Object-based Layered Depth Images for improved virtual view synthesis in rate-constrained context

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Context of multi-view videos

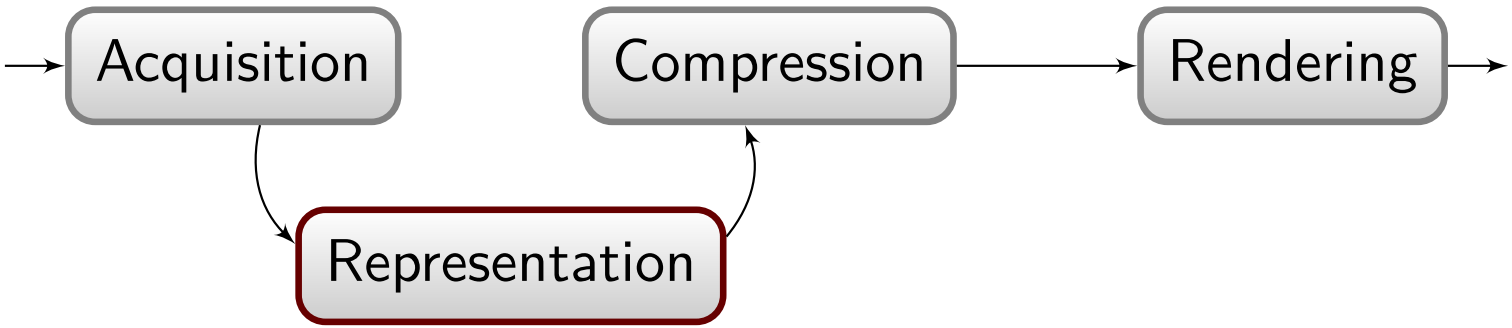
Functionalities:

3DTV: Depth feeling by stereo-vision simulation.

FVV: Live viewpoint selection.

Require a virtual view synthesis method.

Fig: 3D rendering



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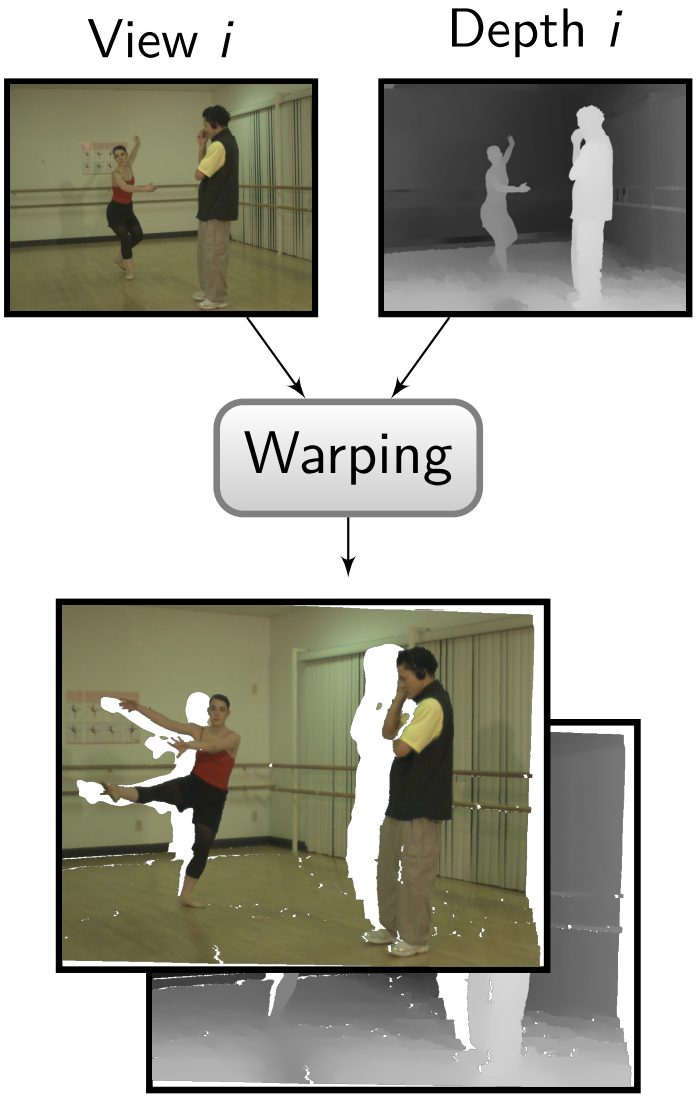
Outline

