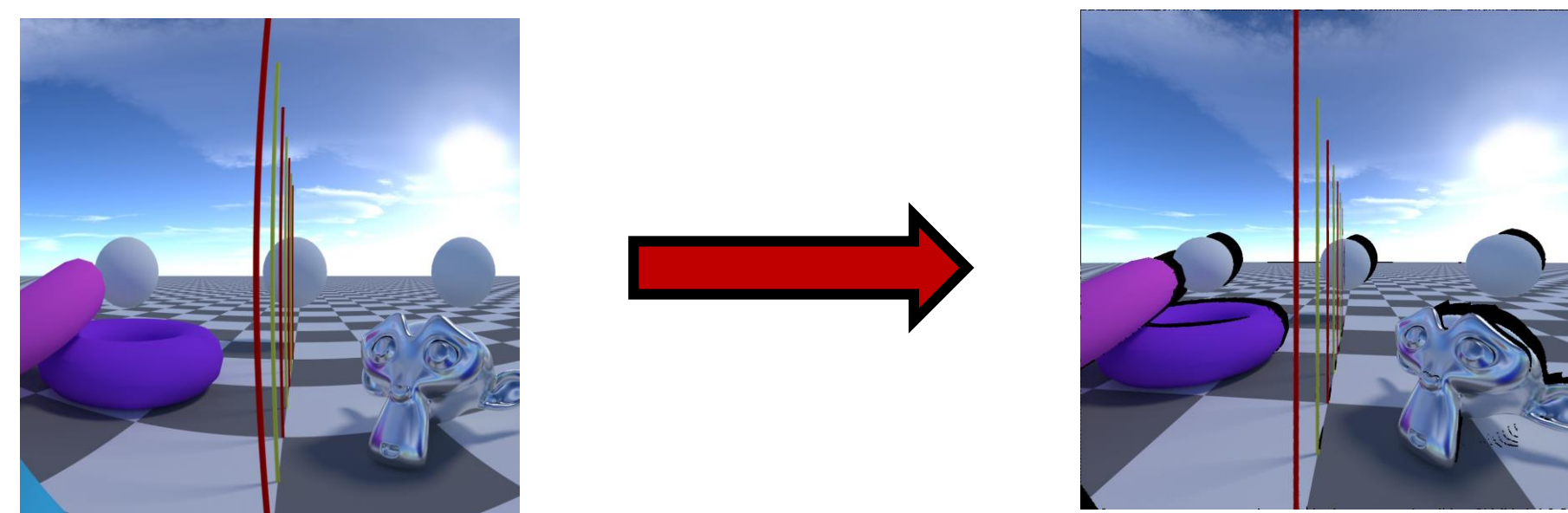# Depth-Aided Exemplar-Based Disocclusions Filling for View Synthesis
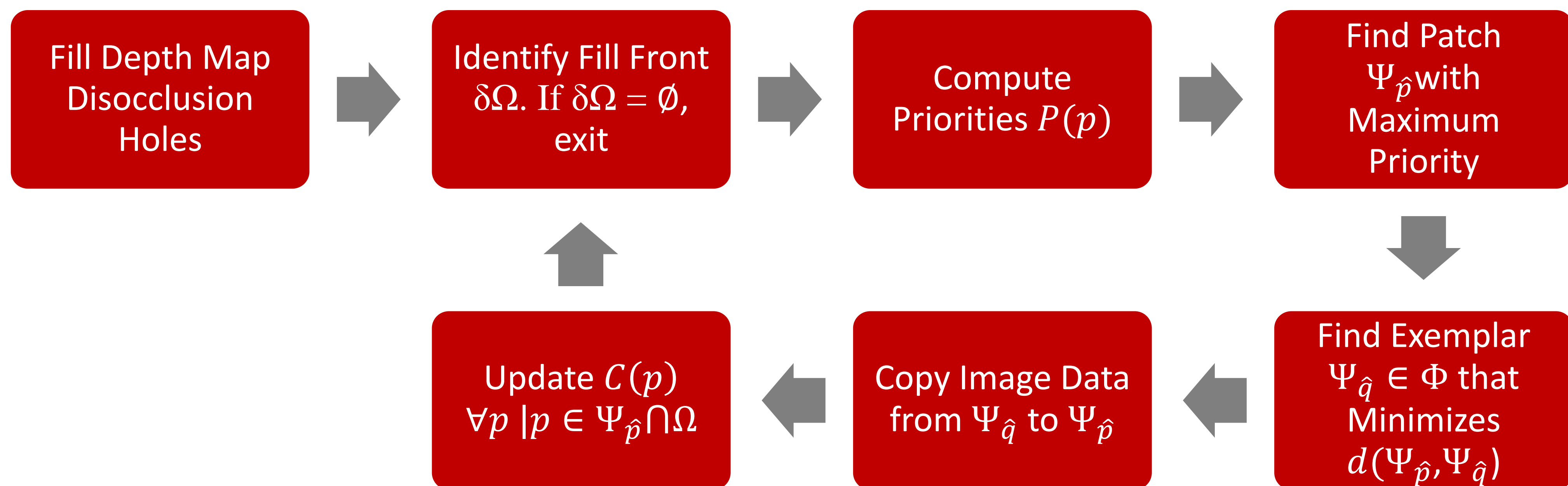
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Motivation

