Solving Small-piece Jigsaw Puzzles by Maximizing Consensus

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Appendix A: Qualitative Reconstruction Results

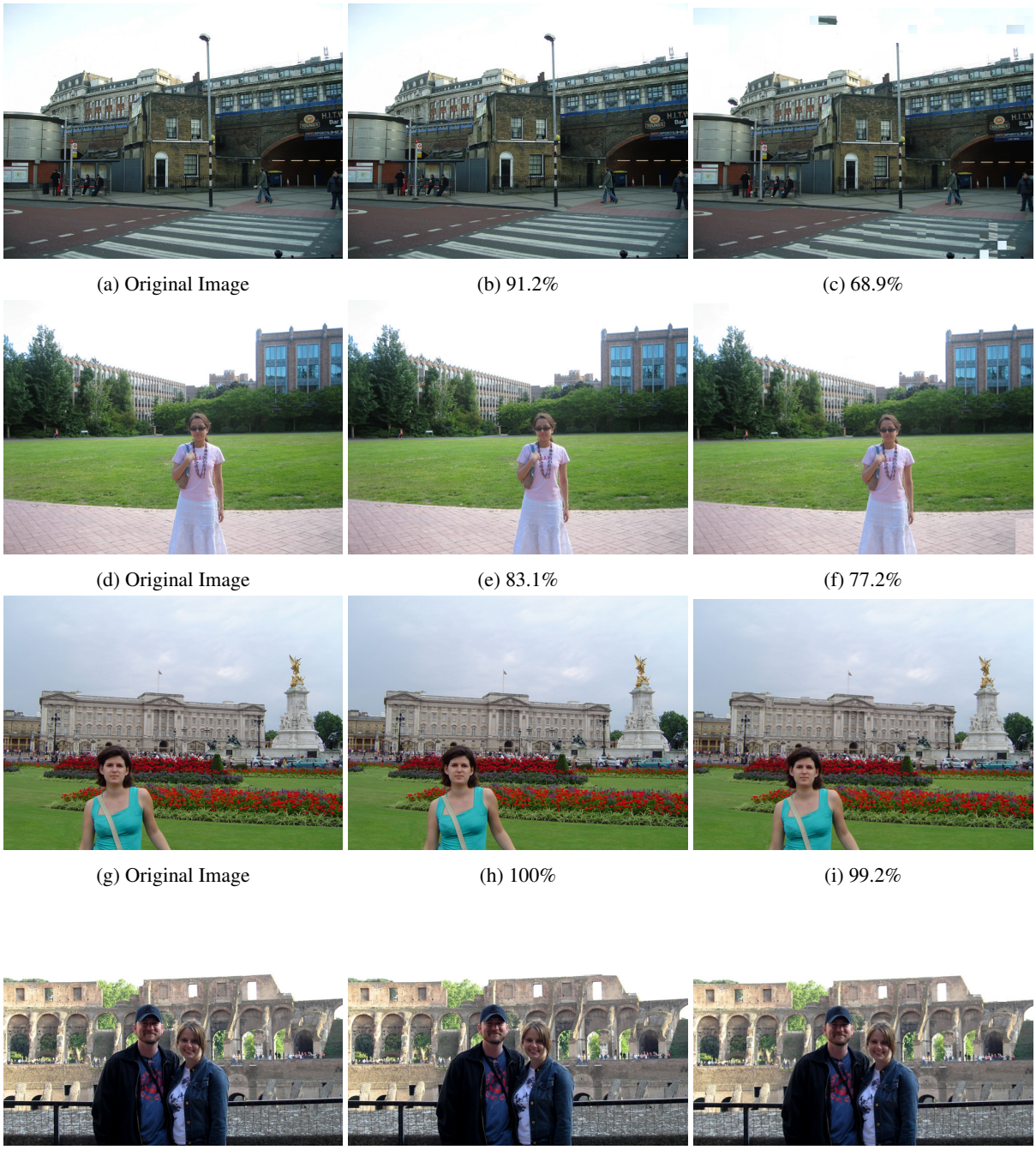
Figure 4 5 6 7 and 8 show qualitative reconstruction results on the challenging unknown orientation piece puzzles from MIT dataset [1]. We varied the number of pieces and the size of each piece for the experiments. When the size of the piece is small, previous algorithms [2, 3] drastically drop their reconstruction performance whereas our proposed algorithm keeps the performance. Our proposed algorithm reduces up to 75% error from the previous work [3] on the unknown orientation piece puzzles (P=14, K=1064).

