

# DEPTH CODING

# Efficient Depth Map Compression based on Lossless Edge Coding and Diffusion

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## Abstract

This new depth map encoding algorithm aims at exploiting the intrinsic depth maps properties. Depth images indeed represent the scene surface and are characterized by areas of smoothly varying grey levels separated by sharp edges at the position of object boundaries. Preserving these characteristics is important to enable high quality view rendering at the receiver side. The proposed algorithm proceeds in three steps: the edges at object boundaries are first detected using a Sobel operator. The positions of the edges are encoded using the JBIG algorithm. The luminance values of the pixels along the edges are then encoded using an optimized path encoder. The decoder runs a fast diffusion-based inpainting algorithm which fills in the unknown pixels within the objects by starting from their boundaries. The performance of the algorithm is assessed against JPEG-2000 and HEVC, both in terms of PSNR of the depth maps versus rate as well as in terms of PSNR of the synthesized virtual views.

## Contributions

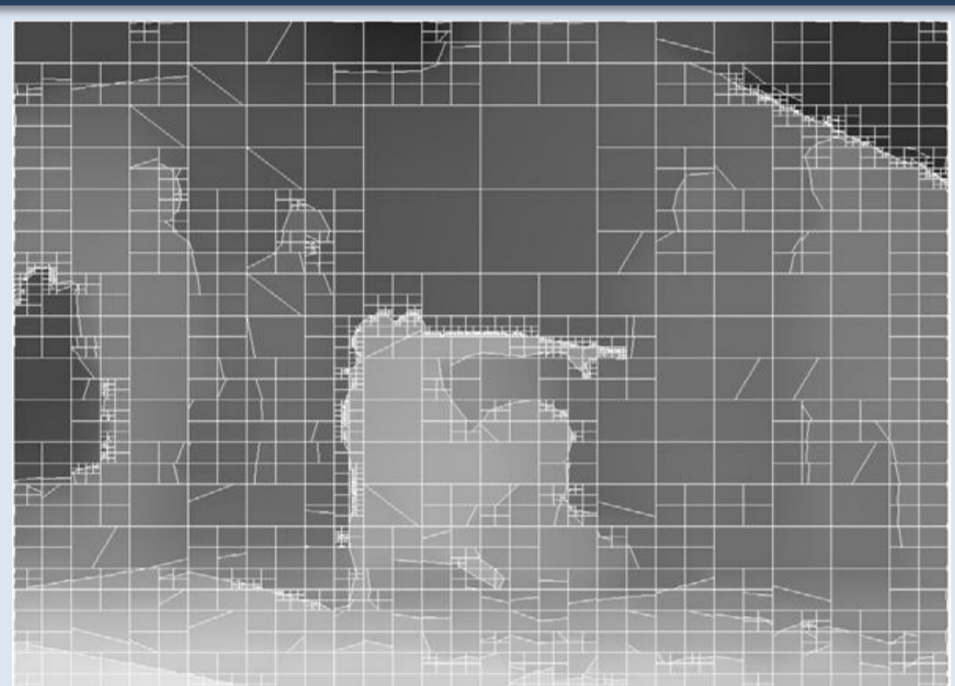
Lossless coding of edge pixel values:  
 no coding artifacts along edges

