

A Hybrid View Synthesis Method for View Interpolation and Extrapolation

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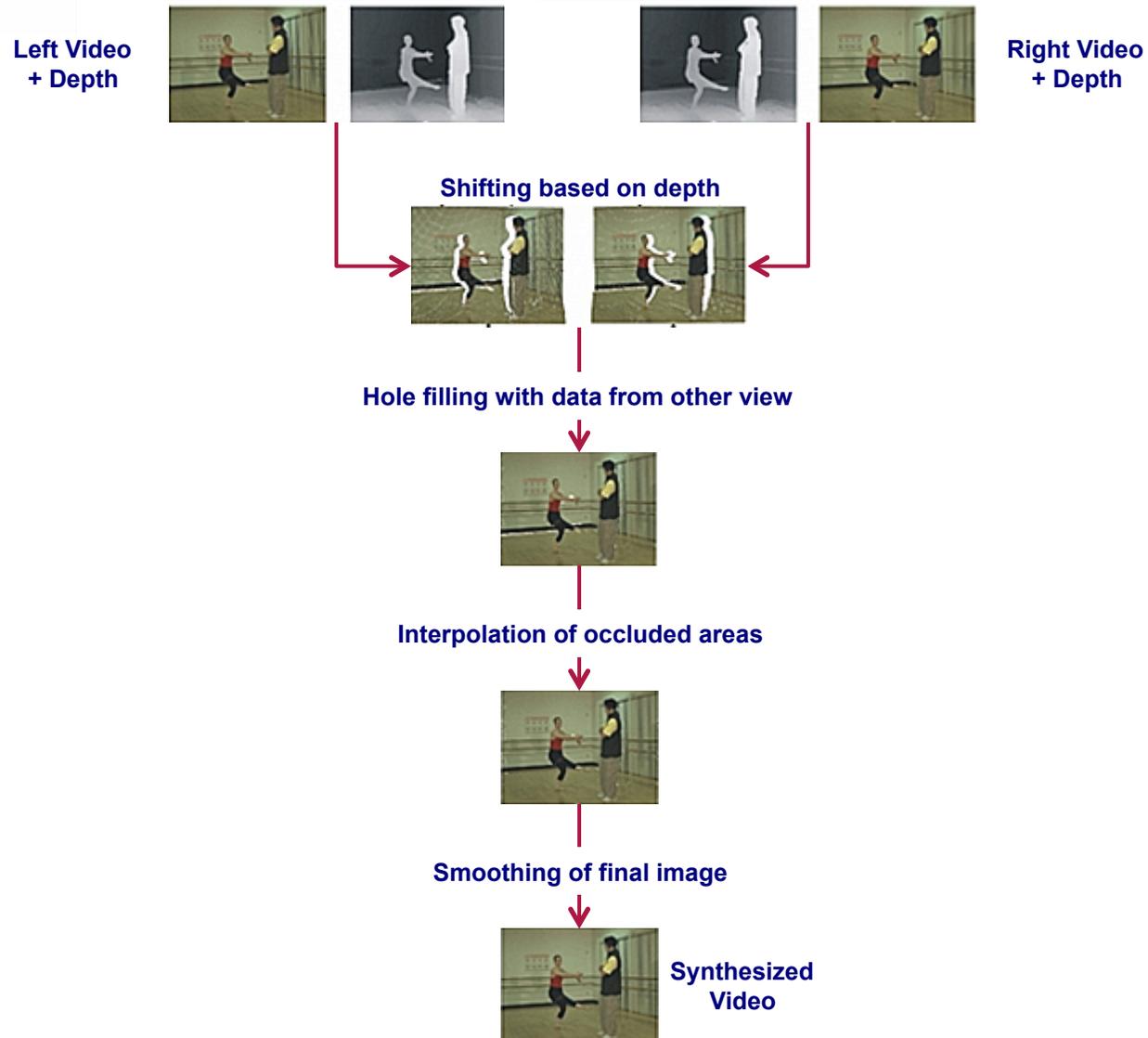
Main Issue with View Synthesizing Process



Real View

- This problem is more severe in the case of extrapolation.

View Synthesis Reference Software (VSRS)



Problem with VSRS

- Interpolation using inpainting produces similar colour to the true view but does not take into account the texture which is missing from the final version



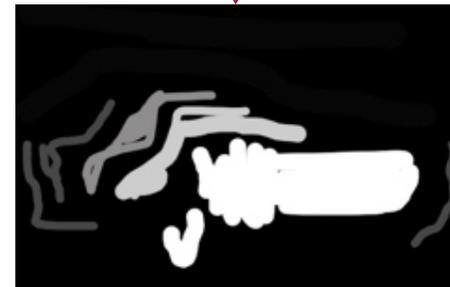
Nonlinear Disparity Mapping (Warping)

- A saliency map is generated which separates areas based on visual importance
- No full depth map is needed only a sparse set of disparity cues
- Original frame is warped using an image warping technique