References

[1] T. S. Cho, S. Avidan, and W. T. Freeman. A probabilistic image jigsaw puzzle solver. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2010. 2, 4, 5, 6, 7, 8, 9

[2] A. C. Gallagher. Jigsaw puzzles with pieces of unknown orientation. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2012. 2, 3, 5, 6, 7, 8, 9

[3] K. Son, J. Hays, and D. Cooper. Solving square jigsaw puzzles with loop constraints. In *Computer Vision ECCV 2014*, Lecture Notes in Computer Science. Springer International Publishing, 2014. 2, 5, 6, 7, 8, 9



(a) Original Image (b) 91.2% (c) 68.9%

(d) Original Image (e) 83.1% (f) 77.2%

(g) Original Image (h) 100% (i) 99.2%

(j) Original Image (k) 66.0% (l) 66.1%

Figure 1: **Reconstructions of challenging unknown orientation piece puzzles from MIT dataset [1].** Left: original image, Middle: our reconstruction results on puzzles where the number pieces is 432 and the size of each piece is 28 by 28 pixels, Right: our reconstruction results on puzzles where the number pieces is 1064 and the size of each piece is 14 by 14 pixels. The performance(%) is Direct Comparison. Although the piece size is reduced and the number of pieces are increased, our algorithm keeps the performance whereas the previous works [2, 3] drop their performance drastically. We reduce up to 75% of reconstruction error from previously the best results [3] when the size of each piece is 14 by 14 pixels and number of pieces is 1064.

(a) Original Image (b) 99.5% (c) 100%

(d) Original Image (e) 100% (f) 66.9%

(g) Original Image (h) 100% (i) 76.2%

(j) Original Image (k) 100% (l) 100%

Figure 2: **Reconstructions of challenging unknown orientation piece puzzles from MIT dataset [1].** Left: original image, Middle: our reconstruction results on puzzles where the number pieces is 432 and the size of each piece is 28 by 28 pixels, Right: our reconstruction results on puzzles where the number pieces is 1064 and the size of each piece is 14 by 14 pixels. The performance(%) is Direct Comparison. Although the piece size is reduced and the number of pieces are increased, our algorithm keeps the performance whereas the previous works [2, 3] drop their performance drastically. We reduce up to 75% of reconstruction error from previously the best results [3] when the size of each piece is 14 by 14 pixels and number of pieces is 1064.

(a) Original Image (b) 98.8% (c) 95.1%

(d) Original Image (e) 100% (f) 100%

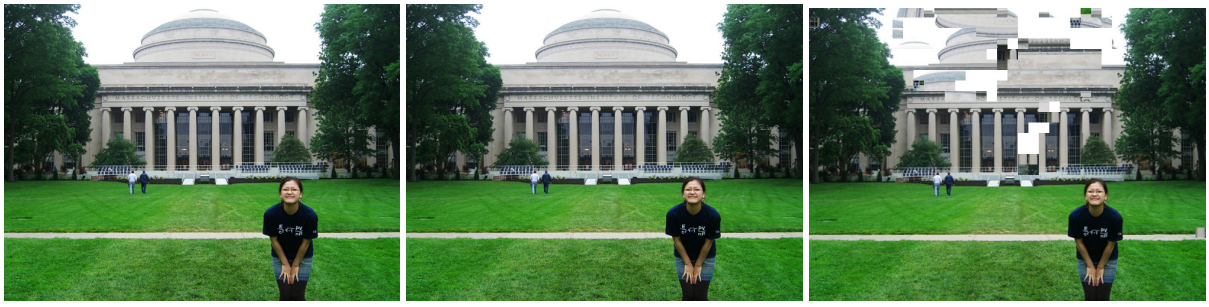
(g) Original Image (h) 100% (i) 99.4%

(j) Original Image (k) 94.4% (l) 100%

Figure 3: **Reconstructions of challenging unknown orientation piece puzzles from MIT dataset [1].** Left: original image, Middle: our reconstruction results on puzzles where the number pieces is 432 and the size of each piece is 28 by 28 pixels, Right: our reconstruction results on puzzles where the number pieces is 1064 and the size of each piece is 14 by 14 pixels. The performance(%) is Direct Comparison. Although the piece size is reduced and the number of pieces are increased, our algorithm keeps the performance whereas the previous works [2, 3] drop their performance drastically. We reduce up to 75% of reconstruction error from previously the best results [3] when the size of each piece is 14 by 14 pixels and number of pieces is 1064.

