An L_1 Image Transform for Edge-Preserving Smoothing and Scene-Level Intrinsic Decomposition

Supplemental Materials

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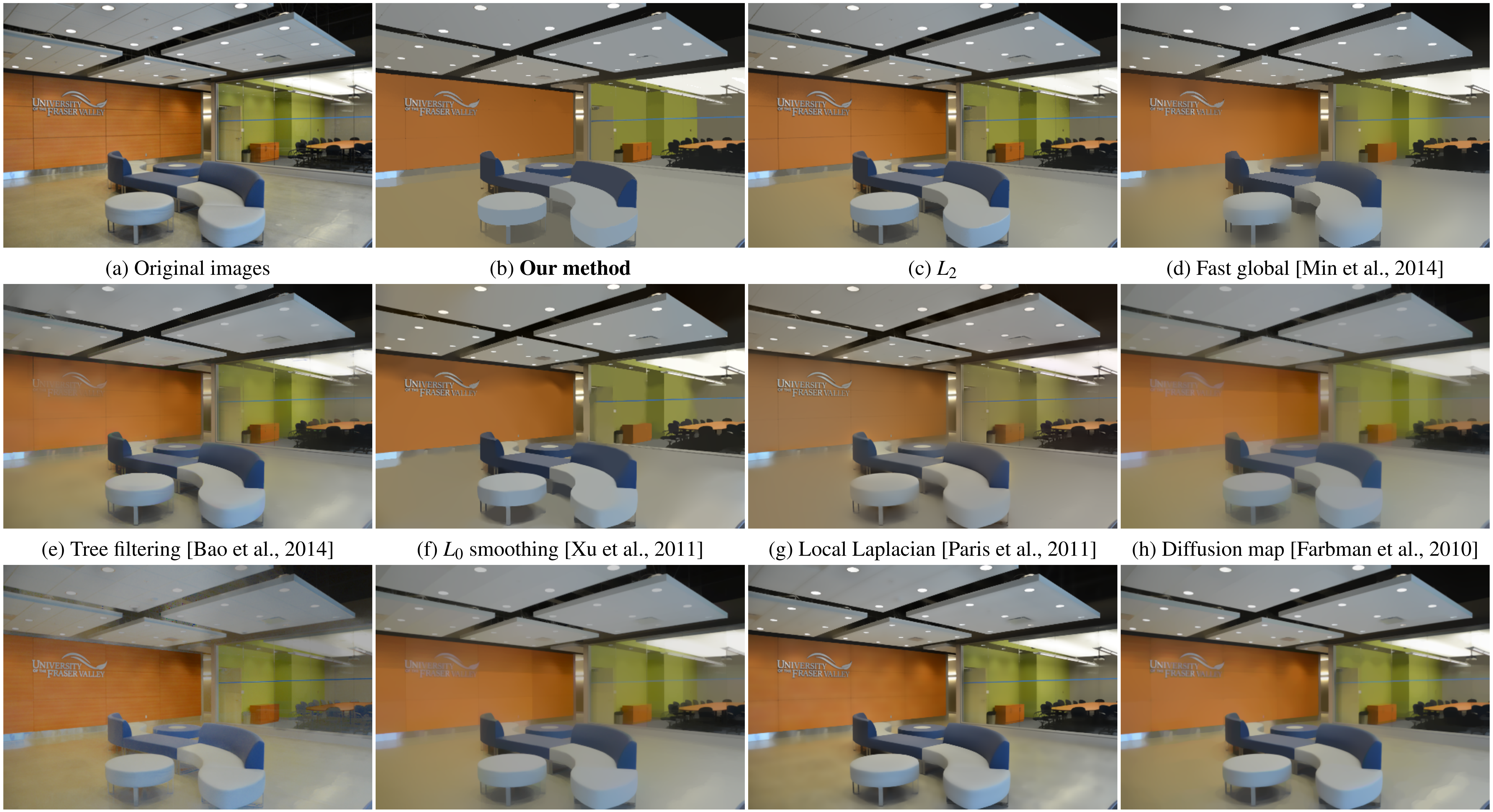
Piecewise Image Flattening



(a) Original images (b) **Our method** (c) L_2 (d) Fast global [Min et al., 2014]

(e) Tree filtering [Bao et al., 2014] (f) L_0 smoothing [Xu et al., 2011] (g) Local Laplacian [Paris et al., 2011] (h) Diffusion map [Farbman et al., 2010]

(i) Wavelets [Fattal, 2009] (j) Multi-scale tone [Farbman et al., 2008] (k) Bilateral [Tomasi, 1998] (l) Total variation [Rudin et al., 1992]

Figure 1: Comparison of piecewise image flattening results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

(a) Original images | (b) **Our method** | (c) L_2 | (d) Fast global [Min et al., 2014]

(e) Tree filtering [Bao et al., 2014] | (f) L_0 smoothing [Xu et al., 2011] | (g) Local Laplacian [Paris et al., 2011] | (h) Diffusion map [Farbman et al., 2010]

(i) Wavelets [Fattal, 2009] | (j) Multi-scale tone [Farbman et al., 2008] | (k) Bilateral [Tomasi, 1998] | (l) Total variation [Rudin et al., 1992]

Figure 2: Comparison of piecewise image flattening results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

(a) Original images | (b) **Our method** | (c) L_2 | (d) Fast global [Min et al., 2014]

(e) Tree filtering [Bao et al., 2014] | (f) L_0 smoothing [Xu et al., 2011] | (g) Local Laplacian [Paris et al., 2011] | (h) Diffusion map [Farbman et al., 2010]

(i) Wavelets [Fattal, 2009] | (j) Multi-scale tone [Farbman et al., 2008] | (k) Bilateral [Tomasi, 1998] | (l) Total variation [Rudin et al., 1992]

Figure 3: Comparison of piecewise image flattening results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

(a) Original images | (b) **Our method** | (c) L_2 | (d) Fast global [Min et al., 2014]

(e) Tree filtering [Bao et al., 2014] | (f) L_0 smoothing [Xu et al., 2011] | (g) Local Laplacian [Paris et al., 2011] | (h) Diffusion map [Farbman et al., 2010]

(i) Wavelets [Fattal, 2009] | (j) Multi-scale tone [Farbman et al., 2008] | (k) Bilateral [Tomasi, 1998] | (l) Total variation [Rudin et al., 1992]

Figure 4: Comparison of piecewise image flattening results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

(a) Original images | (b) **Our method** | (c) L_2 | (d) Fast global [Min et al., 2014]

(e) Tree filtering [Bao et al., 2014] | (f) L_0 smoothing [Xu et al., 2011] | (g) Local Laplacian [Paris et al., 2011] | (h) Diffusion map [Farbman et al., 2010]

(i) Wavelets [Fattal, 2009] | (j) Multi-scale tone [Farbman et al., 2008] | (k) Bilateral [Tomasi, 1998] | (l) Total variation [Rudin et al., 1992]

Figure 5: Comparison of piecewise image flattening results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

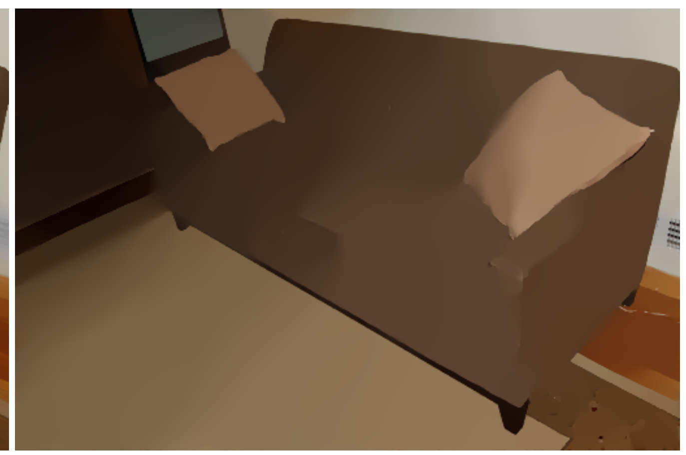
(a) Original images

(b) **Our method**

(c) L_2

(d) Fast global [Min et al., 2014]

(e) Tree filtering [Bao et al., 2014]



(f) L_0 smoothing [Xu et al., 2011]

(g) Local Laplacian [Paris et al., 2011]

(h) Diffusion map [Farbman et al., 2010]

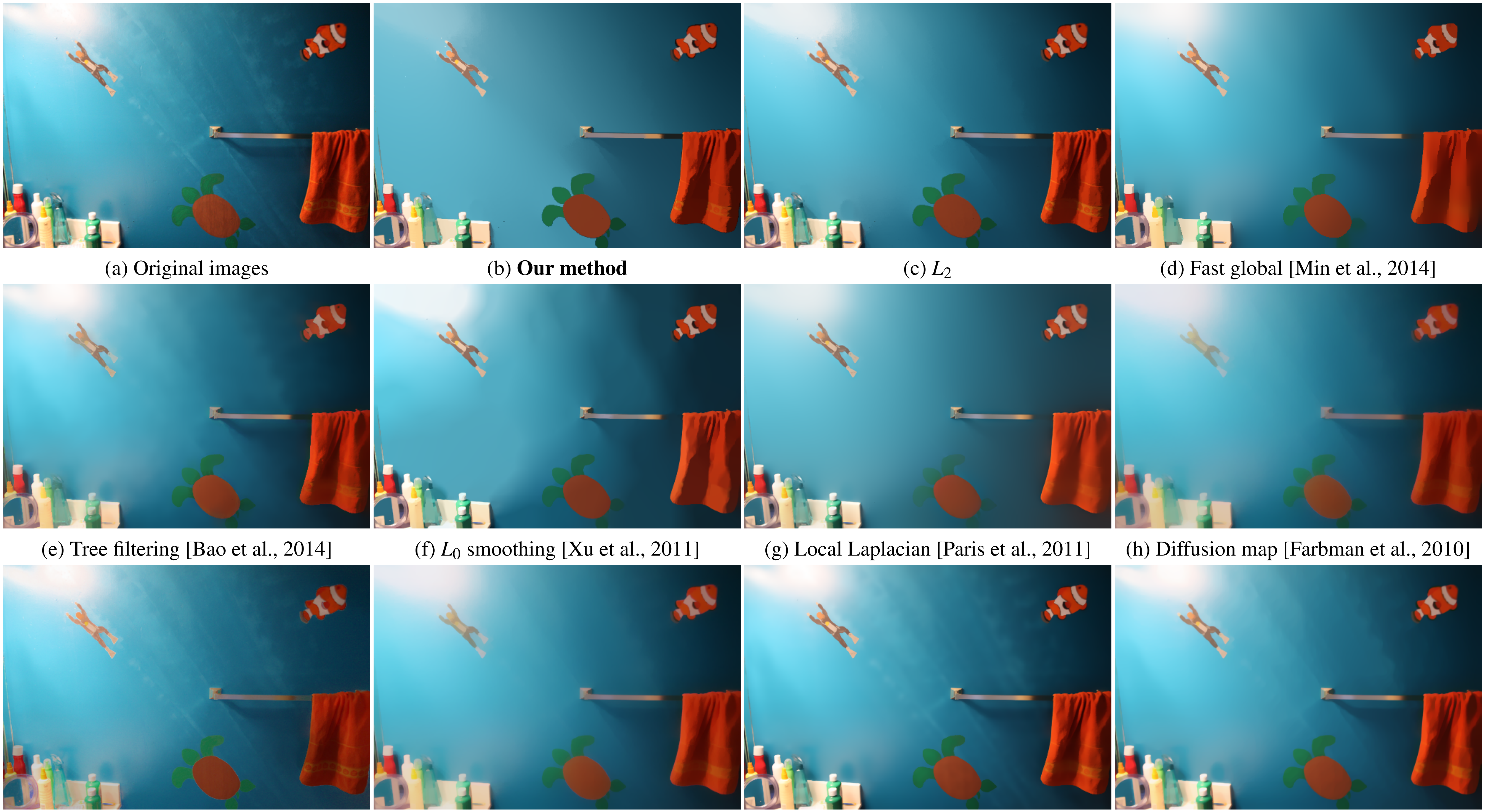
(i) Wavelets [Fattal, 2009]