Original frame



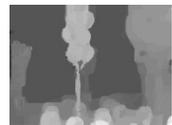
Sparse set of disparity cues



“Warped” 3D view



Our Proposed Interpolation Hybrid Approach



Closer View
+Depth

Create
Primary
Synthesized
View

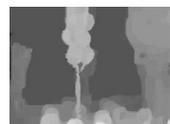
Available
Views +
Depth

Farther View
+Depth



- We create a primary synthesized view based on the closest camera view and its depth map
- The appropriate shifting amount for different objects in the scene is calculated using the depth and texture information by the same formula as used in VSRS

Our Proposed Interpolation Hybrid Approach



Closer View
+Depth



Synth View I
with Holes

Available Views + Depth

Create Primary Synthesized View

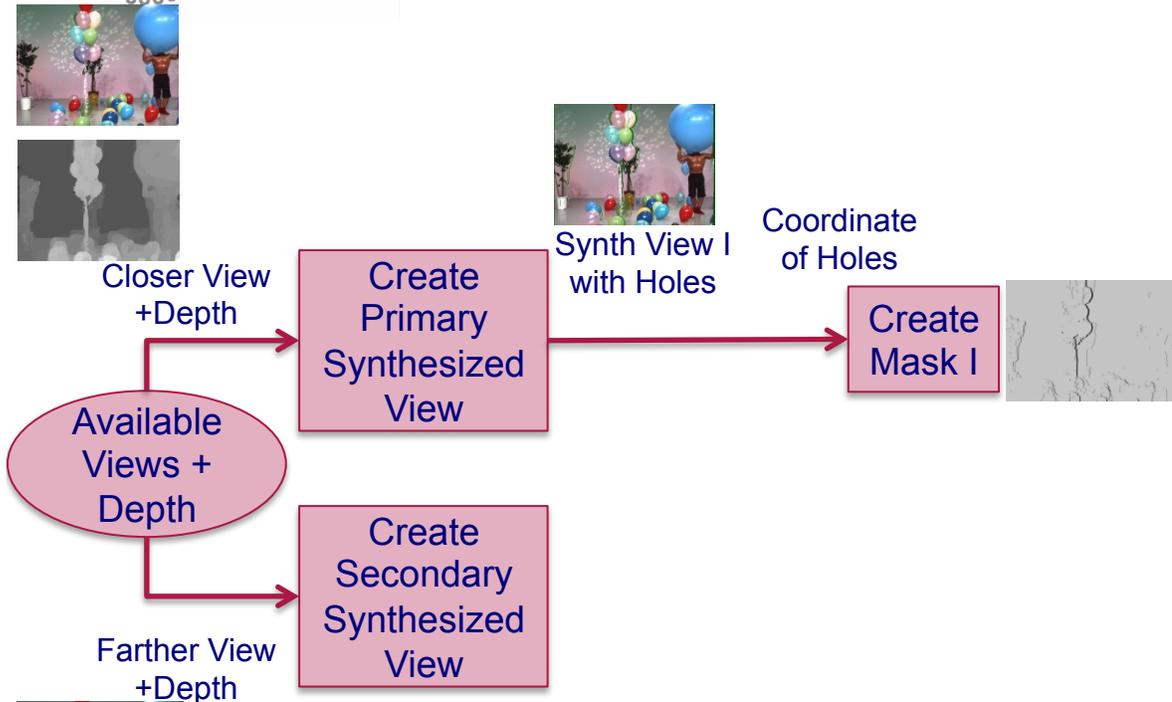
Create Mask I

Farther View
+Depth



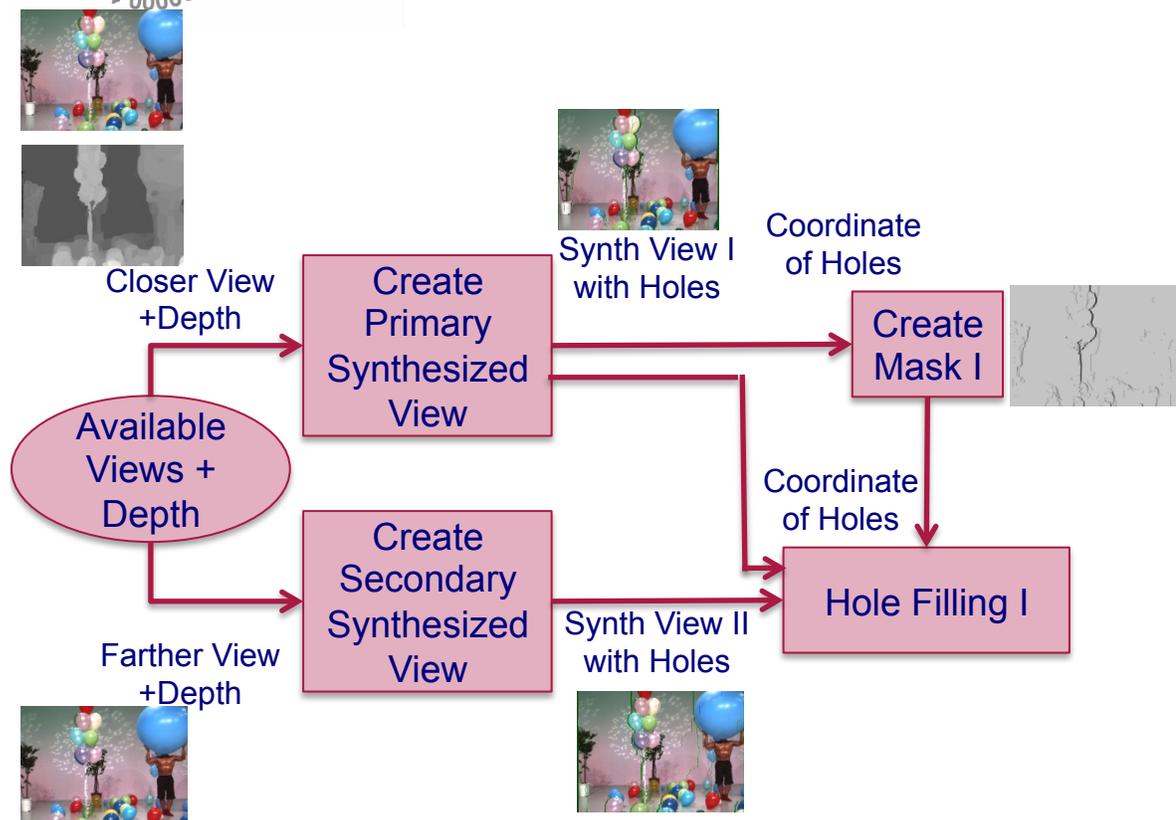
- A mask is created to map the location of holes in the primary view

