# Supplementary Materials - UASNet: Uncertainty Adaptive Sampling Network for Deep Stereo Matching

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This supplemental material provides additional qualitative results, which are not covered in the submission due to the page limit.

## 1. Visualization of Probability Distribution

As shown in Figure 1, the probability distribution along the disparity dimension of each pixel is different. For pixels in texture-less or repeated texture area (subfigures (a)(c)), there are more than one sampling point of a high probability, thus the distribution tends to have several local peaks at the whole disparity range [2][3]. For pixels in occluded area (subfigure (b)), most sampling points have similar probabilities because they have no matching pixels, thus the distribution tends to be flat. For textured region (subfigure (d)), the distribution is sharp, owing to the sampling point corresponding to true disparity has the greatest probability.

A cascade cost volume method [1] proposes a design that leverages the variance of the probability distribution to narrow per-pixel disparity range. As shown in figure 2, six different distributions generate the same variance, whereas the offsets between the predicted (green line) and true disparity (red line) are not the same. Therefore, one-dimension variance is insufficient to estimate disparity range, especially for complex scene of matching ambiguities. This leads to the predicted range (green area) cannot cover ground truth disparity (red line) for subfigures (a)(d)(e)(f). Therefore, we propose uncertainty distribution-guided range prediction (URP) method to explore the more discriminative uncertainty distribution to handle the complex matching ambiguities.

## 2. Qualitative Evaluation of UDS

With the predicted adaptive range, the other challenge is the design of disparity sampling. We propose uncertainty-based disparity sampler (UDS), which adaptively adjust sampling interval to localize disparity with improved accuracy. To demonstrate the effect of UDS, we visualize the comparison results of uniform sampling and our proposed UDS method in figure 3. The uniform sampling method estimates wrong disparities in areas depicted by yellow boxes, where repeated texture and thin structure lead to large disparity range. In comparison, our UDS method estimates correct disparities based on the dense sampling in high matching certainty range.

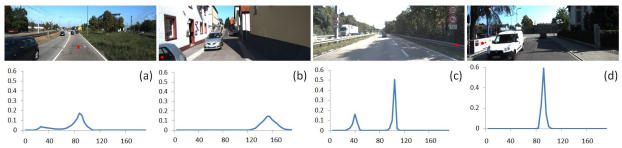


Figure 1. Visualization of single-pixel probability distribution. We show the probability distribution (bottom row) along the disparity dimension of a single pixel in texture-less region (a), occluded region (b), repeated texture region (c) and textured region (d). The red dots in RGB images are the corresponding pixels.

## References

[1] Shuo Cheng, Zexiang Xu, Shilin Zhu, Zhuwen Li, Li Erran Li, Ravi Ramamoorthi, and Hao Su. Deep stereo using adaptive thin volume representation with uncertainty awareness. In *CVPR*, pages 2524–2534, 2020.

[2] Eddy Ilg, Ozgun Cicek, Silvio Galesso, Aaron Klein, Osama Makansi, Frank Hutter, and Thomas Brox. Uncertainty estimates and multi-hypotheses networks for optical flow. In *ECCV*, pages 652–667, 2018.

[3] Sunok Kim, Dongbo Min, Seungryong Kim, and Kwanghoon Sohn. Unified confidence estimation networks for robust stereo matching. *TIP*, 28(3):1299–1313, 2018.