Quick and quality reconstruction  
 by hierarchical diffusion with Seeds

## Objective

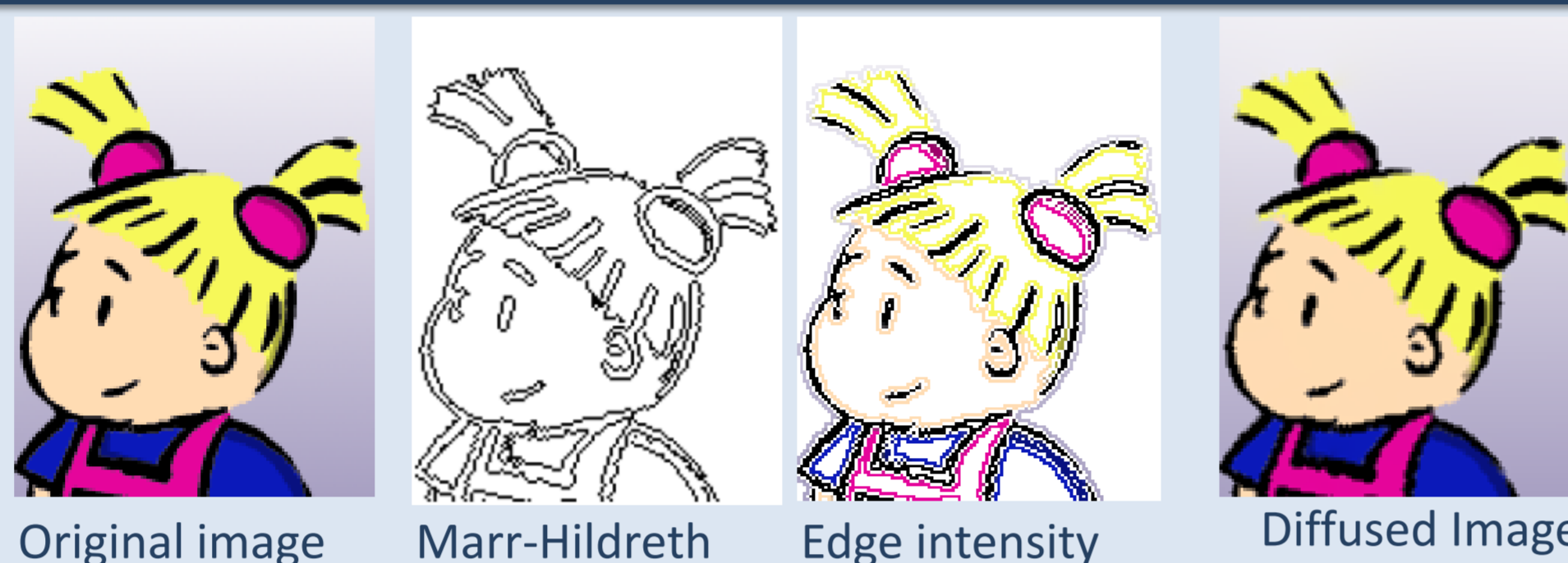
Design a new depth map compression method based on their properties of smooth surface and sharp edges

## SotA: Platelet



Platelet decomposition [1]: Smooth regions approximated by piecewise linear functions, on a quadtree structure. The quadtree decomposition is optimized in the rate-distortion sense. Edges are coded by straight lines. Quadtree, coefficients and vertex coordinates are encoded.

