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TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI

University of South Australia

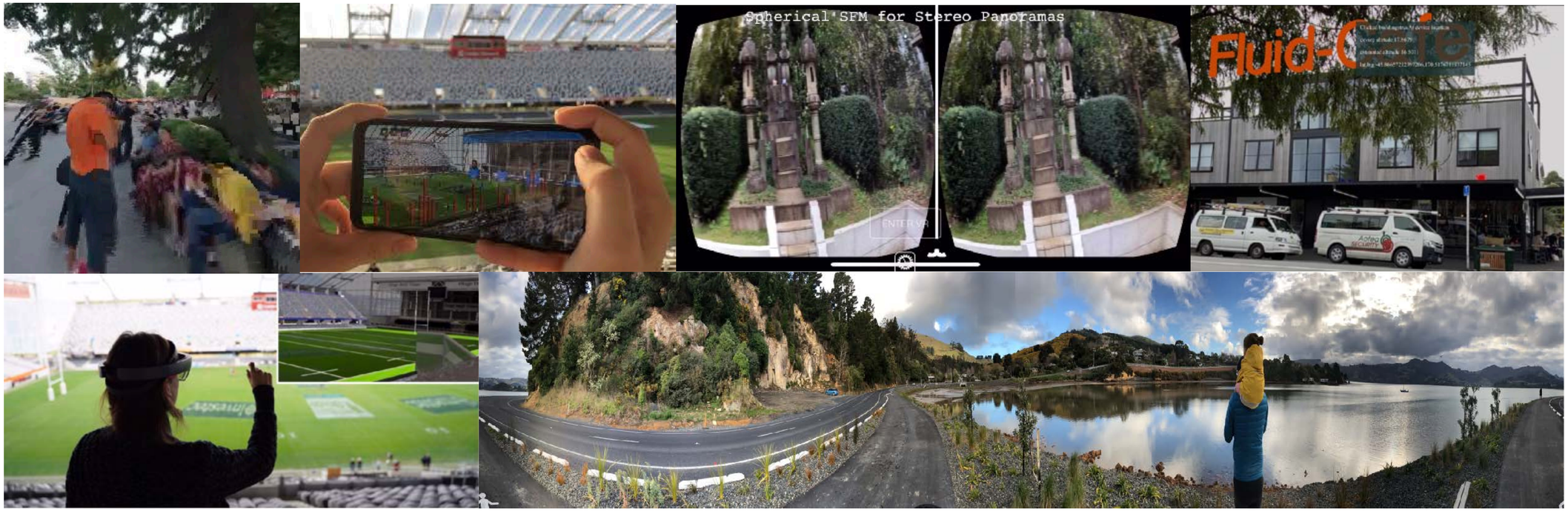
Visual Computing for eXtended Reality (XR)

Stefanie Zollmann

Visual Computing at University of Otago

Visual Computing for XR

http://visualcomputing.otago.ac.nz



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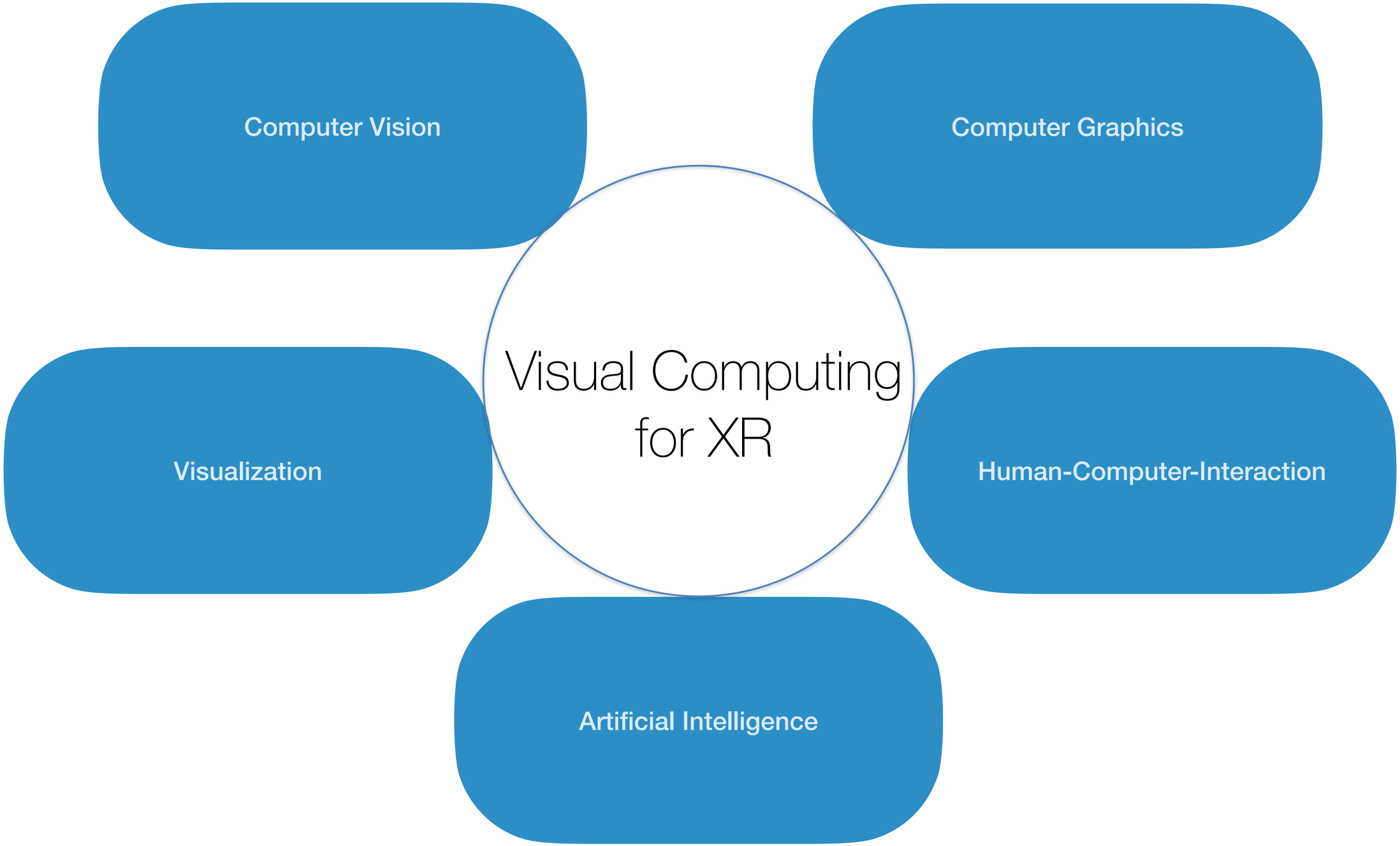
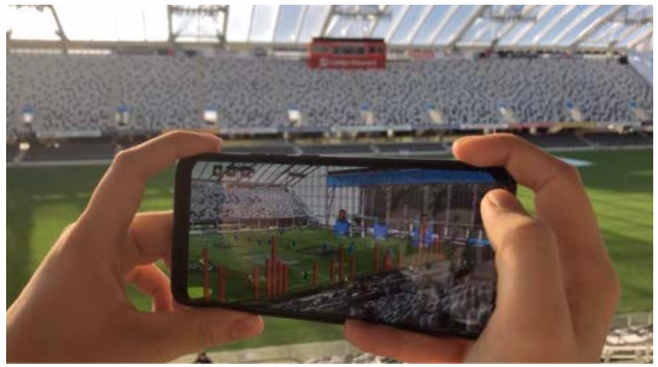