Depth Image-Based Rendering (DIBR)



Warping algorithm

Input: View and associated depth map
Output: New viewpoint (texture & depth)

Disocclusions

Obstructed scene information from reference viewpoint
They appear along depth discontinuities
Solution: Add additional informations (**LDI**)

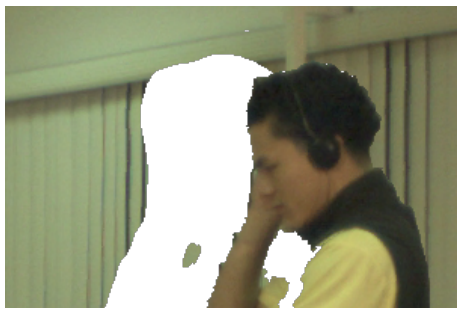
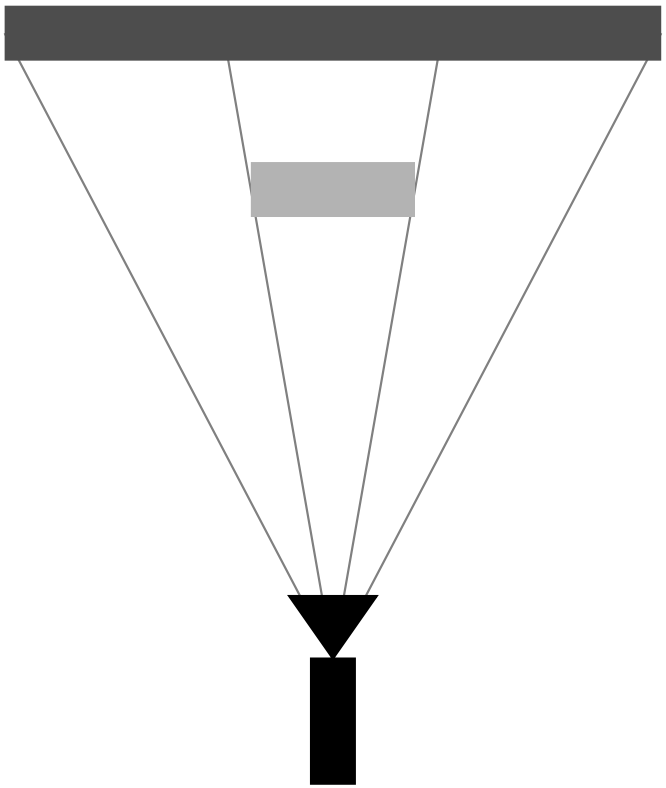


Fig: Disocclusion

Layered Depth Image (LDI) [SGHS98]

A set of layers, containing depth pixels from a single viewpoint



From a reference viewpoint

1st layer ⇒ Reference view

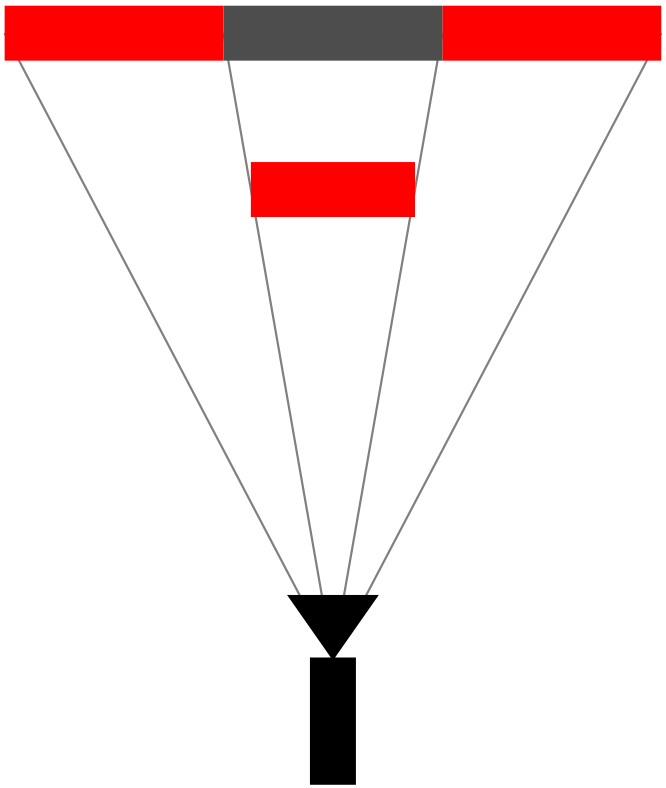
Visible texture and depth

2nd layer ⇒ Residual data

Hidden texture and depth

Layered Depth Image (LDI) [SGHS98]

