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INTERACTIVE
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Diplomarbeitspräsentation

Evaluation of Depth Map Post-processing Techniques for Novel View Generation

Masterstudium:
Medieninformatik

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MOTIVATION

Problem:
- Given a 2D image and the corresponding depth map, Depth-Image-Based Rendering [1] enables generation of novel views that capture synthesized viewpoints of a scene

- Novel views enable (1) generation of 3D content and (2) control over the 3D depth impressoin

- BUT: Errors in depth map affect the quality of the resulting novel views

Goal:
- Evaluate the effects of depth map post-processing on the resulting quality of novel views
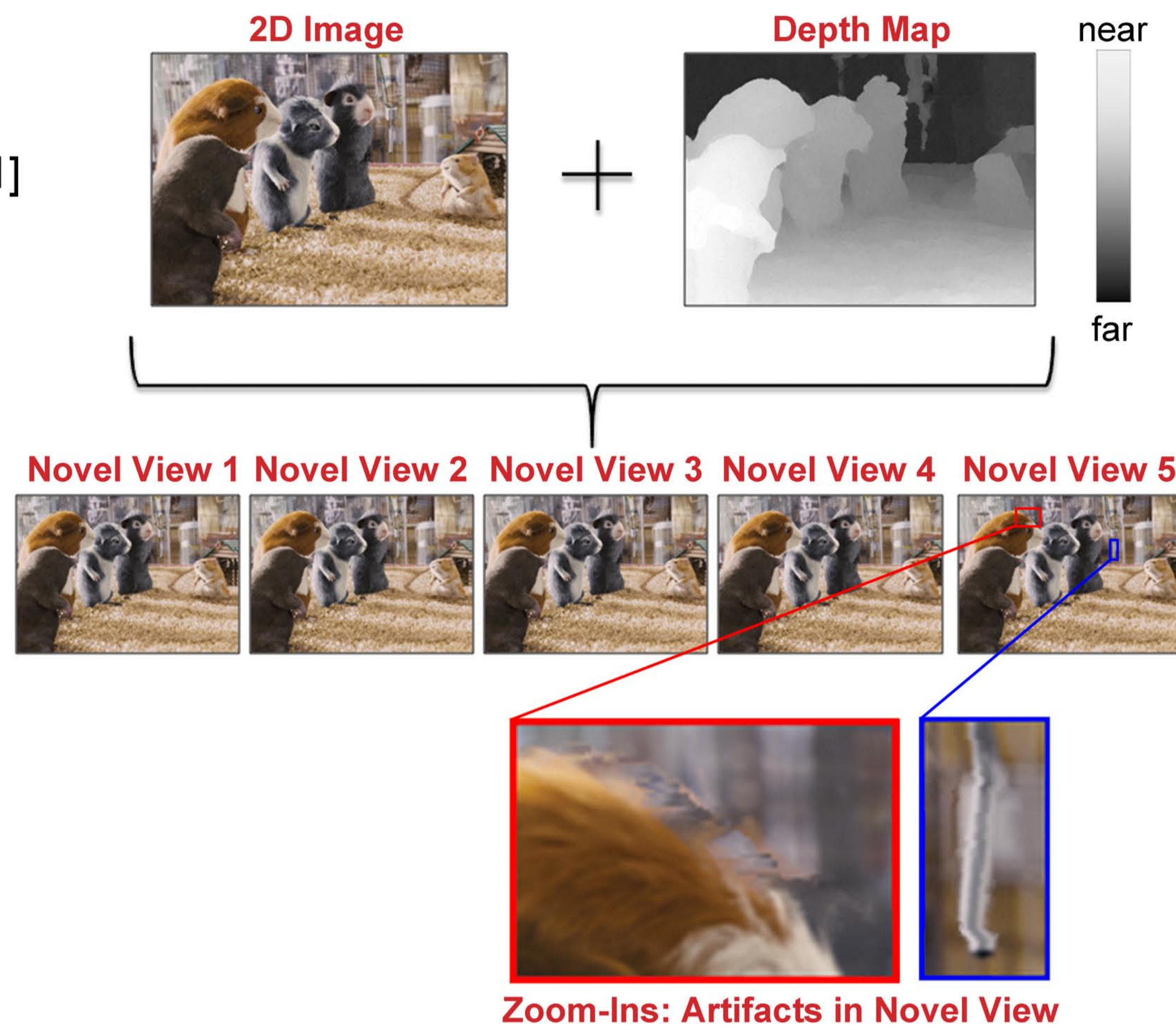
2D Image + Depth Map (near / far)
Novel View 1, Novel View 2, Novel View 3, Novel View 4, Novel View 5
Zoom-Ins: Artifacts in Novel View