Our Proposed Interpolation Hybrid Approach



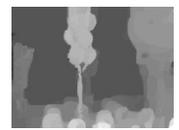
- A secondary synthesized view is generated solely based on the farther view by following the same procedure as creating the primary synthesized view

Our Proposed Interpolation Hybrid Approach

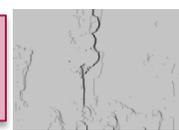


- Holes in the primary synthesized are filled by corresponding available areas in the secondary synthesized view

Our Proposed Interpolation Hybrid Approach



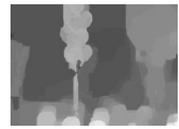
Synth View I with Holes



Closer View +Depth

Available Views + Depth

Farther View +Depth



Create Primary Synthesized View

Create Secondary Synthesized View

Create Mask I

Coordinate of Holes

Hole Filling I

Create Mask II

Synth View II with Holes

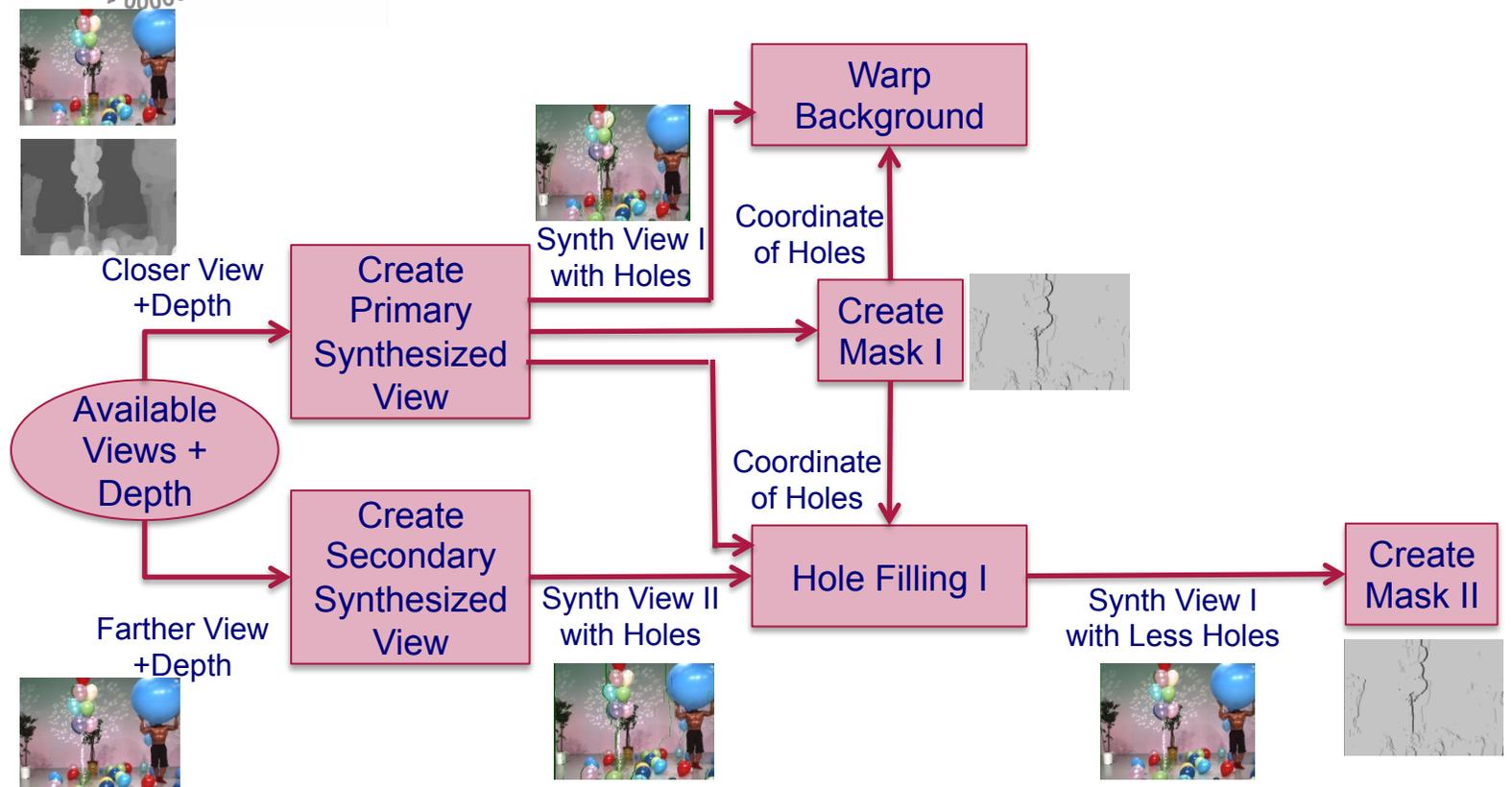


Synth View I with Less Holes



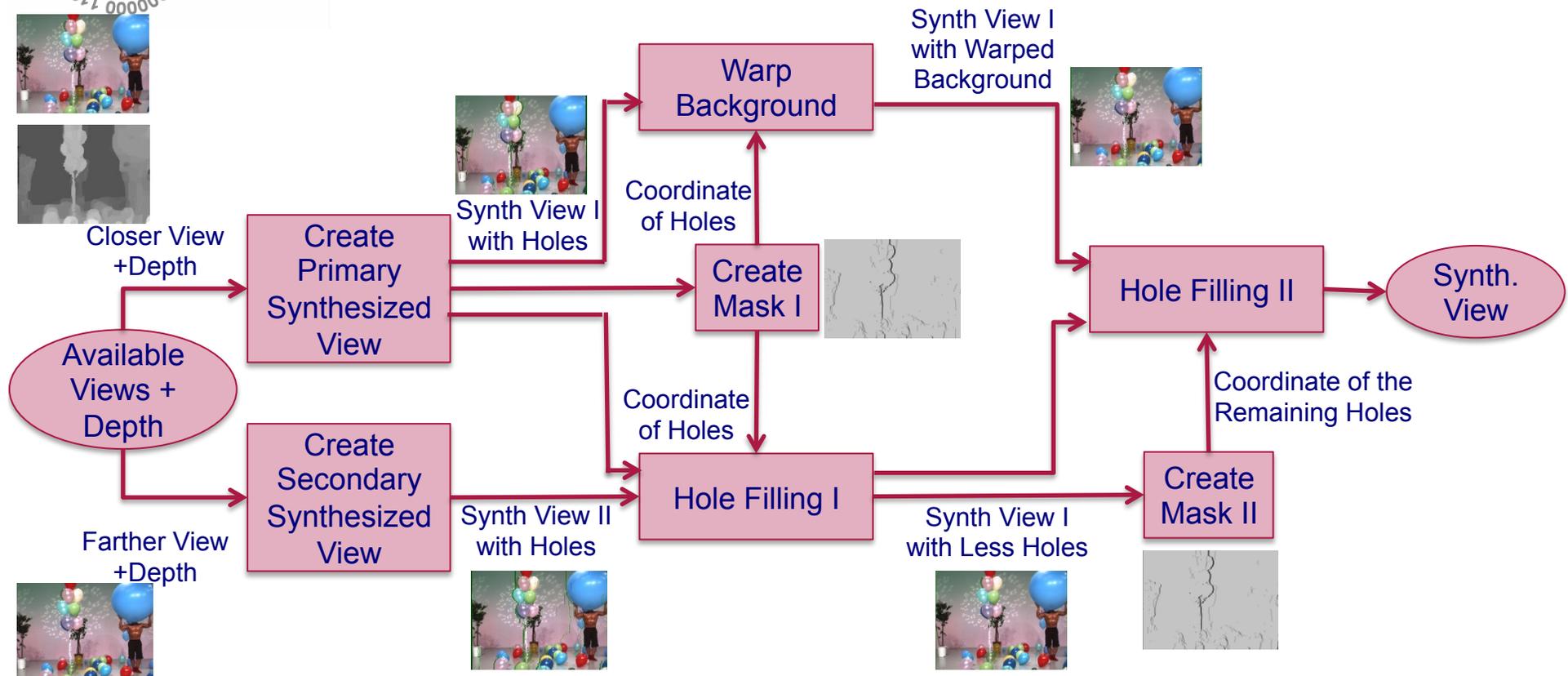
- Another mask is created to map the location of the remaining holes in the primary view