AR Visualization

Visualization, Computer Vision, HCI

VR Videography

Computer Vision, AI, Graphics



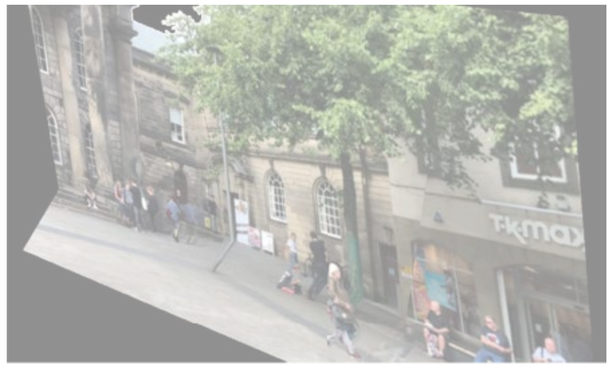
Augmented Reality for Sports

Computer Vision, Visualization, HCI, AI

Examples Visual Computing for XR

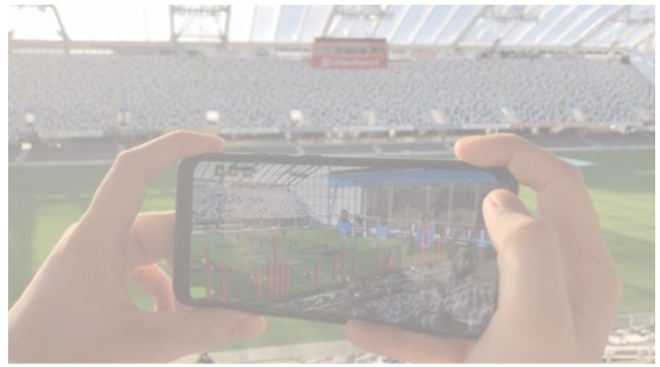
AR Visualization

Visualization, Computer Vision, HCI



VR Videography

Computer Vision, AI, Graphics



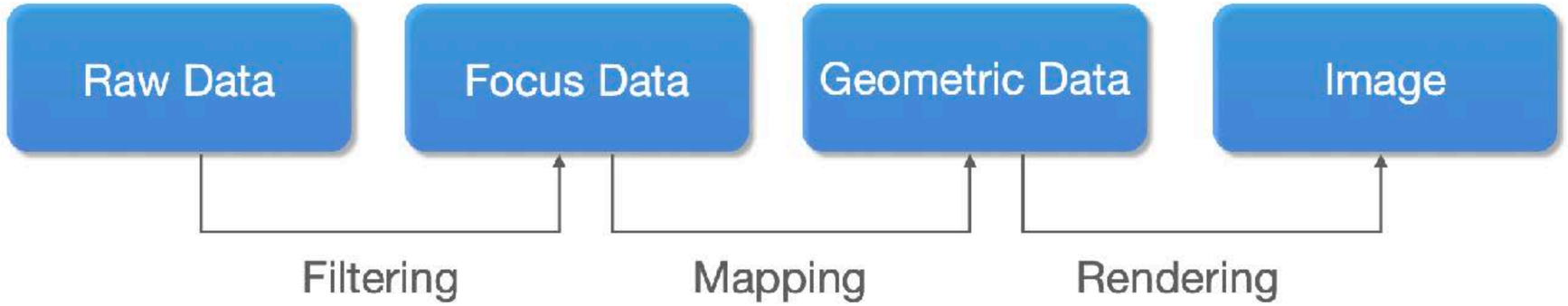
Augmented Reality for Sports

Computer Vision, Visualization, HCI, AI

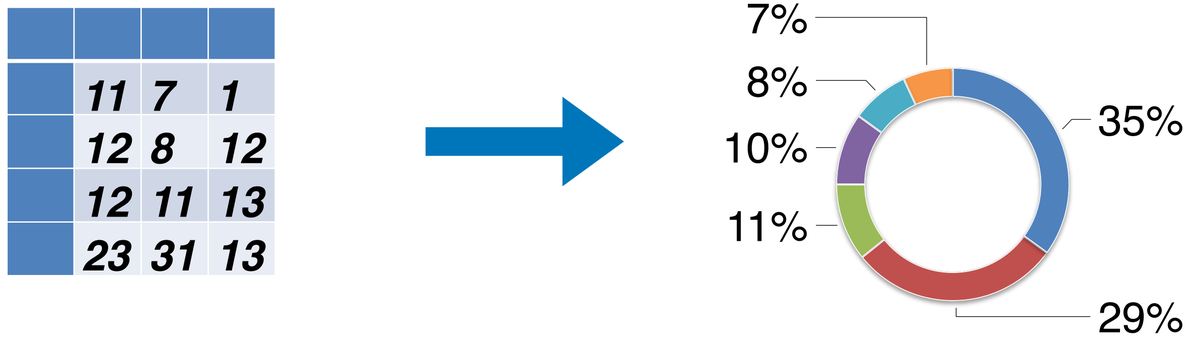
Examples Visual Computing for XR

AR Visualization

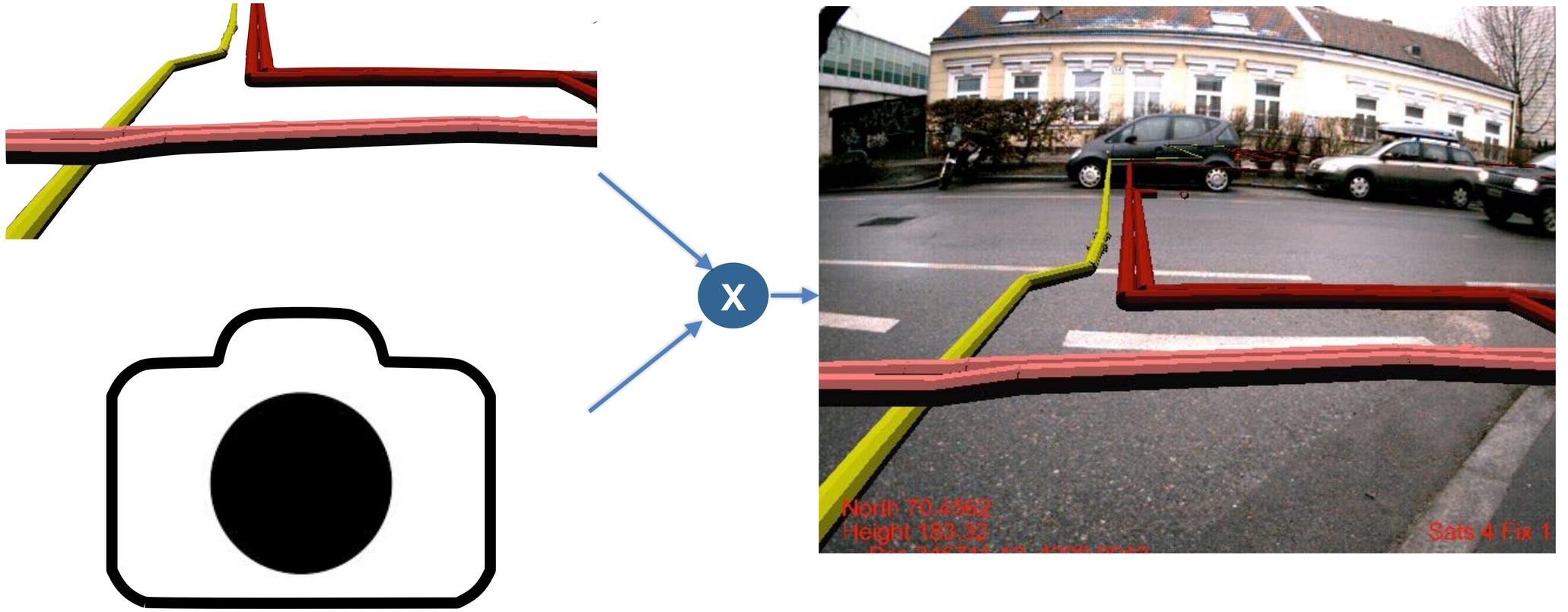
Traditional Visualization Pattern



R. Haber and D. McNaab, “Visualization idioms: a conceptual model for scientific visualization systems”

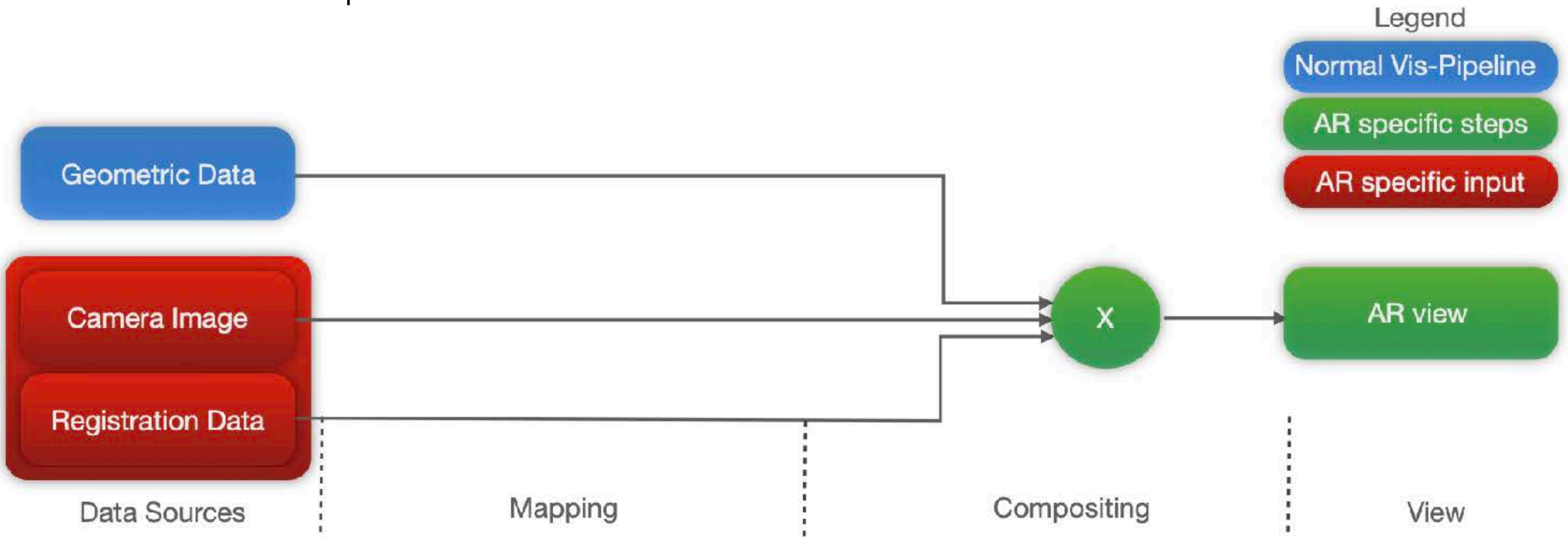


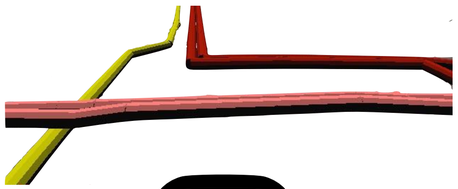
What does it mean for AR?

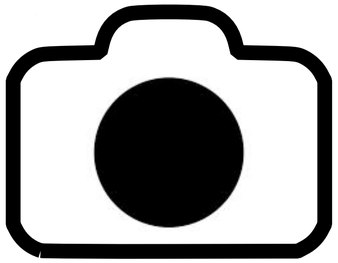


How to combine virtual data and real environment?

Simple AR Visualization Pattern



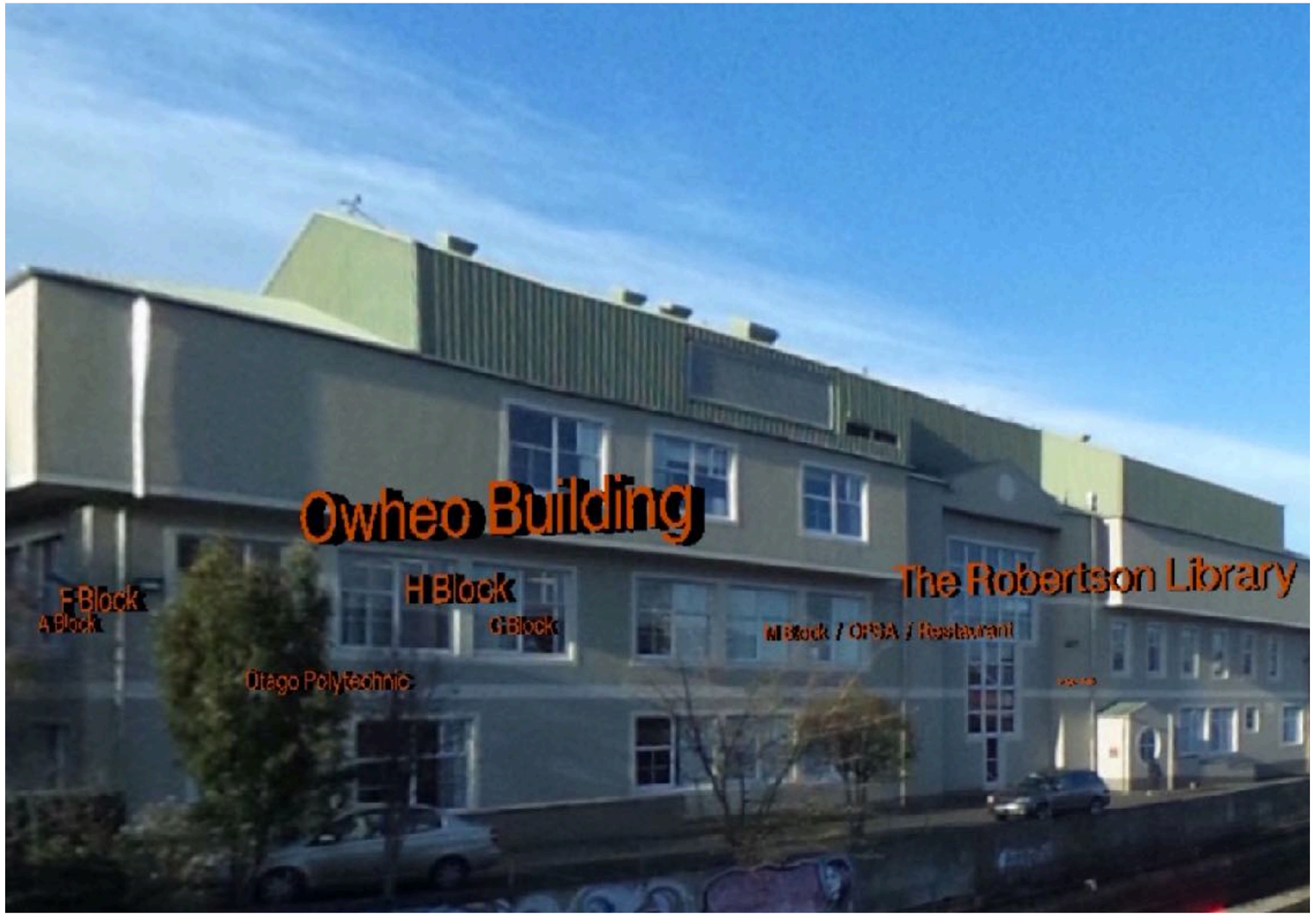




S. Zollmann, T. Langlotz, R. Grasset, WH. Lo, S. Mori, H. Regenbrecht, *Visualization Techniques in Augmented Reality: A Taxonomy, Methods and Patterns*, TVCG, 2020

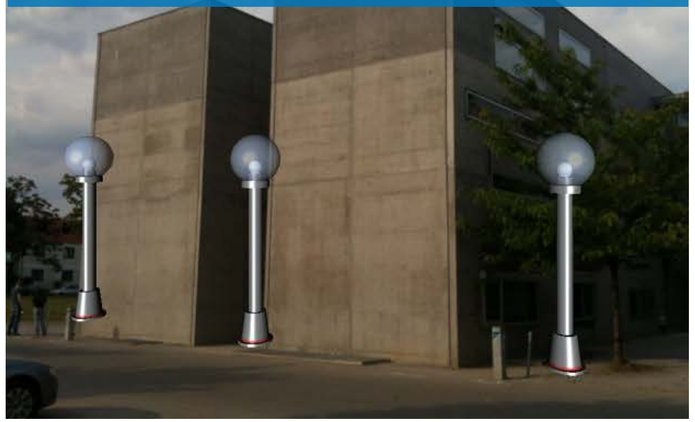
Challenges


North 70.4562
Height 183.32
Sats 4 Fix 1


Owheo Building
F Block
A Block
H Block
G Block
Otago Polytechnic
The Robertson Library
M Block / OPSA / Restaurant

Challenges

Visual Coherence



Visual Coherence for AR

S. Zollmann and G. Reitmayr. 2012. *Dense depth maps from sparse models and image coherence for augmented reality*. In Proceedings ACM symposium on Virtual reality software and technology, 2012

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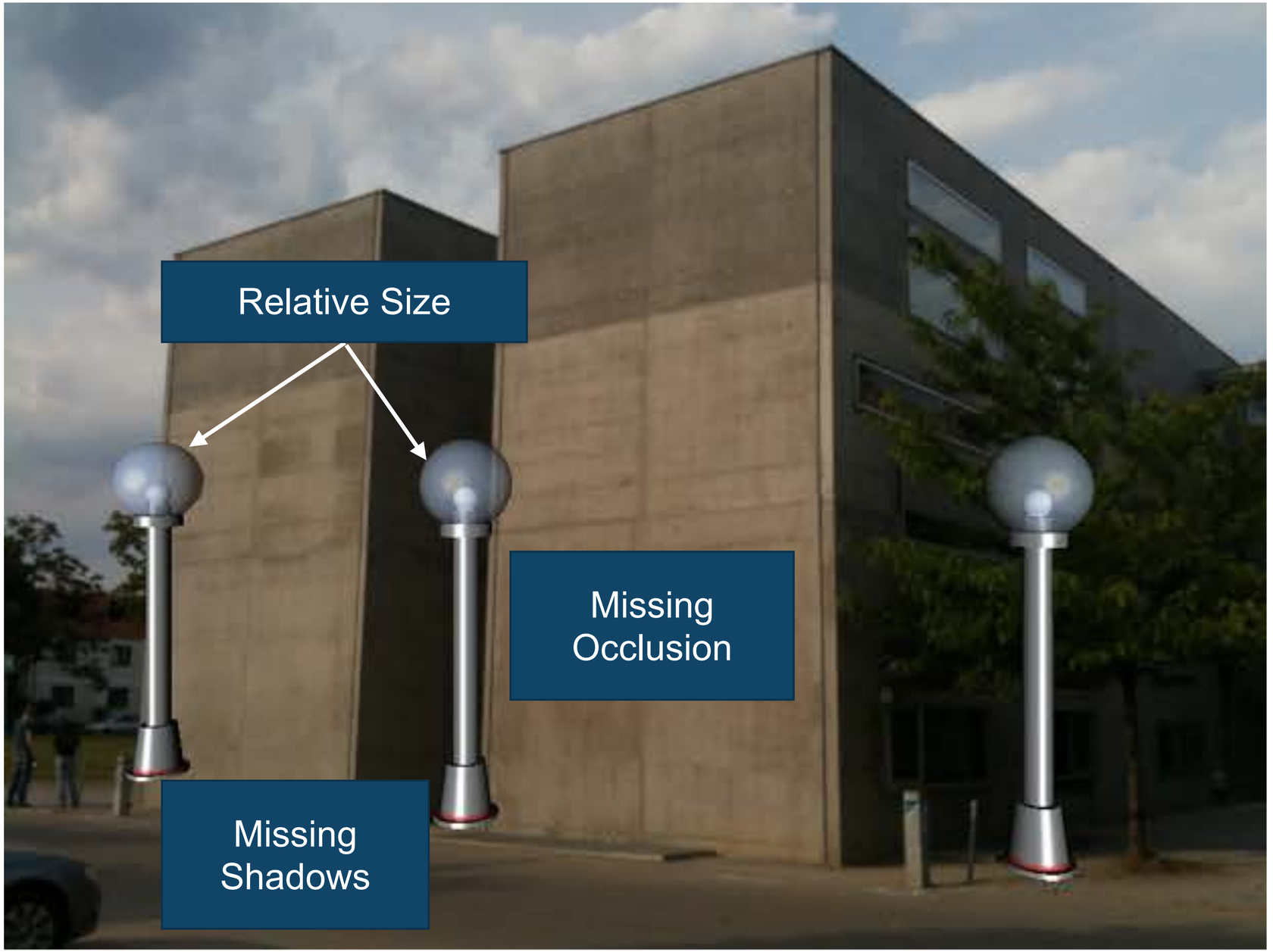