APPROACHES

Names
- Bilateral Filter (BF)
- Joint Bilateral Median Filter (JBMF)
- Weighted Mode Filter (WMF)
- Guided image Filter (GF)
- Guided image Filter+Weighting (GF+W)
- Foreground Protecting Filter (FPF)
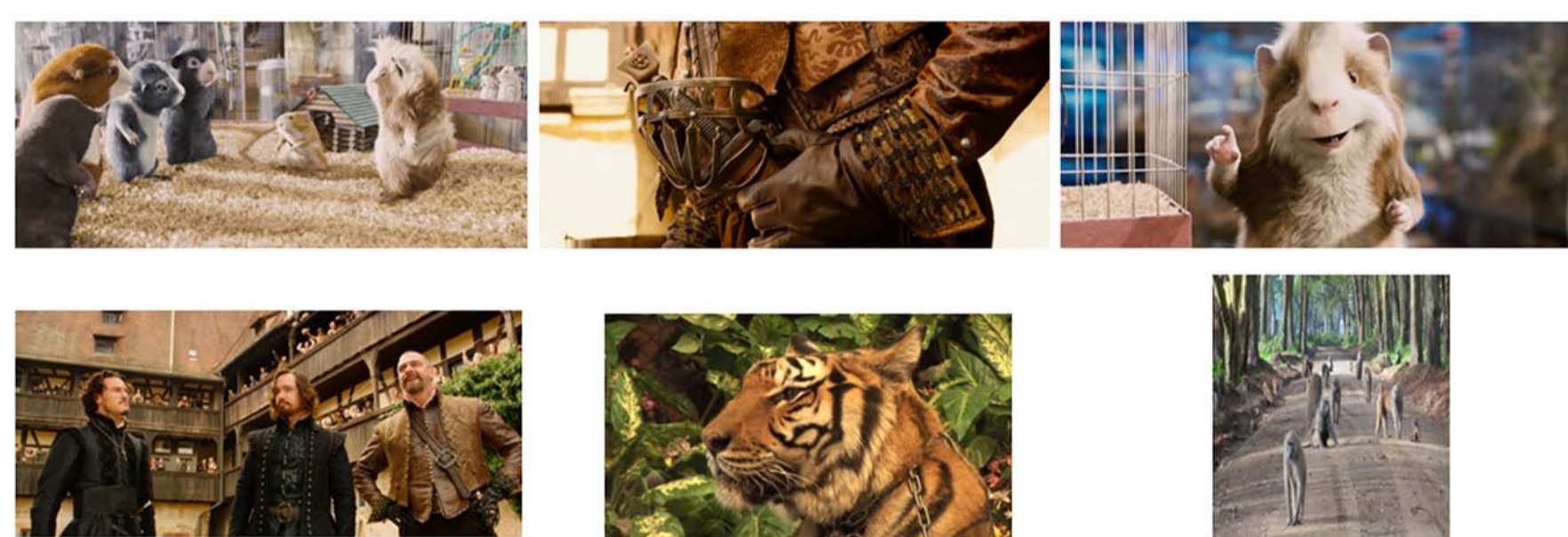- No Post-processing (NP)

Characteristics	BF	JBMF	WMF	GF	GF+W	FPF	NP
Guidance image	-	x	x	x	x	-	-
Local smoothing	x	-	-	x	x	x	-
Local statistics	-	x	x	-	-	-	-
Operates on whole image	x	x	x	x	x	-	-

