Solving Multiple Square Jigsaw Puzzles with Missing Pieces
Supplementary Material - Puzzles With Missing Pieces

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Puzzles of 432 Pieces, where about 5% of the pieces are missing

Figure 1. 10 puzzles out of 20 from the dataset of [5]

	Direct	Neighbor		Direct	Neighbor
Image 1	100%	100%	Image 6	100%	100%
Image 2	100%	100%	Image 7	100%	100%
Image 3	100%	100%	Image 8	100%	100%
Image 4	100%	100%	Image 9	100%	100%
Image 5	100%	100%	Image 10	100%	100%

Puzzles of 432 Pieces, where about 10% of the pieces are missing

Figure 2. 10 puzzles out of 20 from the dataset of [5]

	Direct	Neighbor		Direct	Neighbor
Image 1	100%	100%	Image 6	100%	100%
Image 2	100%	100%	Image 7	100%	100%
Image 3	98.95%	99.69%	Image 8	100%	100%
Image 4	99.23%	99.4%	Image 9	100%	100%
Image 5	100%	100%	Image 10	100%	100%

Puzzles of 432 Pieces, where about 15% of the pieces are missing

| Our Solution | Original Image | | Our Solution | Original Image |

Figure 3. 10 puzzles out of 20 from the dataset of [5]

	Direct	Neighbor		Direct	Neighbor
Image 1	100%	100%	Image 6	100%	100%
Image 2	100%	100%	Image 7	100%	100%
Image 3	97.37%	97.8%	Image 8	100%	100%
Image 4	97.85%	97.7%	Image 9	99.46%	99.35%
Image 5	100%	100%	Image 10	100%	100%

Puzzles of 540 Pieces, where about 5% of the pieces are missing

Our Solution	Original Image	Our Solution	Original Image
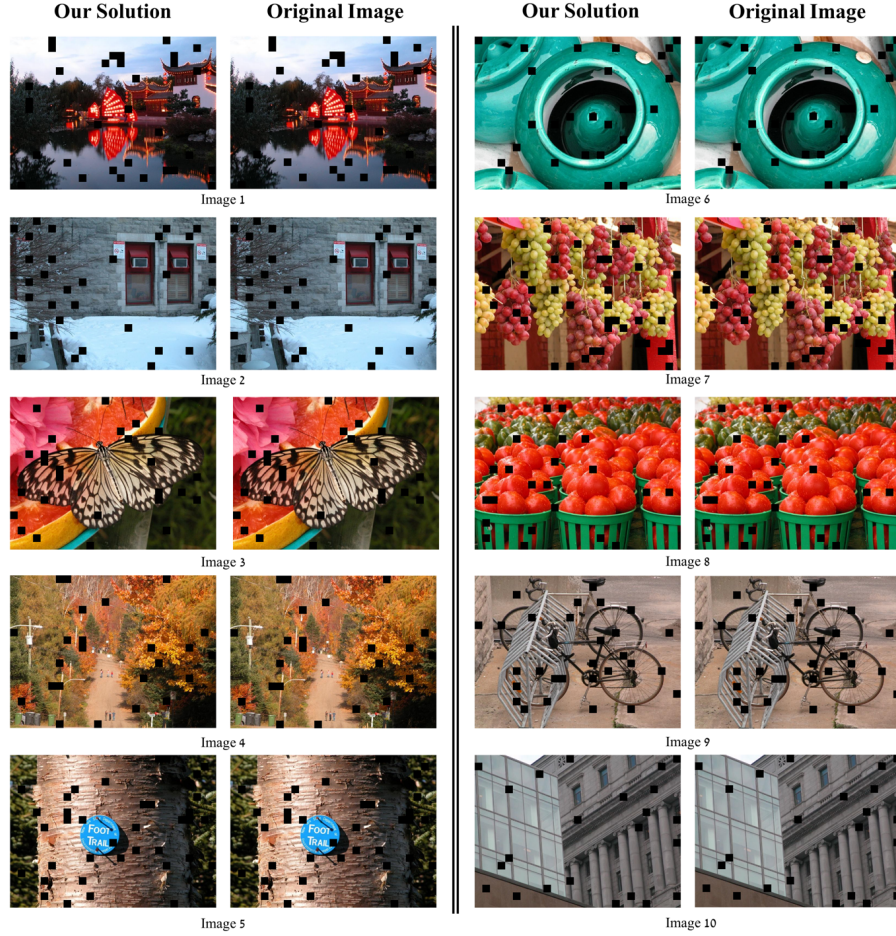
Figure 4. 10 puzzles out of 20 from the dataset of [17]

