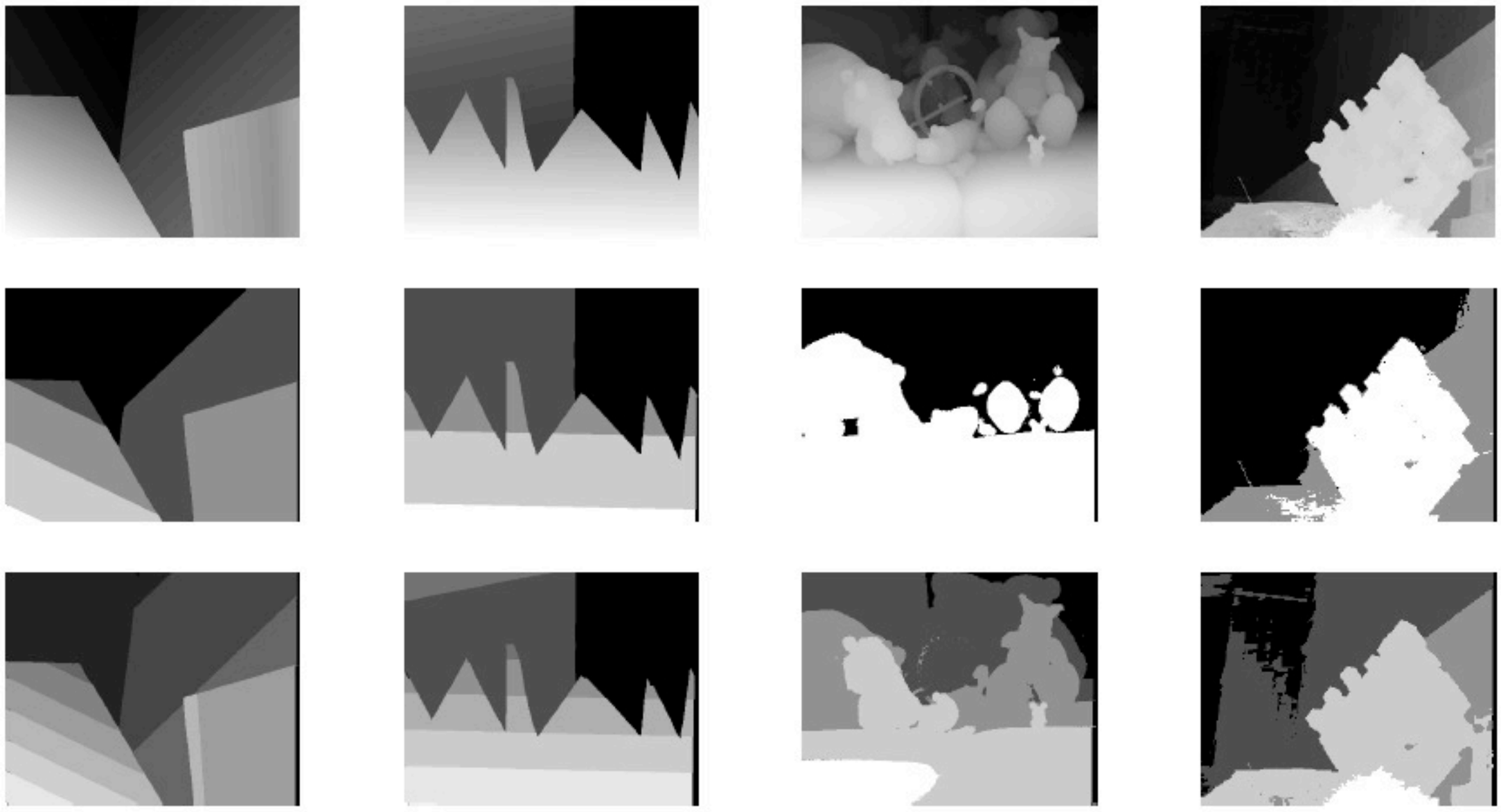
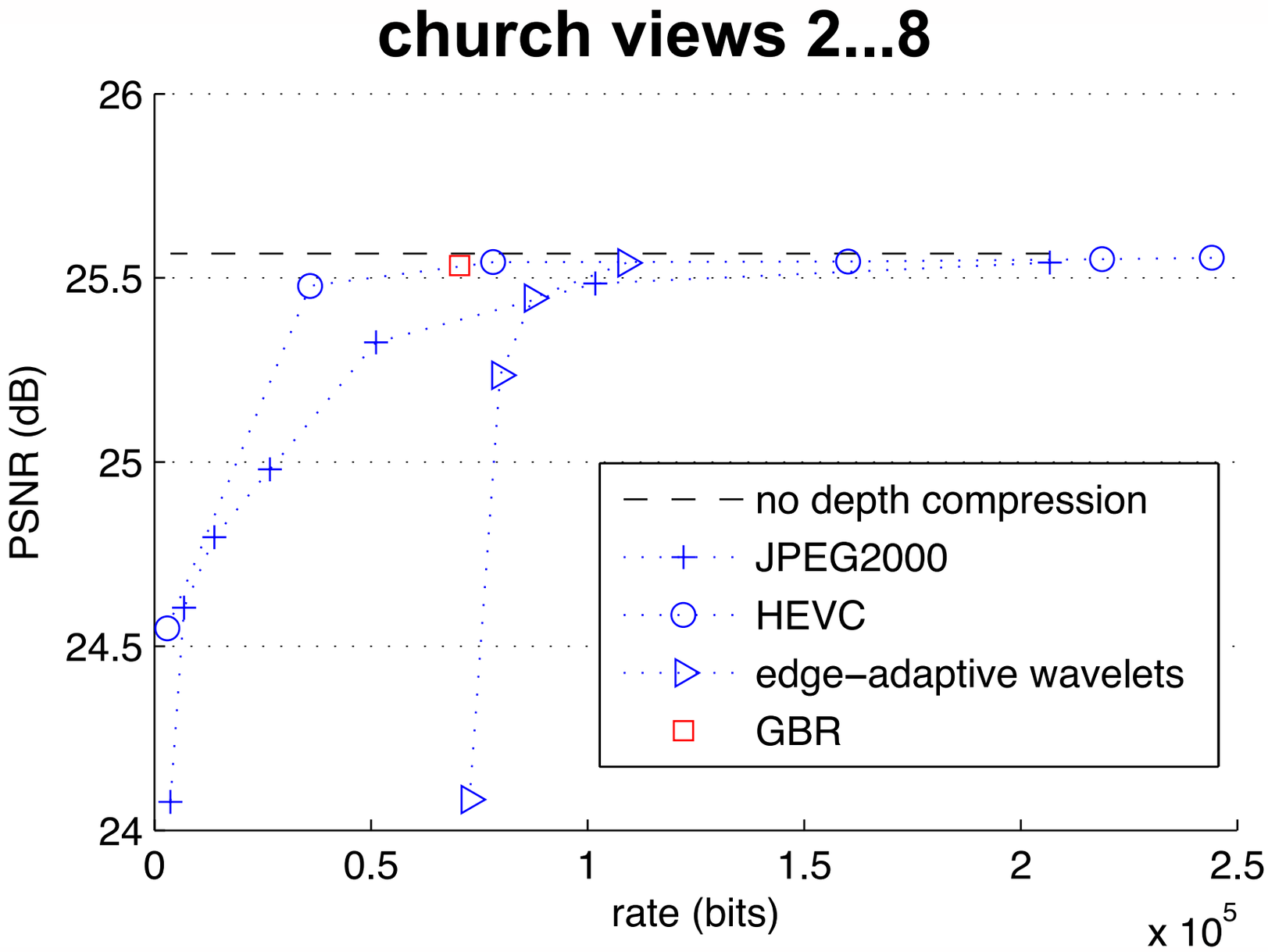