EVALUATION METHODOLOGY

Part 1: Content generation

Dataset
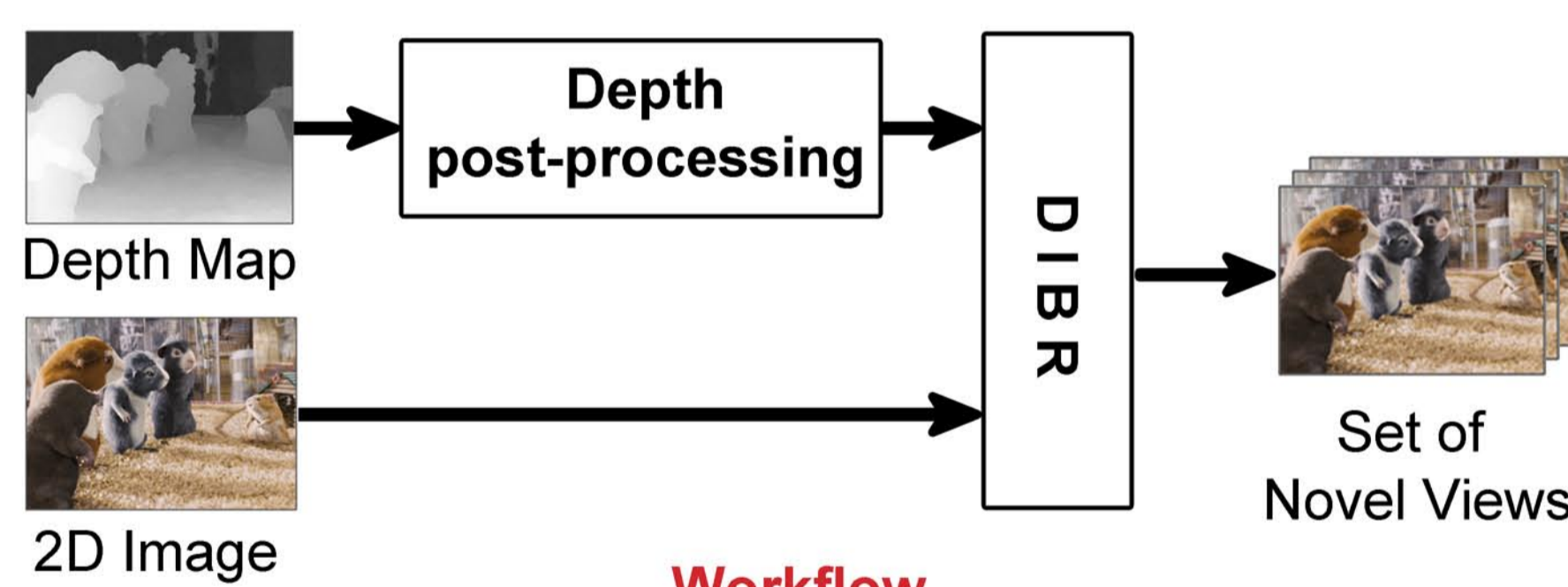
Depth Map → Depth post-processing → DIBR → Set of Novel Views
2D Image → DIBR
Workflow