(j) Multi-scale tone [Farbman et al., 2008]

(k) Bilateral [Tomasi, 1998]

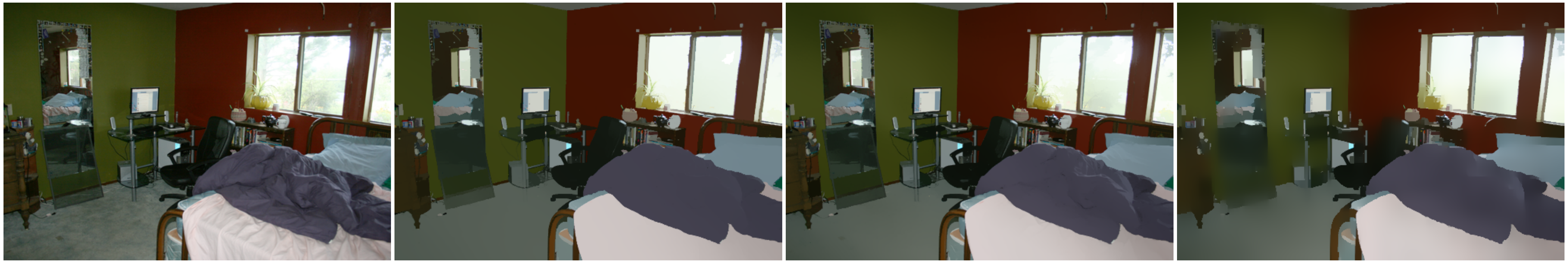
(l) Total variation [Rudin et al., 1992]

Figure 6: Comparison of piecewise image flattening results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

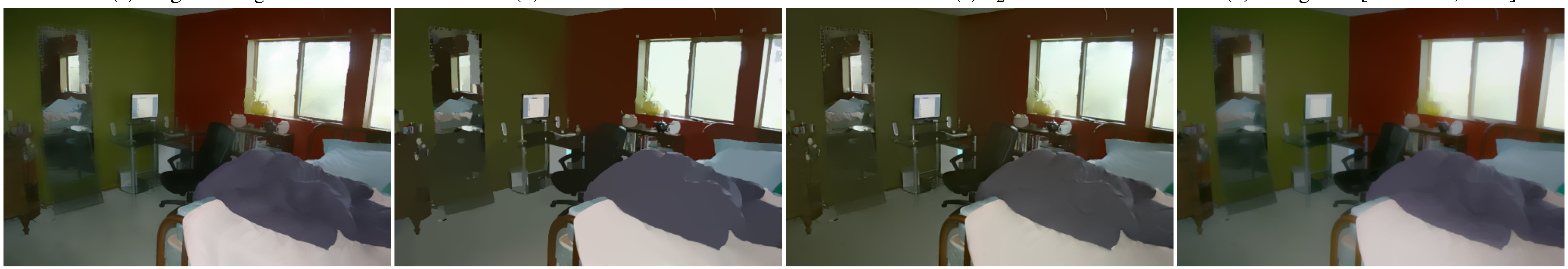


(a) Original images (b) **Our method** (c) L_2 (d) Fast global [Min et al., 2014]
(e) Tree filtering [Bao et al., 2014] (f) L_0 smoothing [Xu et al., 2011] (g) Local Laplacian [Paris et al., 2011] (h) Diffusion map [Farbman et al., 2010]
(i) Wavelets [Fattal, 2009] (j) Multi-scale tone [Farbman et al., 2008] (k) Bilateral [Tomasi, 1998] (l) Total variation [Rudin et al., 1992]

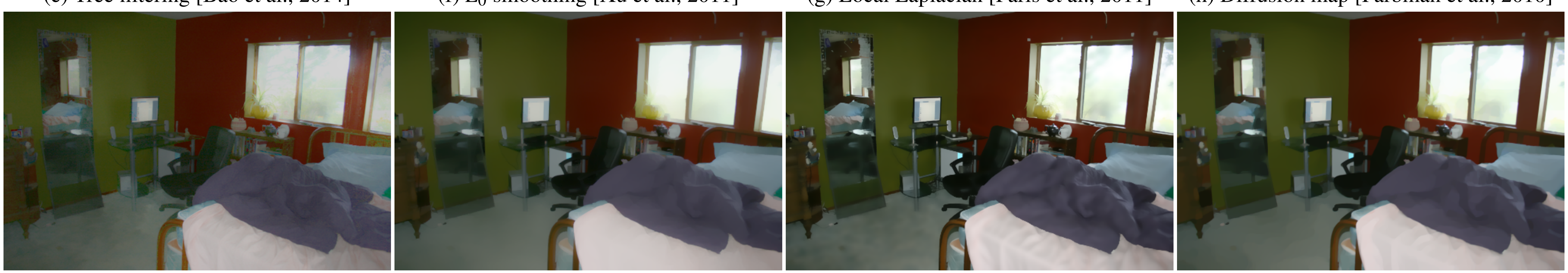
Figure 7: Comparison of piecewise image flattening results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.



(a) Original images (b) **Our method** (c) L_2 (d) Fast global [Min et al., 2014]



(e) Tree filtering [Bao et al., 2014] (f) L_0 smoothing [Xu et al., 2011] (g) Local Laplacian [Paris et al., 2011] (h) Diffusion map [Farbman et al., 2010]



(i) Wavelets [Fattal, 2009] (j) Multi-scale tone [Farbman et al., 2008] (k) Bilateral [Tomasi, 1998] (l) Total variation [Rudin et al., 1992]

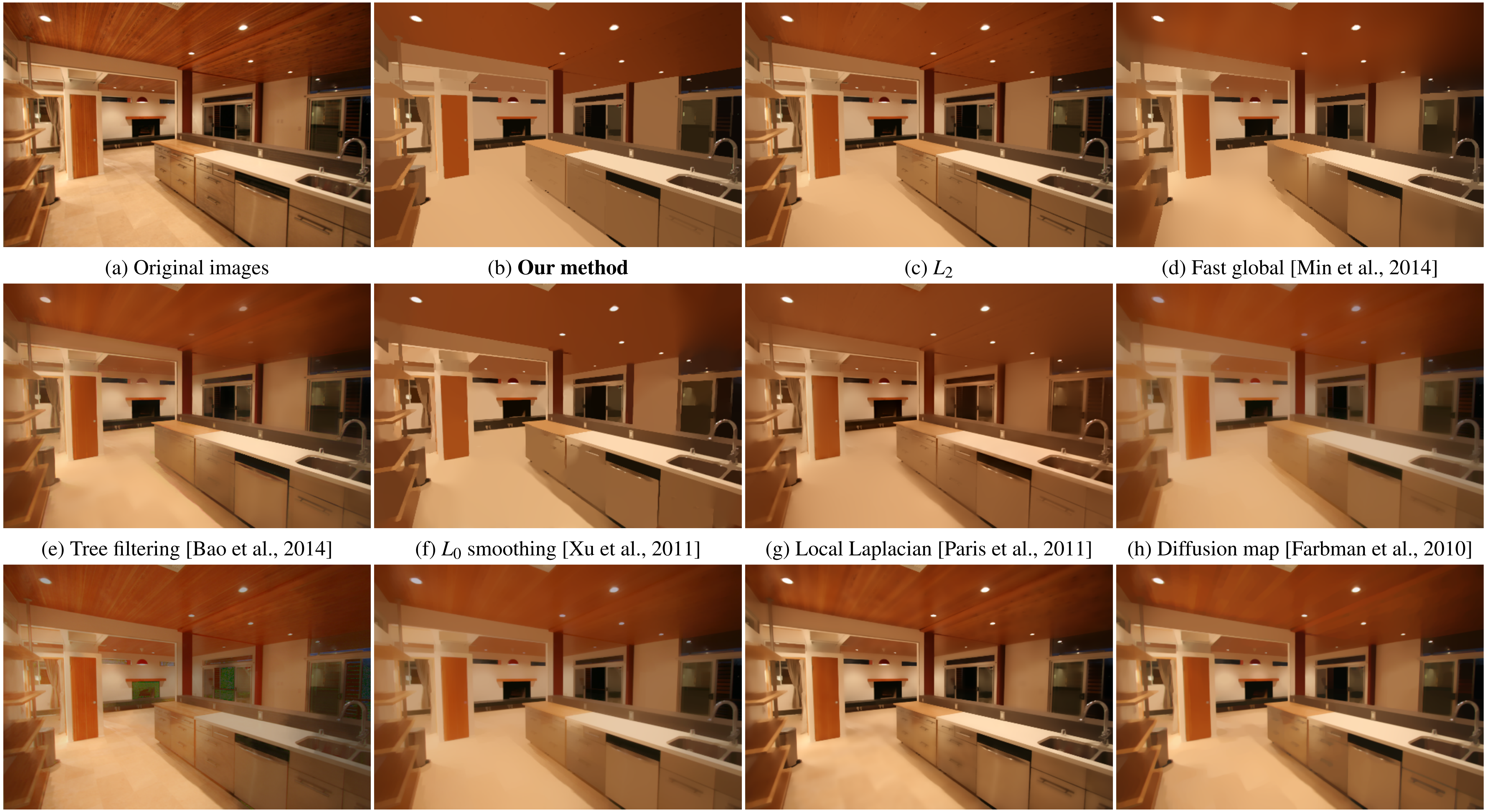
Figure 8: Comparison of piecewise image flattening results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

(a) Original images | (b) **Our method** | (c) L_2 | (d) Fast global [Min et al., 2014]

(e) Tree filtering [Bao et al., 2014] | (f) L_0 smoothing [Xu et al., 2011] | (g) Local Laplacian [Paris et al., 2011] | (h) Diffusion map [Farbman et al., 2010]

(i) Wavelets [Fattal, 2009] | (j) Multi-scale tone [Farbman et al., 2008] | (k) Bilateral [Tomasi, 1998] | (l) Total variation [Rudin et al., 1992]

Figure 9: Comparison of piecewise image flattening results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.