	Direct	Neighbor		Direct	Neighbor
Image 1	100%	100%	Image 6	100%	100%
Image 2	100%	100%	Image 7	100%	100%
Image 3	100%	100%	Image 8	100%	100%
Image 4	100%	100%	Image 9	100%	100%
Image 5	100%	100%	Image 10	100%	100%

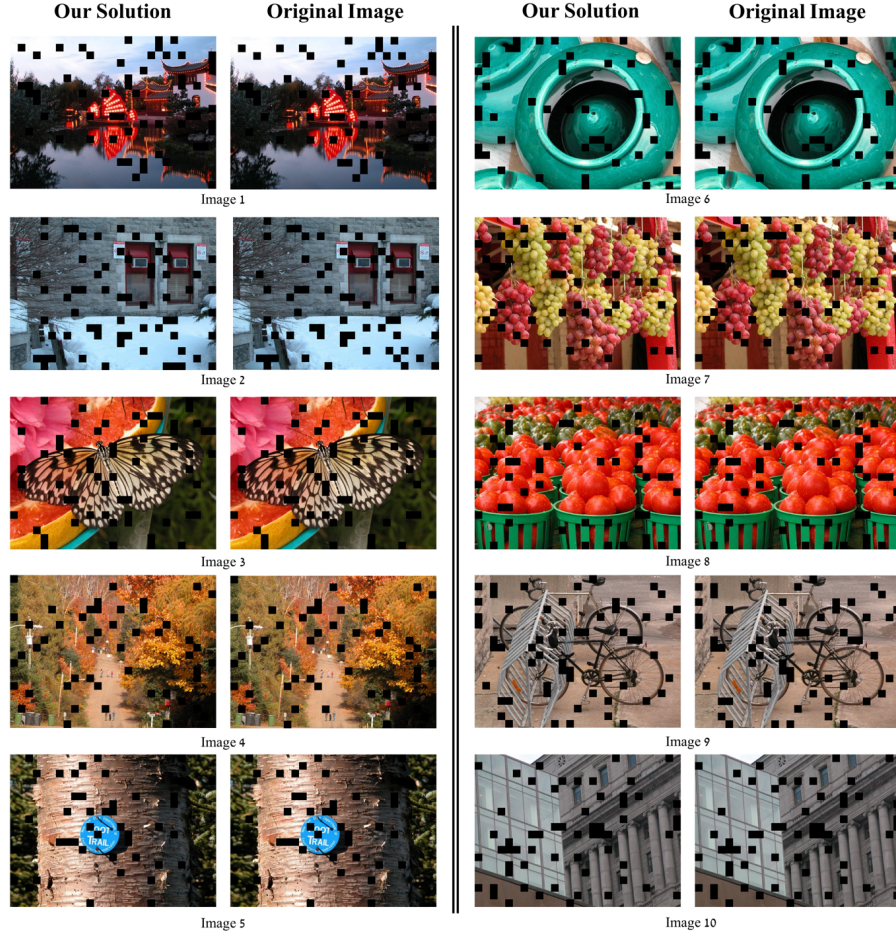**Puzzles of 540 Pieces, where about 10% of the pieces are missing**

Figure 5. 10 puzzles out of 20 from the dataset of [17]

	Direct	Neighbor		Direct	Neighbor
Image 1	100%	100%	Image 6	100%	100%
Image 2	99.39%	99.2%	Image 7	100%	100%
Image 3	100%	100%	Image 8	100%	100%
Image 4	100%	100%	Image 9	100%	100%
Image 5	100%	100%	Image 10	100%	100%