Method:
- Dataset with six stereopairs
- Workflow:
  - (1) Generate depth maps
  - (2) Post-process depth maps
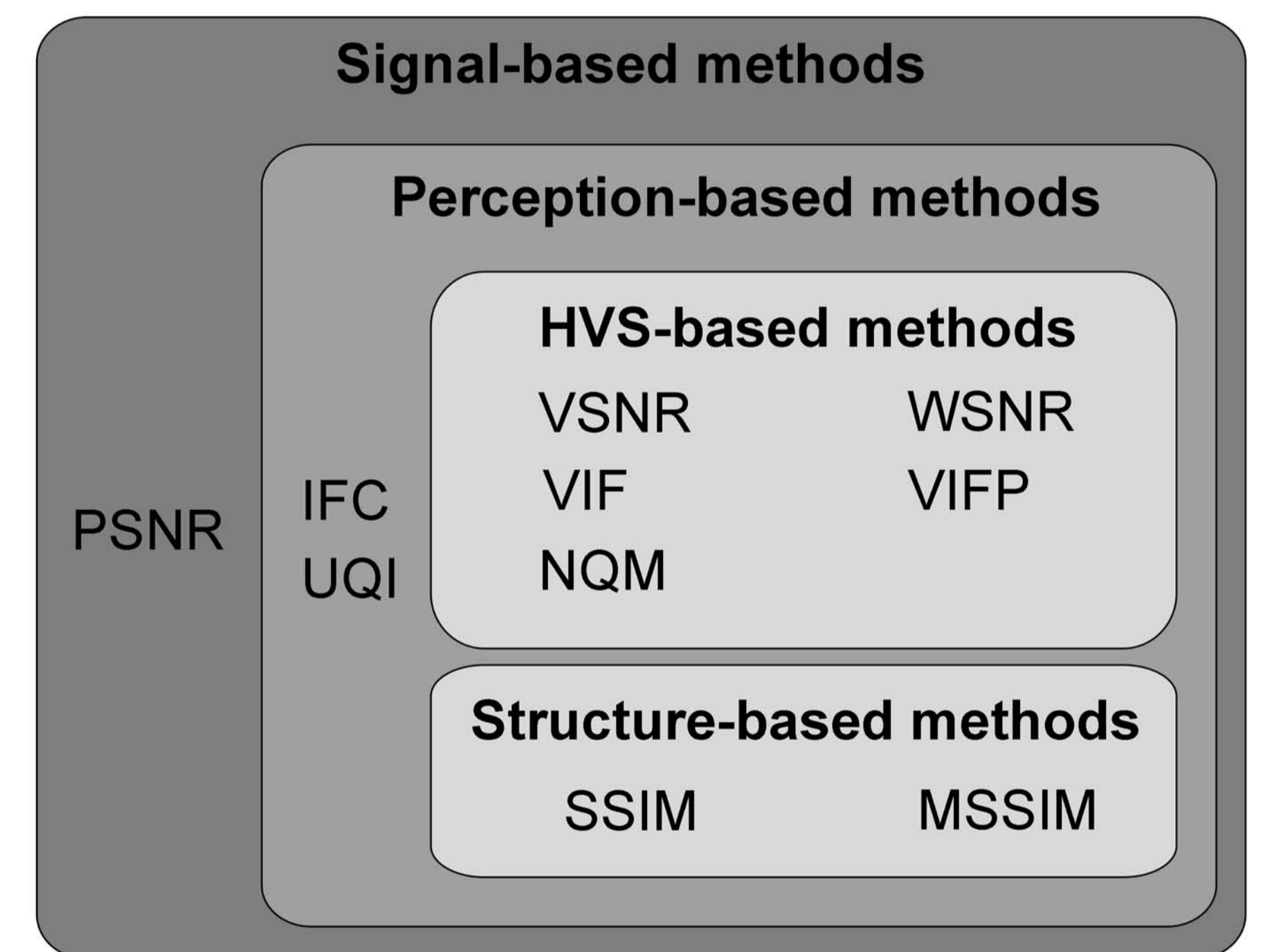 - (3) Generate set of novel views

Part 2: Subjective evaluation

A B Vote
Pair Comparison

Method:
- Pair comparison methodology [2]
- Three choice options:
  - (1) A is better
  - (2) B is better
  - (3) Same

Part 3: Objective evaluation

Signal-based methods
Perception-based methods
HVS-based methods
VSNR WSNR
VIF VIFP
NQM
PSNR IFC UQI
Structure-based methods
SSIM MSSIM
Objective Quality Metrics

