

# Supplementary Document: 360° Optical Flow using Tangent Images

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## 1 Padding Size

The padding size is how much expand on the gnomonic projection coordinate system. When the padding size is 0.1, shown in **Figure 1**, the tangent area is expended from 1.0 to 1.1 ( $1.0 + padding\_size$ ). The tangent image padding extends the field of view (see Section 3.2 in the main paper), such that there is more overlap between the source and target images to find better correspondences and improve optical flow consistency. However, increased padding size reduces the tangent image angular resolution. As shown in the **Figure 2**, the image's field of view (FoV) increasing with raising padding size. We test padding size from 0.0 to 0.6 and show the result in **Figure 3**. Larger padding sizes reduce the spherical end-point error (SEPE). The SEPE plateaus at a padding of around 0.5, which optimally trades off angular resolution and padding size.

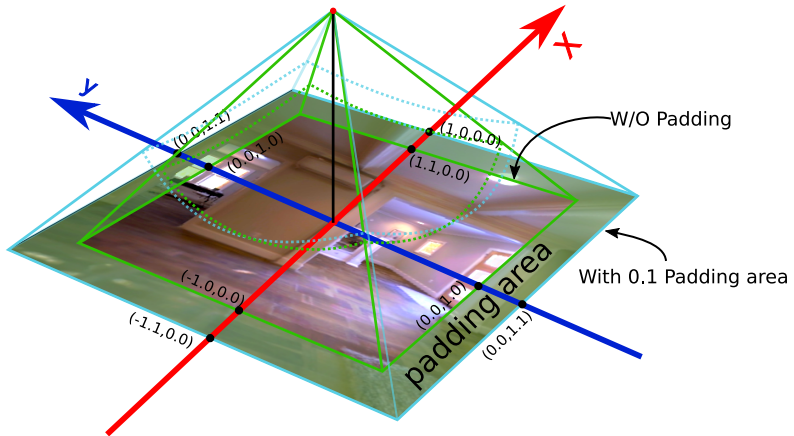


Figure 1: The tangent image padding.

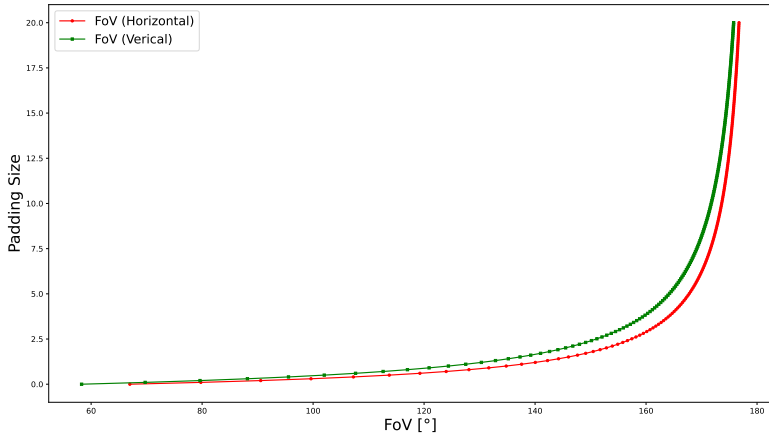


Figure 2: The relationship between tangent image FoV and padding size. The red and green curves are the tangent image horizontal and vertical FoV, respectively.