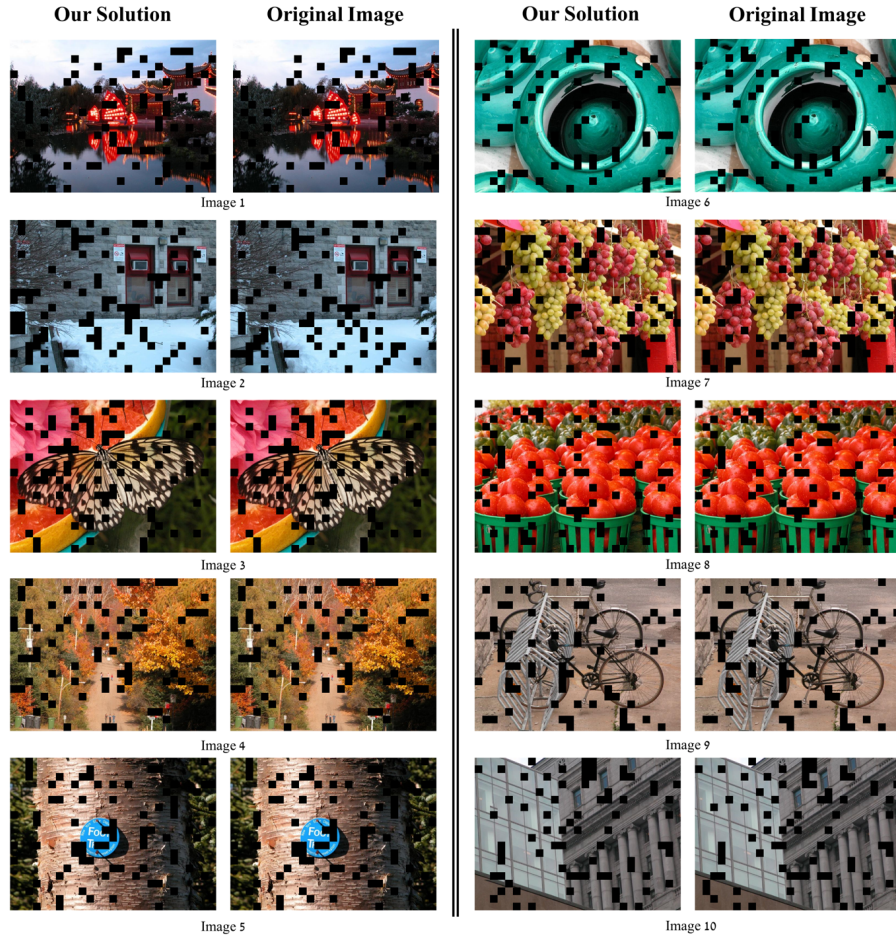**Puzzles of 540 Pieces, where about 15% of the pieces are missing**

| Our Solution | Original Image | Our Solution | Original Image |

Image 1

Image 2

Image 3

Image 4

Image 5

Image 6

Image 7

Image 8

Image 9

Image 10

Figure 6. 10 puzzles out of 20 from the dataset of [17]

	Direct	Neighbor		Direct	Neighbor
Image 1	99.78%	99.87%	Image 6	100%	100%
Image 2	96.86%	97.31%	Image 7	100%	100%
Image 3	100%	100%	Image 8	100%	100%
Image 4	100%	100%	Image 9	100%	100%
Image 5	100%	100%	Image 10	98.49%	98.83%

Puzzles of 805 Pieces, where about 5% of the pieces are missing

| **Our Solution** | **Original Image** | **Our Solution** | **Original Image** |

Image 1

Image 6

Image 2

Image 7

Image 3

Image 8

Image 4

Image 9

Image 5

Image 10

Figure 7. 10 puzzles out of 20 from the dataset of [17]

	Direct	Neighbor		Direct	Neighbor
Image 5	100%	100%	Image 14	100%	100%
Image 7	100%	100%	Image 15	100%	100%
Image 8	100%	100%	Image 17	100%	100%
Image 10	100%	100%	Image 19	100%	100%
Image 13	100%	100%	Image 20	100%	100%

Puzzles of 805 Pieces, where about 10% of the pieces are missing

| Our Solution | Original Image | | Our Solution | Original Image |

Figure 8. 10 puzzles out of 20 from the dataset of [17]