Method:
- Ten objective quality metrics [3]
- Estimation of accuracy:
  - (1) Automatic assessment of quality
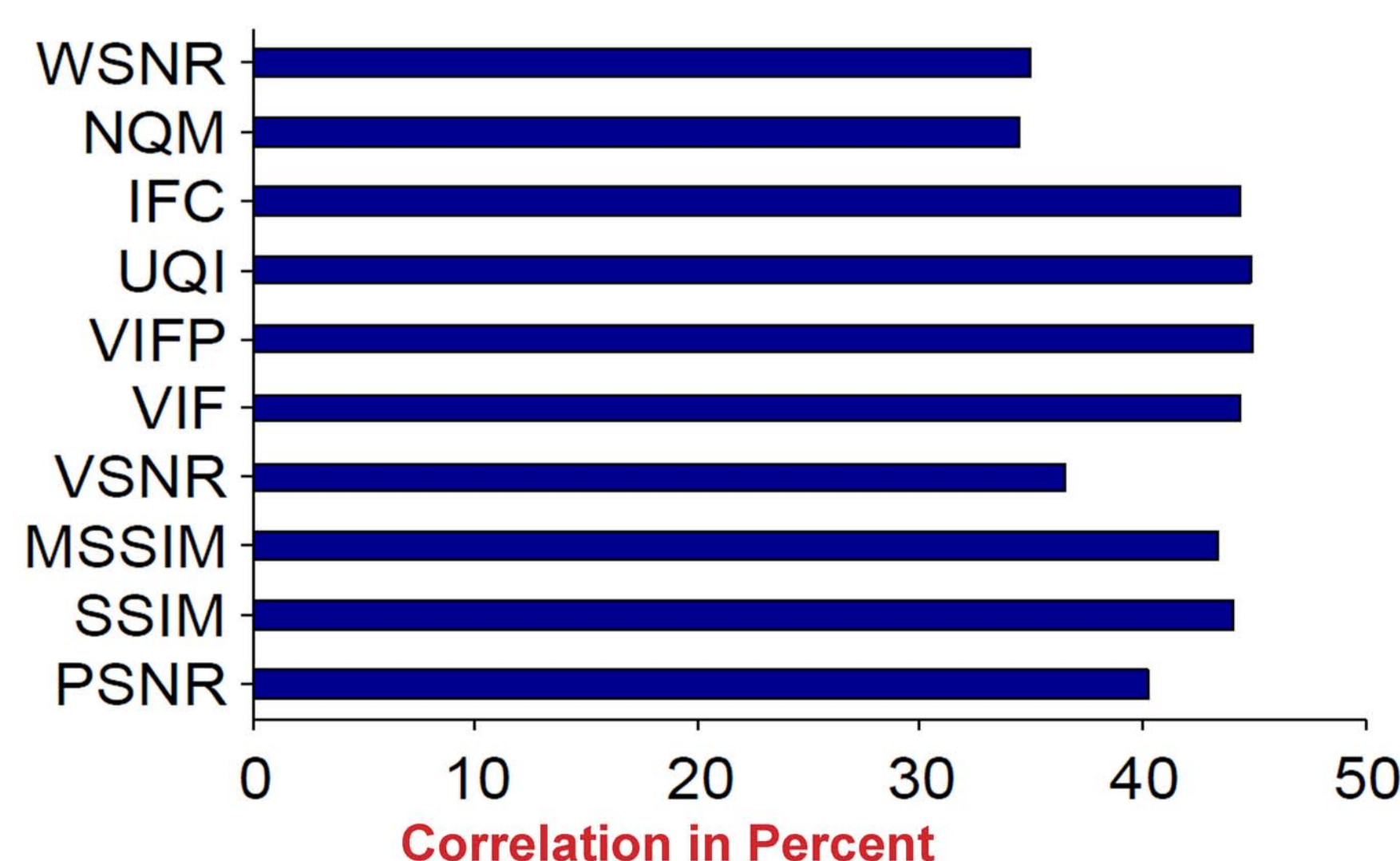 - (2) Correlation computation between subjective and objective scores

RESULTS

Subjective evaluation
- Bilateral filter and guided image filter achieve overall best results [4]