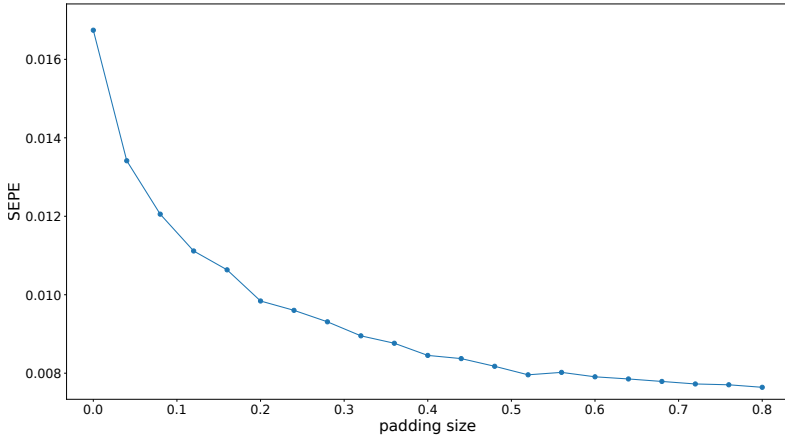


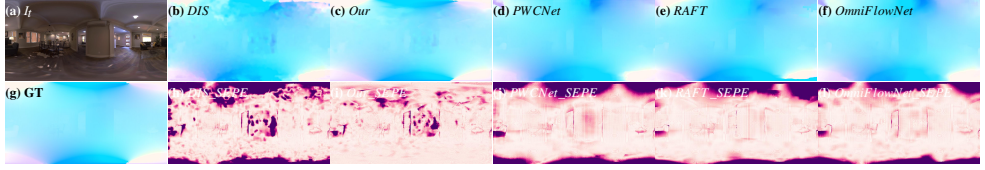
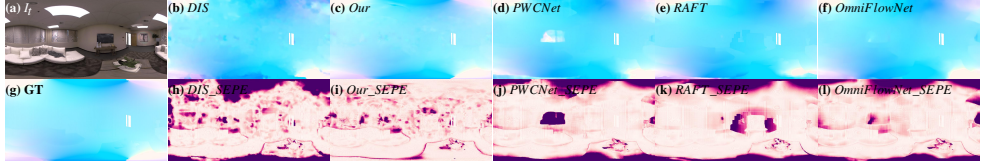
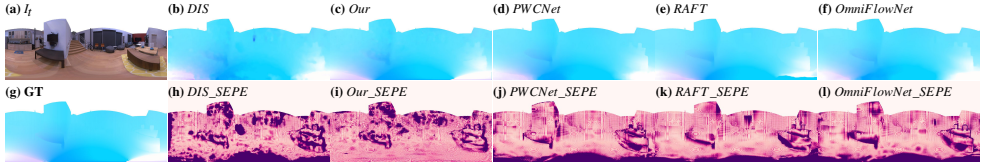
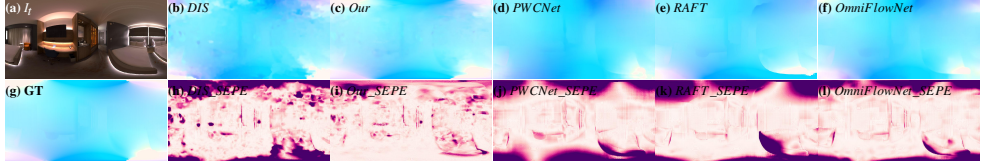
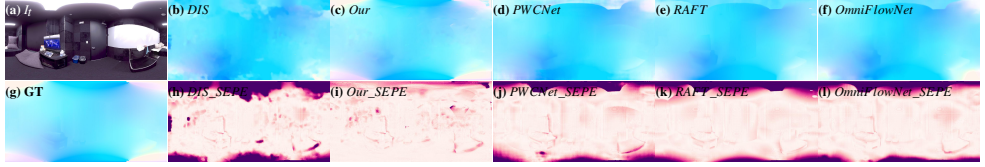
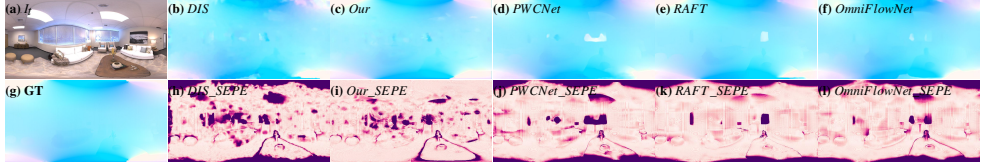
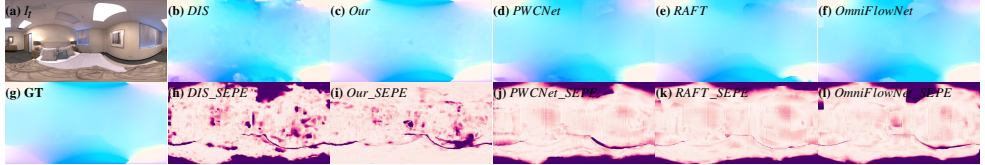
Figure 3: The spherical end-point error (SEPE) for a range of padding sizes.