Our Proposed Interpolation Hybrid Approach



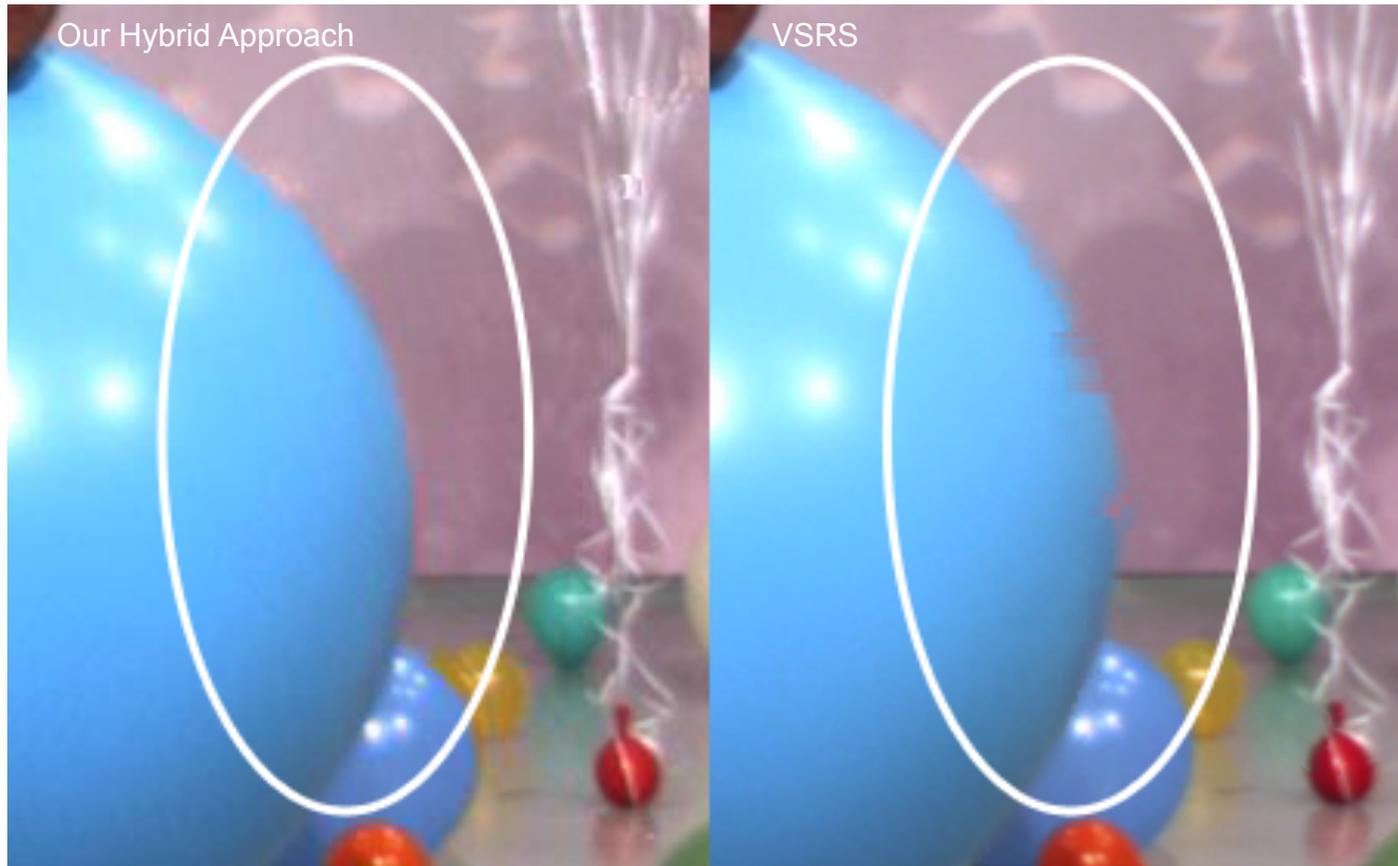
- To fill the remaining holes, our hybrid approach also applies warping to the background area of the primary synthesized view
- To avoid vertical parallax, the warping process for filling the holes should be done only in the horizontal direction

Our Proposed Interpolation Hybrid Approach



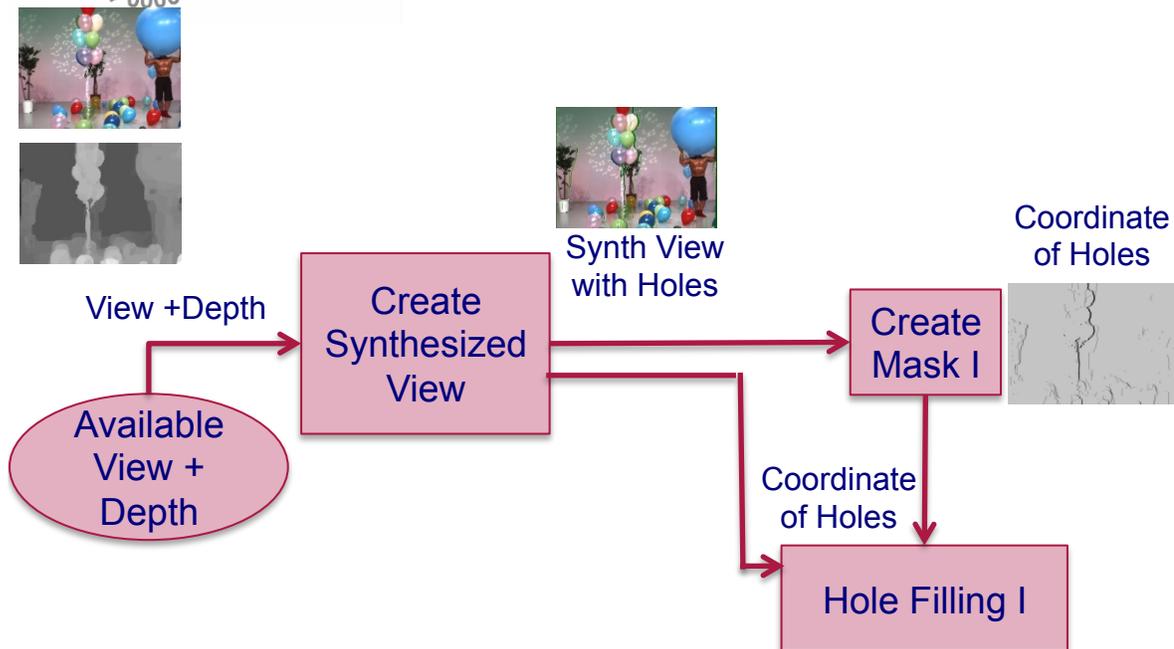
- Once this process is complete, we obtain a virtual view where all the holes are filled either with data from the secondary virtual view or from the warped image