	Direct	Neighbor		Direct	Neighbor
Image 1	99.86%	99.84%	Image 6	100%	100%
Image 2	99.59%	99.84%	Image 7	100%	100%
Image 3	100%	100%	Image 8	100%	100%
Image 4	100%	100%	Image 9	100%	100%
Image 5	100%	100%	Image 10	98.47%	98.87%

Puzzles of 805 Pieces, where about 15% of the pieces are missing

| Our Solution | Original Image | | Our Solution | Original Image |

Figure 9. 10 puzzles out of 20 from the dataset of [17]

	Direct	Neighbor		Direct	Neighbor
Image 1	99.86%	99.82%	Image 6	100%	100%
Image 2	99.56%	99.73%	Image 7	100%	100%
Image 3	99.41%	99.64%	Image 8	99.12%	98.75%
Image 4	100%	100%	Image 9	99.56%	99.45%
Image 5	99.43%	99.41%	Image 10	94.99%	97.89%

Puzzles of 2360 Pieces, where about 5% of the pieces are missing

Our Solution **Original Image**

Image 1

Image 2

Image 3

Figure 10. 3 puzzles out of 3 from the dataset of [17]

Image 1	99.55%	99.42%
Image 2	84.17%	88.09%
Image 3	100%	100%

Puzzles of 2360 Pieces, where about 10% of the pieces are missing

Our Solution   **Original Image**

Image 1

Image 2

Image 3

Figure 11. 3 puzzles out of 3 from the dataset of [17]

	Direct	Neighbor
Image 1	99.62%	99.65%
Image 2	84.79%	86.33%
Image 3	99.49%	99.6%

Puzzles of 2360 Pieces, where about 15% of the pieces are missing

Our Solution   **Original Image**

Image 1

Image 2

Image 3

Figure 12. 3 puzzles out of 3 from the dataset of [17]

	Direct	Neighbor
Image 1	99.36%	99.44%
Image 2	82.87%	88.08%
Image 3	98.4%	98.44%

Puzzles of 3300 Pieces, where about 5% of the pieces are missing

Our Solution   **Original Image**

Image 1
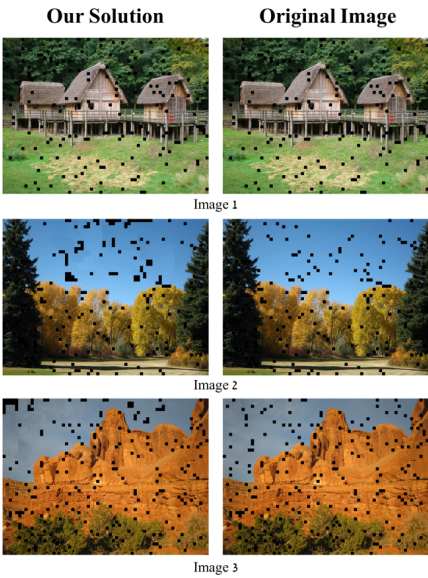
Image 2

Image 3

Figure 13. 3 puzzles out of 3 from the dataset of [17]

	Direct	Neighbor
Image 1	100%	100%
Image 2	78.46%	87.56%
Image 3	93.46%	97.28%

Puzzles of 3300 Pieces, where about 10% of the pieces are missing
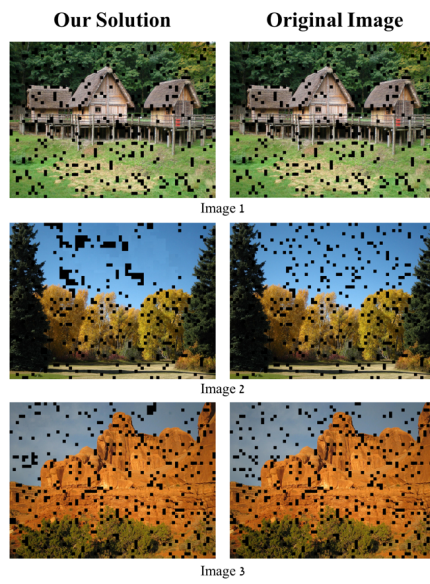
Figure 14. 3 puzzles out of 3 from the dataset of [17]