(a) Original images | (b) **Our method** | (c) L_2 | (d) Fast global [Min et al., 2014]

(e) Tree filtering [Bao et al., 2014] | (f) L_0 smoothing [Xu et al., 2011] | (g) Local Laplacian [Paris et al., 2011] | (h) Diffusion map [Farbman et al., 2010]

(i) Wavelets [Fattal, 2009] | (j) Multi-scale tone [Farbman et al., 2008] | (k) Bilateral [Tomasi, 1998] | (l) Total variation [Rudin et al., 1992]

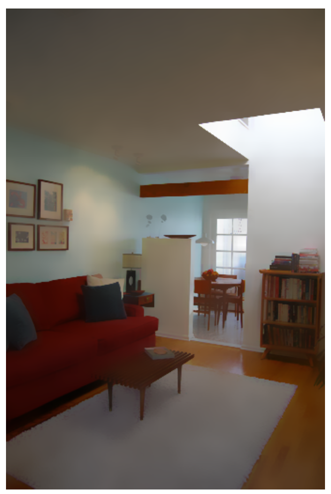
Figure 10: Comparison of piecewise image flattening results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

(a) Original images

(b) **Our method**

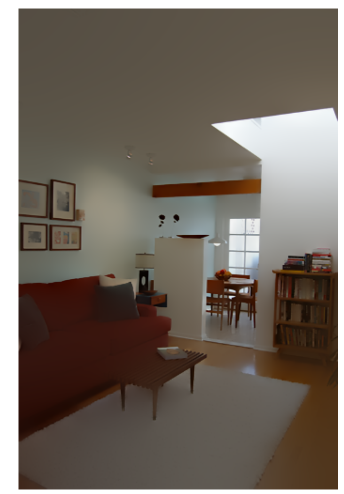
(c) L_2

(d) Fast global [Min et al., 2014]

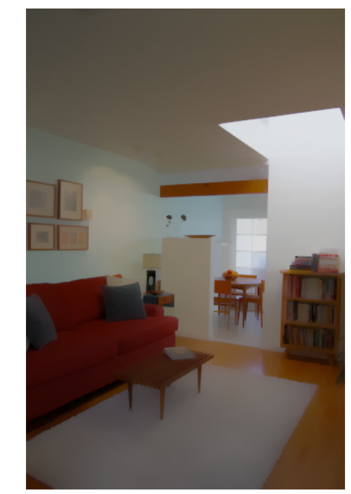


(e) Tree filtering [Bao et al., 2014]

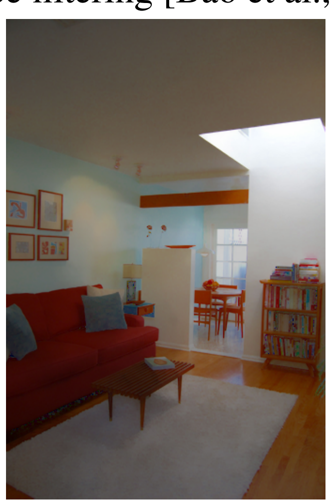
(f) L_0 smoothing [Xu et al., 2011]



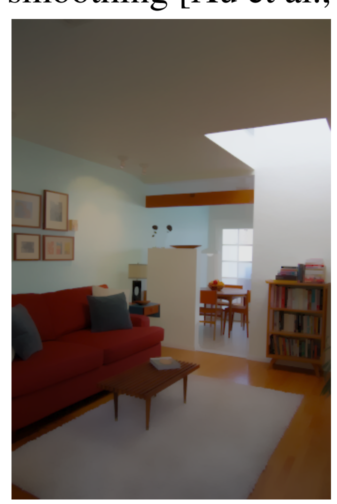
(g) Local Laplacian [Paris et al., 2011]



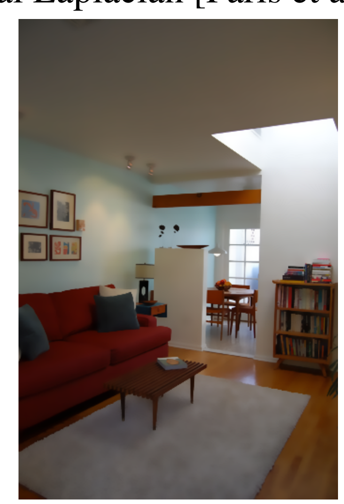
(h) Diffusion map [Farbman et al., 2010]



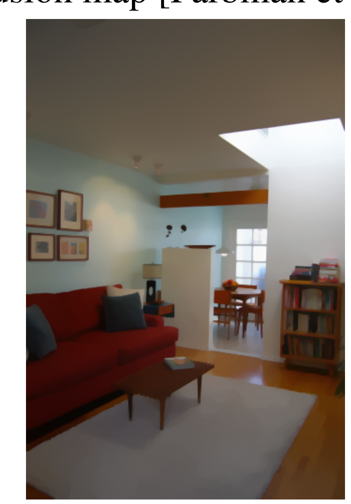
(i) Wavelets [Fattal, 2009]



(j) Multi-scale tone [Farbman et al., 2008]



(k) Bilateral [Tomasi, 1998]



(l) Total variation [Rudin et al., 1992]

Figure 11: Comparison of piecewise image flattening results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

(a) Original images (b) **Our method** (c) L_2 (d) Fast global [Min et al., 2014]

(e) Tree filtering [Bao et al., 2014] (f) L_0 smoothing [Xu et al., 2011] (g) Local Laplacian [Paris et al., 2011] (h) Diffusion map [Farbman et al., 2010]

(i) Wavelets [Fattal, 2009] (j) Multi-scale tone [Farbman et al., 2008] (k) Bilateral [Tomasi, 1998] (l) Total variation [Rudin et al., 1992]

Figure 12: Comparison of piecewise image flattening results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

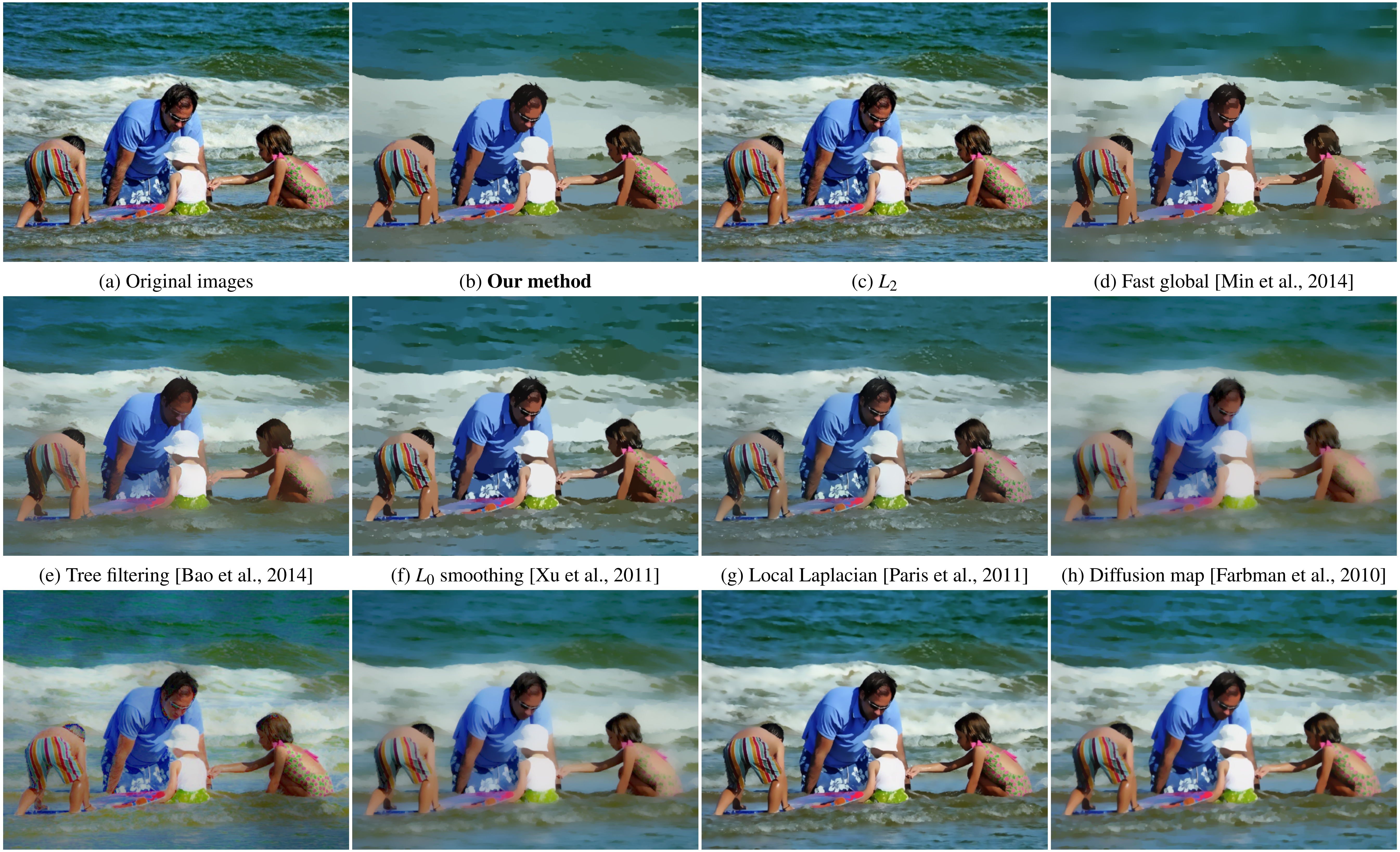
Edge-Preserving Image Smoothing

(a) Original images (b) **Our method** (c) L_2 (d) Fast global [Min et al., 2014]

(e) Tree filtering [Bao et al., 2014] (f) L_0 smoothing [Xu et al., 2011] (g) Local Laplacian [Paris et al., 2011] (h) Diffusion map [Farbman et al., 2010]