(a) Original Image (b) 88.9% (c) 85.7%

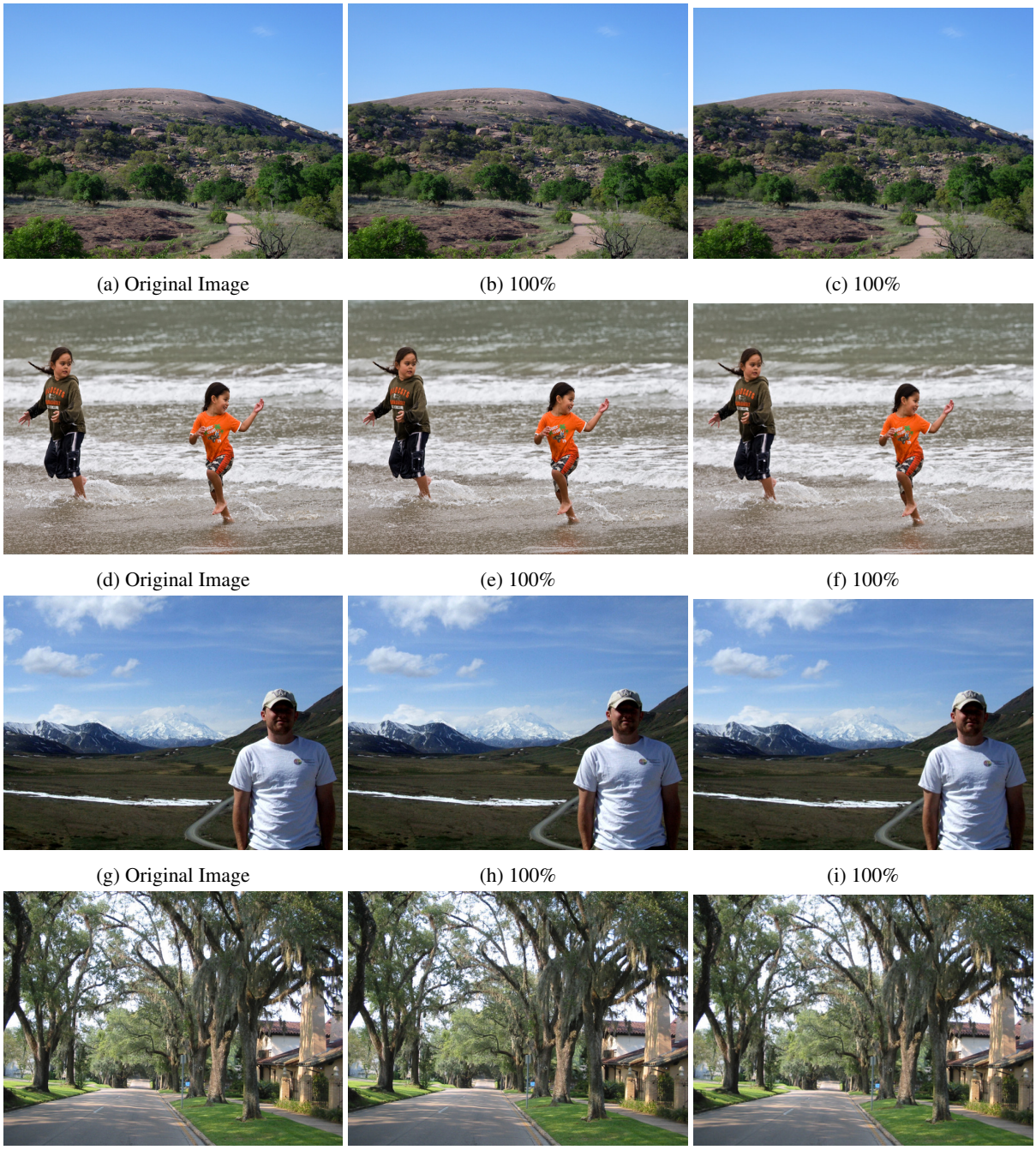
(d) Original Image (e) 100% (f) 100%



(g) Original Image (h) 96.1% (i) 84.0%

(j) Original Image (k) 100% (l) 97.3%

Figure 4: **Reconstructions of challenging unknown orientation piece puzzles from MIT dataset [1].** Left: original image, Middle: our reconstruction results on puzzles where the number pieces is 432 and the size of each piece is 28 by 28 pixels, Right: our reconstruction results on puzzles where the number pieces is 1064 and the size of each piece is 14 by 14 pixels. The performance(%) is Direct Comparison. Although the piece size is reduced and the number of pieces are increased, our algorithm keeps the performance whereas the previous works [2, 3] drop their performance drastically. We reduce up to 75% of reconstruction error from previously the best results [3] when the size of each piece is 14 by 14 pixels and number of pieces is 1064.



(a) Original Image (b) 100% (c) 100%

(d) Original Image (e) 100% (f) 100%

(g) Original Image (h) 100% (i) 100%

(j) Original Image (k) 100% (l) 99.5%

Figure 5: **Reconstructions of challenging unknown orientation piece puzzles from MIT dataset [1].** Left: original image, Middle: our reconstruction results on puzzles where the number pieces is 432 and the size of each piece is 28 by 28 pixels, Right: our reconstruction results on puzzles where the number pieces is 1064 and the size of each piece is 14 by 14 pixels. The performance(%) is Direct Comparison. Although the piece size is reduced and the number of pieces are increased, our algorithm keeps the performance whereas the previous works [2, 3] drop their performance drastically. We reduce up to 75% of reconstruction error from previously the best results [3] when the size of each piece is 14 by 14 pixels and number of pieces is 1064.