Visual Comparison with VSRS



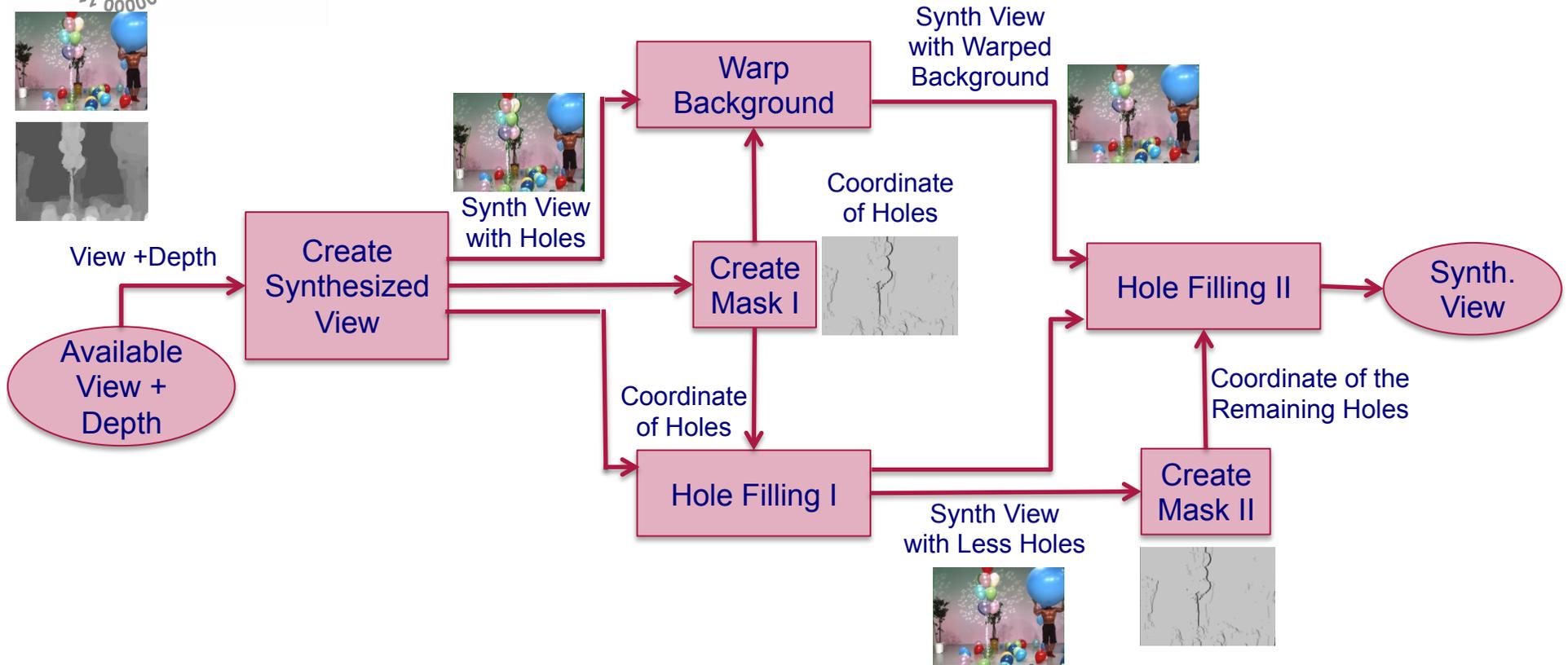
A frame from our Hybrid Interpolation method shown on the left compared to the same frame generated by VSRS on the right