	Direct	Neighbor
Image 1	100%	100%
Image 2	78.24%	88.49%
Image 3	93.82%	97.38%

Puzzles of 3300 Pieces, where about 15% of the pieces are missing

Our Solution   Original Image

Image 1
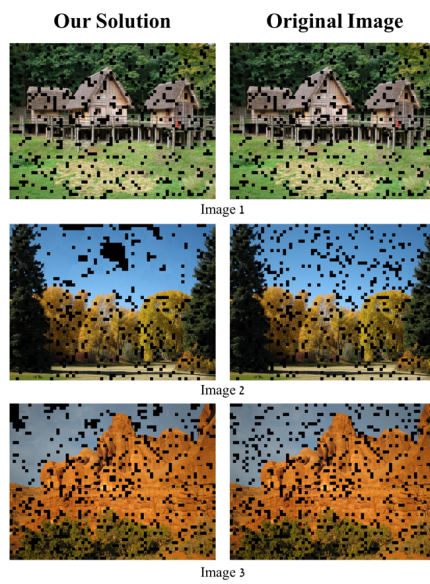
Image 2

Image 3

Figure 15. 3 puzzles out of 3 from the dataset of [17]

	Direct	Neighbor
Image 1	99.93%	99.89%
Image 2	76.66%	86.6%
Image 3	90.97%	96.84%

Puzzles of 5015 Pieces, where about 5% of the pieces are missing

| **Our Solution** | **Original Image** | **Our Solution** | **Original Image** |

Figure 16. 8 puzzles out of 20 from the dataset of [19]

	Direct	Neighbor		Direct	Neighbor
Image 1	100%	100%	Image 4	100%	100%
Image 2	100%	100%	Image 5	100%	100%
Image 3	99.92%	99.98%	Image 6	100%	100%
			Image 7	99.92%	99.88%
			Image 8	100%	100%

Puzzles of 5015 Pieces, where about 10% of the pieces are missing

| Our Solution | Original Image | Our Solution | Original Image |

Figure 17. 8 puzzles out of 20 from the dataset of [19]

	Direct	Neighbor		Direct	Neighbor
Image 1	100%	100%	Image 4	100%	100%
Image 2	100%	100%	Image 5	99.87%	99.91%
Image 3	99.93%	99.96%	Image 6	100%	100%
			Image 7	99.6%	99.52%
			Image 8	100%	100%

Puzzles of 5015 Pieces, where about 15% of the pieces are missing

Our Solution   **Original Image**   **Our Solution**   **Original Image**

Figure 18. 8 puzzles out of 20 from the dataset of [19]

	Direct	Neighbor		Direct	Neighbor
Image 1	99.97%	100%	Image 4	100%	100%
Image 2	99.79%	99.94%	Image 5	99.81%	99.85%
Image 3	99.41%	99.49%	Image 6	99.5%	100%
			Image 7	97.64%	98.81%
			Image 8	99.98%	99.99%