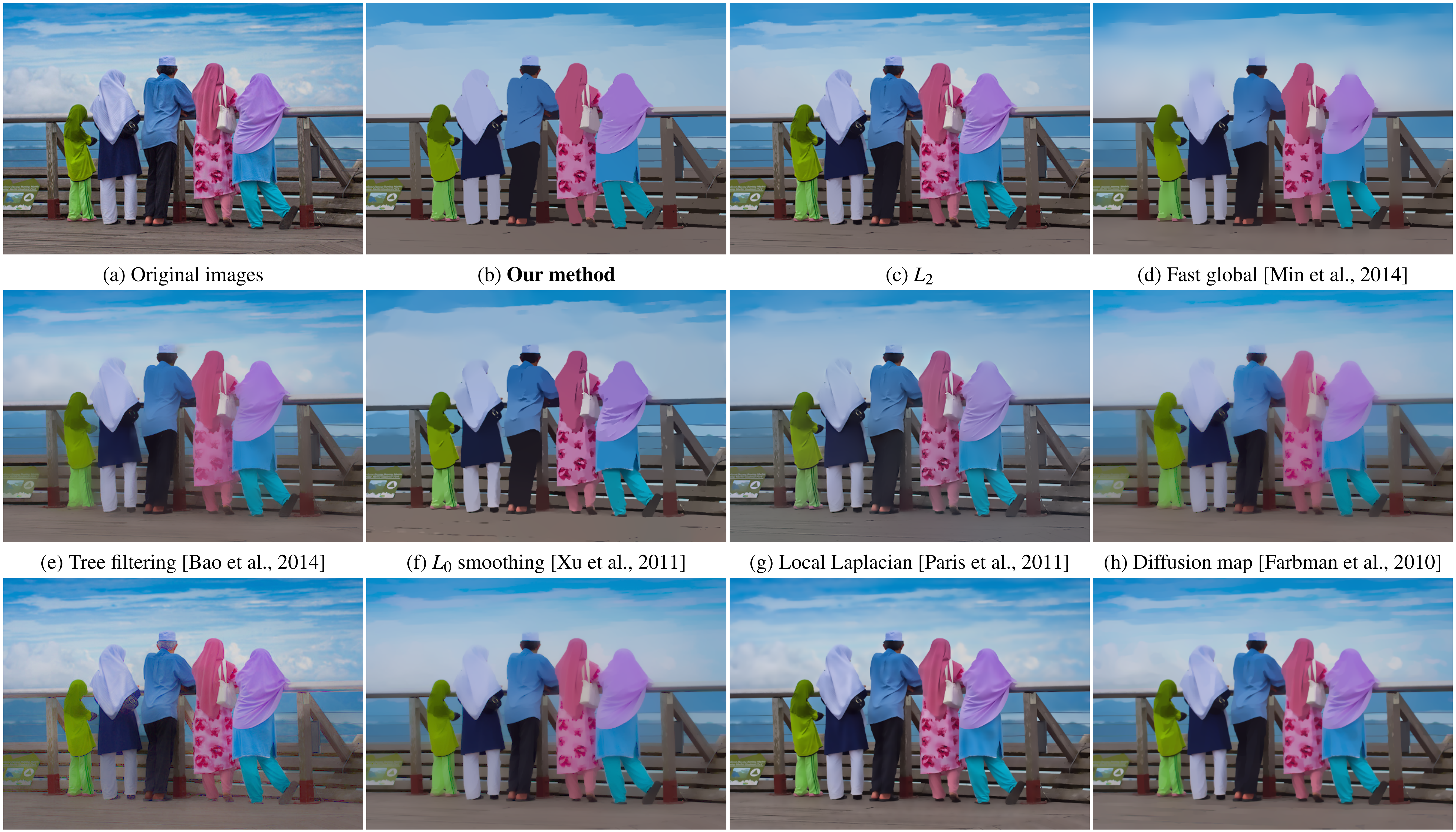
(i) Wavelets [Fattal, 2009] (j) Multi-scale tone [Farbman et al., 2008] (k) Bilateral [Tomasi, 1998] (l) Total variation [Rudin et al., 1992]

Figure 13: Comparison of edge-preserving image smoothing results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.



(a) Original images
(b) **Our method**
(c) L_2
(d) Fast global [Min et al., 2014]
(e) Tree filtering [Bao et al., 2014]
(f) L_0 smoothing [Xu et al., 2011]
(g) Local Laplacian [Paris et al., 2011]
(h) Diffusion map [Farbman et al., 2010]
(i) Wavelets [Fattal, 2009]
(j) Multi-scale tone [Farbman et al., 2008]
(k) Bilateral [Tomasi, 1998]
(l) Total variation [Rudin et al., 1992]

Figure 14: Comparison of edge-preserving image smoothing results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

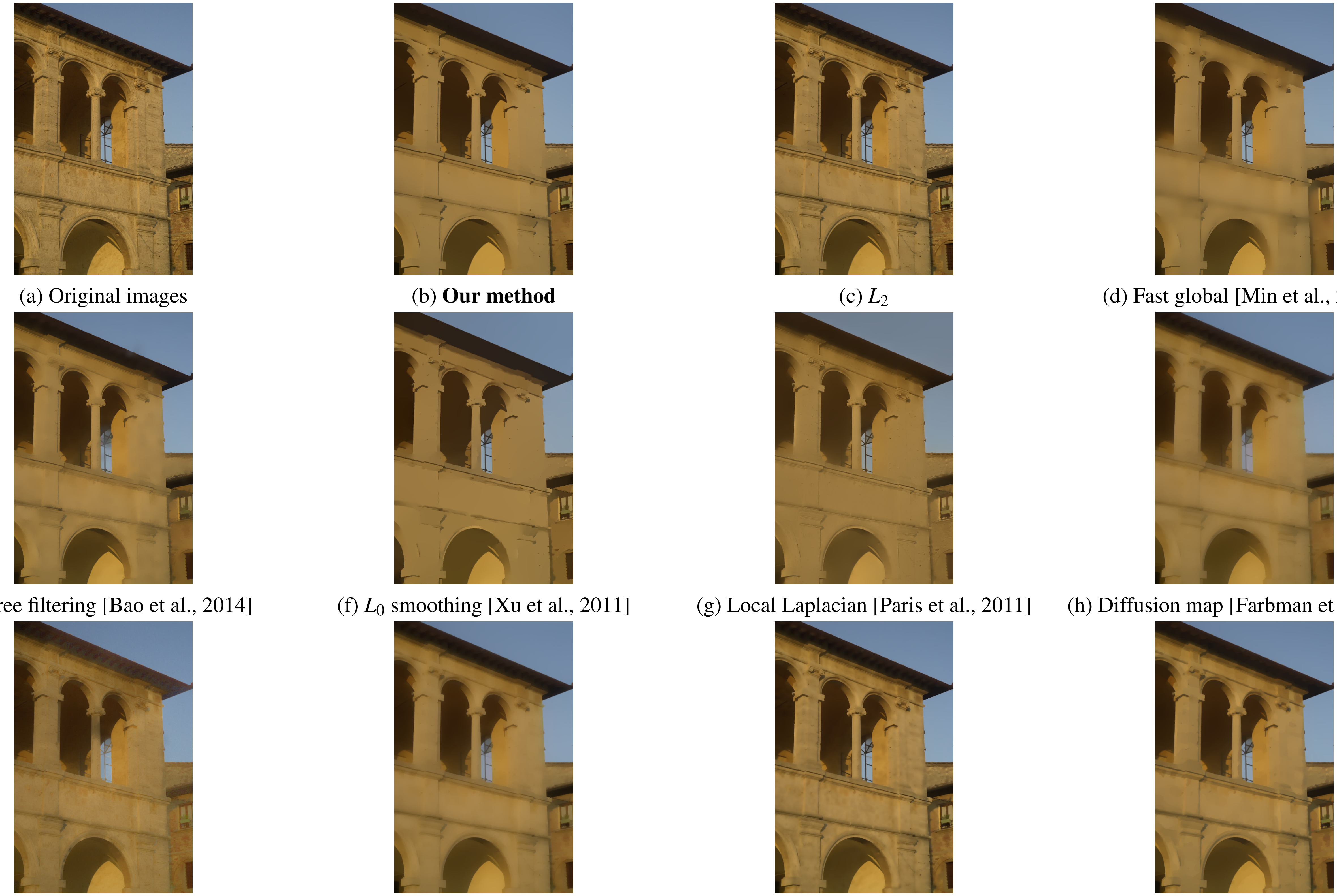


(a) Original images (b) **Our method** (c) L_2 (d) Fast global [Min et al., 2014]

(e) Tree filtering [Bao et al., 2014] (f) L_0 smoothing [Xu et al., 2011] (g) Local Laplacian [Paris et al., 2011] (h) Diffusion map [Farbman et al., 2010]

(i) Wavelets [Fattal, 2009] (j) Multi-scale tone [Farbman et al., 2008] (k) Bilateral [Tomasi, 1998] (l) Total variation [Rudin et al., 1992]

Figure 15: Comparison of edge-preserving image smoothing results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.



(a) Original images (b) **Our method** (c) L_2 (d) Fast global [Min et al., 2014]

(e) Tree filtering [Bao et al., 2014] (f) L_0 smoothing [Xu et al., 2011] (g) Local Laplacian [Paris et al., 2011] (h) Diffusion map [Farbman et al., 2010]

(i) Wavelets [Fattal, 2009] (j) Multi-scale tone [Farbman et al., 2008] (k) Bilateral [Tomasi, 1998] (l) Total variation [Rudin et al., 1992]

Figure 16: Comparison of edge-preserving image smoothing results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

(a) Original images | (b) **Our method** | (c) L_2 | (d) Fast global [Min et al., 2014]

(e) Tree filtering [Bao et al., 2014] | (f) L_0 smoothing [Xu et al., 2011] | (g) Local Laplacian [Paris et al., 2011] | (h) Diffusion map [Farbman et al., 2010]

(i) Wavelets [Fattal, 2009] | (j) Multi-scale tone [Farbman et al., 2008] | (k) Bilateral [Tomasi, 1998] | (l) Total variation [Rudin et al., 1992]

Figure 17: Comparison of edge-preserving image smoothing results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

(a) Original images (b) **Our method** (c) L_2 (d) Fast global [Min et al., 2014]

(e) Tree filtering [Bao et al., 2014] (f) L_0 smoothing [Xu et al., 2011] (g) Local Laplacian [Paris et al., 2011] (h) Diffusion map [Farbman et al., 2010]

(i) Wavelets [Fattal, 2009] (j) Multi-scale tone [Farbman et al., 2008] (k) Bilateral [Tomasi, 1998] (l) Total variation [Rudin et al., 1992]

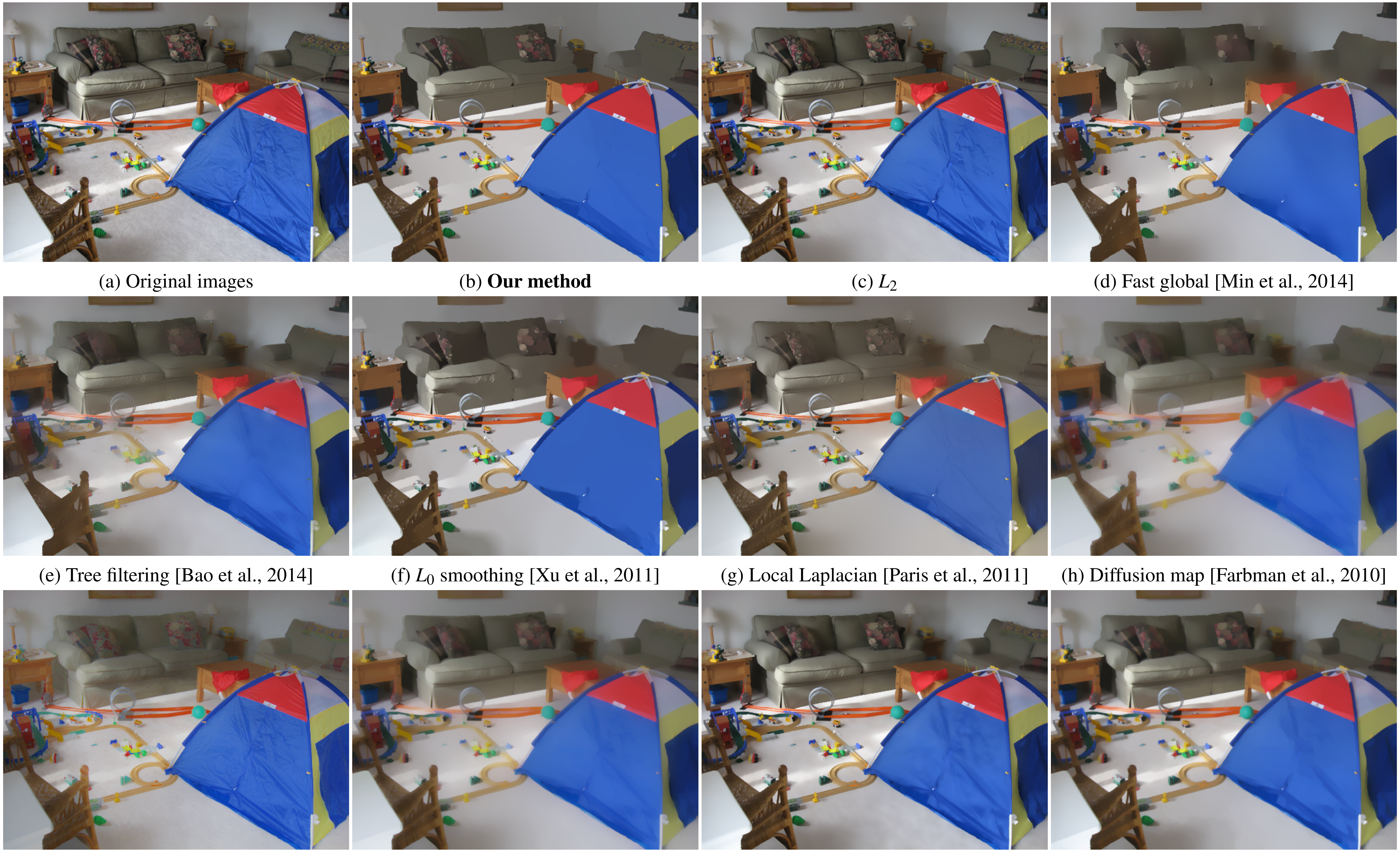
Figure 18: Comparison of edge-preserving image smoothing results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