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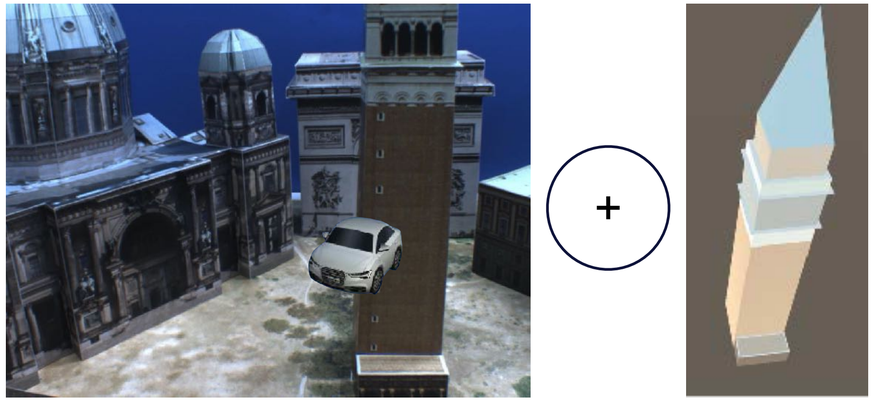
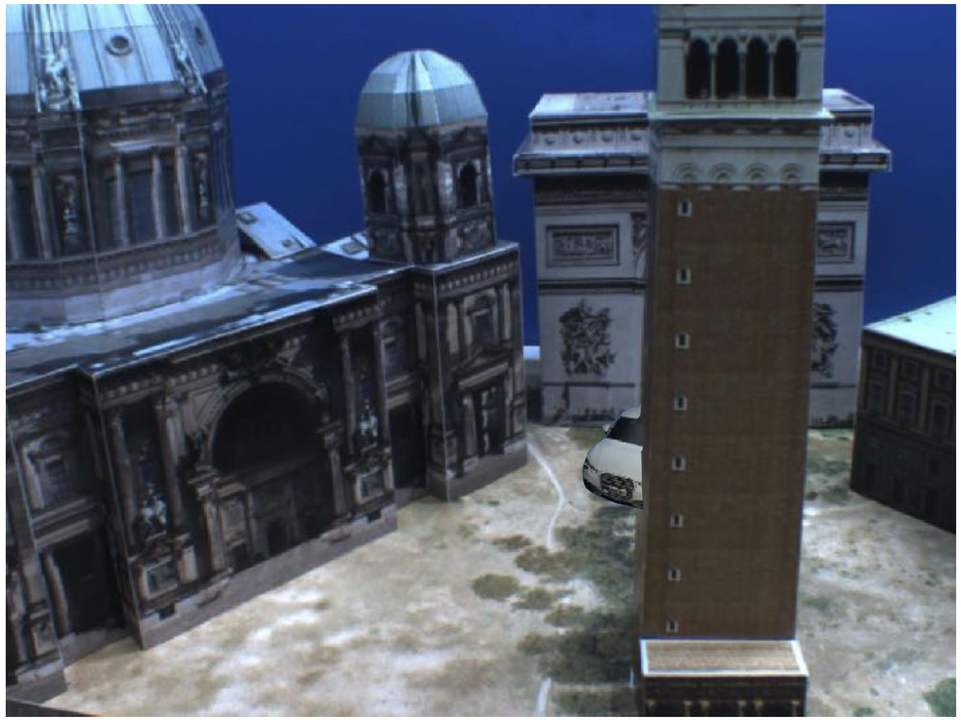
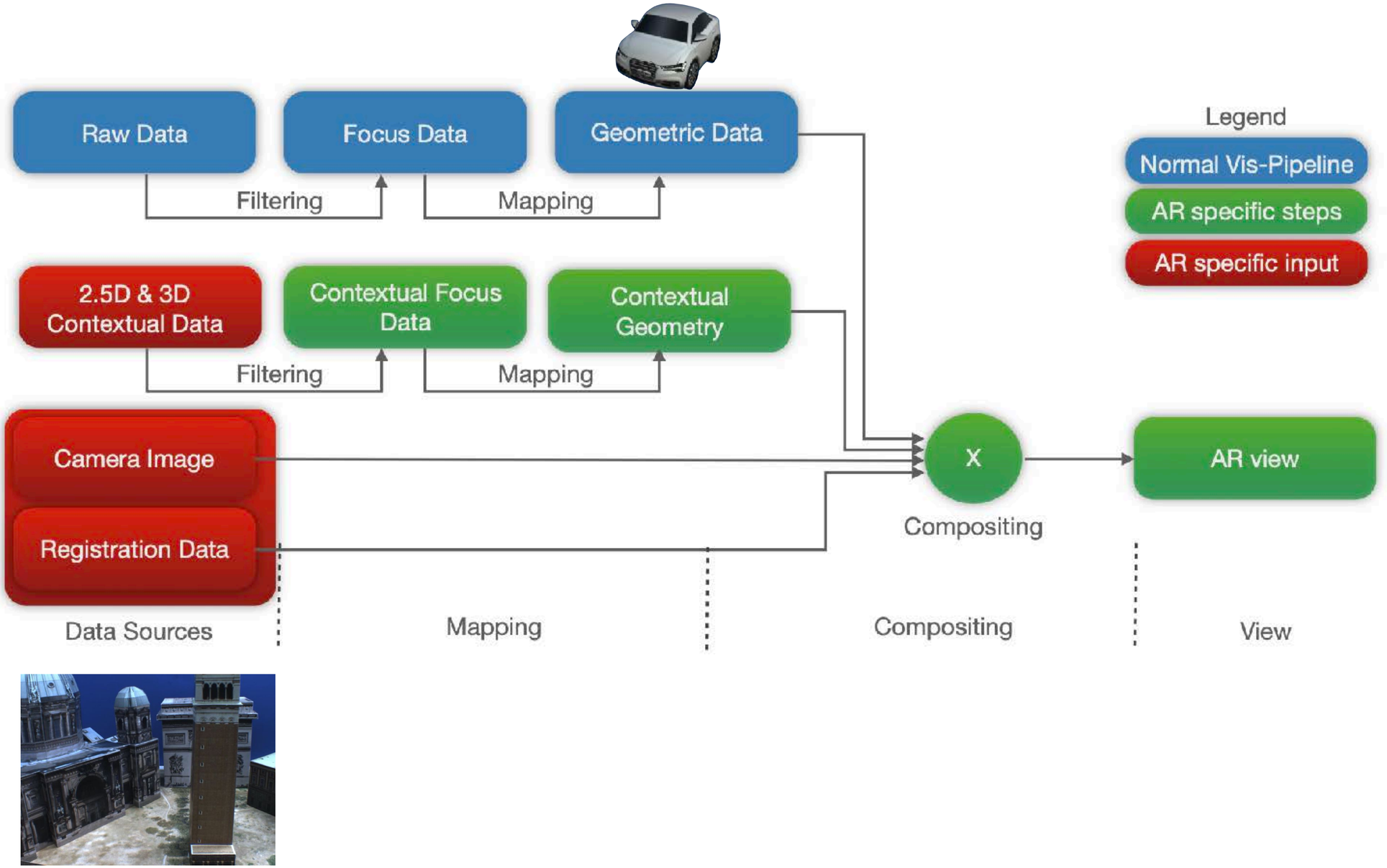
Visual Coherence in AR Using 3D Models

Visual Coherence Using 3D Models





Models and Image data: Gruber et al. The City of Sights: Design, Construction, and Measurement of an Augmented Reality Stage Set, ISMAR 2010



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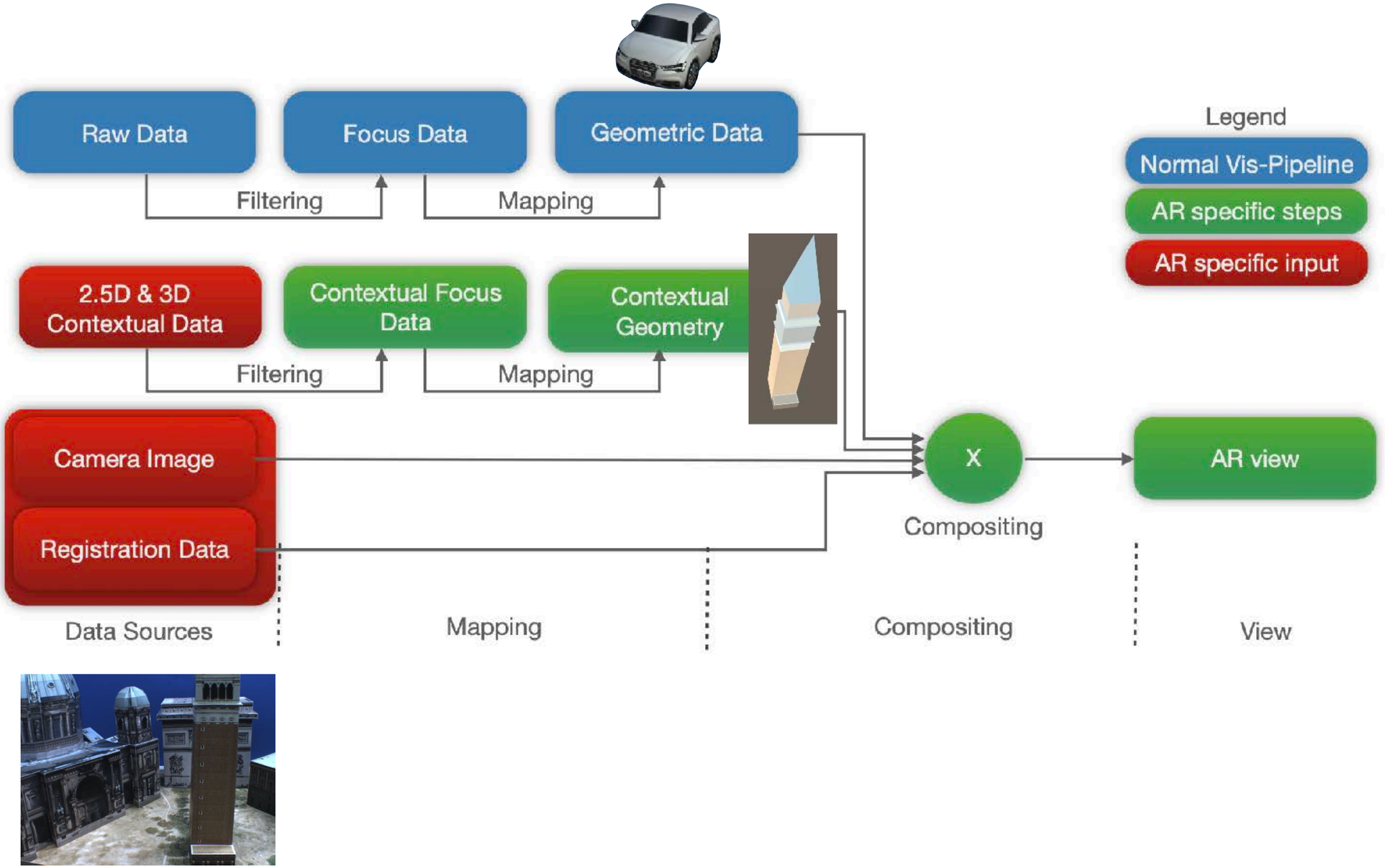

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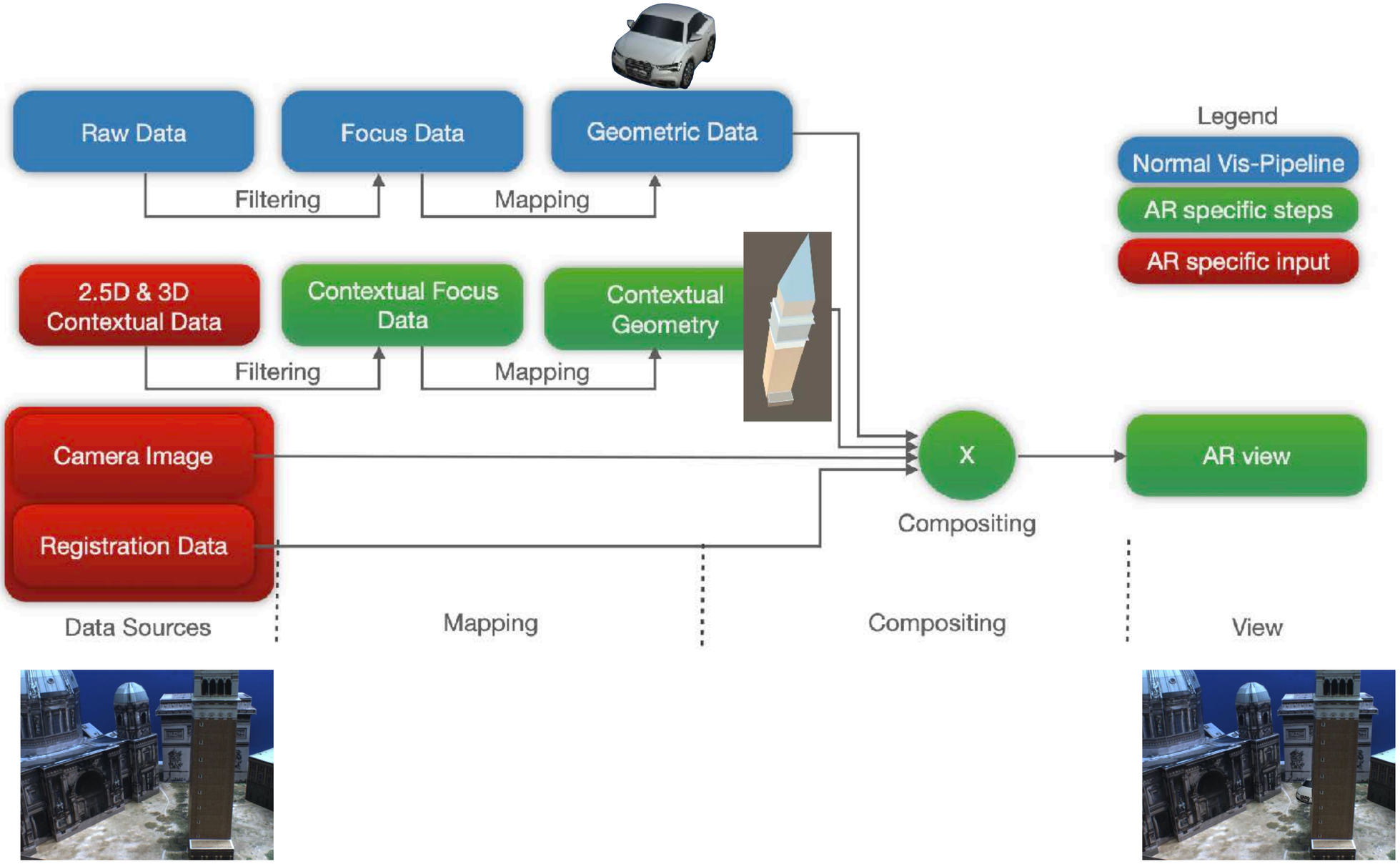