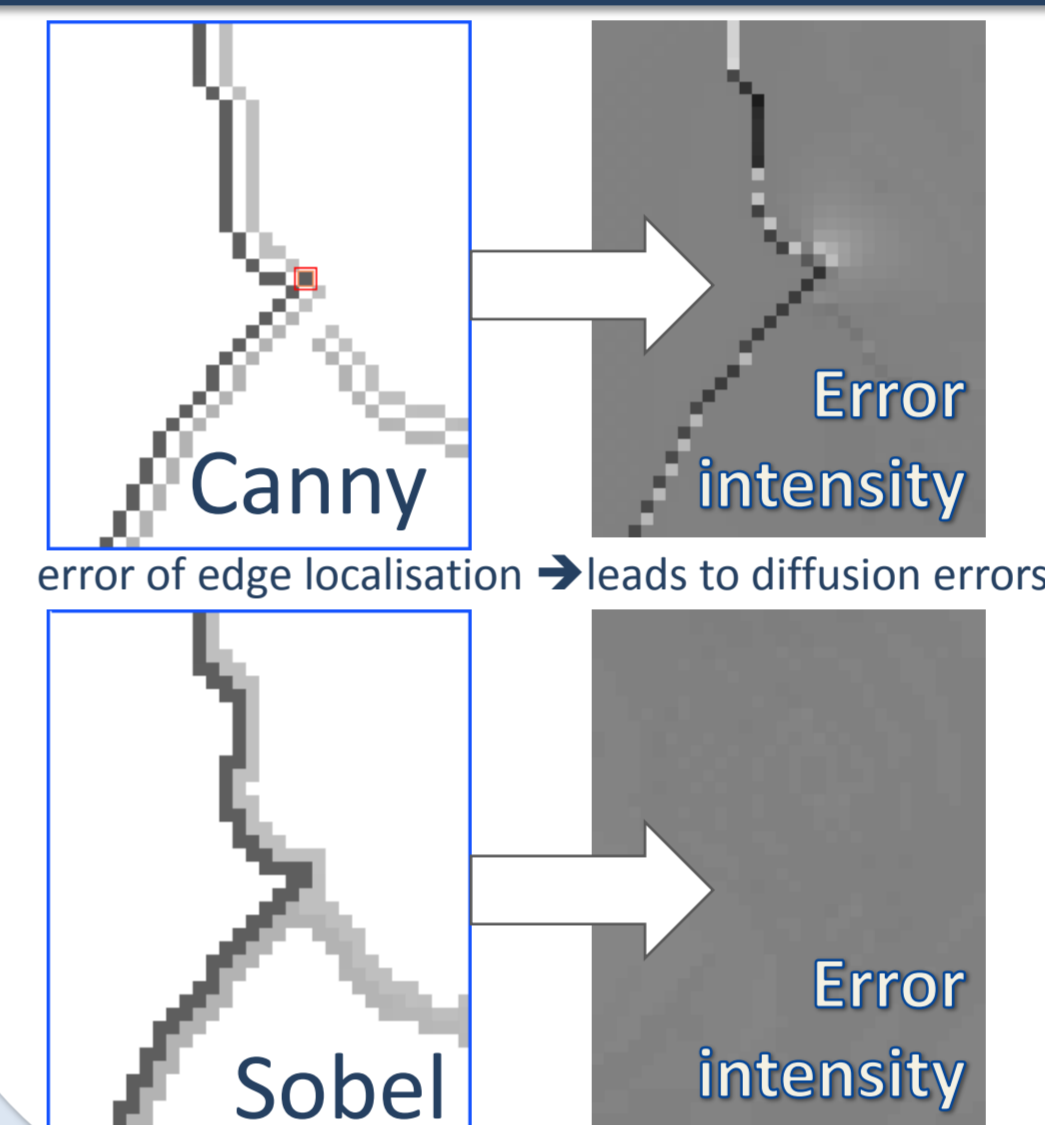
## Diffusion for cartoon image coding



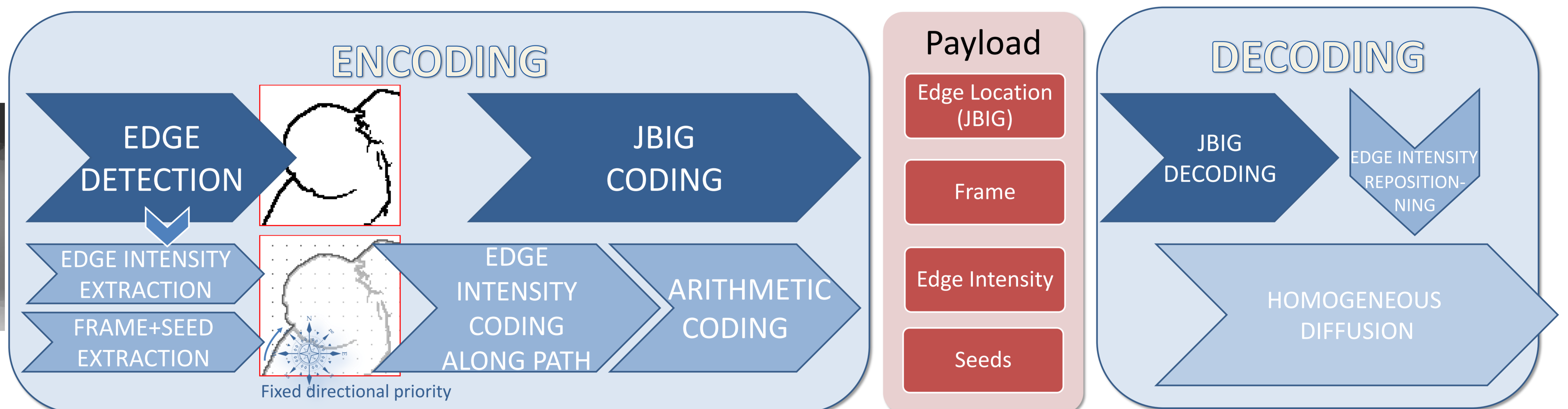
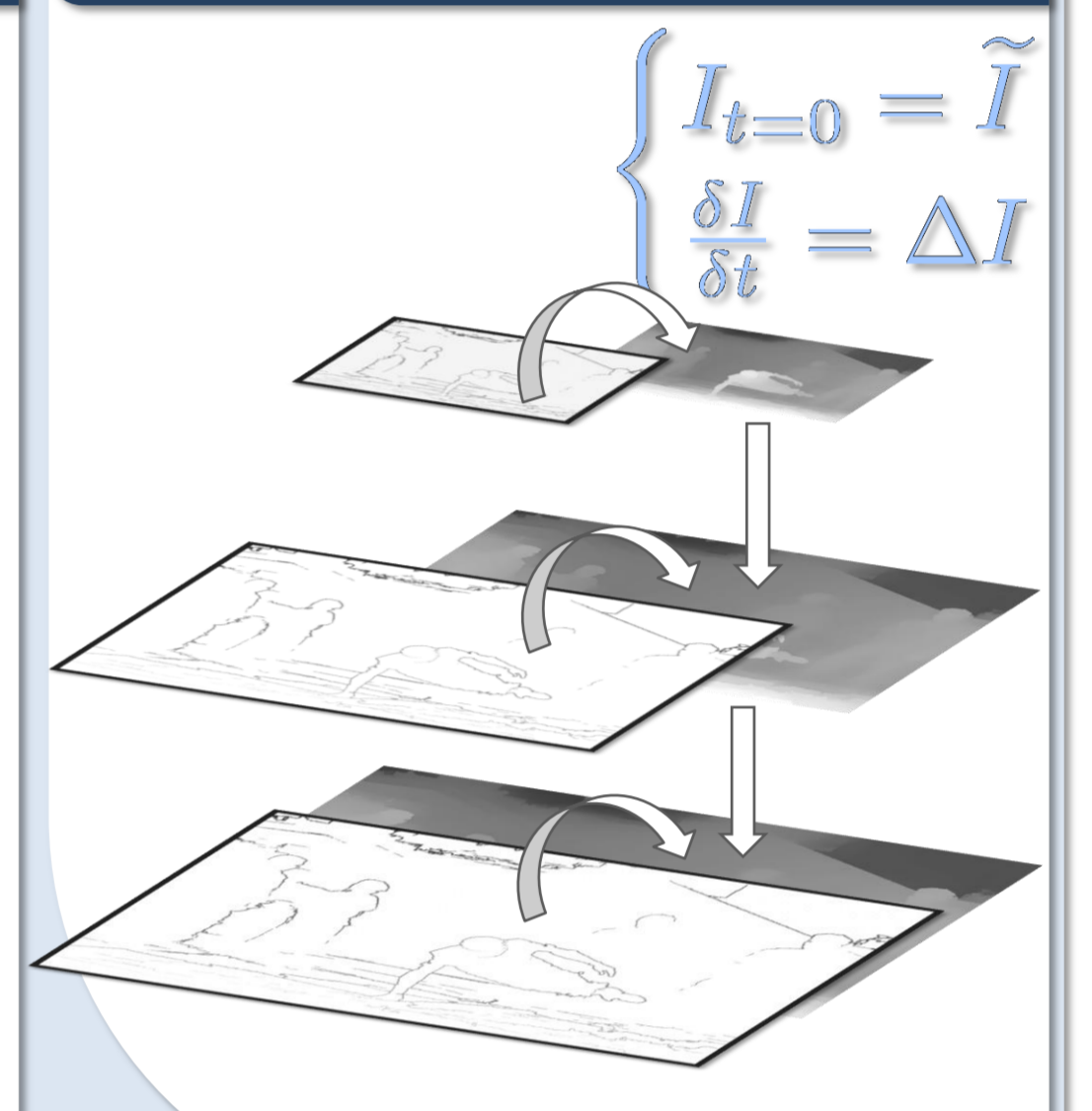
Edge based Cartoon Image compression [2]: Edge locations are encoded with JBIG. Edge neighbor pixel values are stored by their order of occurrence along edges, then subsampled and zipped