(a) Original images (b) **Our method** (c) L_2 (d) Fast global [Min et al., 2014]

(e) Tree filtering [Bao et al., 2014] (f) L_0 smoothing [Xu et al., 2011] (g) Local Laplacian [Paris et al., 2011] (h) Diffusion map [Farbman et al., 2010]

(i) Wavelets [Fattal, 2009] (j) Multi-scale tone [Farbman et al., 2008] (k) Bilateral [Tomasi, 1998] (l) Total variation [Rudin et al., 1992]

Figure 19: Comparison of edge-preserving image smoothing results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

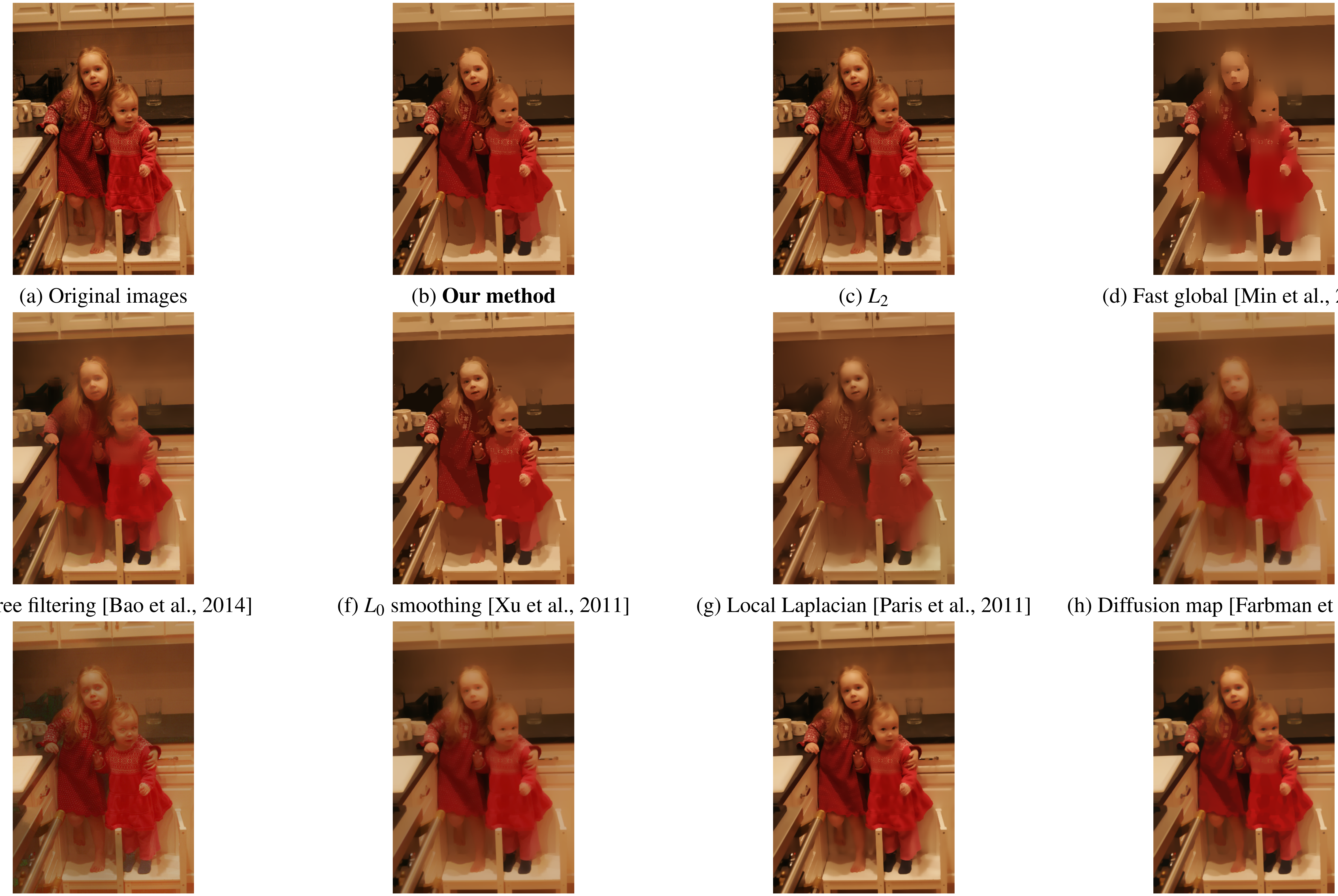


(a) Original images (b) **Our method** (c) L_2 (d) Fast global [Min et al., 2014]

(e) Tree filtering [Bao et al., 2014] (f) L_0 smoothing [Xu et al., 2011] (g) Local Laplacian [Paris et al., 2011] (h) Diffusion map [Farbman et al., 2010]

(i) Wavelets [Fattal, 2009] (j) Multi-scale tone [Farbman et al., 2008] (k) Bilateral [Tomasi, 1998] (l) Total variation [Rudin et al., 1992]

Figure 20: Comparison of edge-preserving image smoothing results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.



(a) Original images
(b) **Our method**
(c) L_2
(d) Fast global [Min et al., 2014]
(e) Tree filtering [Bao et al., 2014]
(f) L_0 smoothing [Xu et al., 2011]
(g) Local Laplacian [Paris et al., 2011]
(h) Diffusion map [Farbman et al., 2010]
(i) Wavelets [Fattal, 2009]
(j) Multi-scale tone [Farbman et al., 2008]
(k) Bilateral [Tomasi, 1998]
(l) Total variation [Rudin et al., 1992]

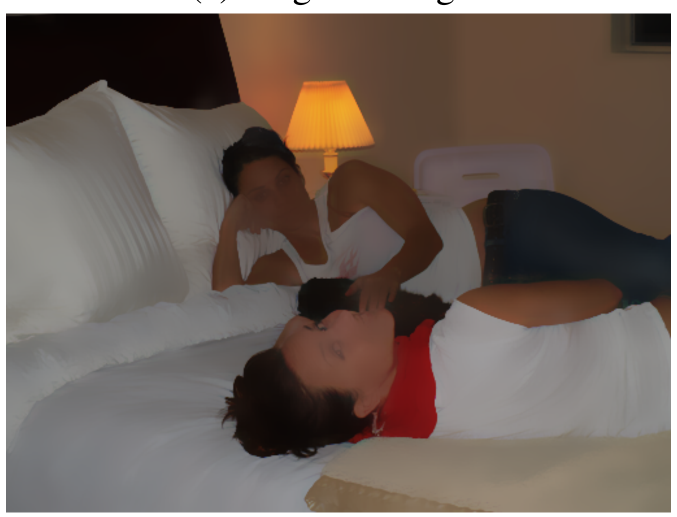
Figure 21: Comparison of edge-preserving image smoothing results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

(a) Original images

(b) **Our method**

(c) L_2

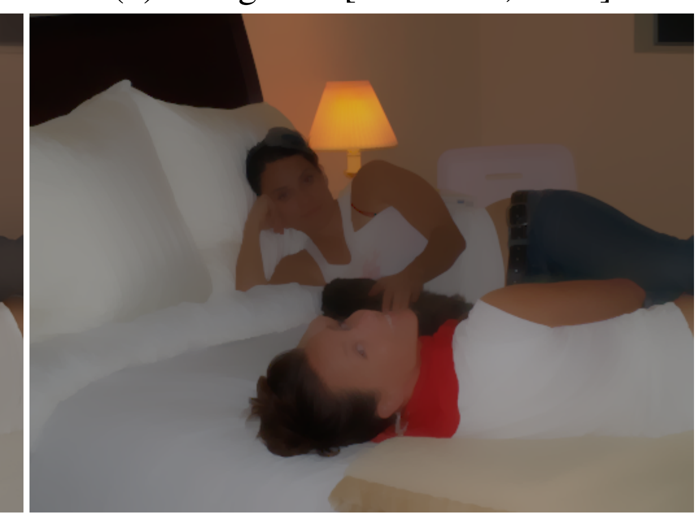
(d) Fast global [Min et al., 2014]



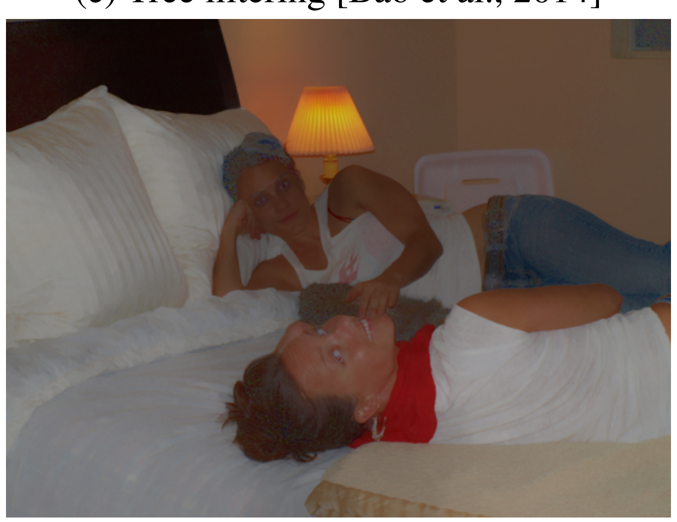
(e) Tree filtering [Bao et al., 2014]

(f) L_0 smoothing [Xu et al., 2011]

(g) Local Laplacian [Paris et al., 2011]



(h) Diffusion map [Farbman et al., 2010]



(i) Wavelets [Fattal, 2009]