A set of layers, containing depth pixels from a single viewpoint



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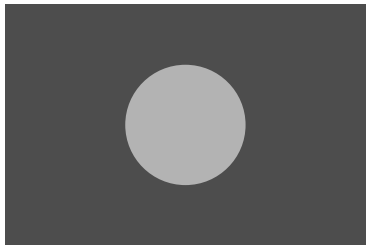

1st layer

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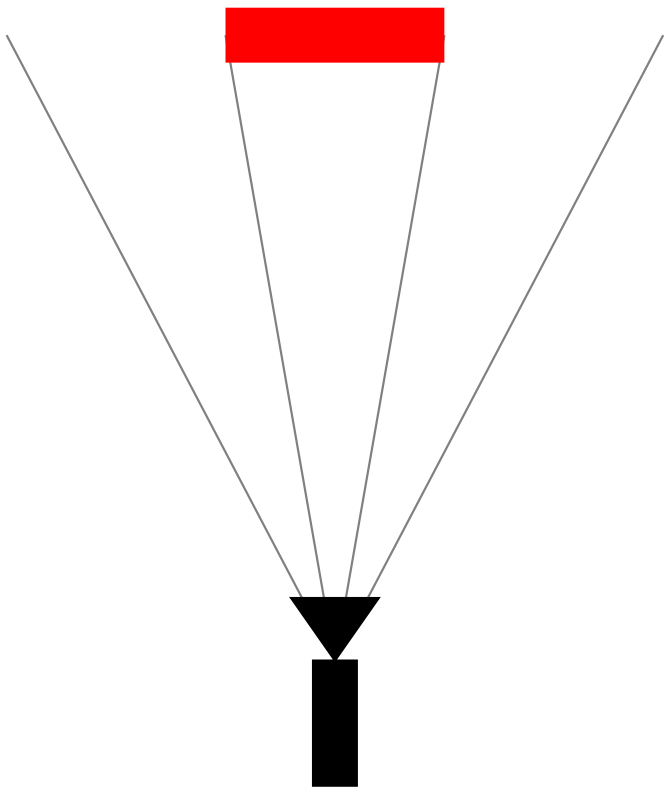
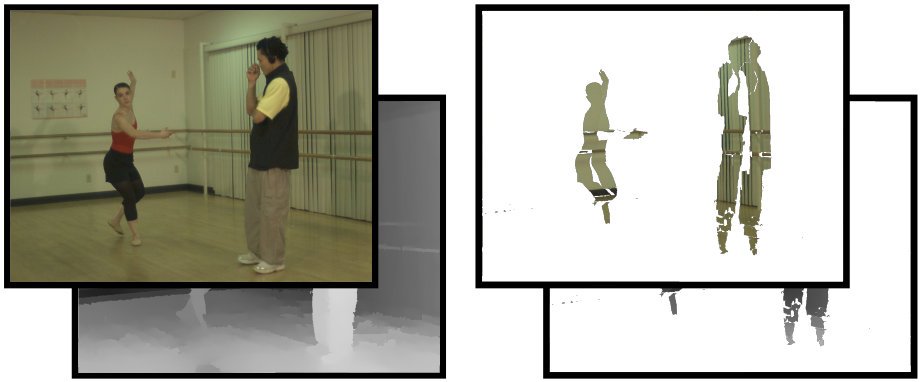


From a reference viewpoint

1st layer ⇒ Reference view
Visible texture and depth
2nd layer ⇒ Residual data
Hidden texture and depth