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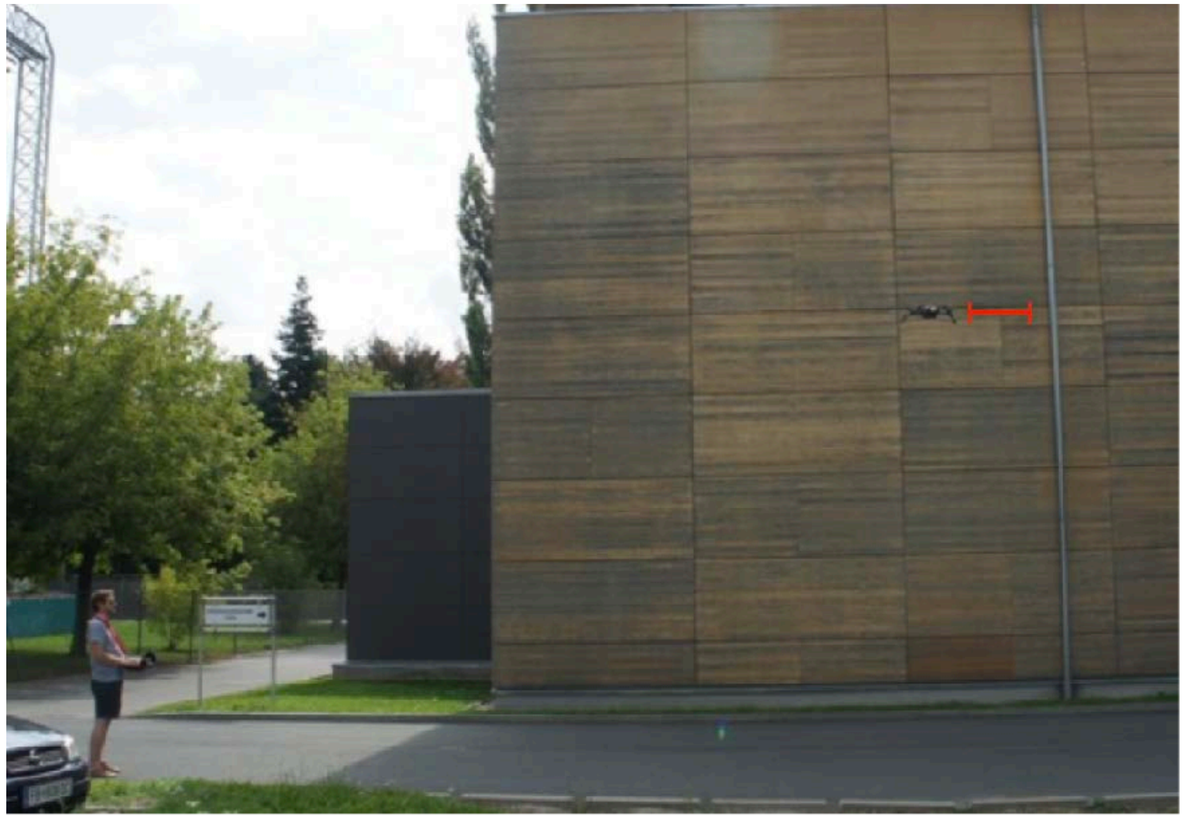

S. Zollmann, C. Hoppe, T. Langlotz and G. Reitmayr, *FlyAR: Augmented Reality Supported Micro Aerial Vehicle Navigation*, in IEEE Transactions on Visualization and Computer Graphics

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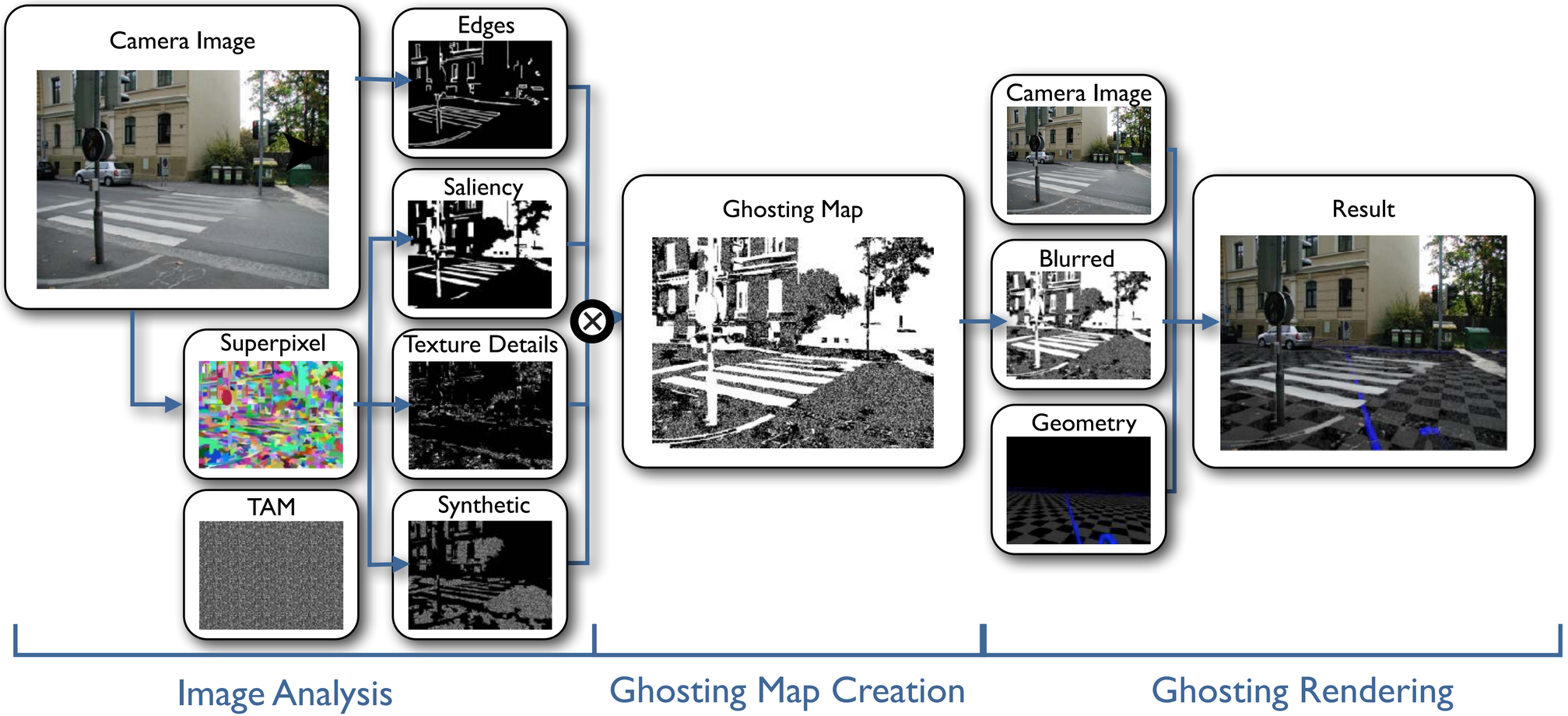
Visual Coherence in AR Using Image Data

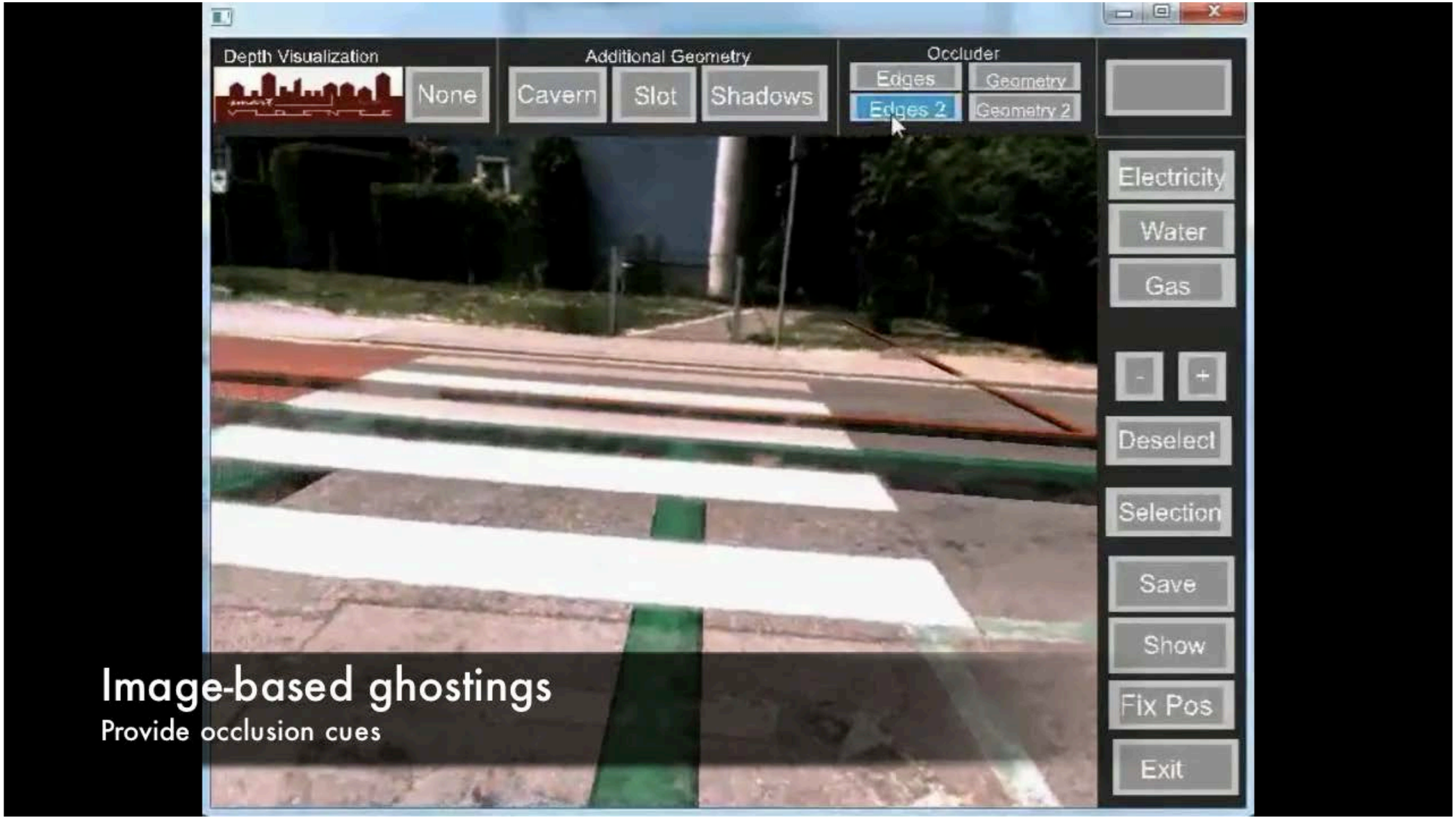
X-Ray AR

Complete occlusion?

Using important image elements for occlusion.