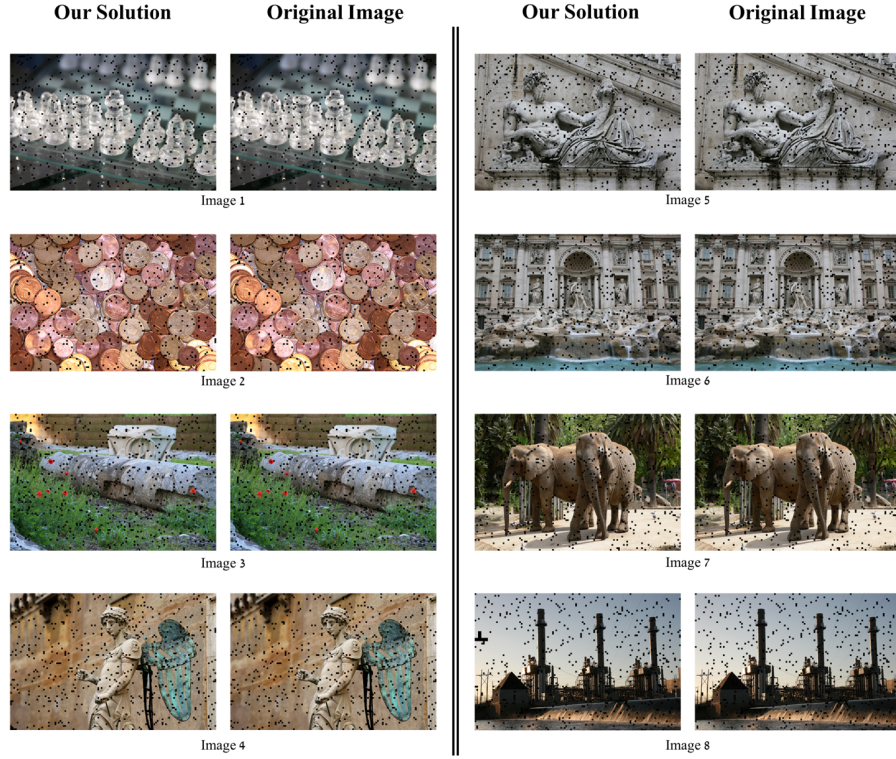**Puzzles of 10375 Pieces, where about 5% of the pieces are missing**

| Our Solution | Original Image | | Our Solution | Original Image |

Figure 19. 8 puzzles out of 20 from the dataset of [19]

	Direct	Neighbor		Direct	Neighbor
Image 1	99.97%	99.96%	Image 5	99.96%	99.94%
Image 2	99.94%	99.9%	Image 6	99.99%	99.99%
Image 3	99.99%	99.99%	Image 7	100%	100%
Image 4	99.75%	99.67%	Image 8	99.62%	99.48%

Puzzles of 10375 Pieces, where about 10% of the pieces are missing

Our Solution	Original Image	Our Solution	Original Image

Figure 20. 8 puzzles out of 20 from the dataset of [19]

	Direct	Neighbor		Direct	Neighbor
Image 1	99.73%	99.86%	Image 5	99.97%	99.99%
Image 2	99.96%	99.93%	Image 6	99.82%	99.86%
Image 3	99.99%	100%	Image 7	99.95%	99.99%
Image 4	99.61%	99.56%	Image 8	98.74%	98.88%

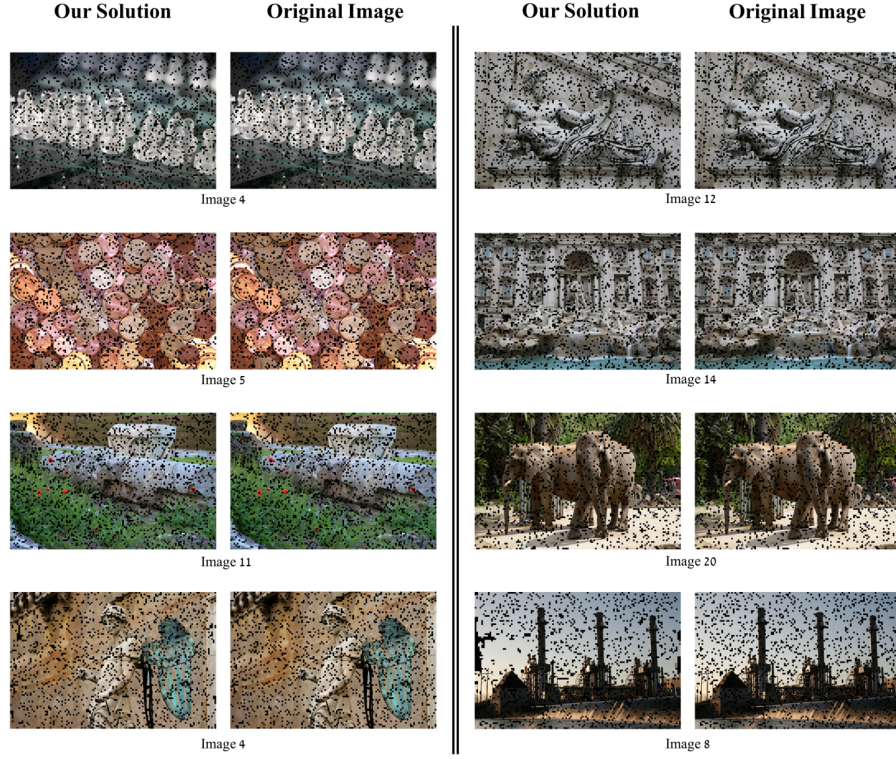# Puzzles of 10375 Pieces, where about 15% of the pieces are missing