## How ?

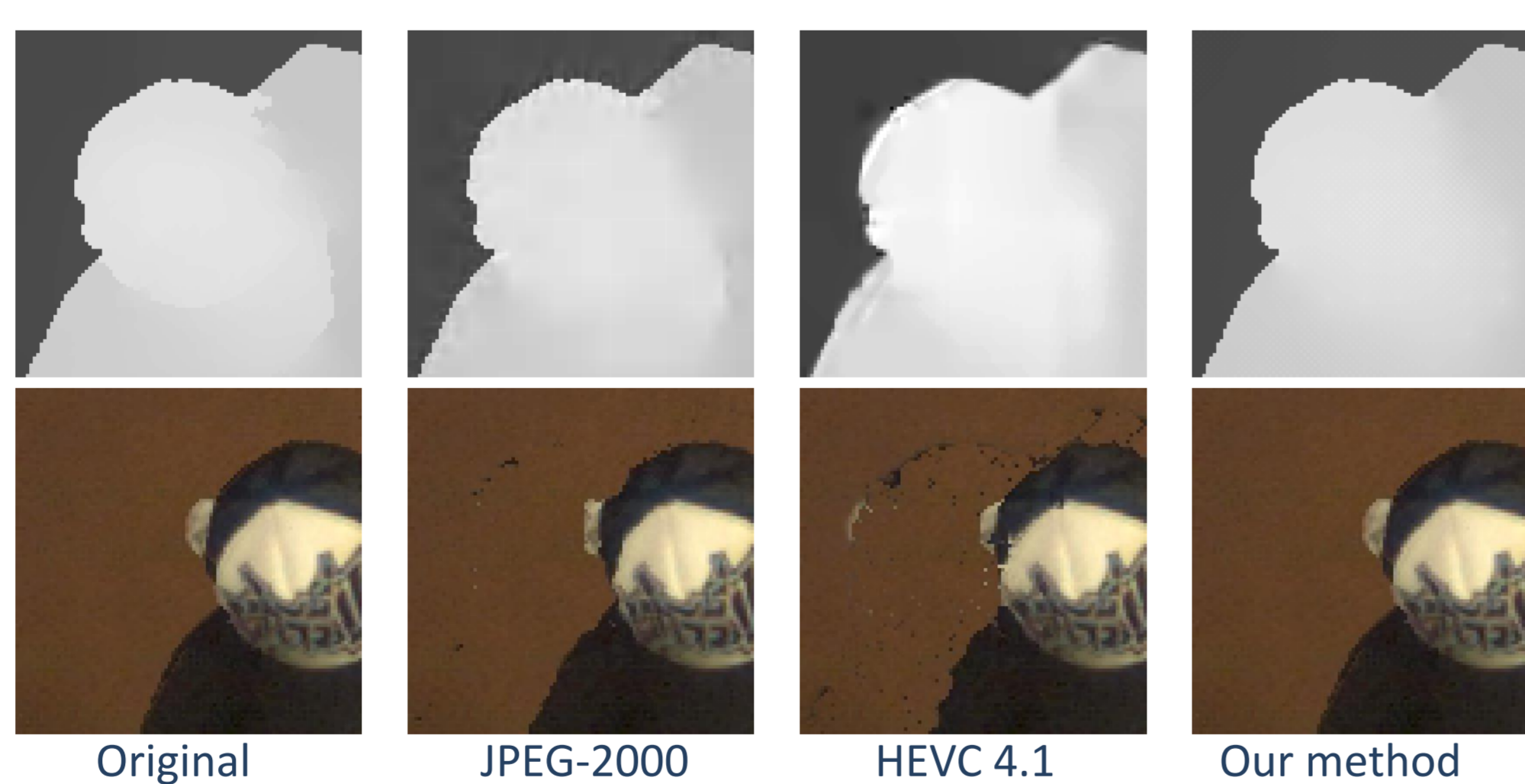