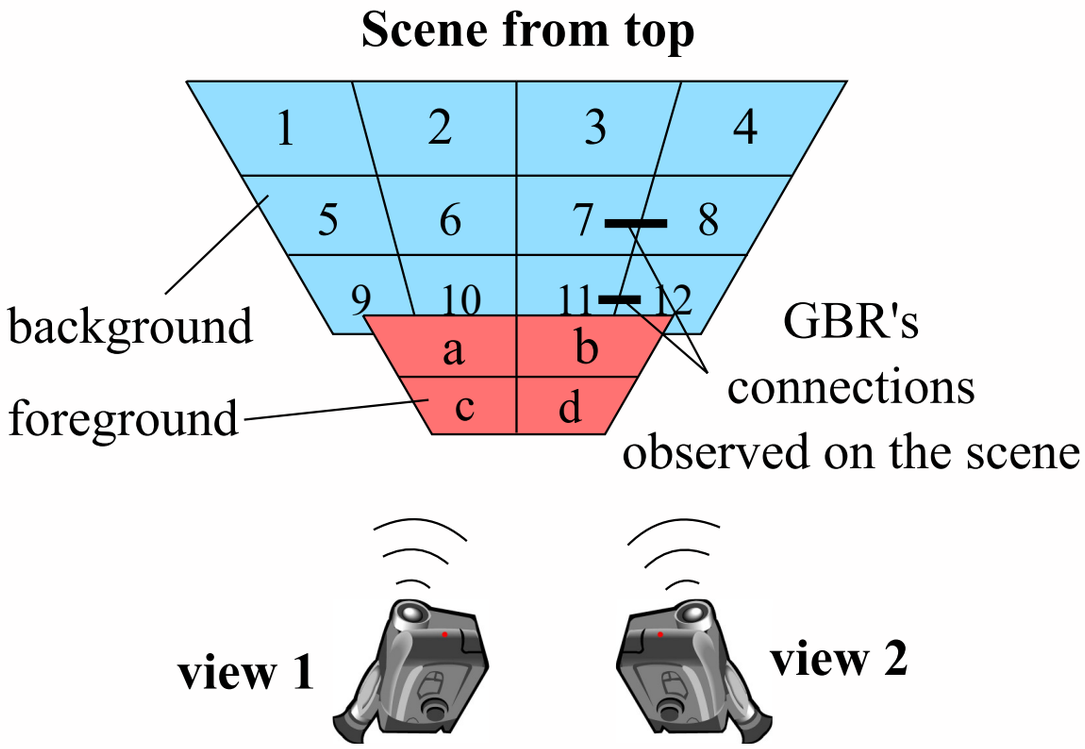