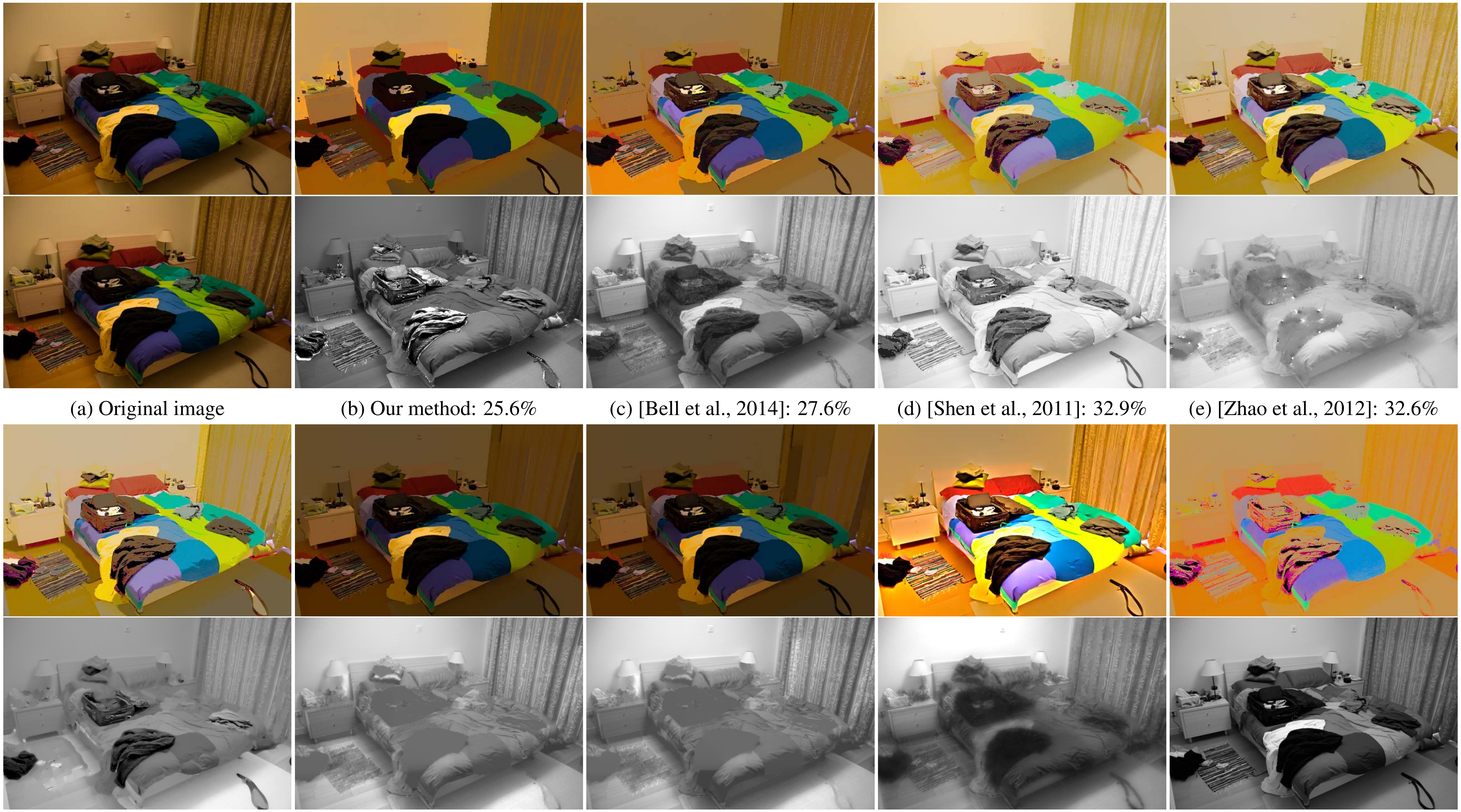
(j) Multi-scale tone [Farbman et al., 2008]

(k) Bilateral [Tomasi, 1998]

(l) Total variation [Rudin et al., 1992]

Figure 22: Comparison of edge-preserving image smoothing results between our method and other state-of-the-art methods. The parameters used in our method have been listed in Section 5.1 of the paper. For other methods, we carefully adjusted their parameters to obtain the optimal results.

Intrinsic Image Decomposition

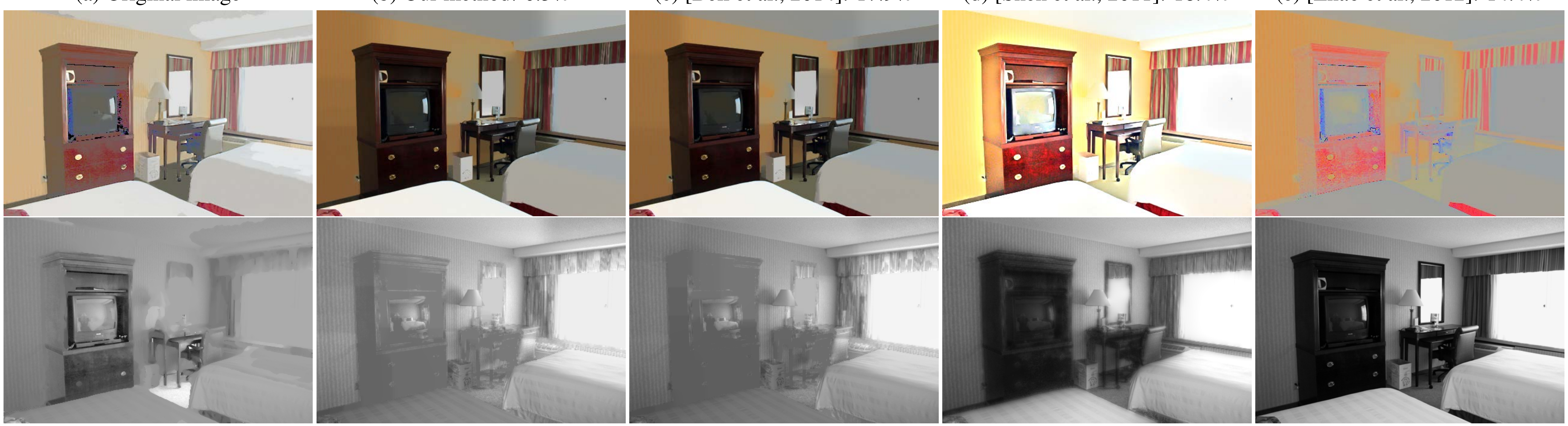


(a) Original image (b) Our method: 25.6% (c) [Bell et al., 2014]: 27.6% (d) [Shen et al., 2011]: 32.9% (e) [Zhao et al., 2012]: 32.6%

(f) [Garces et al., 2012]: 25.5% (g) Color Retinex: 37.3% (h) Grayscale Retinex: 32.0% (i) [Bonneel et al., 2014]: 41.2% (j) Baseline Reflectance: 28.2%

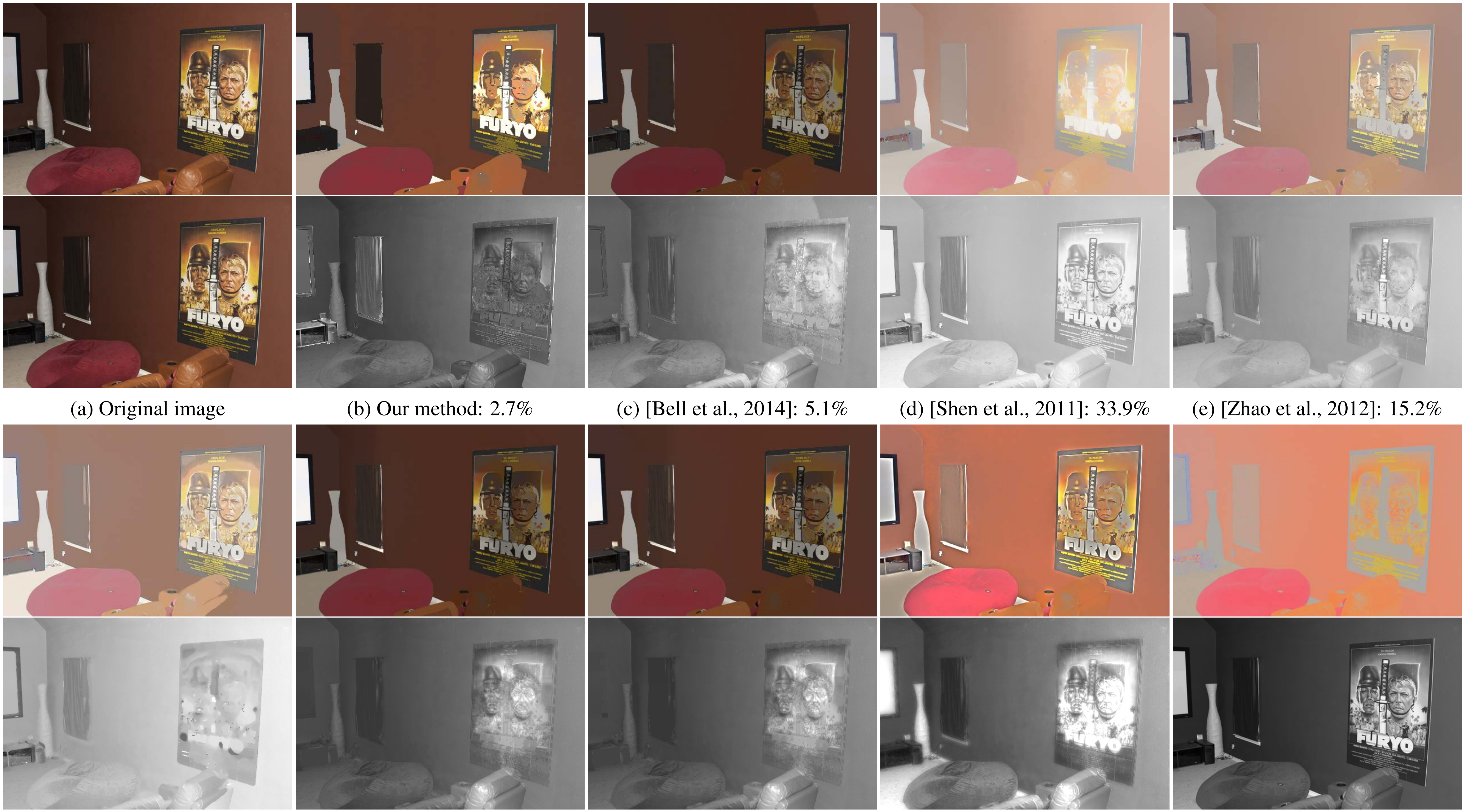
Figure 23: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 0.3% (c) [Bell et al., 2014]: 17.9% (d) [Shen et al., 2011]: 18.4% (e) [Zhao et al., 2012]: 14.4%



(f) [Garces et al., 2012]: 18.8% (g) Color Retinex: 17.5% (h) Grayscale Retinex: 22.7% (i) [Bonneel et al., 2014]: 10.3% (j) Baseline Reflectance: 41.5%