Our Proposed Hybrid Extrapolation Approach



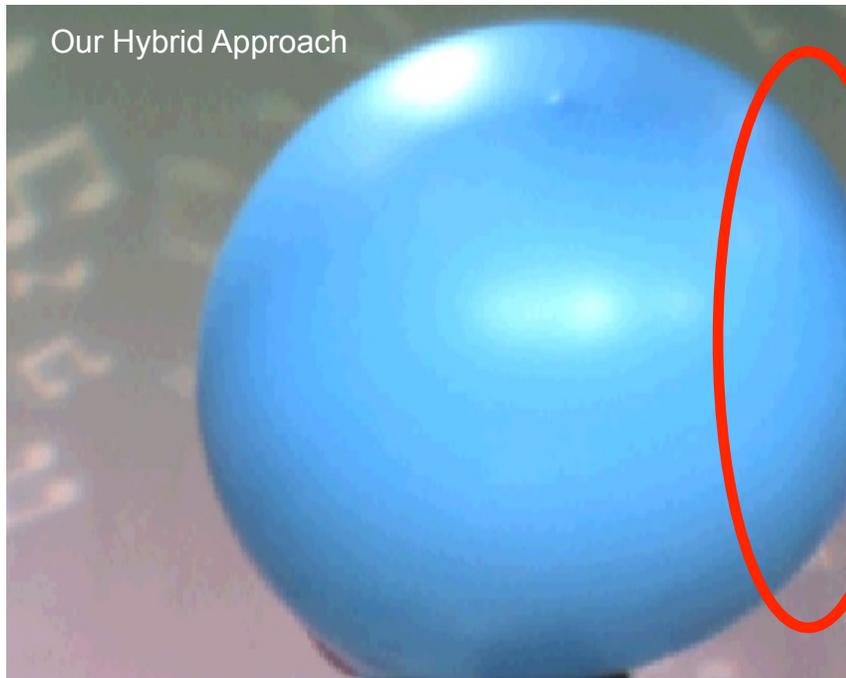
- Holes smaller than a defined threshold (cracks) in the synthesized view are filled by inpainting using linear interpolation

Our Proposed Hybrid Extrapolation Approach



- Once this process is complete, we obtain a virtual view where all the holes are filled either with linearly interpolated data or data from the warped image

Visual Comparison with VSRS



A cropped frame from our Hybrid method shown on the left compared to the same frame generated by VSRS on the right

Subjective Evaluation

- View Interpolation: 20 subjects (18 to 57 years old)
 - 13 left-eye dominant and 7 right-eye dominant subjects
- View Extrapolation: 18 subjects (21 to 28 years old)
 - 8 left-eye dominant and 10 right-eye dominant subjects
- 46" Full HD Hyundai 3D TV with passive glasses
 - brightness: 80, contrast: 80, color: 50, R: 70, G: 45, B: 30 (Recommendation by MPEG)



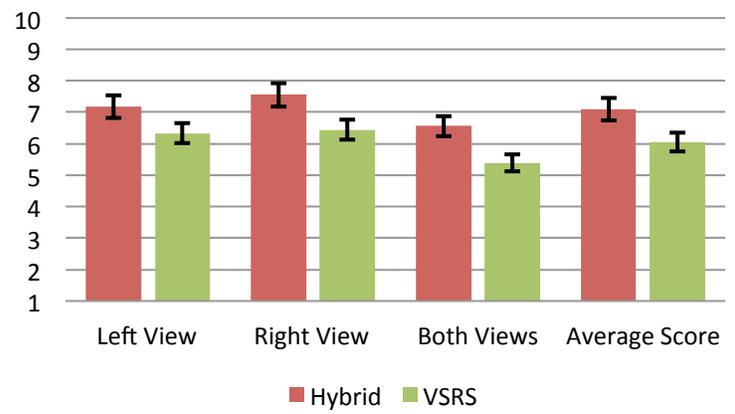
Subjective Test Setup

- Viewing conditions based on ITU-R Recommendations BT.500
- 3 Test Sequences:
 - “Balloons” (1024x768, 30fps, 300 frames),
 - “Kendo” (1024x768, 30fps, 300 frames)
 - “GT_Fly” (1920x1088, 25fps, 250 frames).
- Test Scenarios:
 - Only right view is synthesized
 - Only left view is synthesized
 - Both views are synthesized
- Subjects were asked to rate a combination of “naturalness”, “depth impression” and “comfort” (1-10 score)
- For our view interpolation tests there were 2 outliers which were removed from the result set
- There were no outliers for the view extrapolation tests