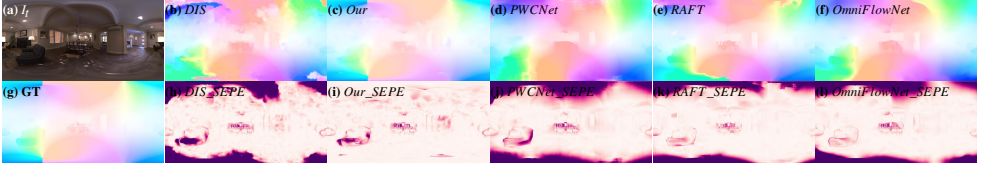
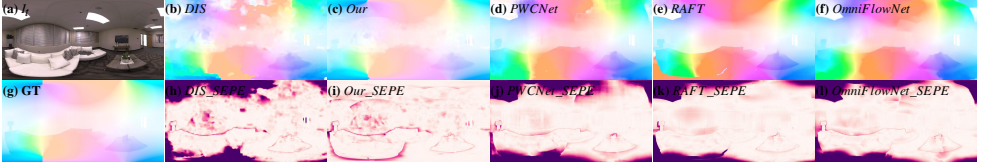
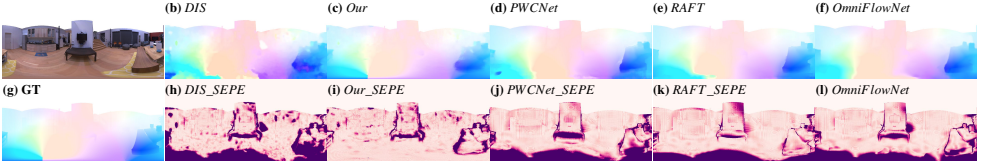
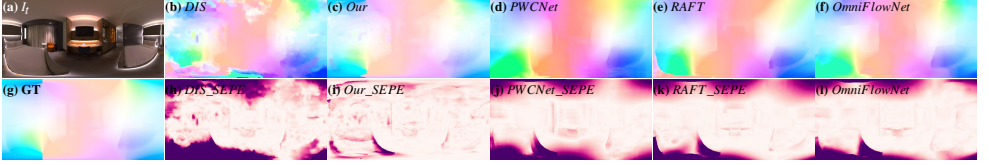
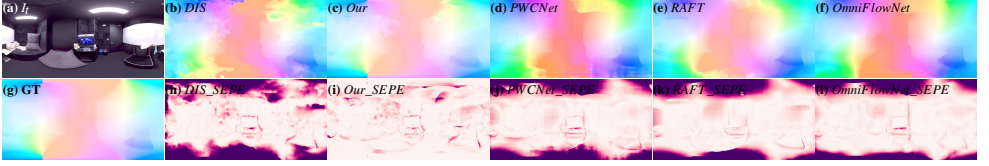
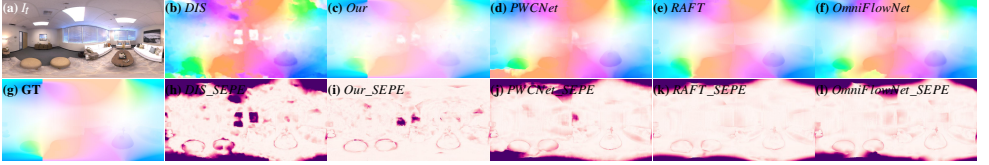
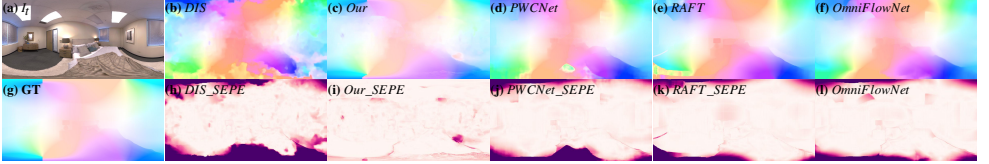
## 2 Additional Results

Here we show additional results for quantitative and qualitative evaluation.