Quality score — NP, BF, JBMF, GF, GF+W, WMF, FPF
Normalized Quality Scores
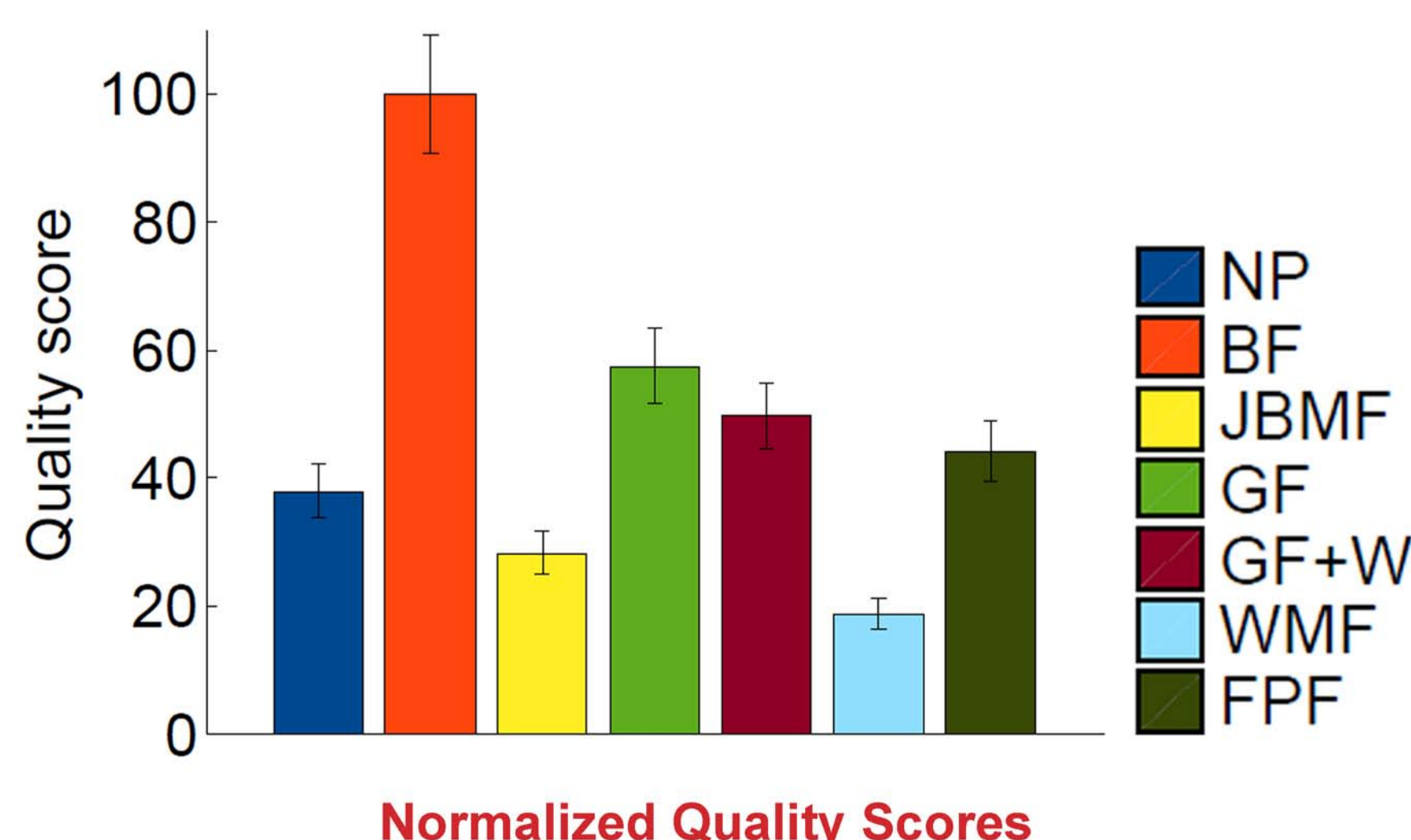
Objective evaluation
- All metrics have a correlation below 50 %

WSNR, NQM, IFC, UQI, VIFP, VIF, VSNR, MSSIM, SSIM, PSNR
Correlation in Percent

CONCLUSION

- Edge-preserving filters based on local smoothing achieve best results

- Depth range within a scene has strong impact on effectiveness of depth post-processing

- Objective metrics under investigation are not sufficient to predict quality of novel views

Future work:
- Evaluation of depth map post-processing on stereoscopic video content

[1] C. Fehn. Depth-image-based rendering (DIBR), compression and transmission for a new approach on 3D-TV. In: Stereoscopic Displays and Virtual Reality Systems XI, pages 93 -104, 2004
[2] ITU-R Recommendation BT.2021. Subjective methods for the assessment of stereoscopic 3DTV systems, 2012
[3] E. Bosc, P.L. Callet, L. Morin, and M. Pressigout. Visual quality assessment of synthesized views in the context of 3D-TV. In: 3D-TV System with Depth-Image-Based Rendering: Architectures, Techniques and Challenges. Springer, 2013
[4] M. Nezveda, N. Brosch, F. Seitner and M. Gelautz. Depth map post-processing for depth-image-based rendering: a user study, In: Proc. SPIE 9011, Stereoscopic Displays and Applications XXV, 2014

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