Figure 21. 8 puzzles out of 20 from the dataset of [19]

	Direct	Neighbor		Direct	Neighbor
Image 1	99.76%	99.83%	Image 5	99.85%	99.93%
Image 2	99.84%	99.89%	Image 6	99.28%	99.45%
Image 3	99.99%	99.99%	Image 7	99.85%	99.95%
Image 4	99.33%	99.31%	Image 8	96.87%	97.62%

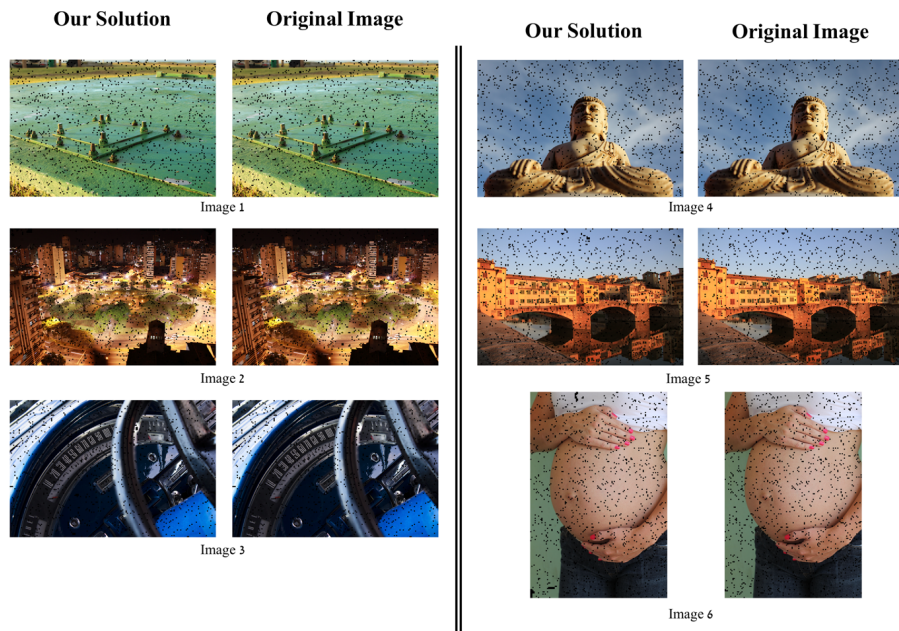# Puzzles of 22755 Pieces, where about 5% of the pieces are missing

Our Solution **Original Image** **Our Solution** **Original Image**

Image 1

Image 2

Image 3

Image 4

Image 5

Image 6

Figure 22. 6 puzzles out of 20 from the dataset of [19]

	Direct	Neighbor		Direct	Neighbor
Image 1	100%	100%	Image 4	99.94%	99.94%
Image 2	98.51%	98.85%	Image 5	99.84%	99.85%
Image 3	99.73%	99.66%	Image 6	99.75%	99.69%