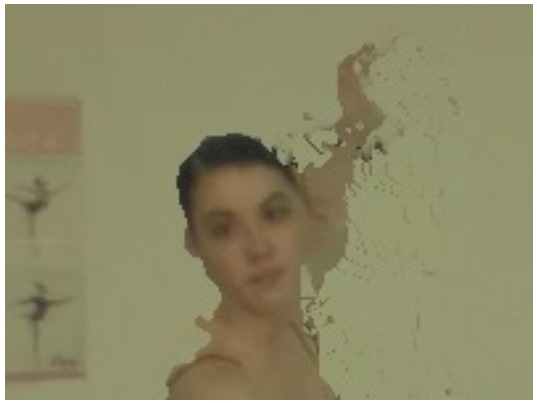
1st layer 2nd layer

LDI from real multi-view plus depth sequence [JMG09]



1st layer 2nd layer

Compressed depth map



Synthesized virtual view

Fig: Rendering impact of depth map compression

Limitations

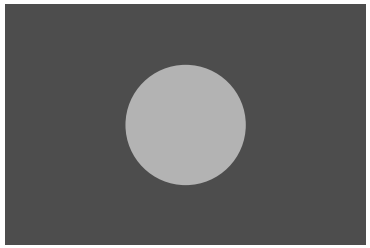
- Redundant boundaries in both layers
- Moving elements in both layers
- Layers contain large depth discontinuities

(Discontinuities are hard to compress)

Outline

Object-based LDI representation

This representation organizes pixels into layers to enhance depth continuity



1^{st} layer

2^{nd} layer

Fig: Classical LDI depth layers

Foreground

Background

Fig: Object-based LDI depth layers

Method based on a growing-region algorithm

Region R initialized with pixels where Z_{FG} and Z_{BG} are already defined.

For each pixel q outside R:

- Extrapolate Z_{FG} and Z_{BG}.
- Classify q.

Object-based LDI representation

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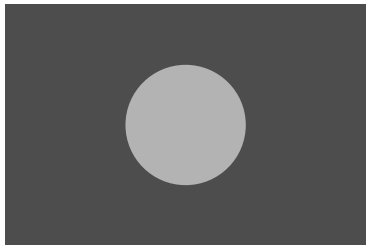

1^{st} layer

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Method based on a growing-region algorithm

Region R initialized with pixels where Z_{FG} and Z_{BG} are already defined.
For each pixel q outside R:
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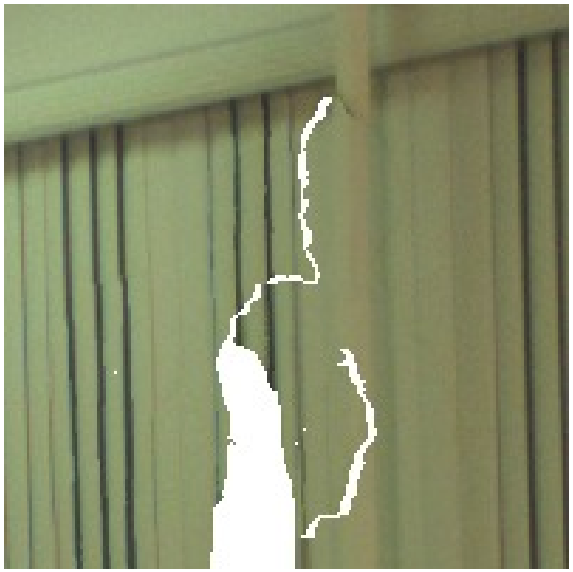
- Classify q.

Classification: Initializing

Foreground Unclassified Background

Classification: Results



Foreground

Unclassified

Background

Background inpainting [CPT03]

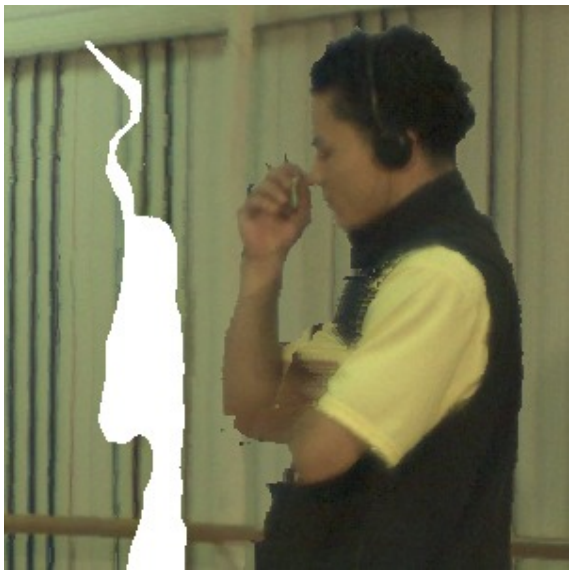
Advantages

- Remove unnecessary boundaries
- Inpainting processed once, before encoding stage
- No need of inpainting method at rendering stage