S. Zollmann, D. Kalkofen, E. Mendez and G. Reitmayr, "*Image-based ghostings for single layer occlusions in augmented reality,*" 2010 IEEE International Symposium on Mixed and Augmented Reality



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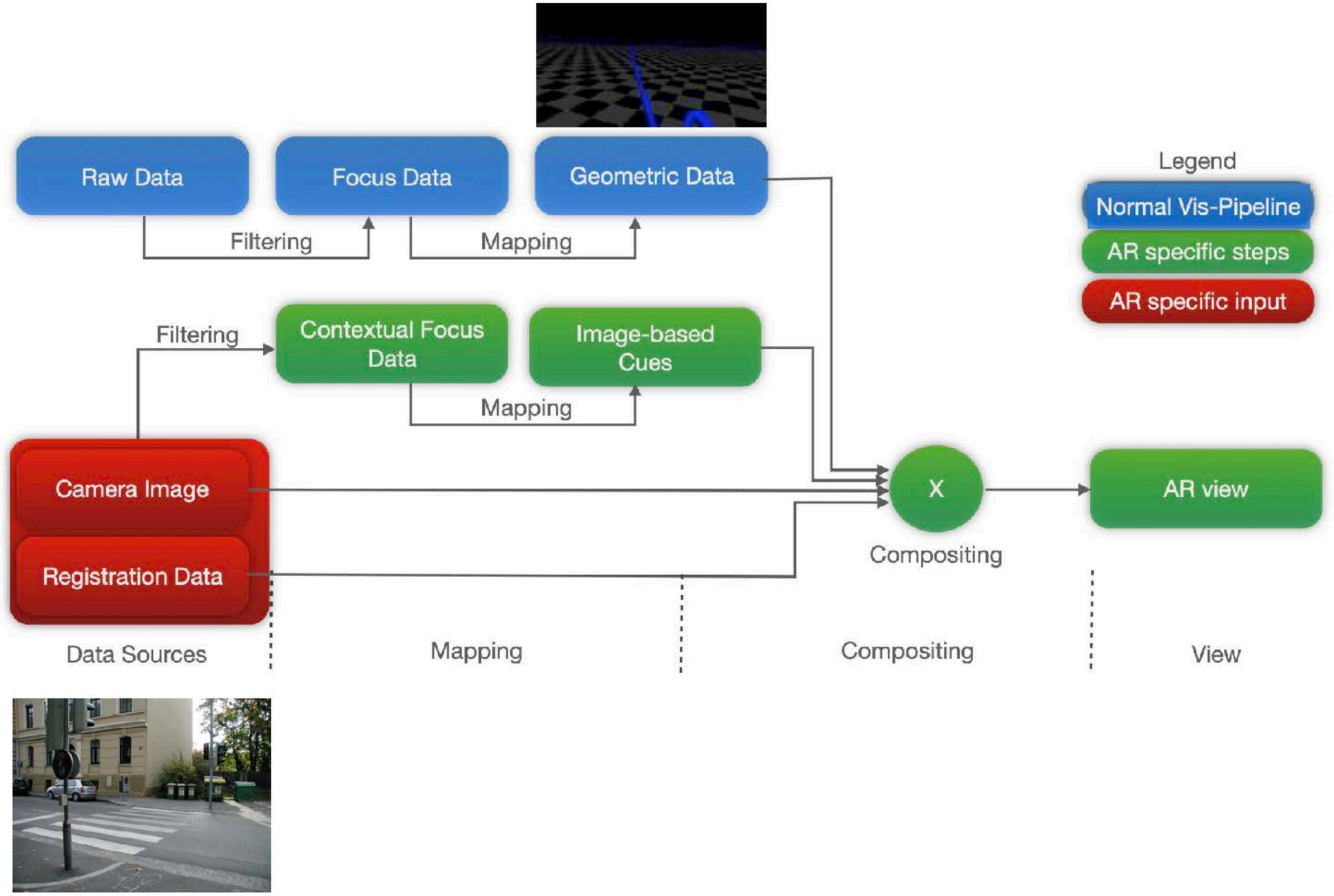

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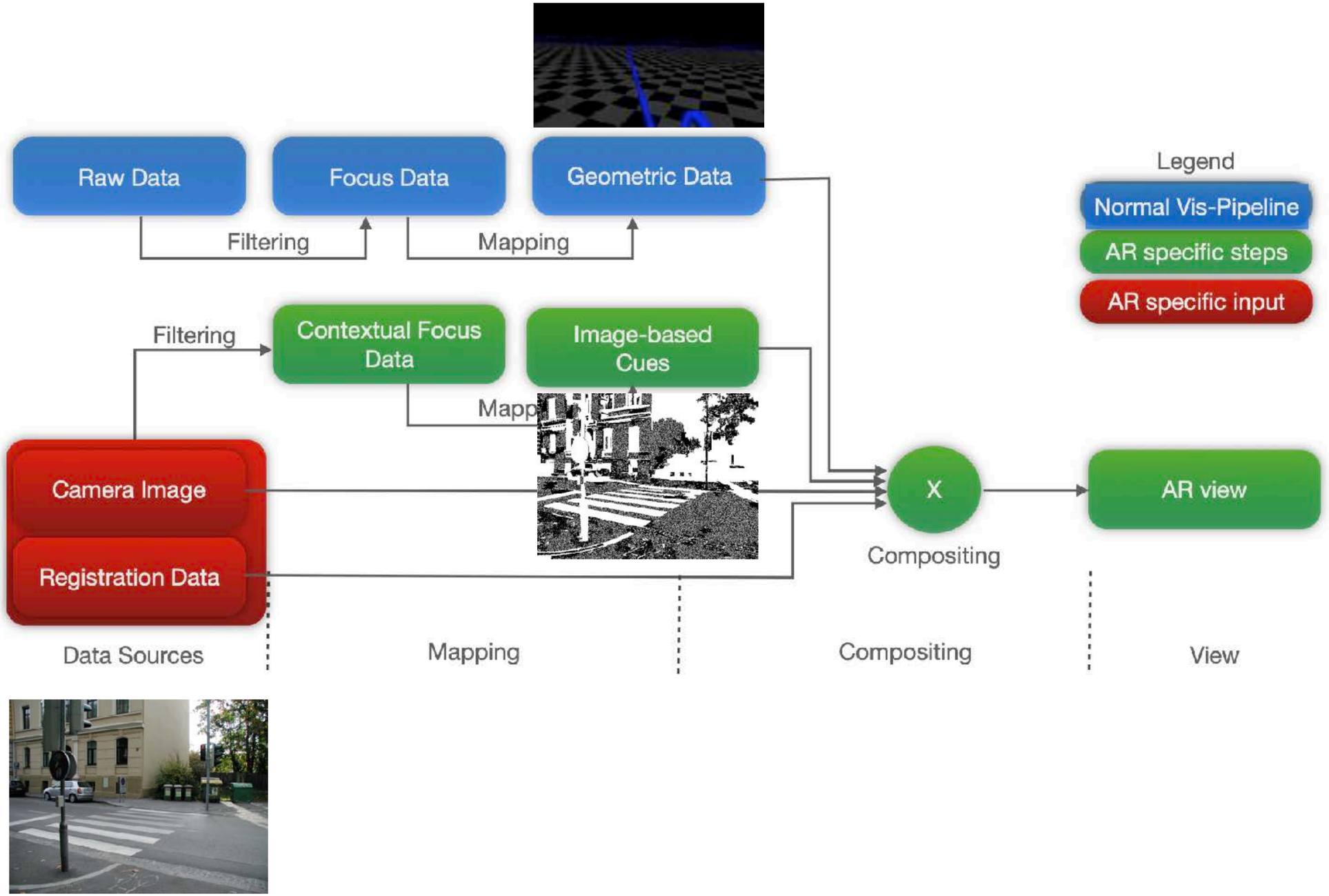

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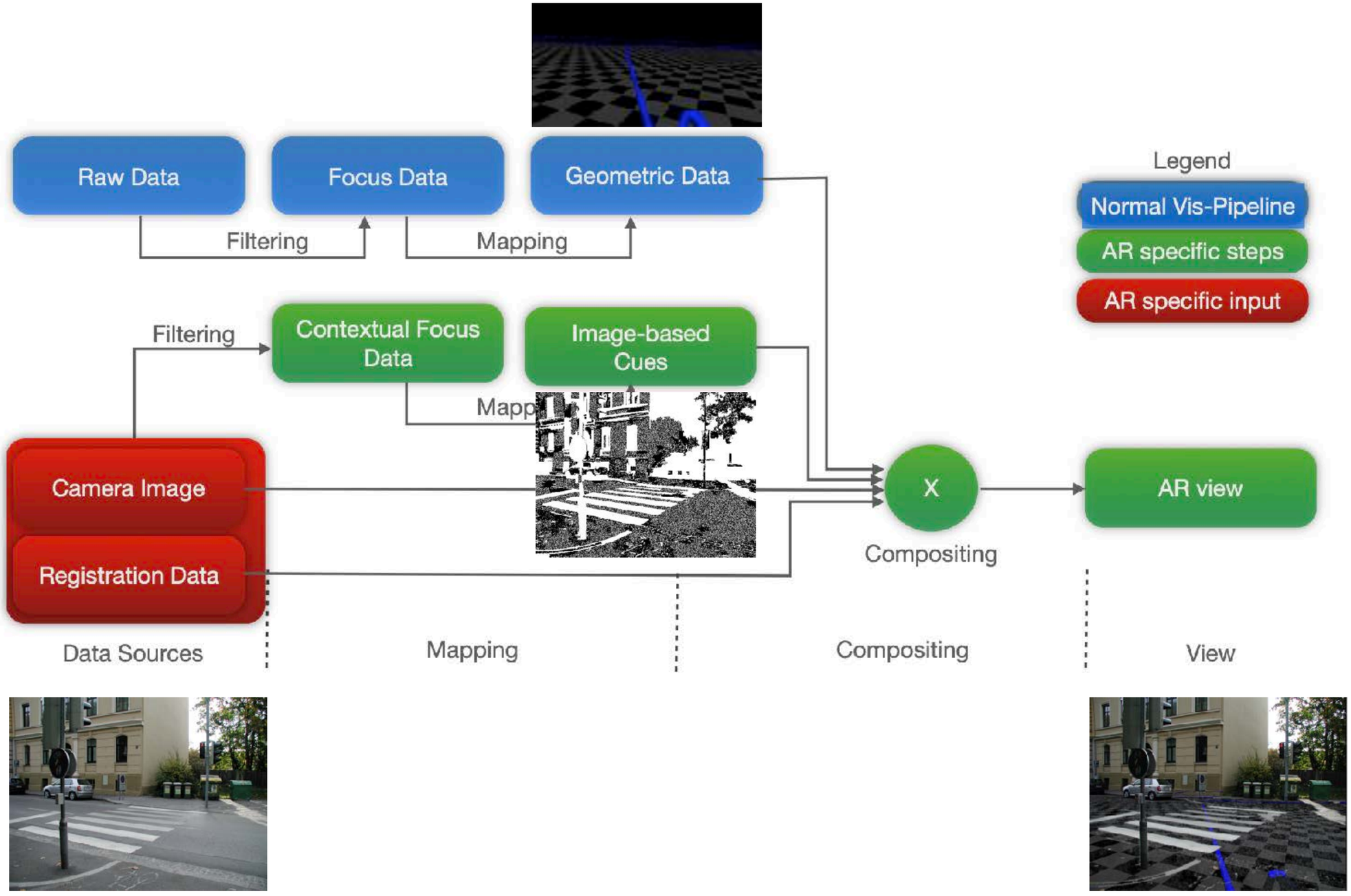

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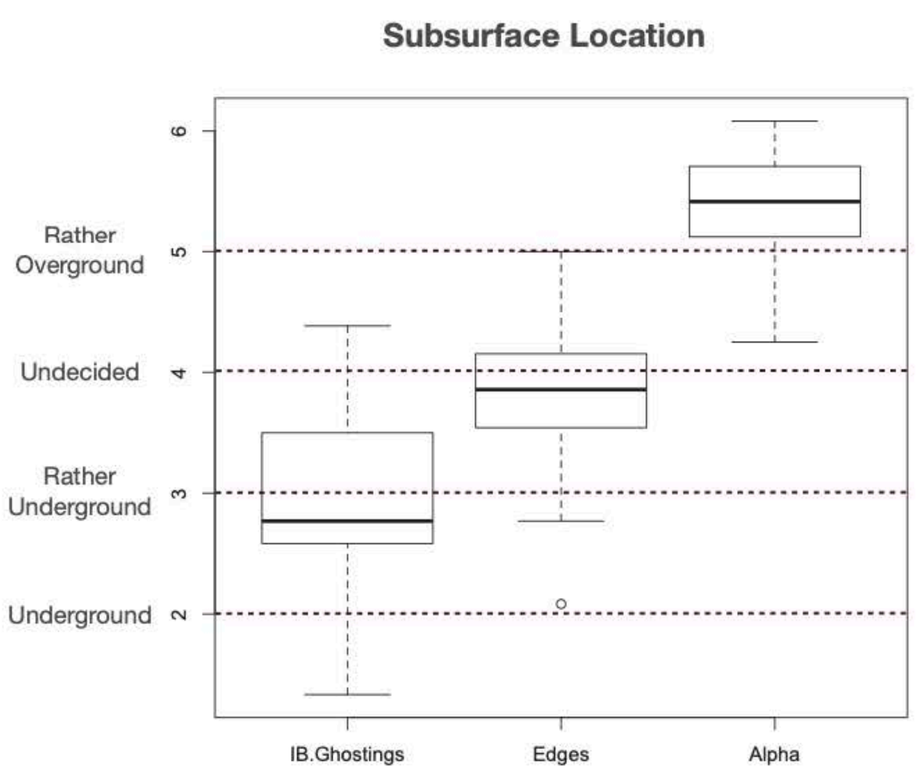
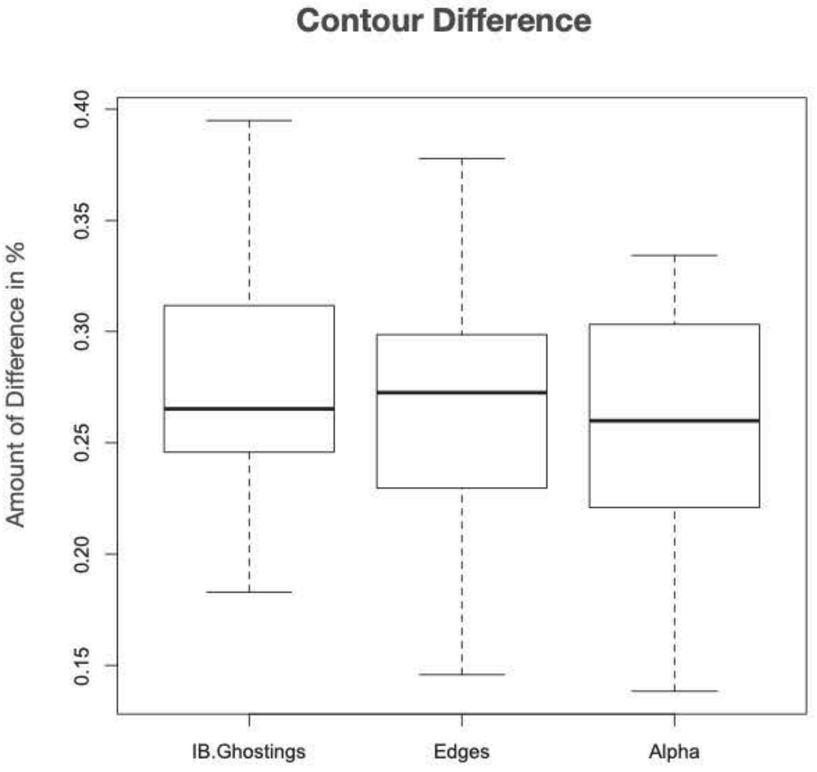
User Experience