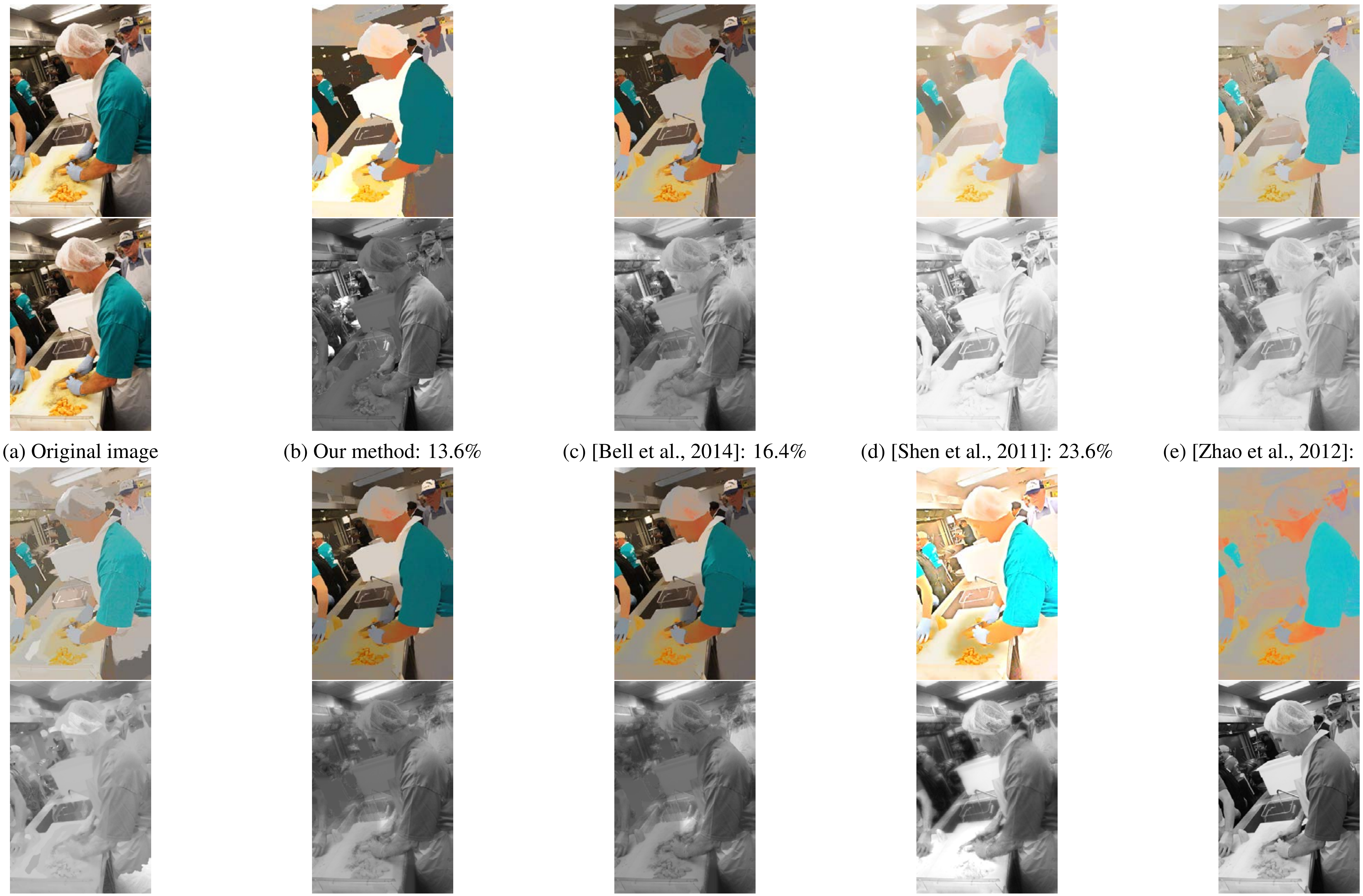
Figure 24: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



(a) Original image (b) Our method: 2.7% (c) [Bell et al., 2014]: 5.1% (d) [Shen et al., 2011]: 33.9% (e) [Zhao et al., 2012]: 15.2%

(f) [Garces et al., 2012]: 12.4% (g) Color Retinex: 14.9% (h) Grayscale Retinex: 10.4% (i) [Bonneel et al., 2014]: 27.6% (j) Baseline Reflectance: 29.8%

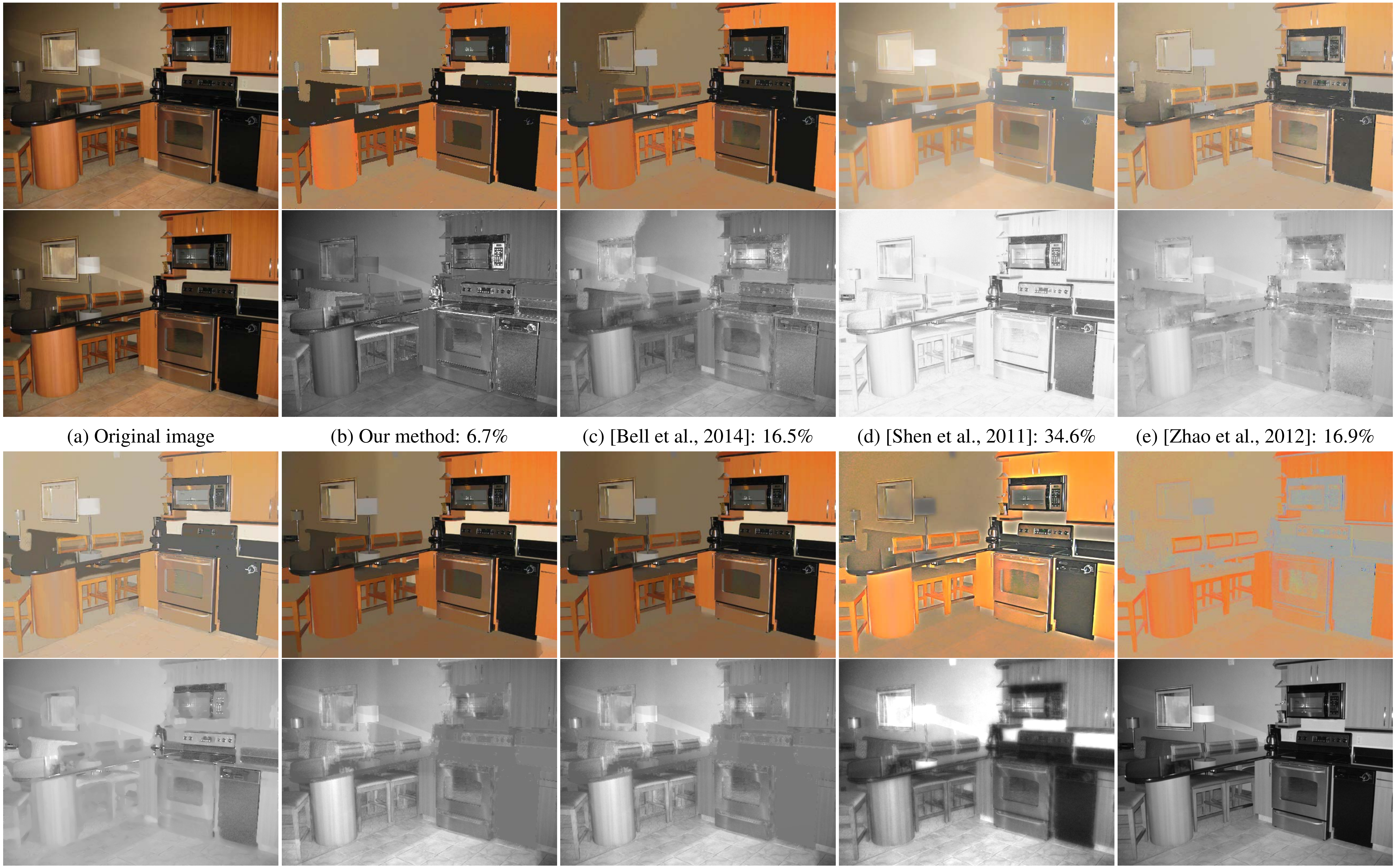
Figure 25: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



(a) Original image (b) Our method: 13.6% (c) [Bell et al., 2014]: 16.4% (d) [Shen et al., 2011]: 23.6% (e) [Zhao et al., 2012]: 19.2%

(f) [Garces et al., 2012]: 28.9% (g) Color Retinex: 21.6% (h) Grayscale Retinex: 24.6% (i) [Bonneel et al., 2014]: 24.4% (j) Baseline Reflectance: 40.1%

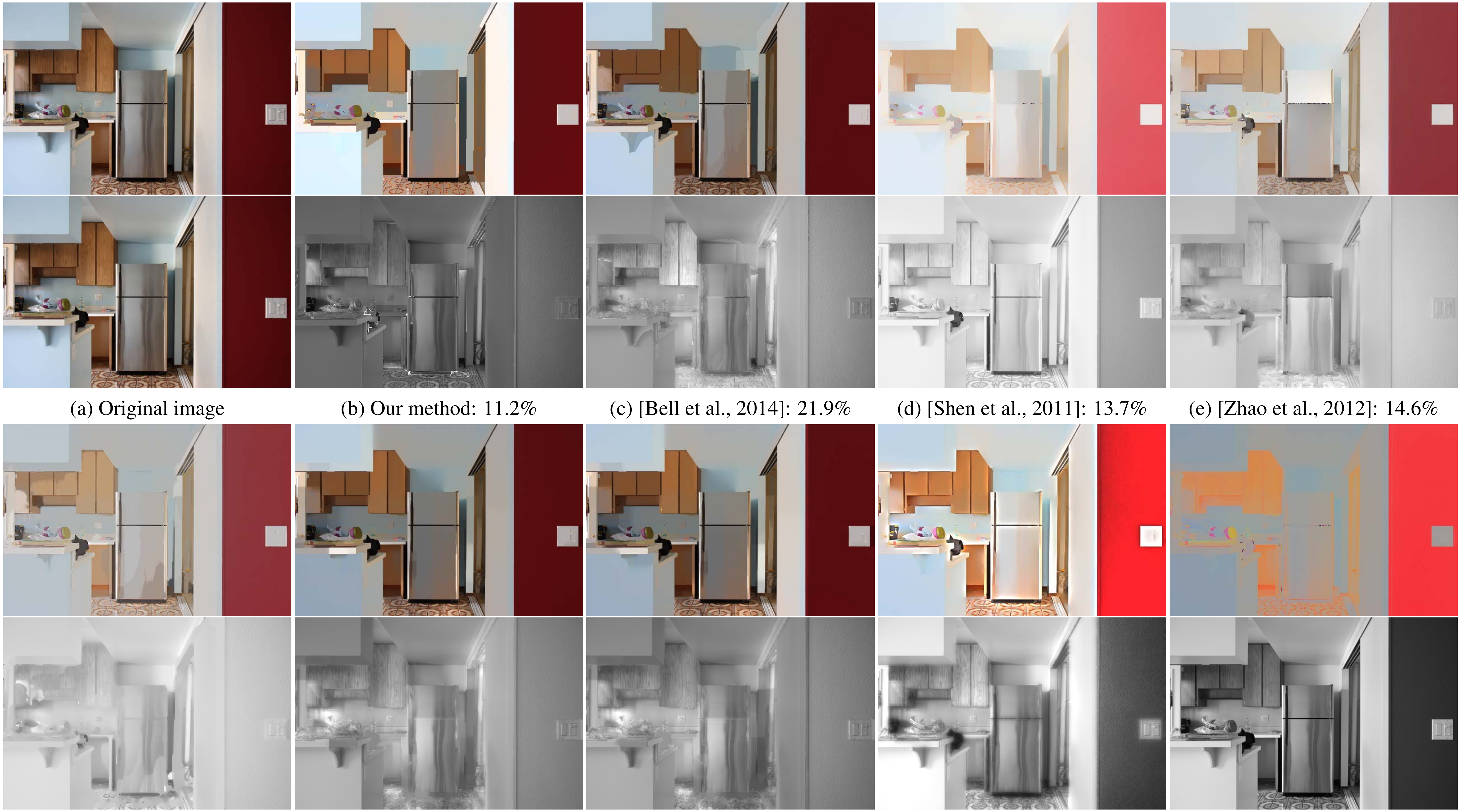
Figure 26: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