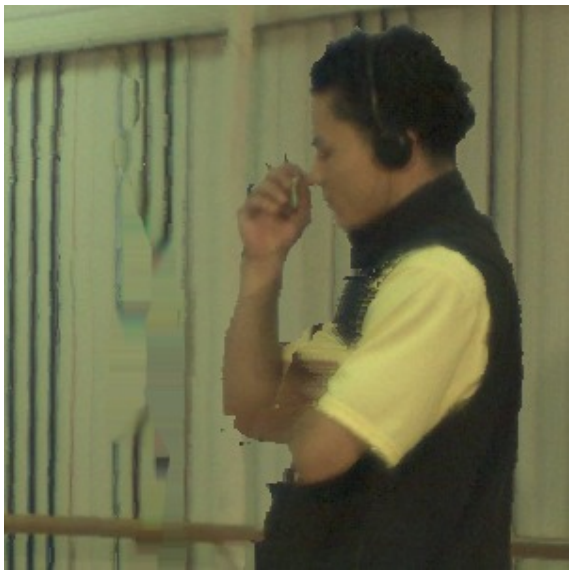
Fig: Background inpainting

Outline

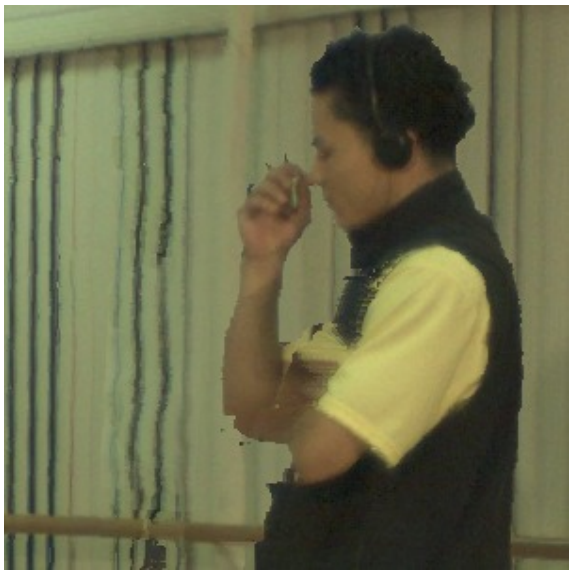
Rendering results



Classical LDI rendering



Virtual view inpainting