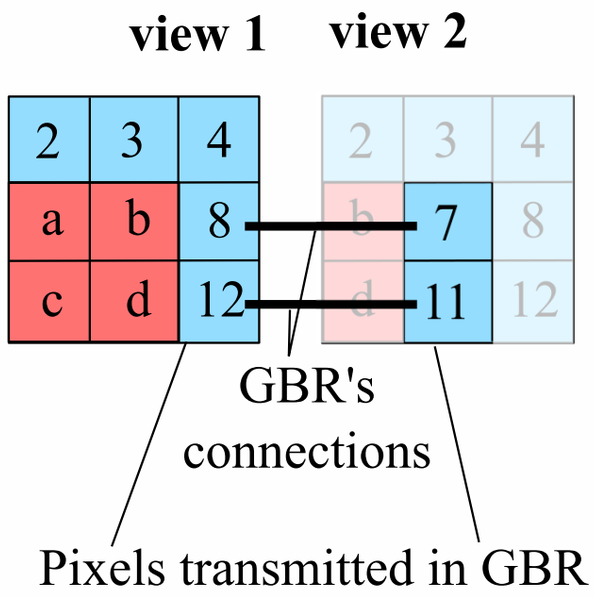
Fig. 13: Illustration of depth images (first row), GBR geometry for view 2 prediction (second row), and GBR geometry for view 3 prediction (third row), for the "Venus", "Sawtooth", "Couch" and "Statue" multiview datasets of Table I.