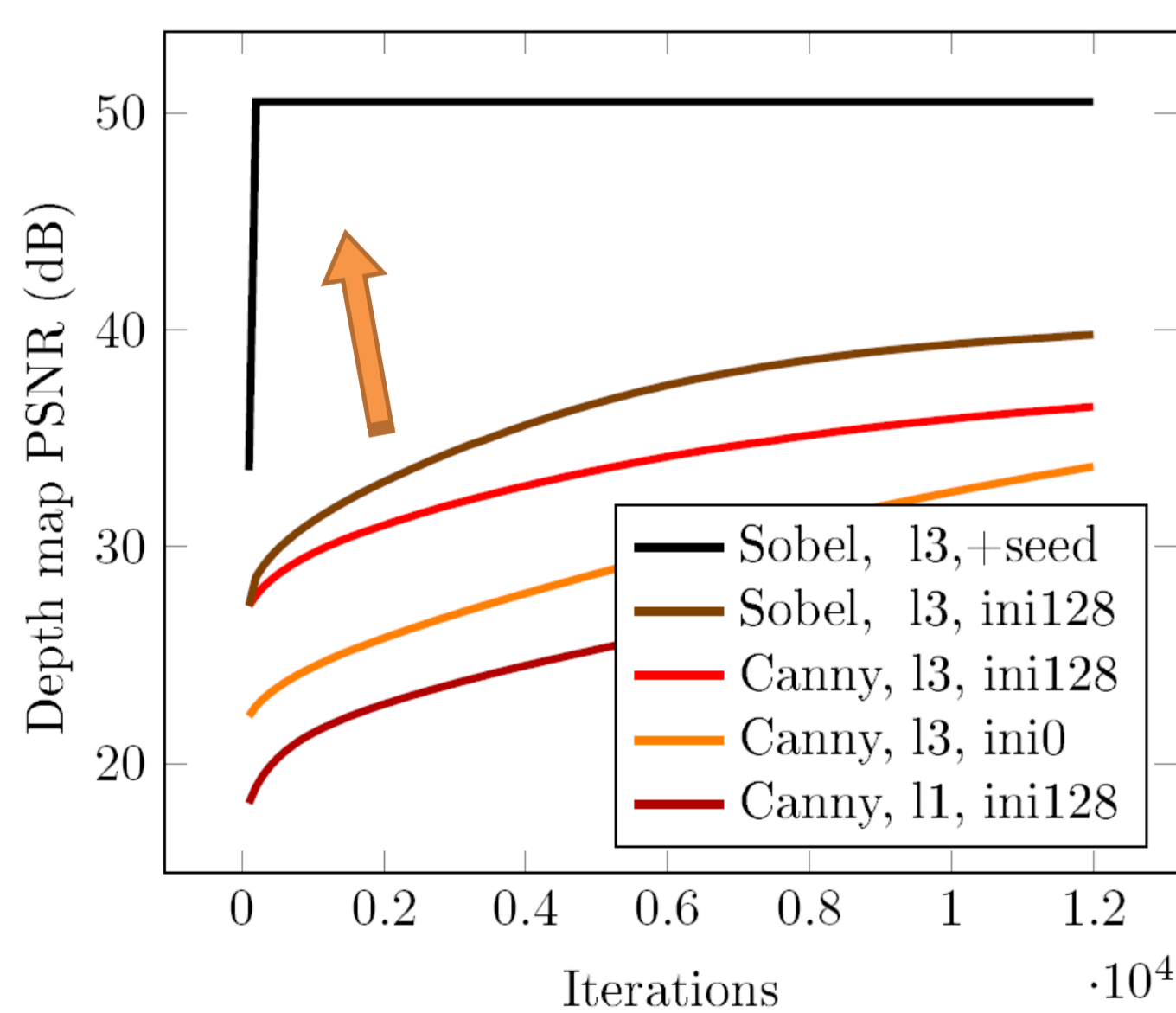
### Accurate Edge detector