O-LDI rendering

Fast mesh-based rendering

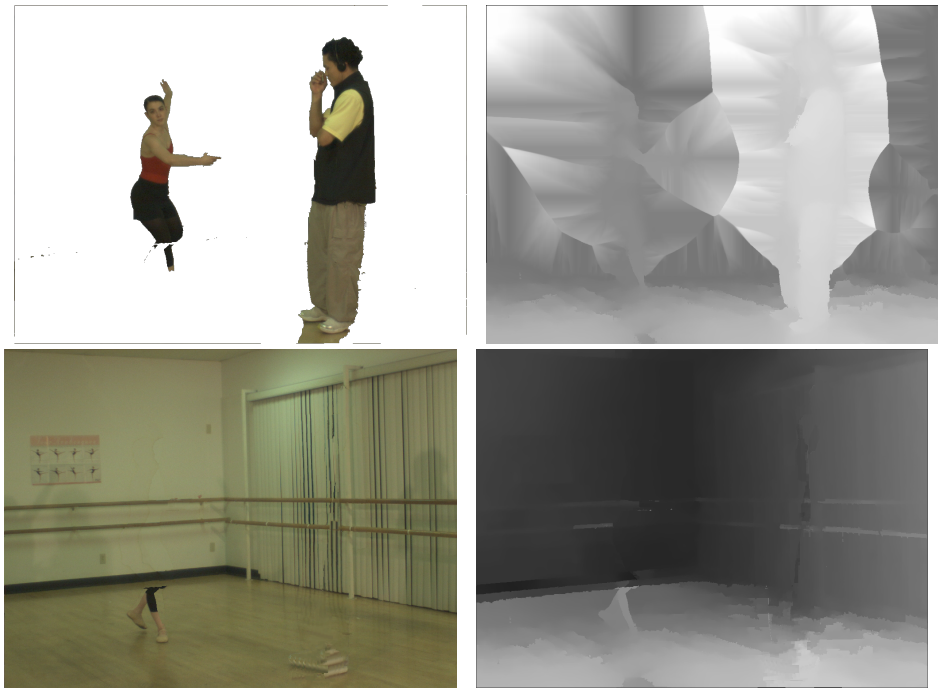


Fig: Object-based LDI

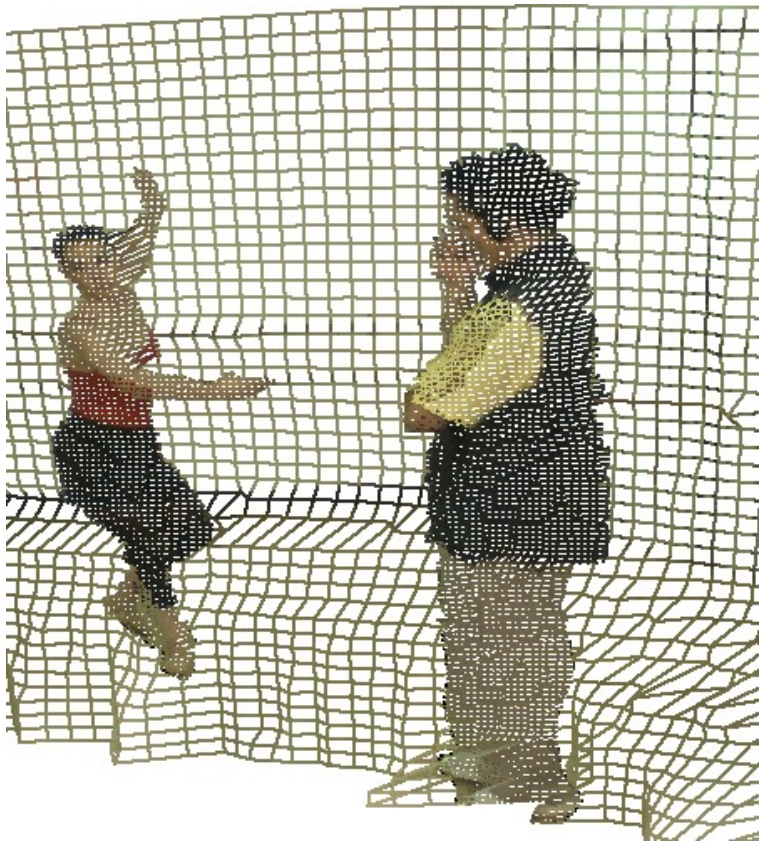
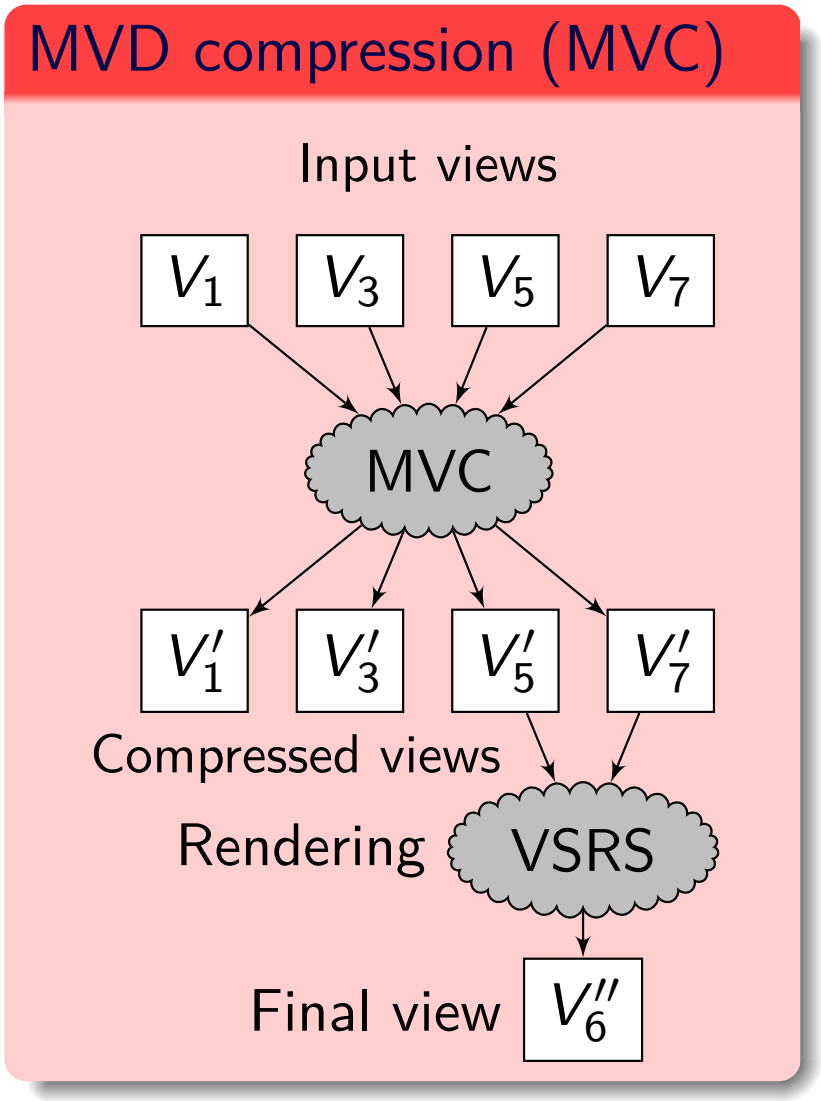