RD results


church views 2...8
PSNR (dB)
26
25.5
25
24.5
24
0
0.5
1
1.5
2
2.5
rate (bits)
x 10^5
no depth compression
JPEG2000
HEVC
edge−adaptive wavelets
GBR

Luminance coding: intuitions





- An edge links: two pixels that are neighbours in the 3D scene
- These pixels are to be coded together

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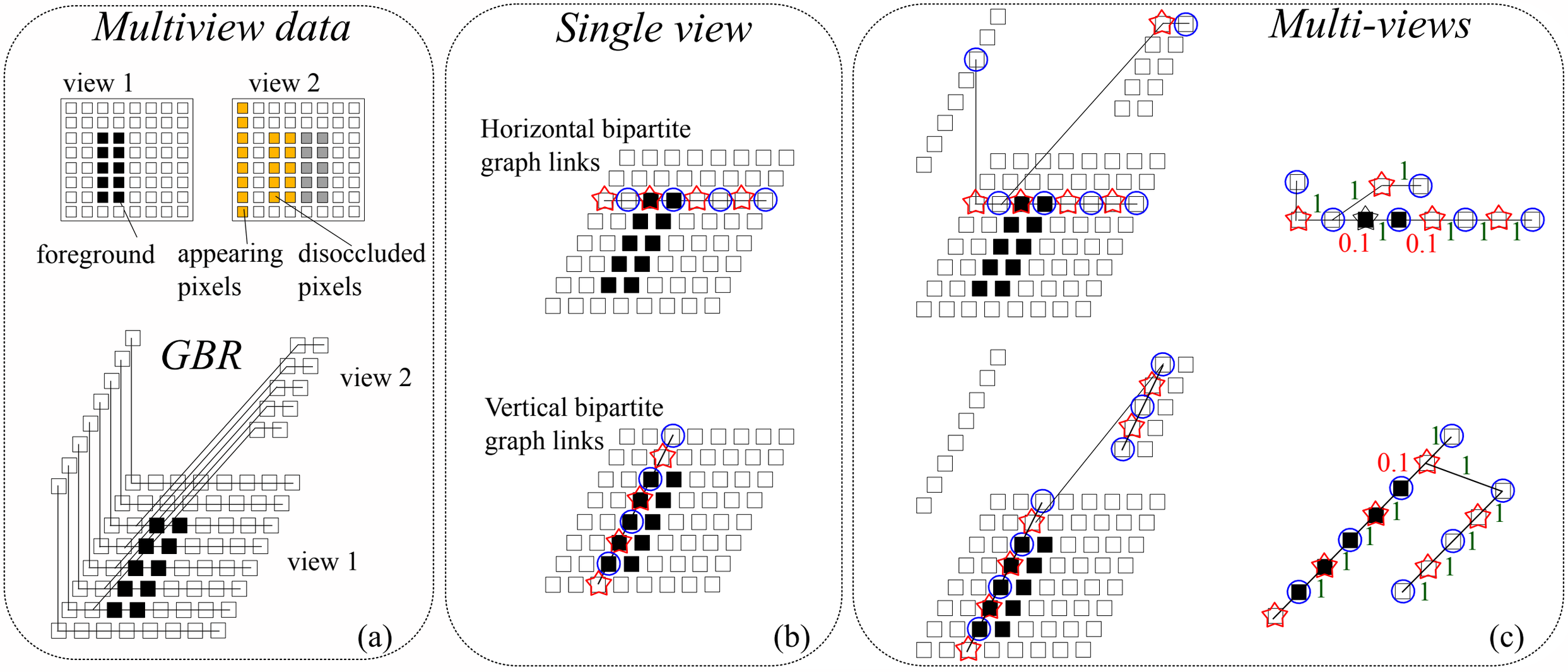
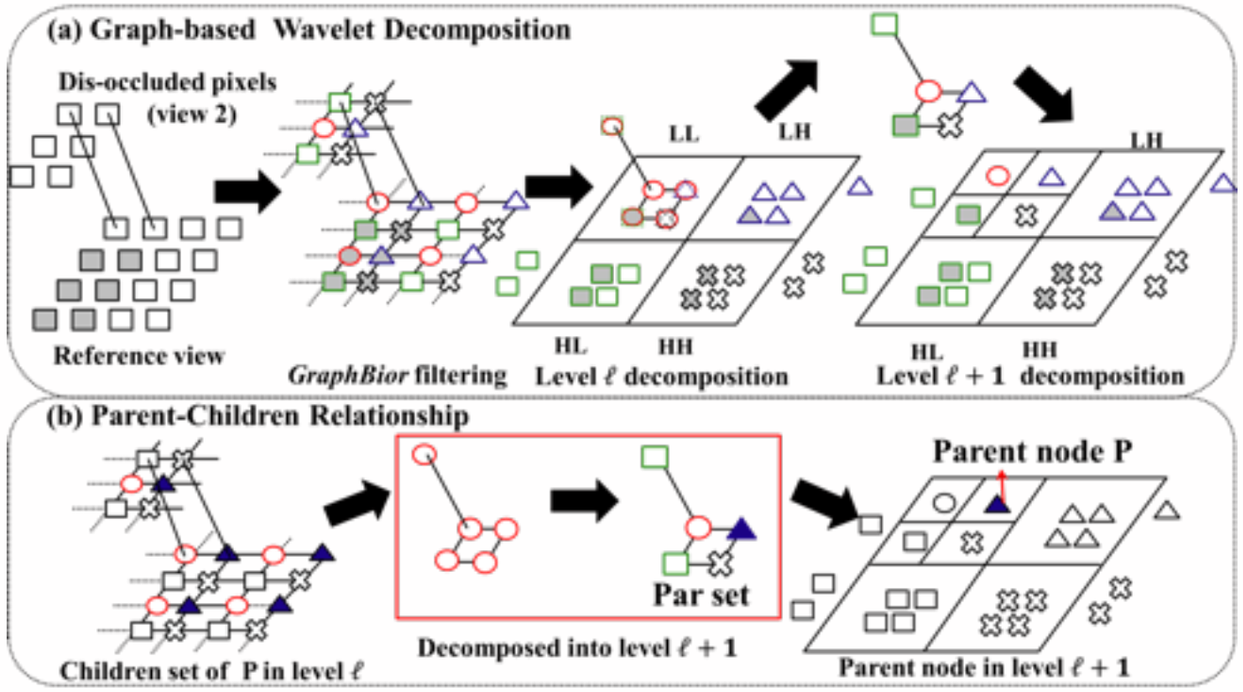
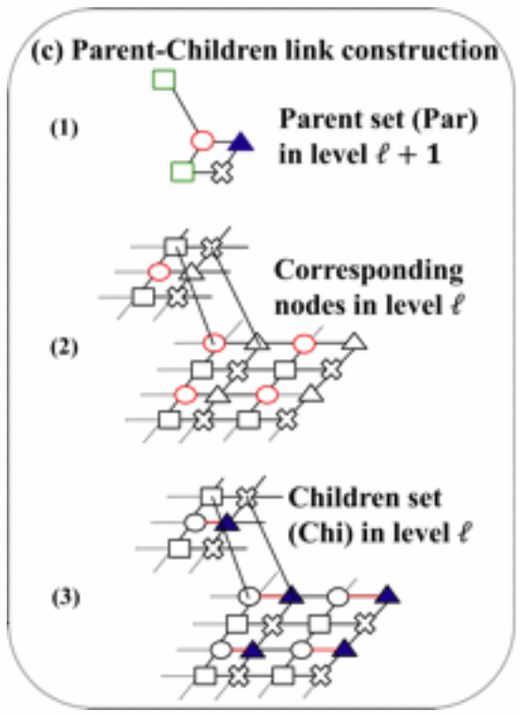
Graph-based transform: *GraphBior* filterbanks