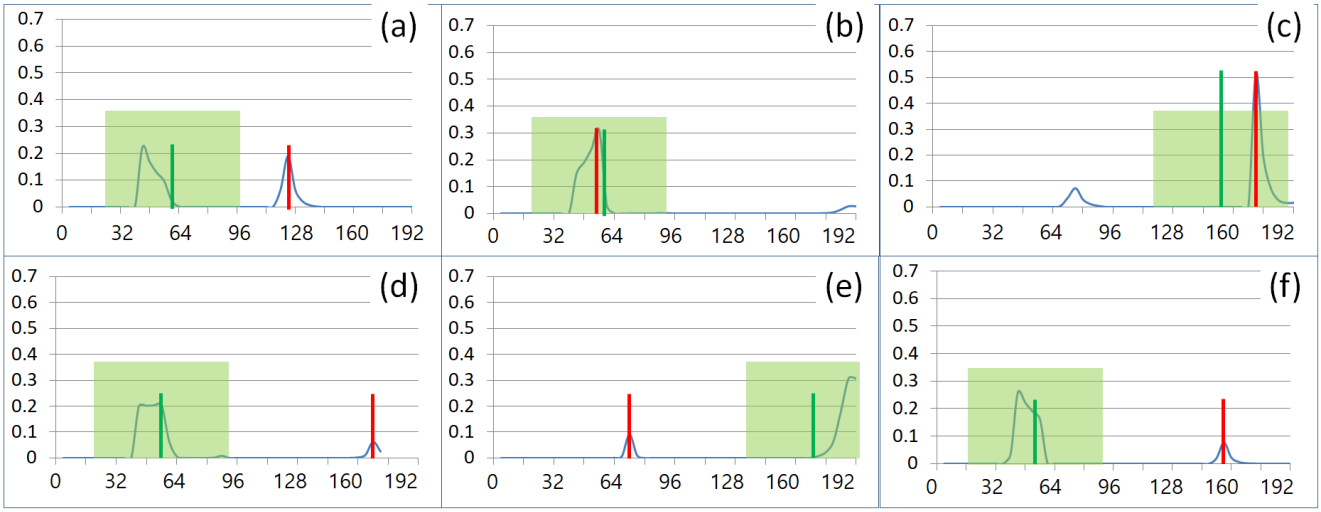


Figure 2. The six different probability distributions correspond to the same variance. The green area, green line and red line represent predicted range by [1], predicted disparity and true disparity, respectively. (a)(d)(e)(f) cannot estimate the disparity range correctly, and (b)(c) predict a larger disparity range than the offset between the true disparity and the predicted disparity.

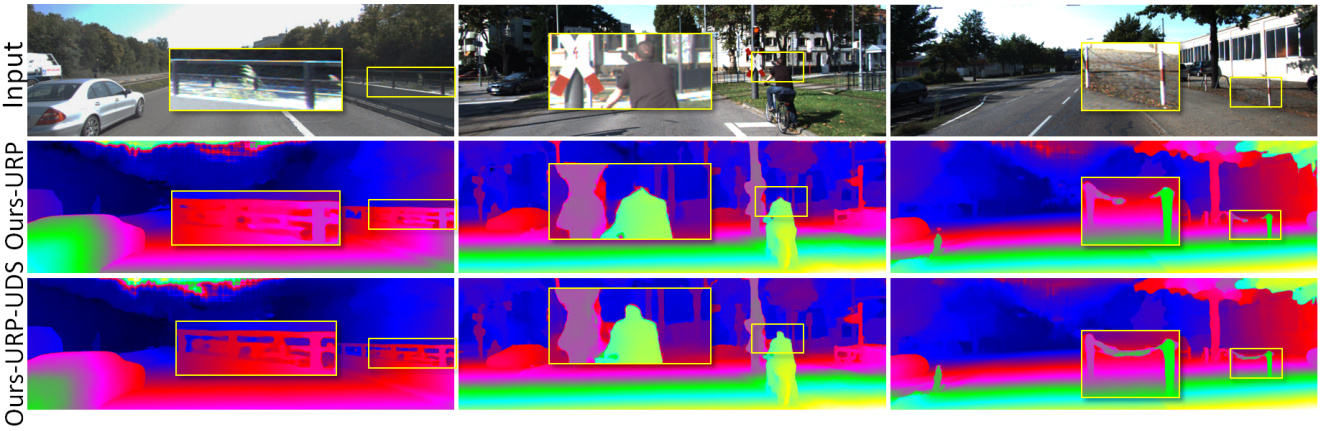


Figure 3. Qualitative comparison results between uniform sampling (Ours-URP) and our proposed uncertainty-based disparity sampling (Ours-URP-UDS) on KITTI 2015 test set. Our proposed UDS can correctly estimate the disparity on thin and long highway barrier and head of cyclist through adaptively adjusting sampling interval to localize disparity with improved accuracy.