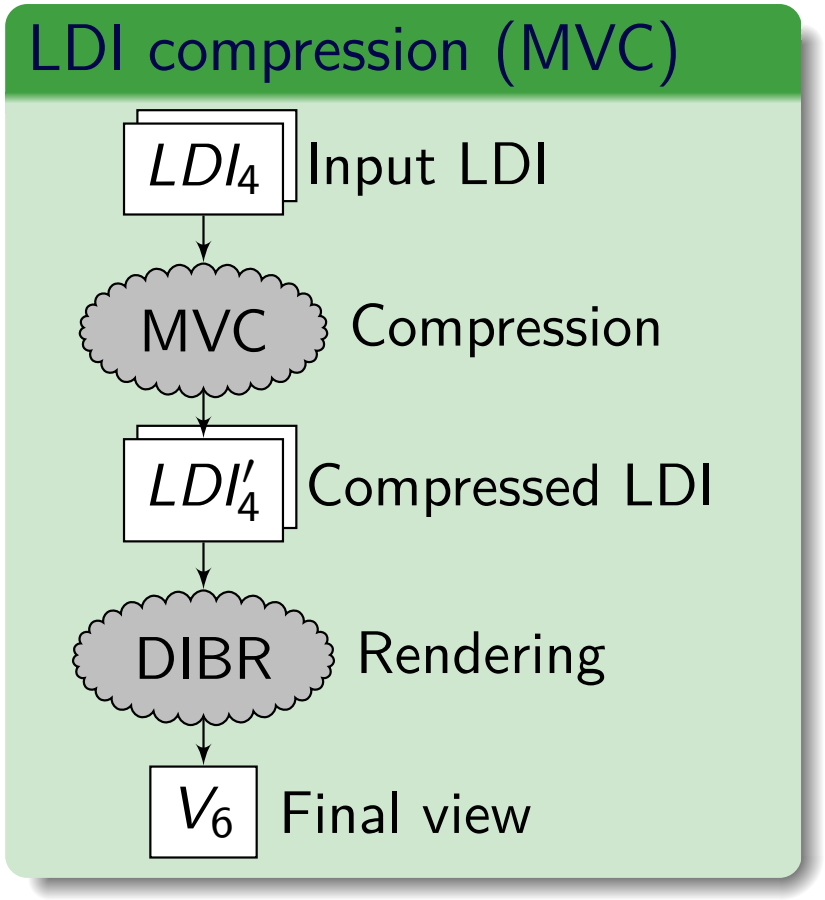
Fig: Meshes rendering

Continuous layers can be rendered as meshes.
Foreground mesh is partially transparent.