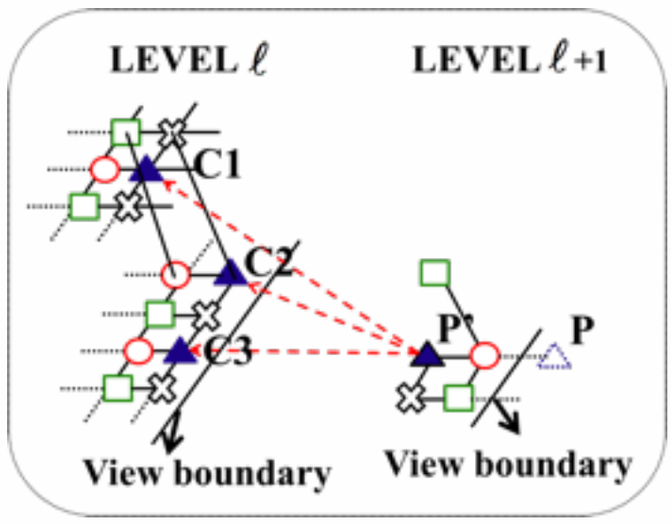


S. Narang, Y. Chao, and A. Ortega, "*Critically sampled graph-based wavelet transforms for image coding,*" in APSIPA ASC, Kaohsiung, Taiwan, Oct 2013.