Zollmann, Stefanie, Raphael Grasset, Gerhard Reitmayr, and Tobias Langlotz. "Image-based X-ray visualization techniques for spatial understanding in Outdoor Augmented Reality." OZChi. 2014

Challenges

Depth Understanding

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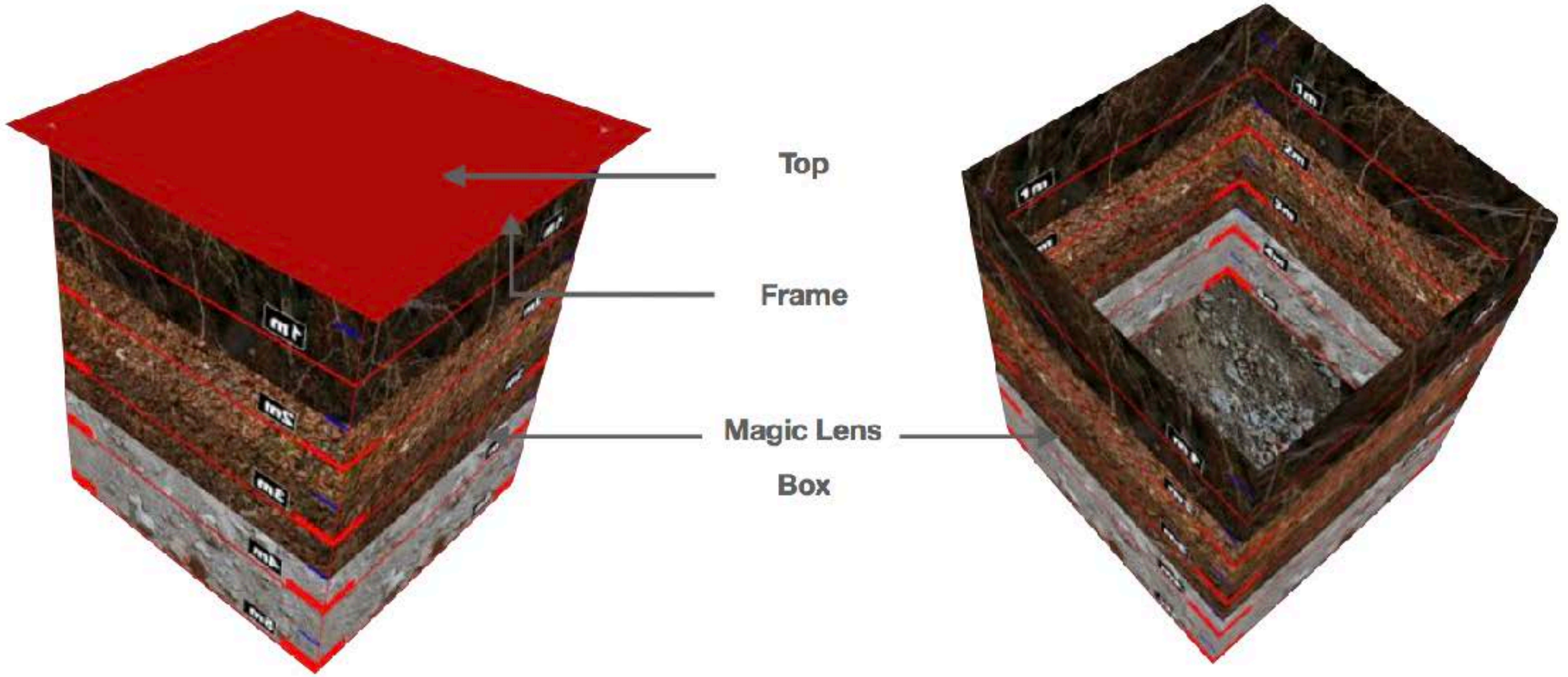
At which depth?

S. Zollmann, G. Schall, S. Junghanns, and G. Reitmayr, "*Comprehensible and Interactive Visualizations of GIS Data in Augmented Reality,*" Adv. Vis. Comput. 2012.



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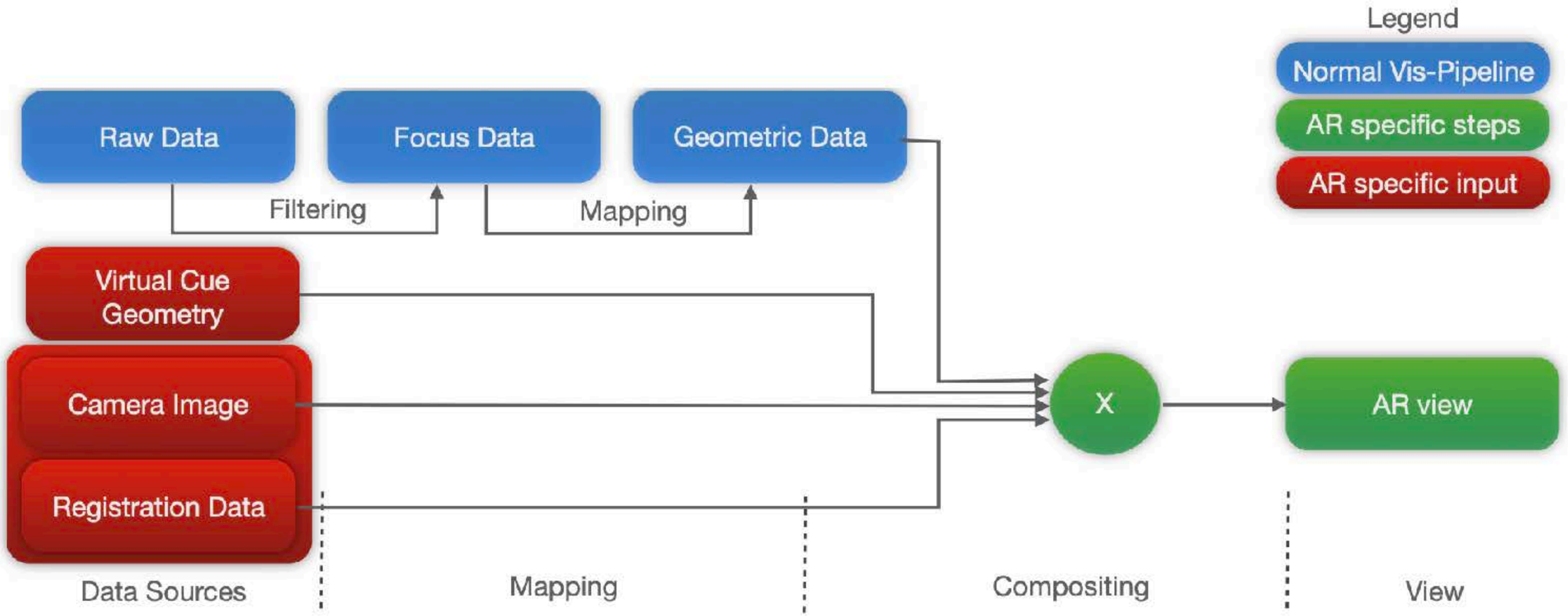

S. Zollmann, T. Langlotz, R. Grasset, WH. Lo, S. Mori, H. Regenbrecht, *Visualization Techniques in Augmented Reality: A Taxonomy, Methods and Patterns*, TVCG, 2020

Challenges

Information Clutter

P. Skinner, J. Ventura and S. Zollmann, "*Indirect Augmented Reality Browser for GIS Data*," 2018 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)

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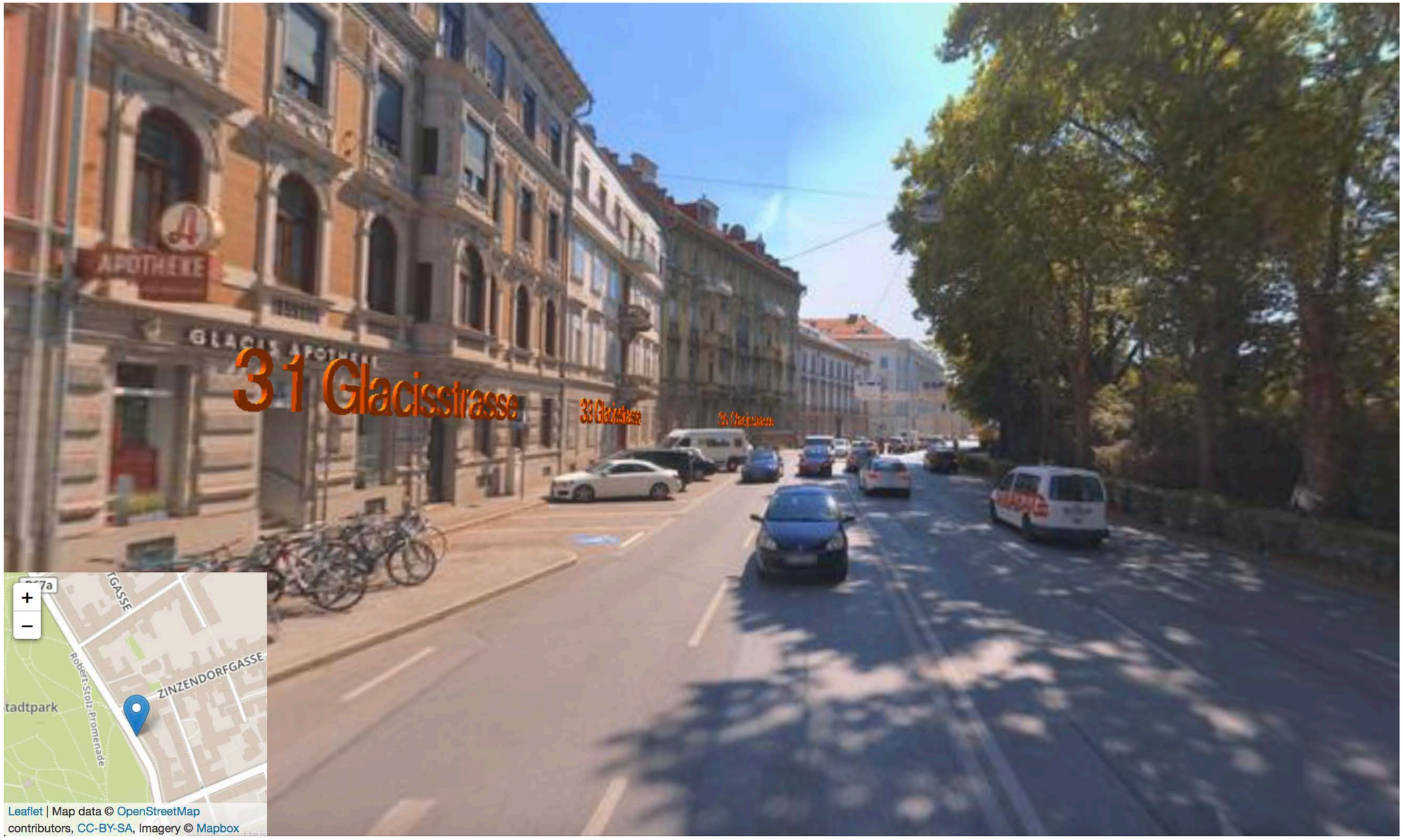

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Clicked buildingstrueAt device location
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estimated altitude 16.5011
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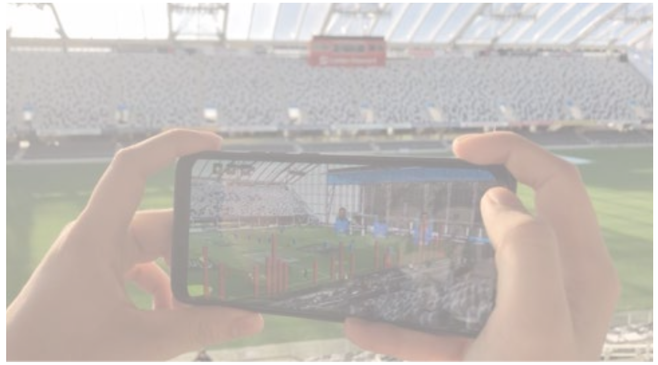
Union Street116