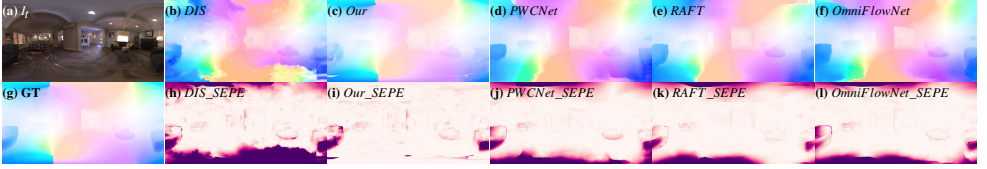
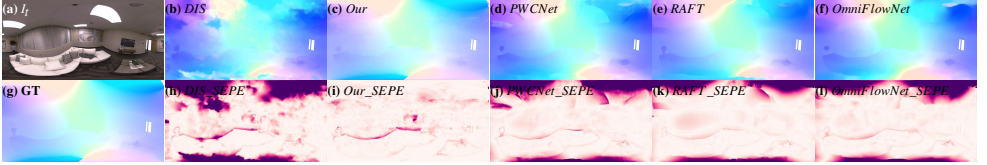
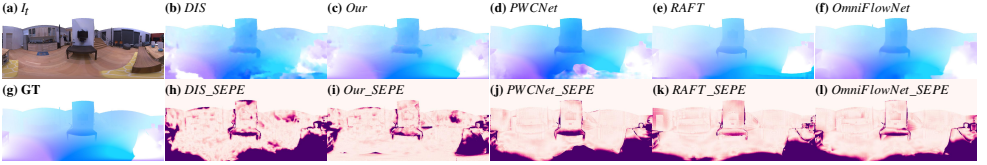
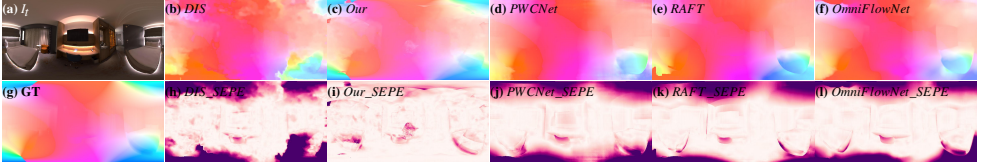
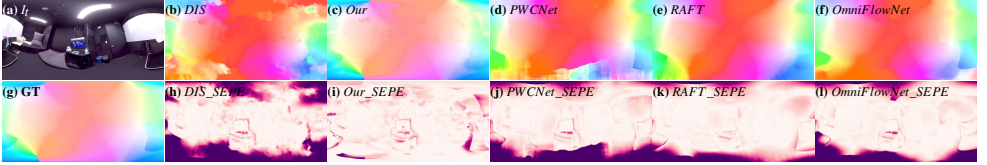
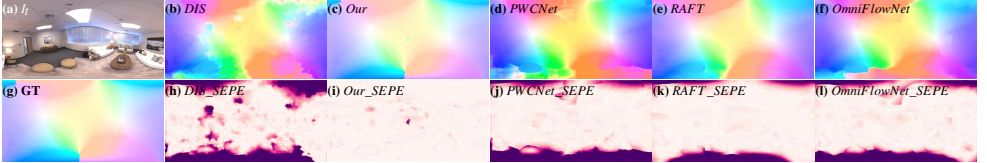
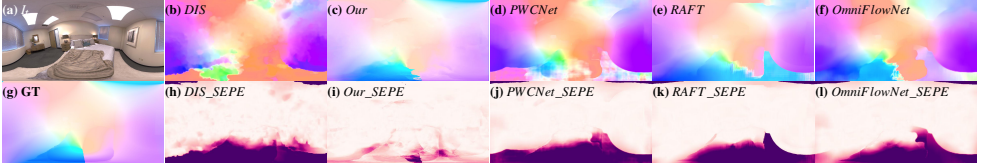
**Quantitative Evaluation.** Figure 4, Figure 5 and Figure 6 show additional results and comparisons on the Replica 360° dataset, for circular, linear and random camera motions, respectively. Our method’s SEPE heatmaps show consistently smaller errors near the poles (top and bottom image edges).

**Qualitative Evaluation.** In Figure 7, we show additional interpolation error heatmaps on the OmniPhotos dataset [14]. They visualize the interpolation error [14], i.e. the RGB colour difference between the source image and backward-warped target image.

*Circle:apartment\_0**Circle:apartment\_1**Circle:fri\_apartment\_0**Circle:hotel\_0**Circle:office\_1**Circle:room\_0**Circle:room\_1*Figure 4: Estimated 360° optical flow and error heatmaps on the Replica 360° dataset (*Circle*).

*Line:apartment\_0**Line:apartment\_1**Line:frl\_apartment\_1**Line:hotel\_0**Line:office\_1**Line:room\_0**Line:room\_1*Figure 5: Estimated 360° optical flow and error heatmaps on the Replica 360° dataset (*Line*).



*Line:apartment\_0**Line:apartment\_1**Line:fri\_apartment\_1**Line:hotel\_0**Line:office\_1**Line:room\_0**Line:room\_1*Figure 6: Estimated 360° optical flow and error heatmaps on the Replica 360° dataset (*Line*).