Extension of SPIHT algorithm





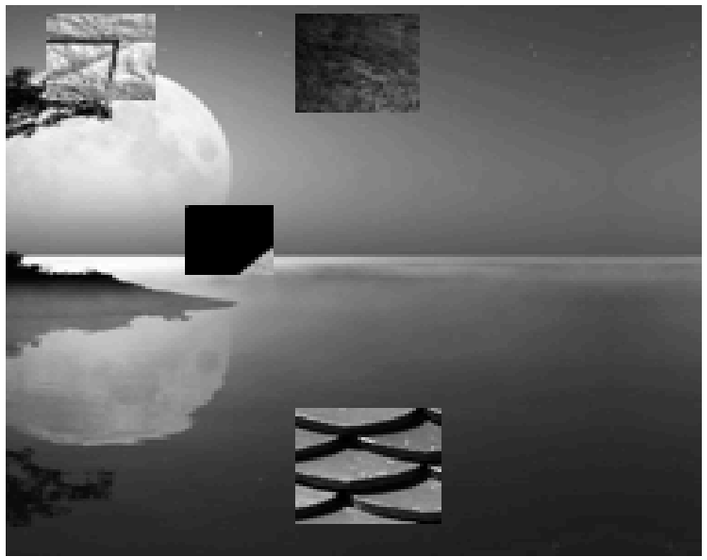


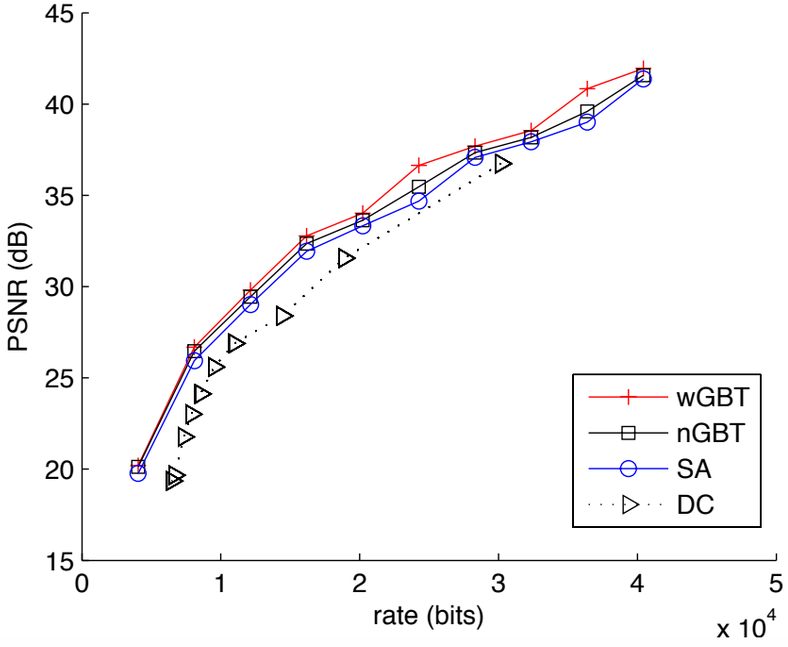
Experiments

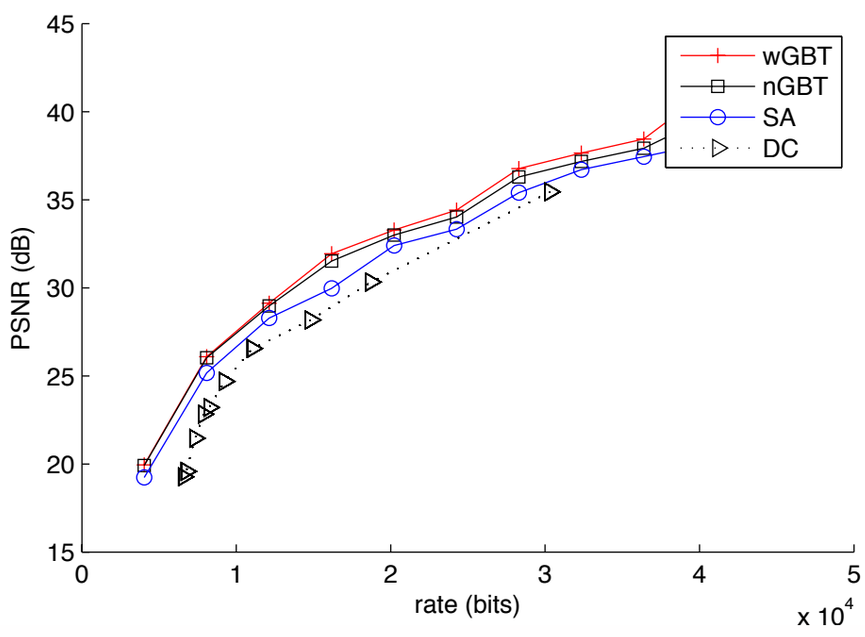
- Comparison

- DC: previous GBR
- SA: shape-adaptive coding
- nGBT: non-weighted GBT
- wGBT: weighted GBT