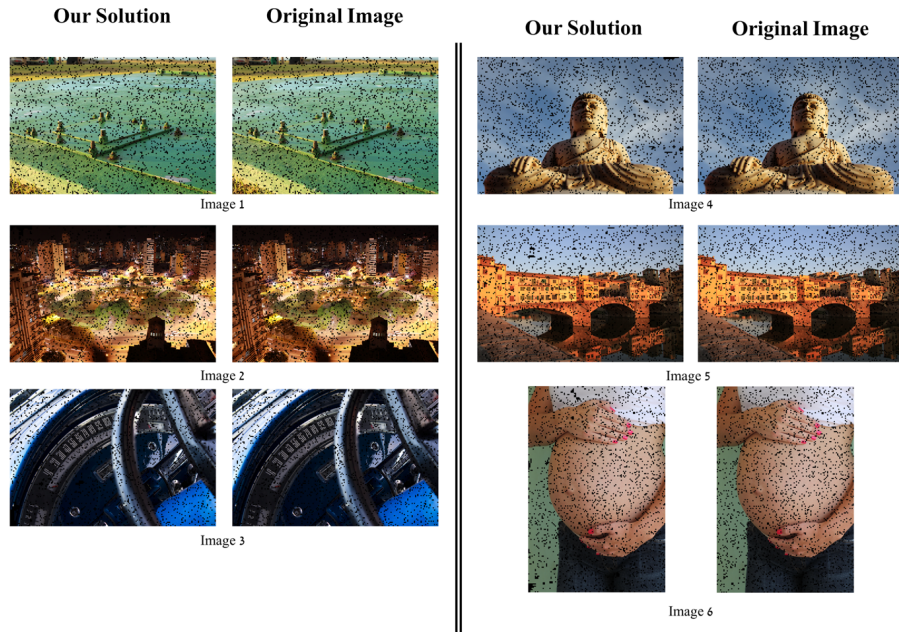## Puzzles of 22755 Pieces, where about 10% of the pieces are missing

Our Solution   **Original Image**   **Our Solution**   **Original Image**

Image 1

Image 2

Image 3

Image 4

Image 5

Image 6

Figure 23. 6 puzzles out of 20 from the dataset of [19]

	Direct	Neighbor		Direct	Neighbor
Image 1	99.99%	99.99%	Image 4	99.69%	99.7%
Image 2	98.53%	98.74%	Image 5	99.41%	99.49%
Image 3	99.03%	99%	Image 6	99.48%	99.45%

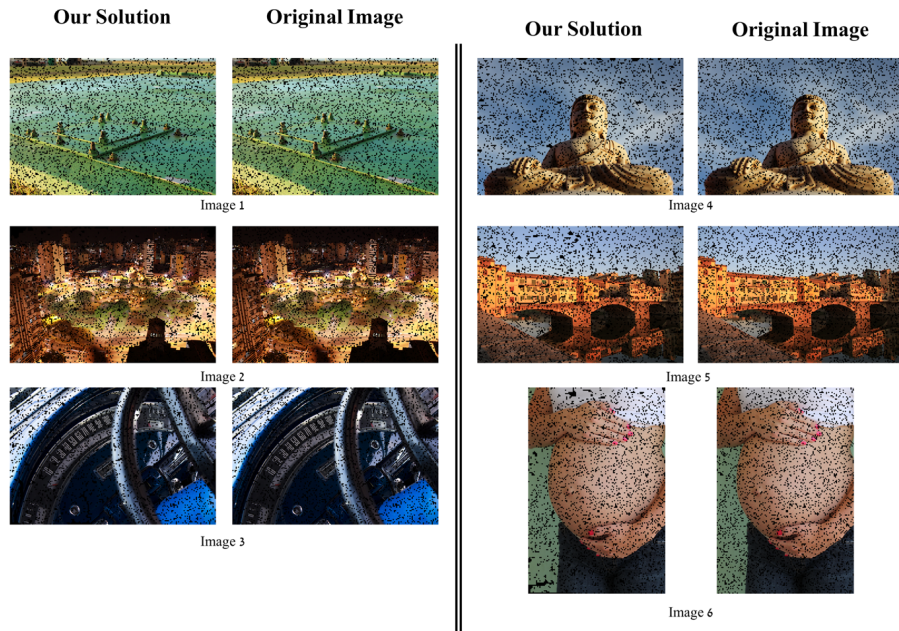**Puzzles of 22755 Pieces, where about 15% of the pieces are missing**

Figure 24. 6 puzzles out of 20 from the dataset of [19]

	Direct	Neighbor		Direct	Neighbor
Image 1	99.9%	99.95%	Image 4	99.17%	99.3%
Image 2	97.19%	97.8%	Image 5	97.09%	98.88%
Image 3	96.59%	98.2%	Image 6	97.66%	98.9%