Virtual reality is a new and rapidly expanding area seeking to immerse the user in completely new surroundings. Total immersion is currently hindered in pre-recorded environments by the user's inability to move inside the scene. Additional views can be synthesized through Depth-image-based-rendering (DIBR), but DIBR causes disocclusion holes – spatial regions that were not visible in the reference view. These holes can be filled with traditional inpainting, but the additional depth data can be leveraged to produce higher quality, more accurate results.
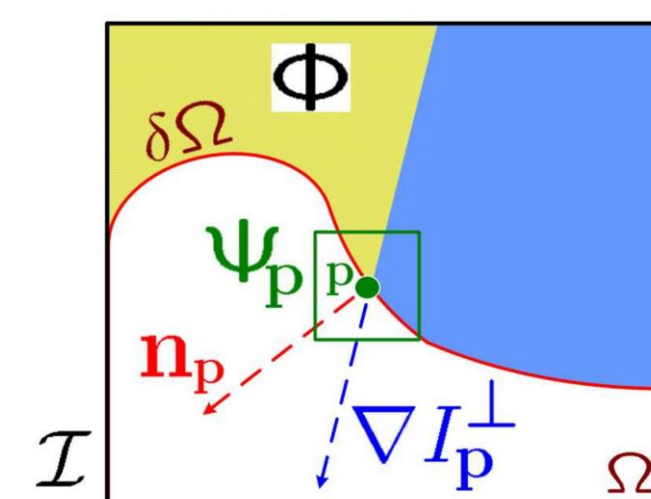

The Algorithm

Fill Depth Map Disocclusion Holes → Identify Fill Front $\delta\Omega$. If $\delta\Omega = \emptyset$, exit → Compute Priorities $P(p)$ → Find Patch $\Psi_{\hat{p}}$ with Maximum Priority ↓ Find Exemplar $\Psi_{\hat{q}} \in \Phi$ that Minimizes $d(\Psi_{\hat{p}}, \Psi_{\hat{q}})$ ← Copy Image Data from $\Psi_{\hat{q}}$ to $\Psi_{\hat{p}}$ ← Update $C(p)$ $\forall p \,|\, p \in \Psi_{\hat{p}} \cap \Omega$ → (back to Identify Fill Front)

Related Work

Daribo

$$P(p) = C(p) \cdot D(p) \cdot L(p)$$

$$C(p) = \frac{1}{|\Psi_p|} \sum_{q \in \Psi_p \cap \Phi} C(q)$$

$$D(p) = \langle \nabla^\perp I_p, n_p \rangle / \alpha$$

$$L(p) = \frac{|Z_p|}{\left(|Z_p| + \sum_{q \in \Psi_p \cap \Phi}(Z_p - \overline{Z_p})^2\right)}$$

$$\Psi_{\hat{q}} = \underset{\Psi_q \in \Phi}{\operatorname{argmin}}\{d(\Psi_{\hat{p}}, \Psi_q) + \beta d(Z_{\hat{p}}, Z_q)\}$$