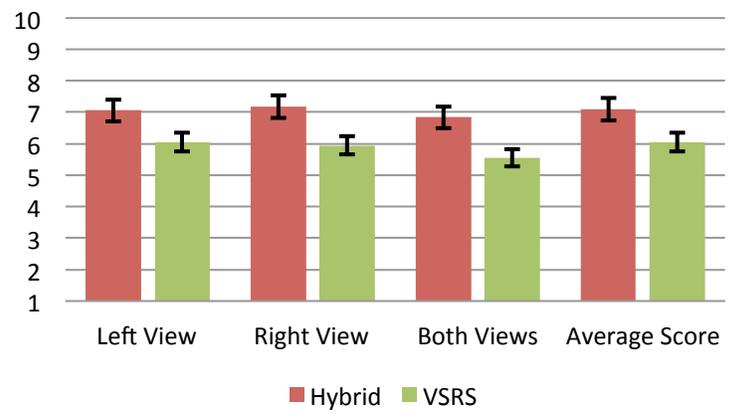


Interpolation Results

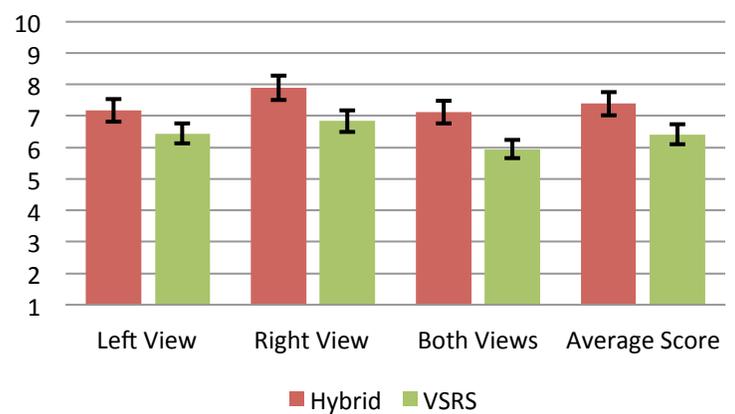
Balloons Synthesized Views



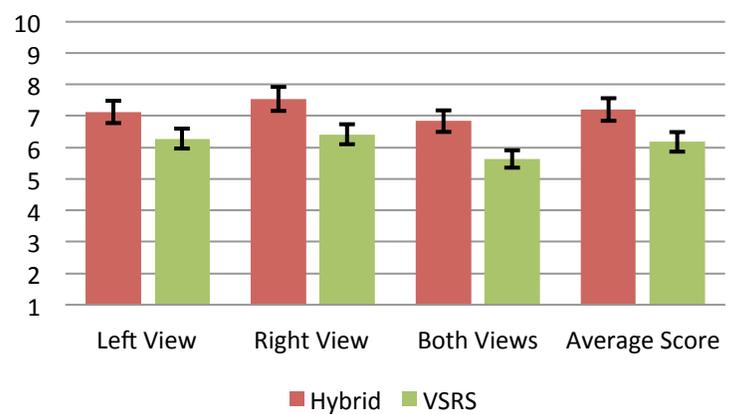
Kendo Synthesized Views



GT_Fly Synthesized Views

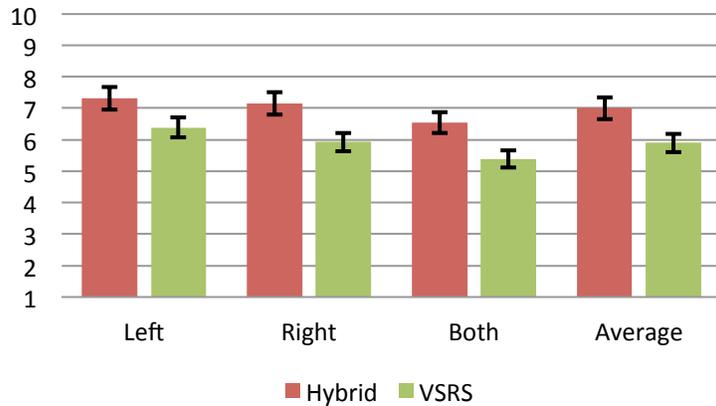


Averages for Synthesized Views

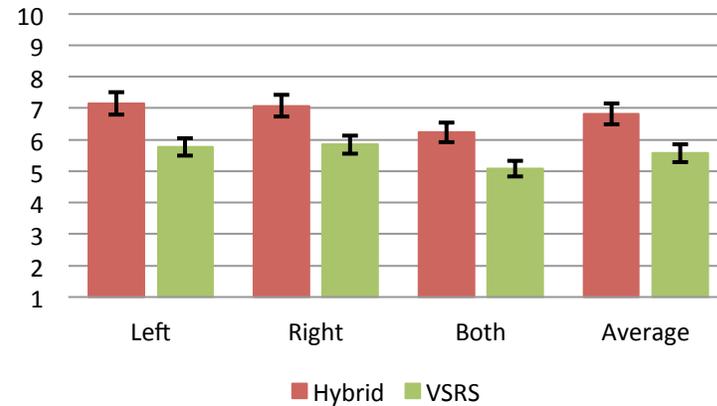


Extrapolation Results

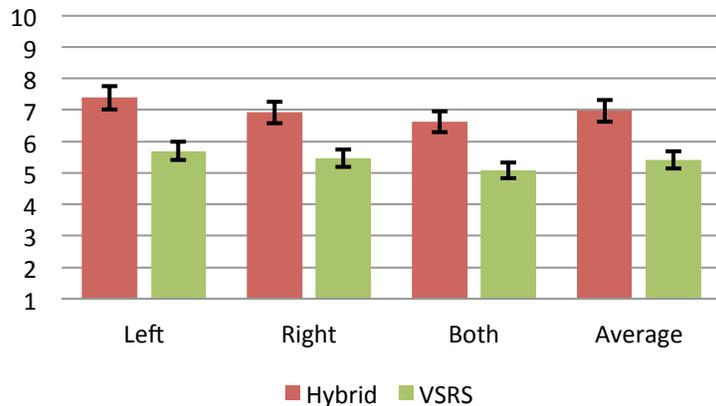
Balloons Synthesized Views



Kendo Synthesized Views



GT_Fly Synthesized Views



Averages for Synthesized Views