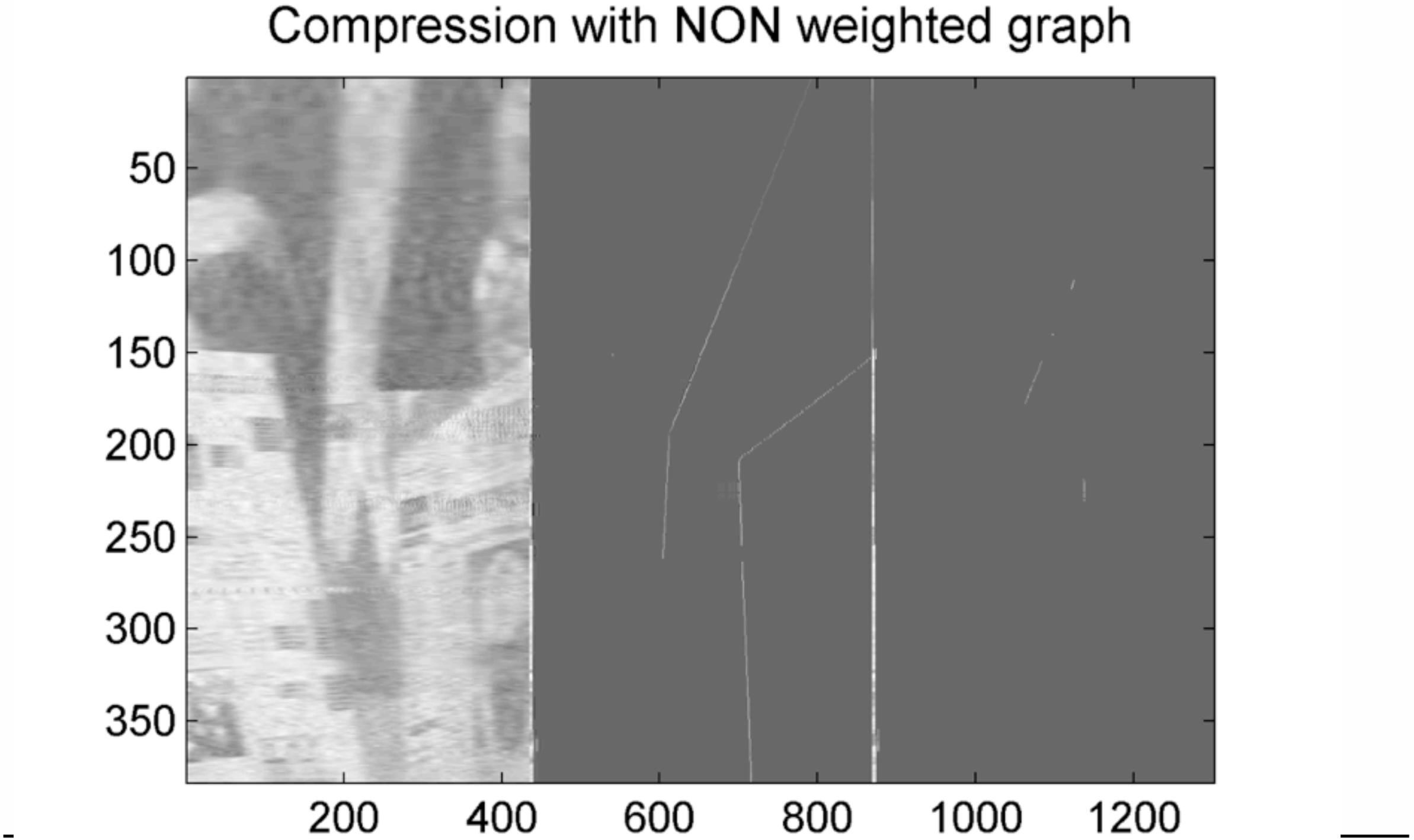
Experiments



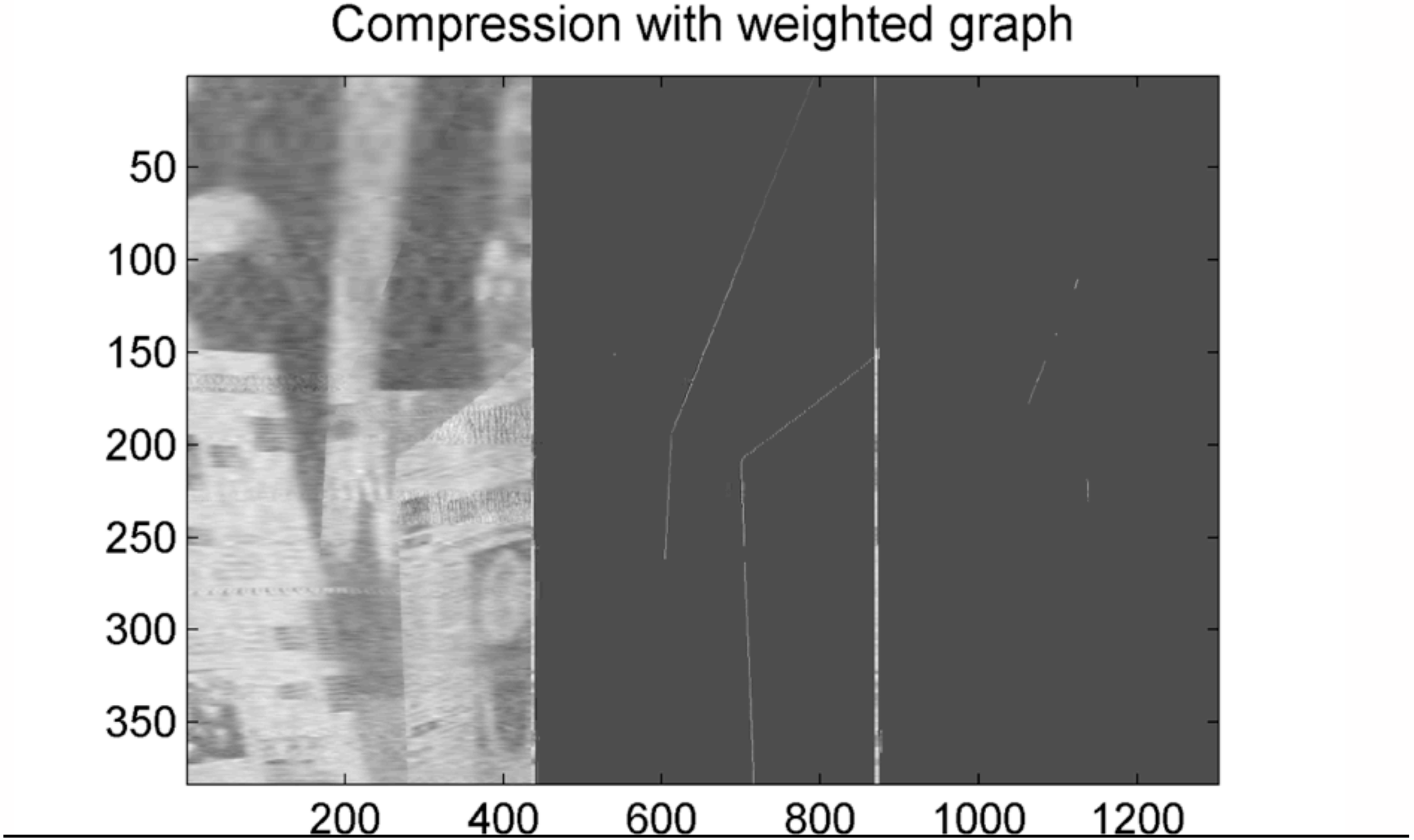




Visual reconstruction



Visual reconstruction



Conclusion

- Conclusion
  - Compact geometry representation
  - GBR offers meaningful links betweens pixels of different views
  - Graph-based transform is general and can adapt to every kind of geometry

- Future work
  - Explore other kinds of graph-based transform
  - Include a concept of residual images to correct prediction error