Ružić

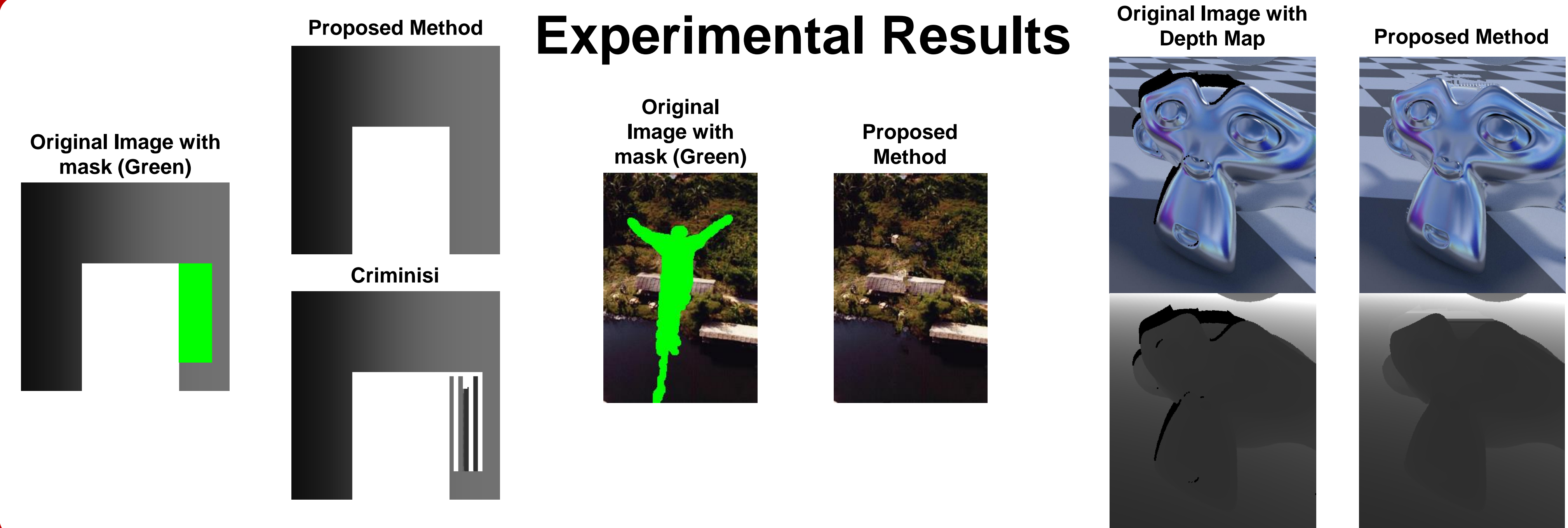
Row of missing pixels   Local window

$$\Psi_{\hat{q}} = \sum_{i=1}^{L} \Psi_{\hat{q},i}$$

Jain

$$l(b_i) = \beta \sigma_{\mathcal{N}}^2 b_i + \frac{1}{c(b_i)}$$

Experimental Results

Original Image with mask (Green)

Proposed Method

Criminisi

Original Image with mask (Green)

Proposed Method

Original Image with Depth Map

Proposed Method

References:

[1] Criminisim, P. Perez, and K. Tomaya, "Region filling and object removal by exemplar-based image inpainting," *IEEE Trans. Image Process.*, vol.13, no.9, pp.1200-1212, 2004
[2] K. Jain, L. C. Tran, R. Khoshebeh, and T. Q. Nguyen, "Efficient stereo-to-multiview synthesis," in *ICASSP 2011*, 2011, pp.889-892
[3] Daribo and H. Saito, "A novel inpainting-based layered depth video for 3DTV," *IEEE Trans. On Broadcasting*, vol. 57, no. 2, pp. 533-541`, 2011
[4] T. Ruzic, L. Jovanov, H. Q. Luong, A. Pizurica, and W. Philips "Depth-guided patch-based disocclusion filling for view synthesis via markov random field modelling," in *ICSPCS 2014*, pp. 1-9, 15-17, 2014