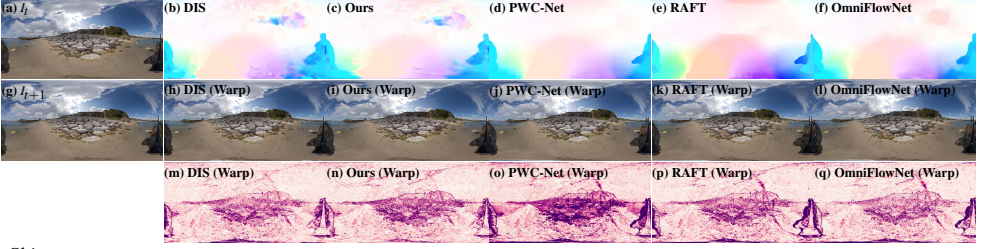
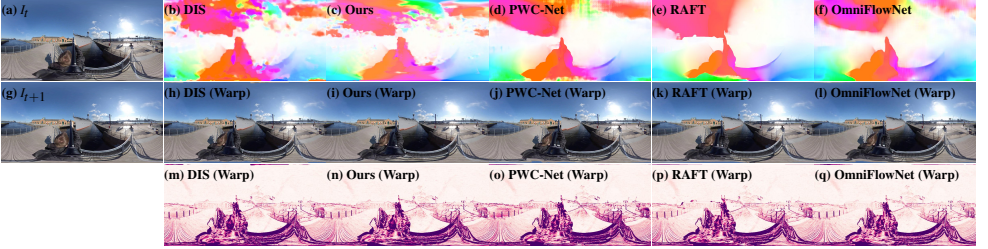
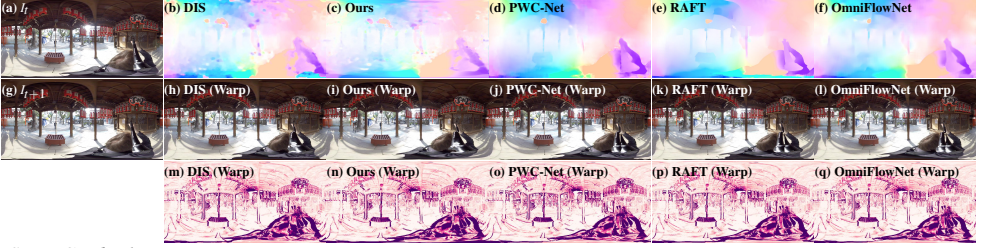
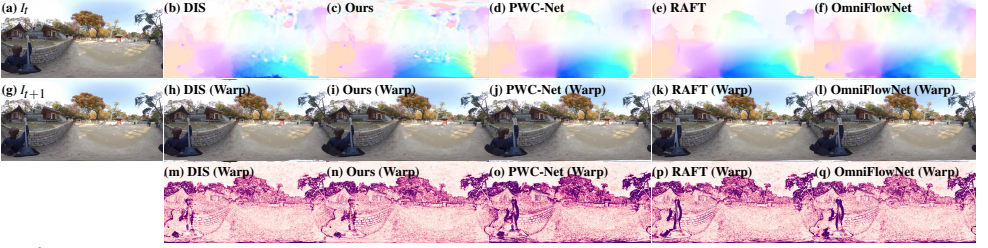
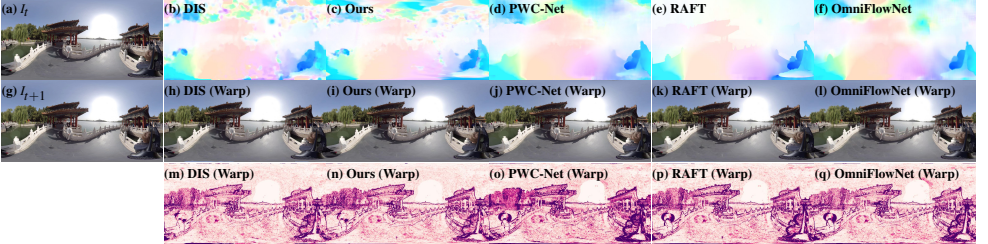
*Ballintov**Ship**Temple3**SecretGarden1**Wulongting*

Figure 7: Backward warping results on several OmniPhotos datasets.

## References

- [1] Simon Baker, Daniel Scharstein, J. Lewis, Stefan Roth, Michael Black, and Richard Szeliski. A database and evaluation methodology for optical flow. *IJCV*, 92(1):1–31, 2011. doi:[10.1007/s11263-010-0390-2](https://doi.org/10.1007/s11263-010-0390-2).
- [2] Tobias Bertel, Mingze Yuan, Reuben Lindroos, and Christian Richardt. OmniPhotos: Casual 360° VR photography. *ACM Trans. Graph.*, 39(6):267:1–12, 2020. doi:[10.1145/3414685.3417770](https://doi.org/10.1145/3414685.3417770).