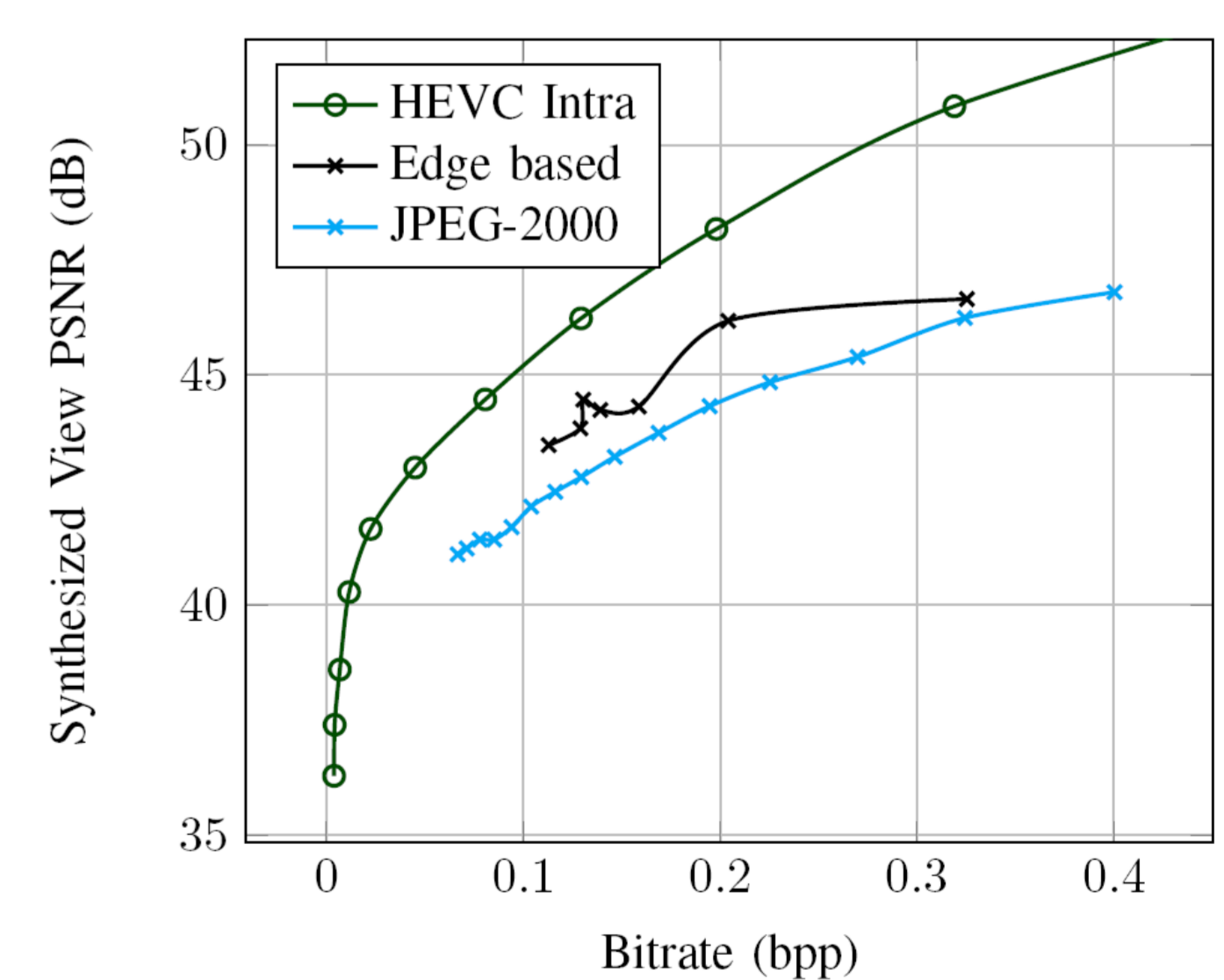
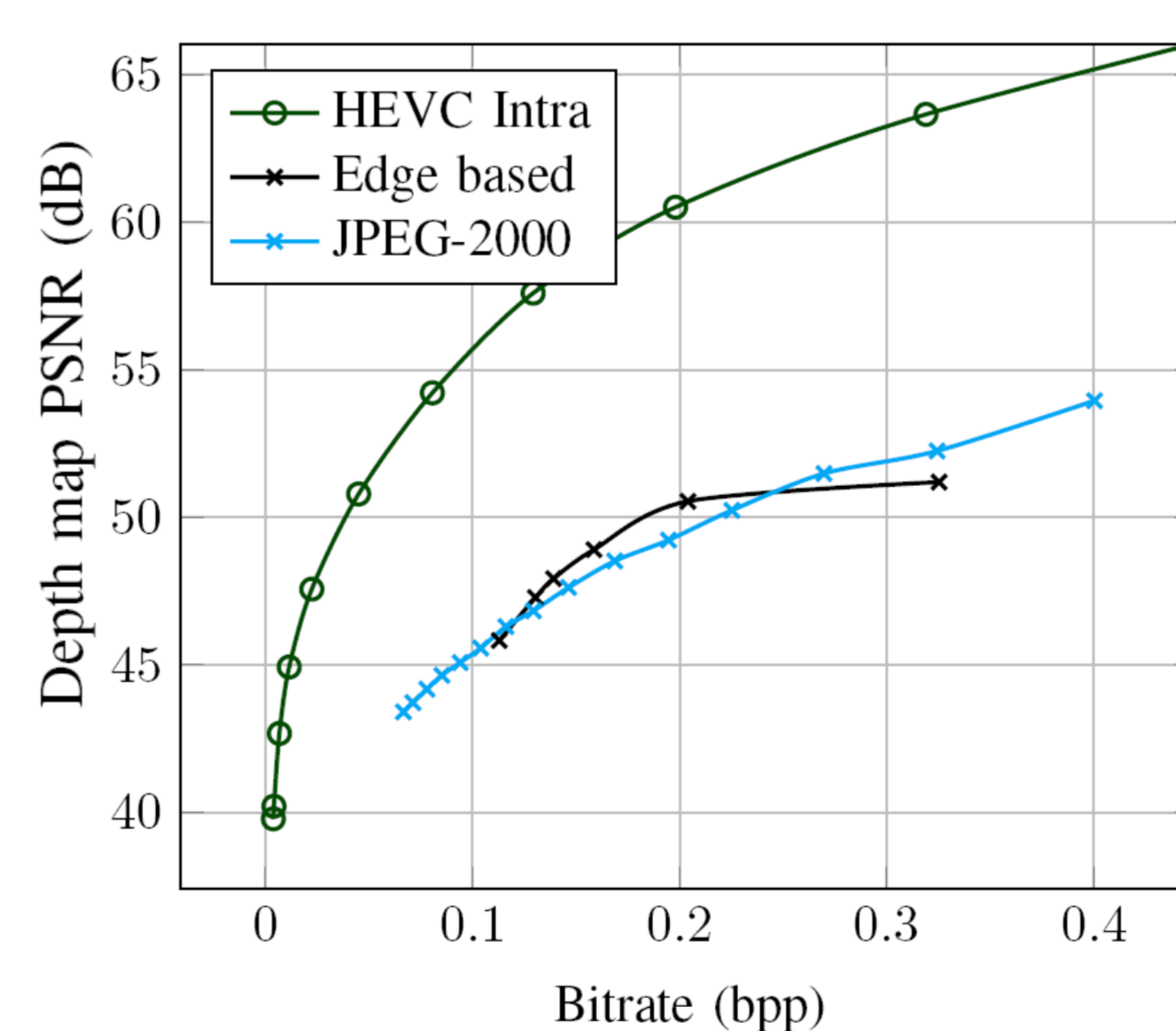
### Hierarchical diffusion



## Gain of Seeds



## Results



## Conclusion

We proposed a new method for lossless-edge depth map coding based on optimized path and fast homogeneous Diffusion. Our method, combined with a Sobel edge detection, provides a simple but efficient compression of edges enabling a perfect restoration of the depth map contours. Then it outperforms JPEG-2000 in term of PSNR, while being competitive to HEVC in term of perceived quality. Thanks to careful edge selection and seeding, we also manage to increase the quality reconstruction of previous works based on edge image coding. Thus this lossless edge coding method could be locally applied to color image compression, especially on uniform areas. In this case the edge detection method should probably be optimized depending on edge smoothness. Finally, a depth map video encoder is in our scope for future research.

[1] P. Merkle, Y. Morvan, A. Smolic, D. Farin, K. Müller and T. Wiegand, The effects of multiview depth video compression on multiview rendering. Signal Processing: Image Communication, 24,1-2, 2009, p73-88

[2] M. Mainberger and J. Weickert, Edge-based image compression with homogeneous diffusion, Computer Analysis of Images and Patterns, 2009, p476-483