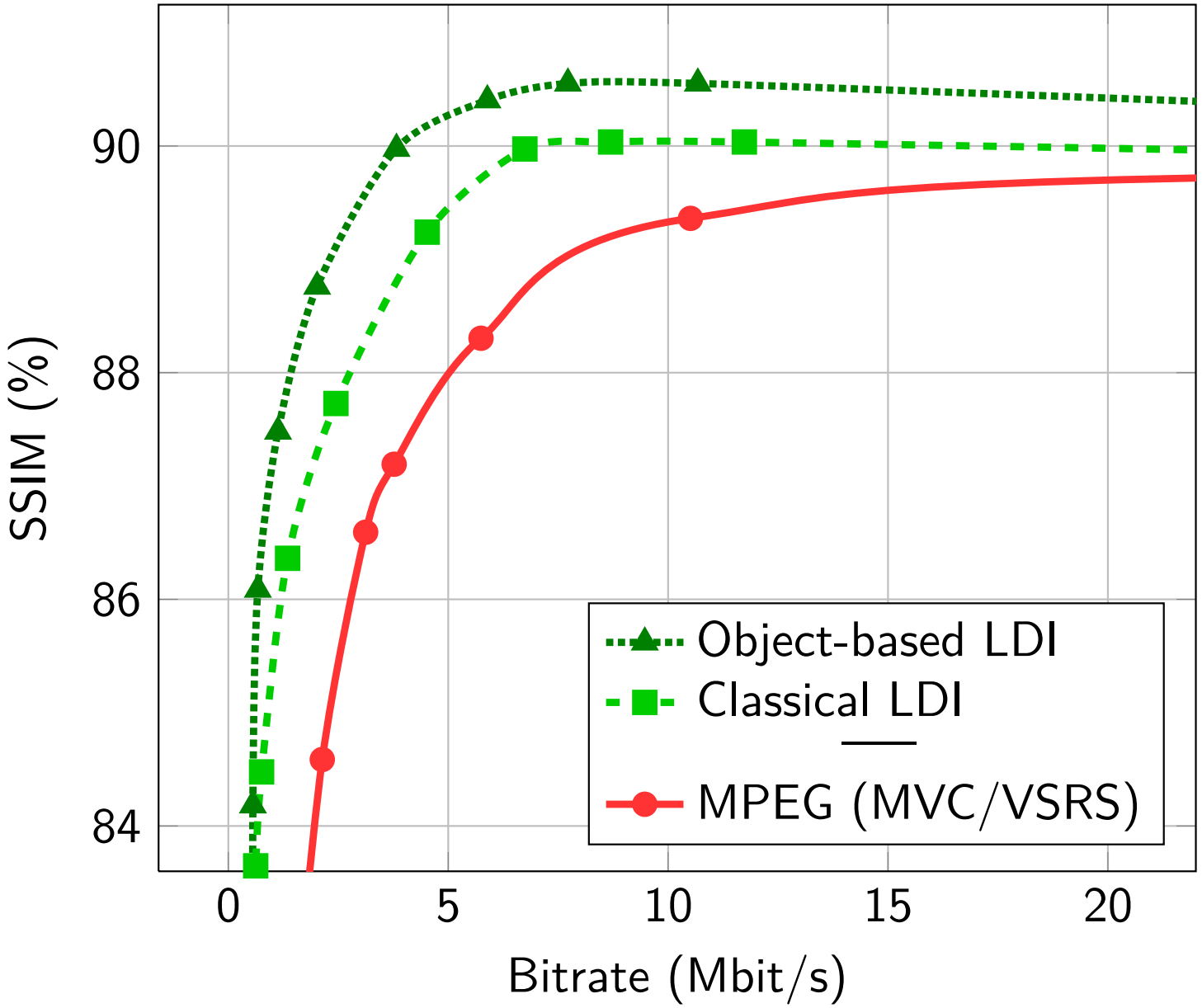
Outline

LDI and MVD compression schemes





Rate-distortion curve



Conclusions on Object-Based LDI

Advantages

- Remove unnecessary boundaries $\Rightarrow$ Improve compression
- Static background along time
- Compatible with fast mesh-based rendering
- Depth continuity improves rendering quality

Limit

- No backward compatibility with 2D decoding scheme

Questions?

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[JMG09] Vincent Jantet, Luce Morin, and Christine Guillemot.
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