AR Visualization

Visualization, Computer Vision, HCI

VR Videography

Computer Vision, AI, Graphics

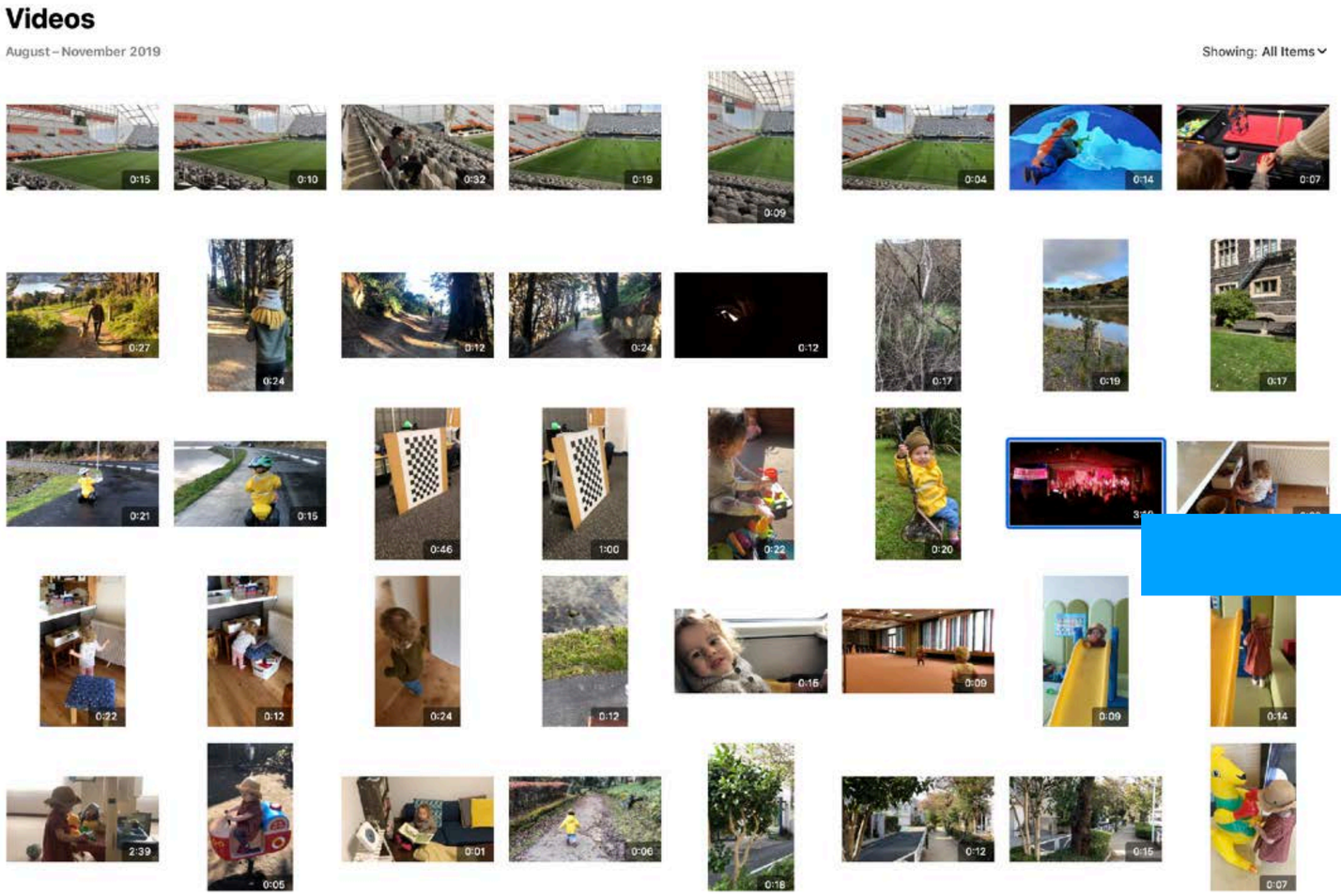


Augmented Reality for Sports

Computer Vision, Visualization, HCI, AI

Examples Visual Computing for XR

VR Videography: Motivation



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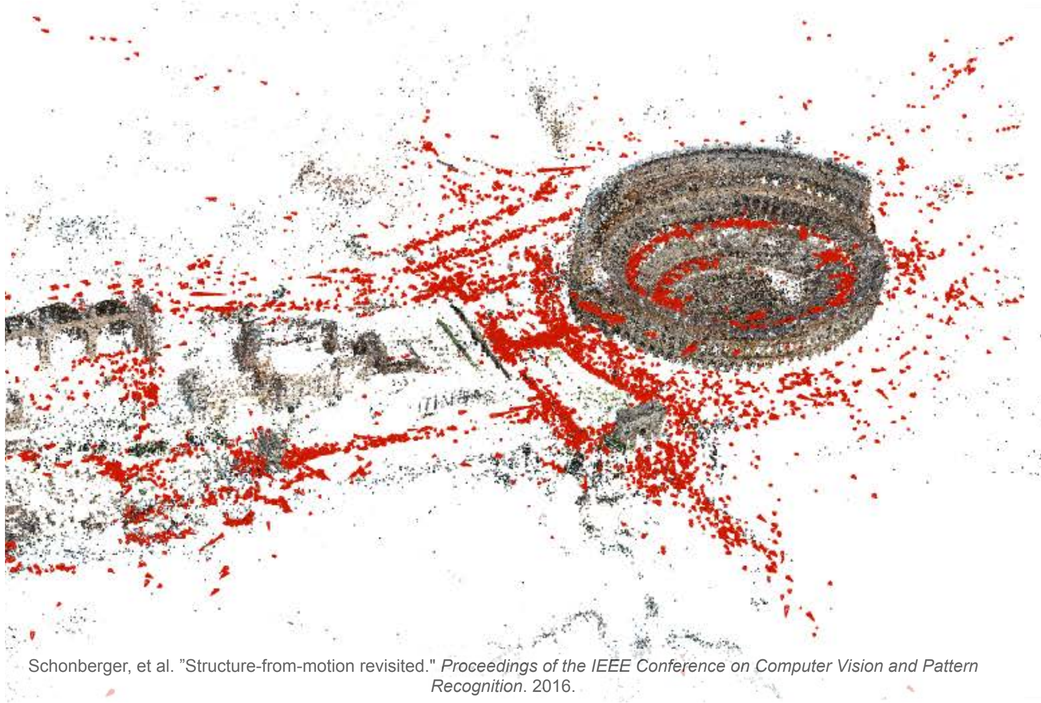
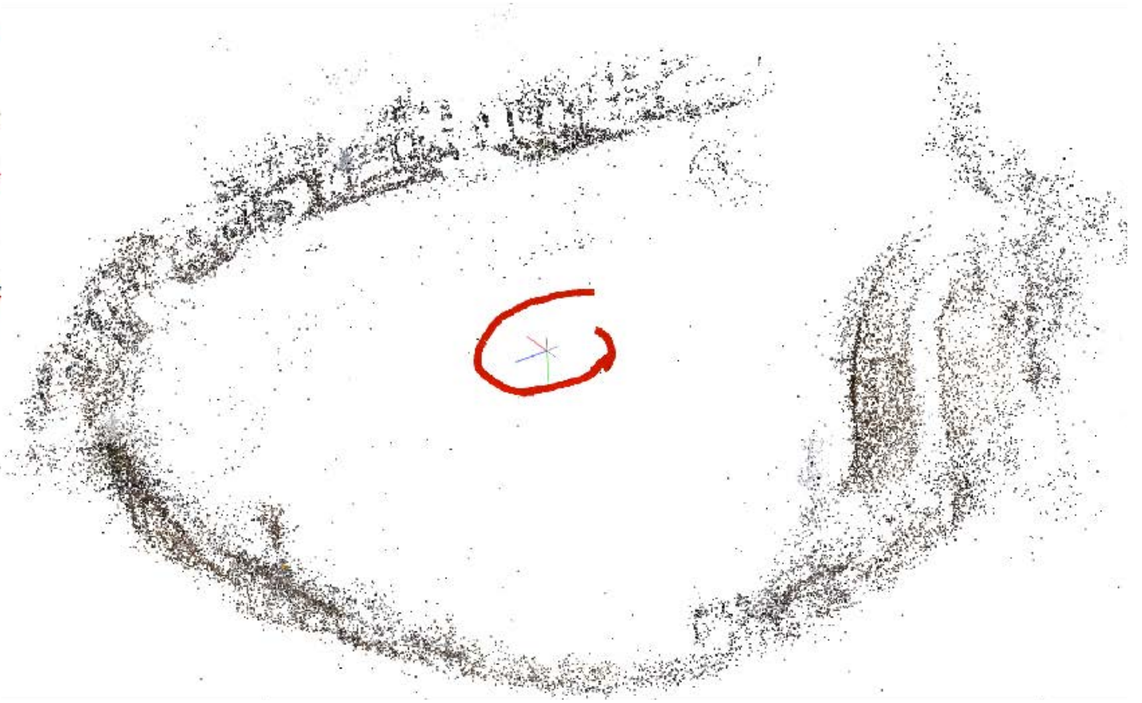
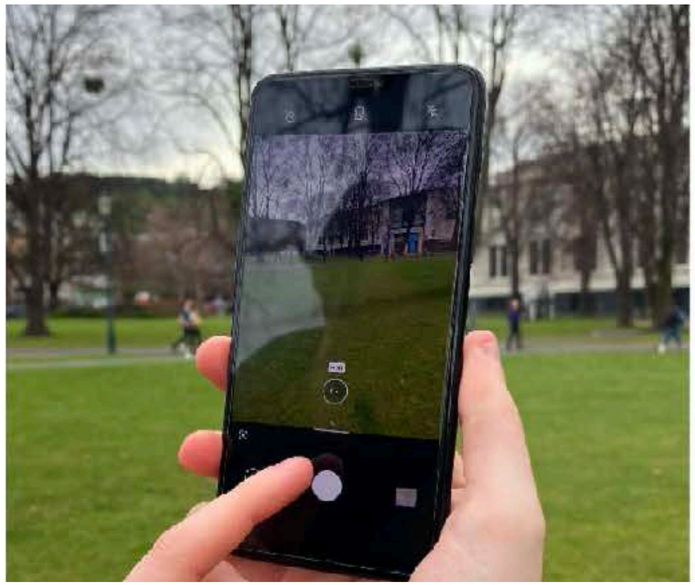
VR Videography: Challenges

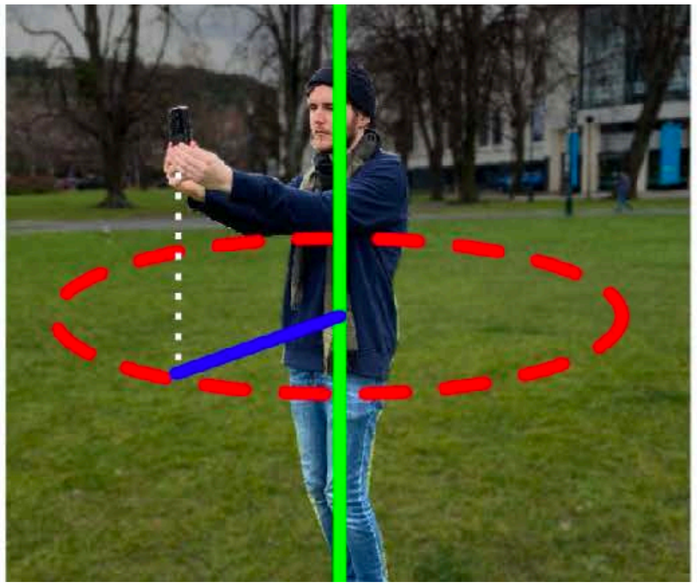


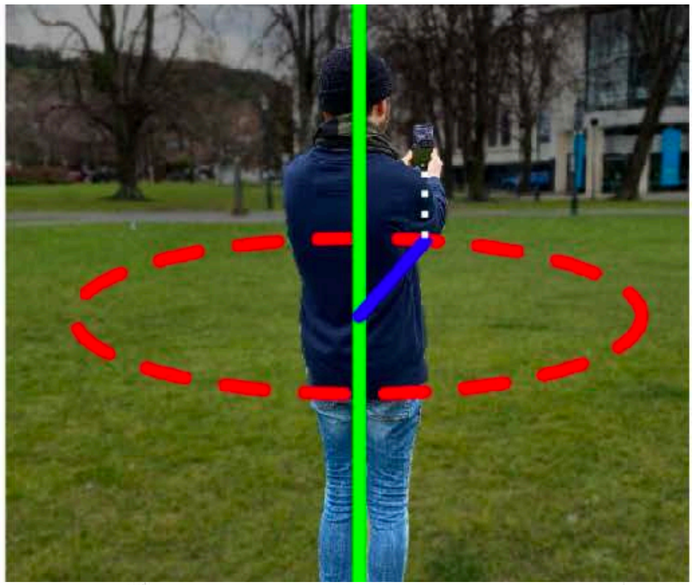
Schonberger, et al. ”Structure-from-motion revisited." *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*. 2016.

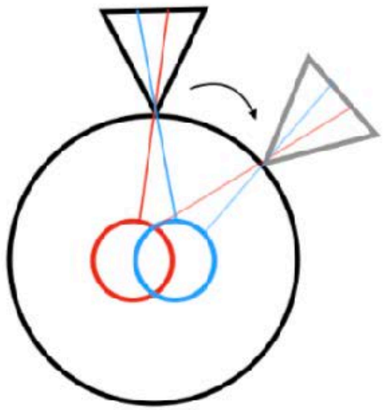


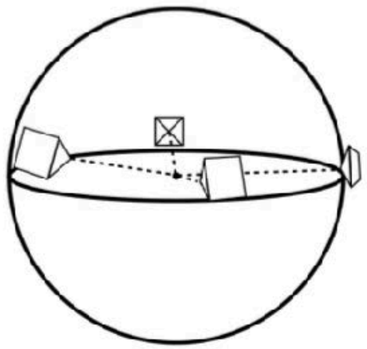
Spherical Structure-from-Motion





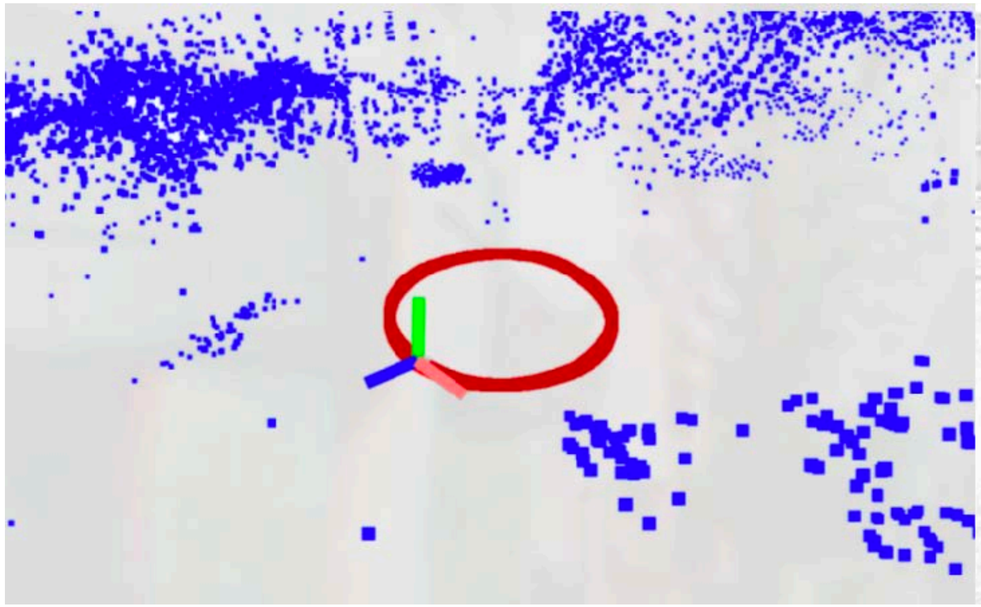


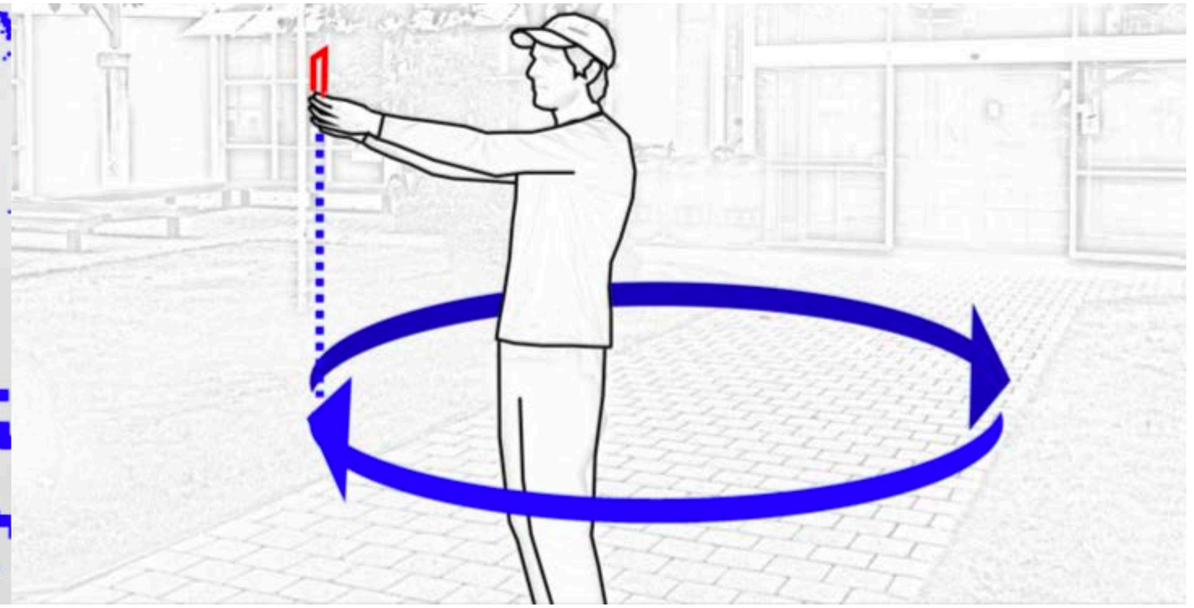


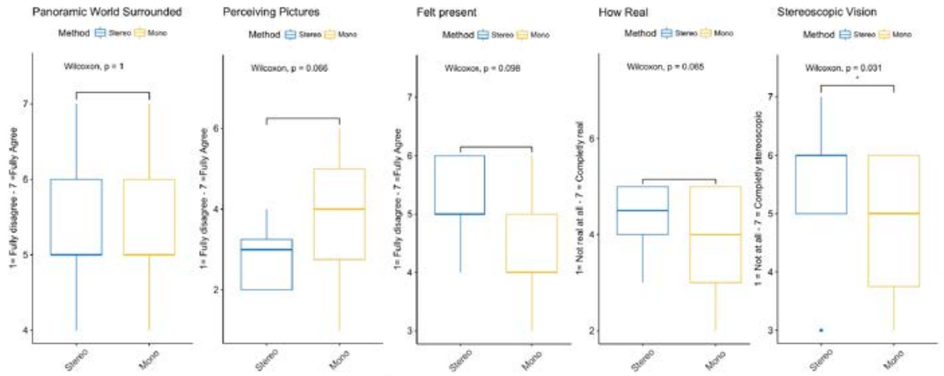


Baker, L., Mills, S., Zollmann, S., & Ventura, J. (2020, March). CasualStereo: Casual Capture of Stereo Panoramas with Spherical Structure-from-Motion. In 2020 IEEE Conference on Virtual Reality and 3D User Interfaces (VR) (pp. 782-790). IEEE.

CasualStereo: Casual Capture of Stereo Panoramas







Method	Images	Time	Hardware
Megastereo [30]	100 - 300	2-3 hours	Single camera
Jump [2]	16	231 s	16-camera rig
Schroers et al. [32]	16	20 min.	16-camera rig
Instant3D [15]	20 - 200	35 s	Stereo camera
Ours	200 - 700	3 - 10 min.	Single camera

Baker, L., Mills, S., Zollmann, S., & Ventura, J. (2020, March). CasualStereo: Casual Capture of Stereo Panoramas with Spherical Structure-from-Motion. In 2020 IEEE Conference on Virtual Reality and 3D User Interfaces (VR) (pp. 782-790). IEEE.

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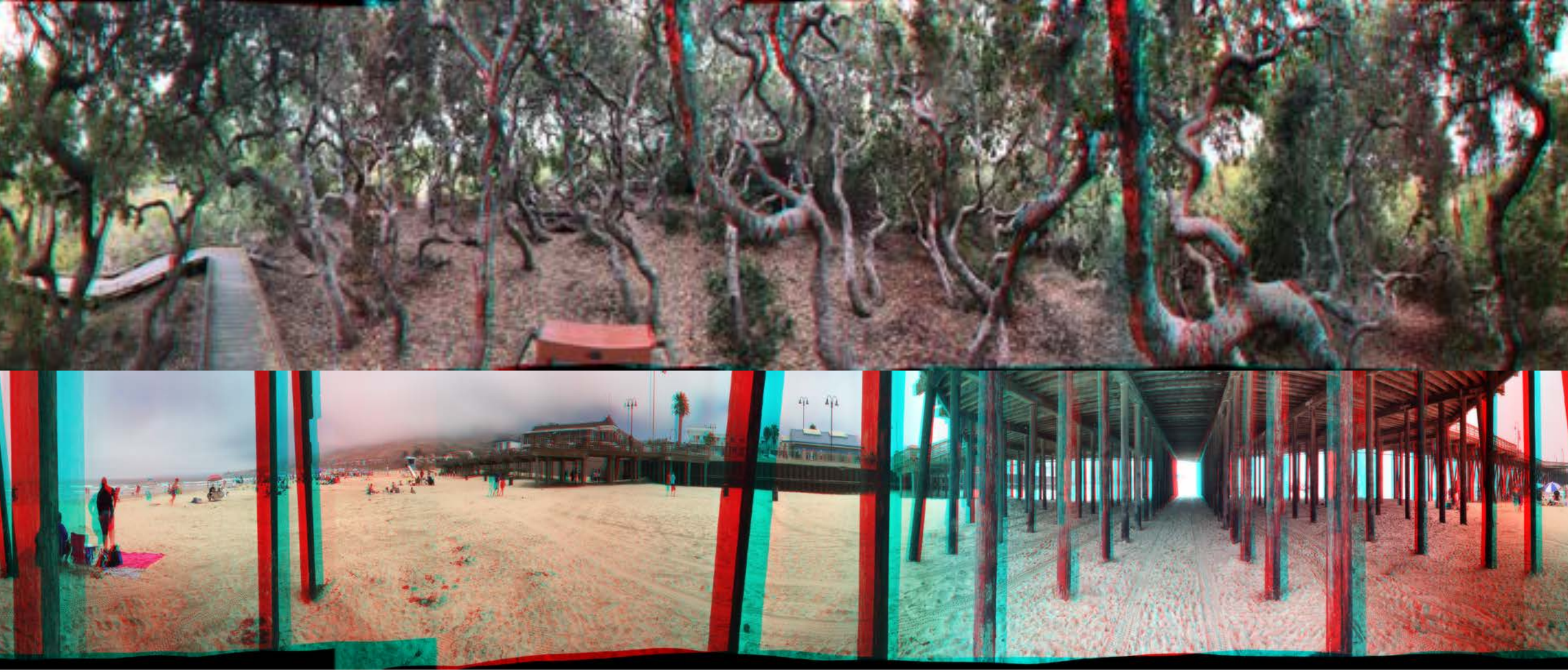

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CasualStereo: Casual Capture of Stereo Panoramas

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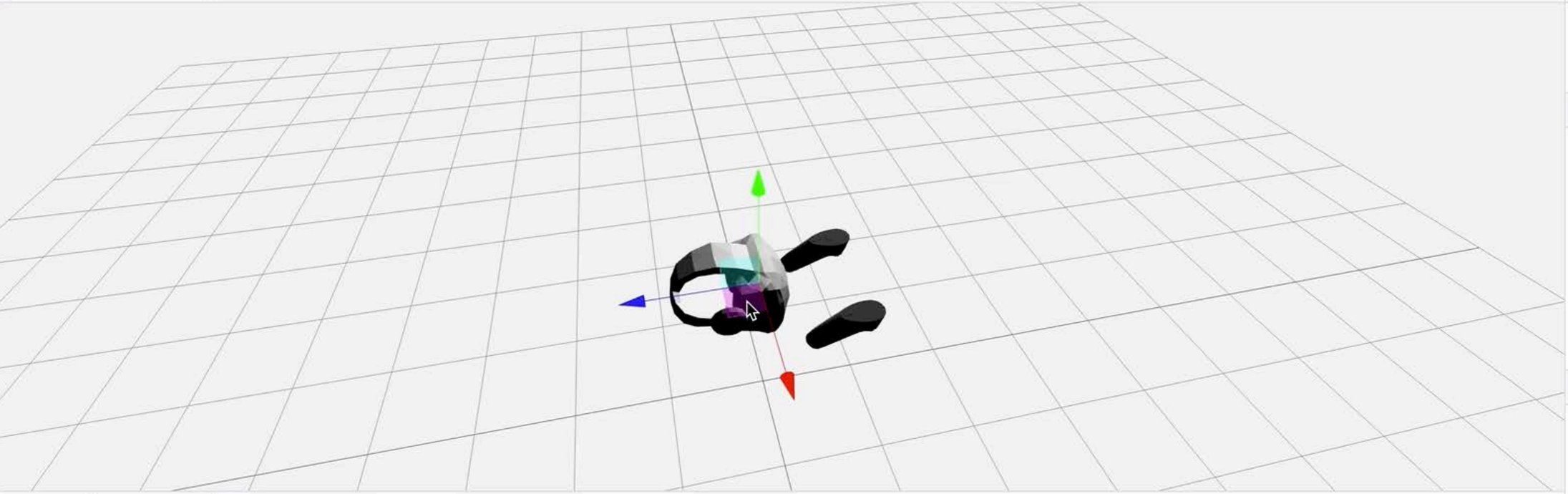
T·k·max
INPUT VIDEO

Elements Console Sources Network Performance Memory Application Security Audits WebVR Three.js Inspector HTML validator WebXR WebGL Insight 1

Oculus Quest

Stereo effect



Headset

position: 0.04 1.60 0.04

rotation: 0.00 0.00 0.00

Right controller

position: 0.50 1.50 -1.00

rotation: 0.00 0.00 0.00

select button

squeeze button

Left controller

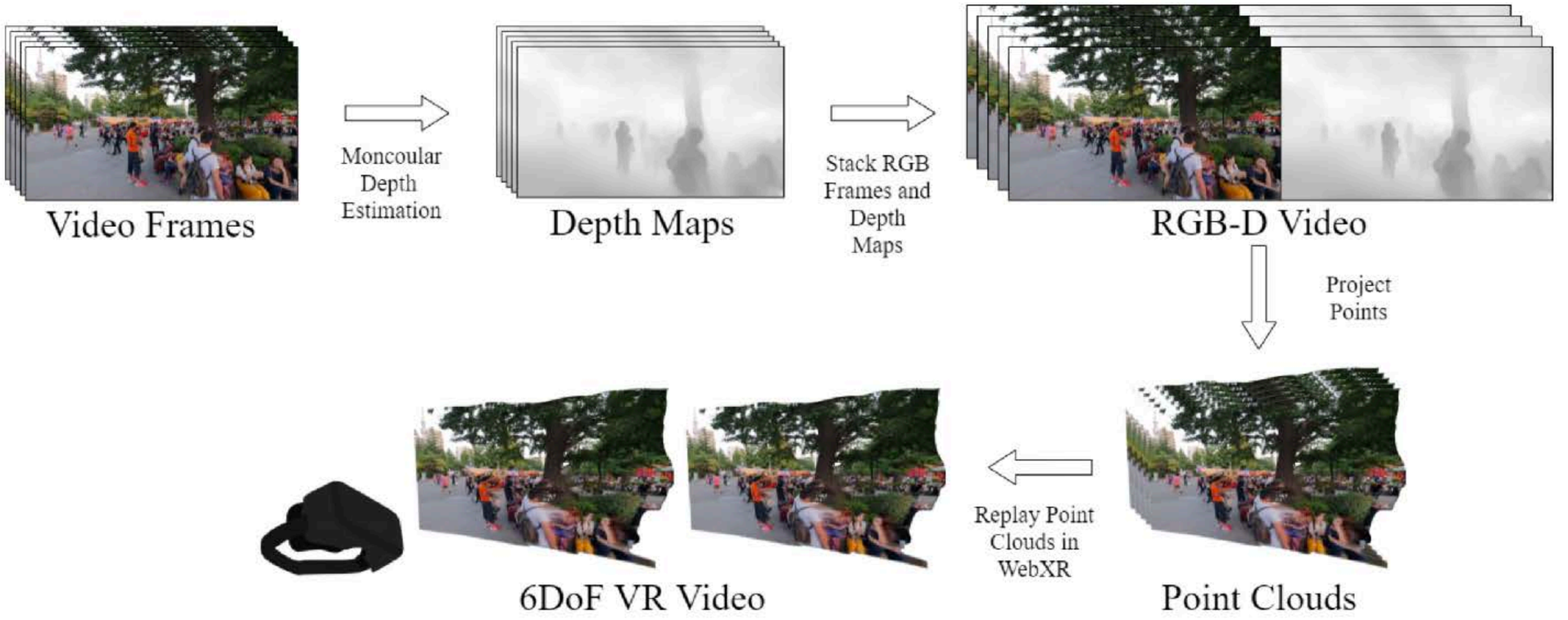
position: -0.50 1.50 -1.00

rotation: 0.00 0.00 0.00

select button

Reset pose Exit immersive

Monocular Depth Estimation



Monocular Depth Estimation

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University of South Australia

Visual Computing for eXtended Reality (XR)

Stefanie Zollmann

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
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