(a) Original image (b) Our method: 6.7% (c) [Bell et al., 2014]: 16.5% (d) [Shen et al., 2011]: 34.6% (e) [Zhao et al., 2012]: 16.9%

(f) [Garces et al., 2012]: 7.6% (g) Color Retinex: 25.0% (h) Grayscale Retinex: 23.5% (i) [Bonneel et al., 2014]: 32.5% (j) Baseline Reflectance: 38.2%

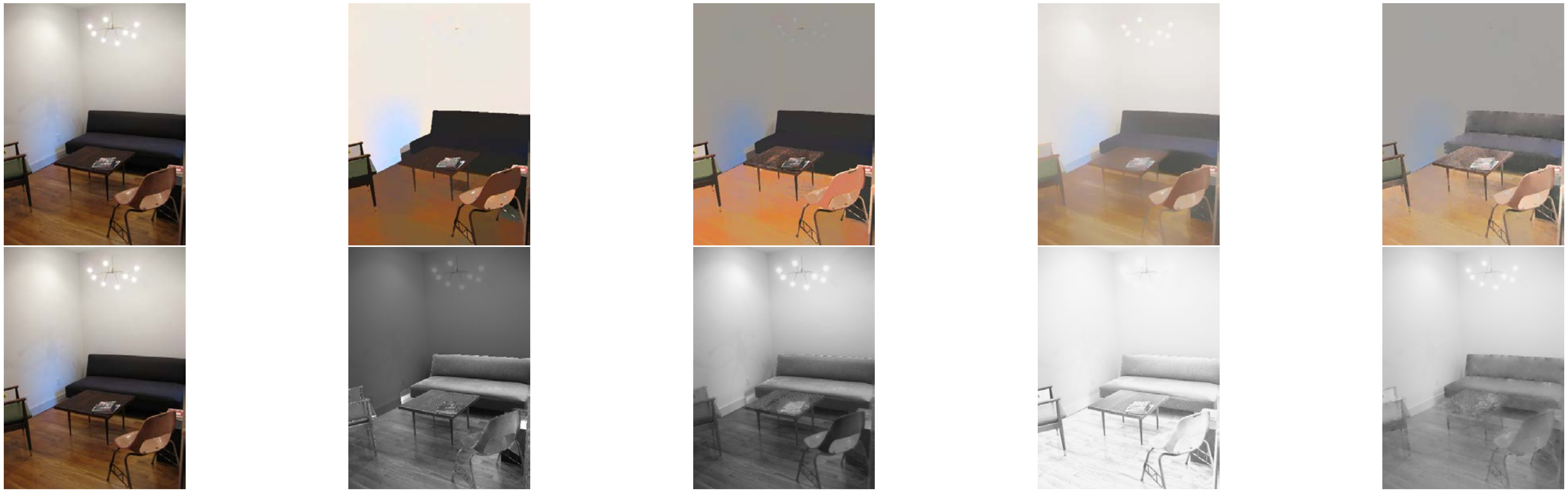
Figure 27: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



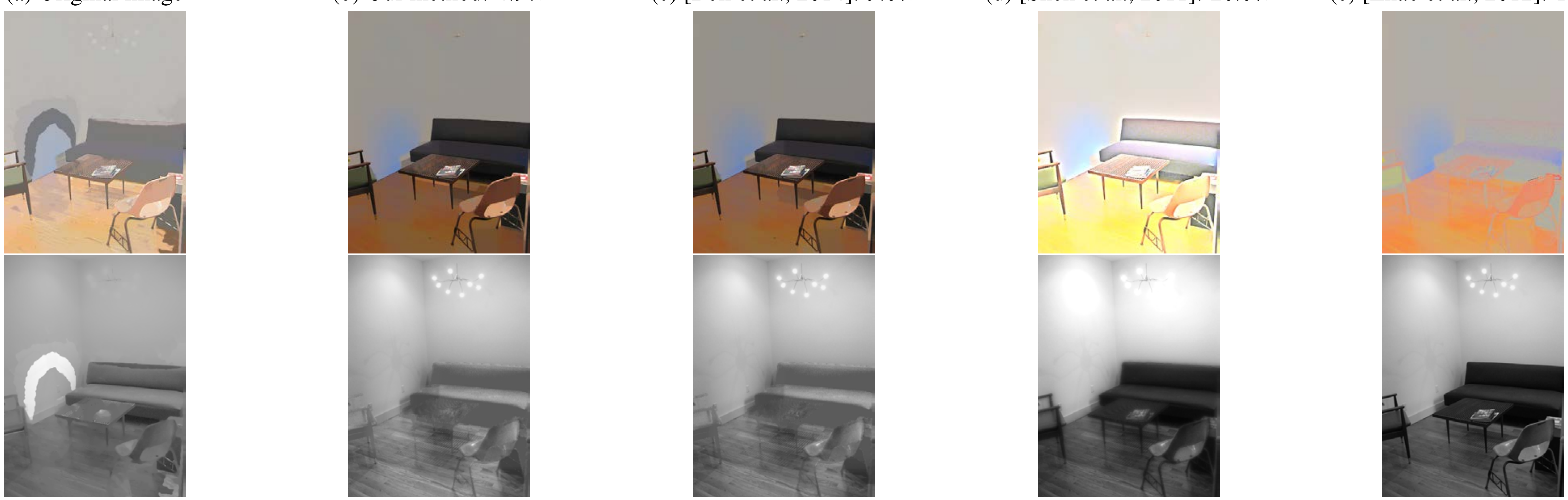
(a) Original image (b) Our method: 11.2% (c) [Bell et al., 2014]: 21.9% (d) [Shen et al., 2011]: 13.7% (e) [Zhao et al., 2012]: 14.6%

(f) [Garces et al., 2012]: 14.3% (g) Color Retinex: 13.4% (h) Grayscale Retinex: 19.9% (i) [Bonneel et al., 2014]: 19.2% (j) Baseline Reflectance: 12.3%

Figure 28: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

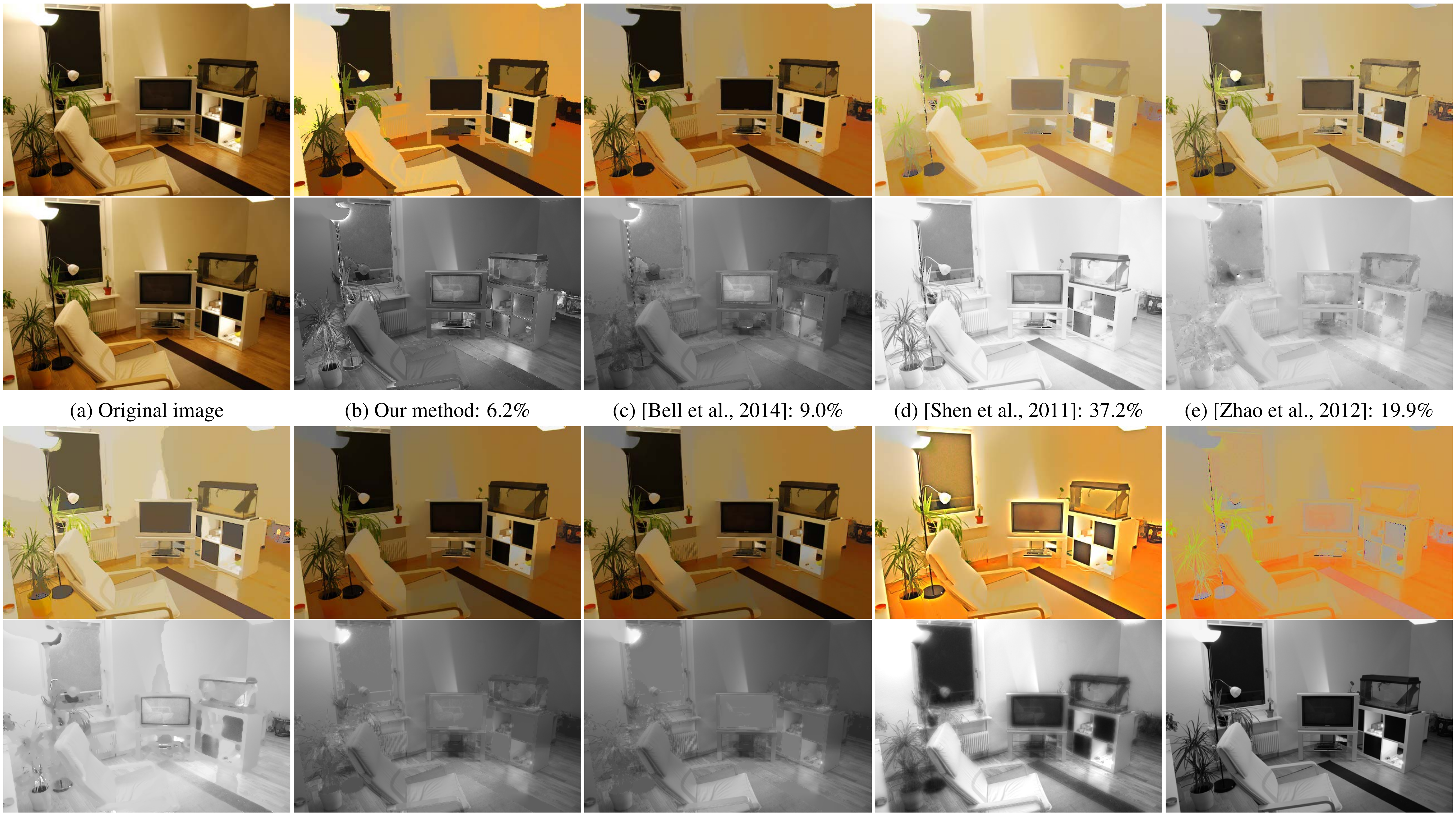


(a) Original image (b) Our method: 4.9% (c) [Bell et al., 2014]: 9.0% (d) [Shen et al., 2011]: 20.0% (e) [Zhao et al., 2012]: 14.6%



(f) [Garces et al., 2012]: 15.1% (g) Color Retinex: 11.9% (h) Grayscale Retinex: 12.6% (i) [Bonneel et al., 2014]: 19.6% (j) Baseline Reflectance: 18.3%

Figure 29: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



(a) Original image (b) Our method: 6.2% (c) [Bell et al., 2014]: 9.0% (d) [Shen et al., 2011]: 37.2% (e) [Zhao et al., 2012]: 19.9%

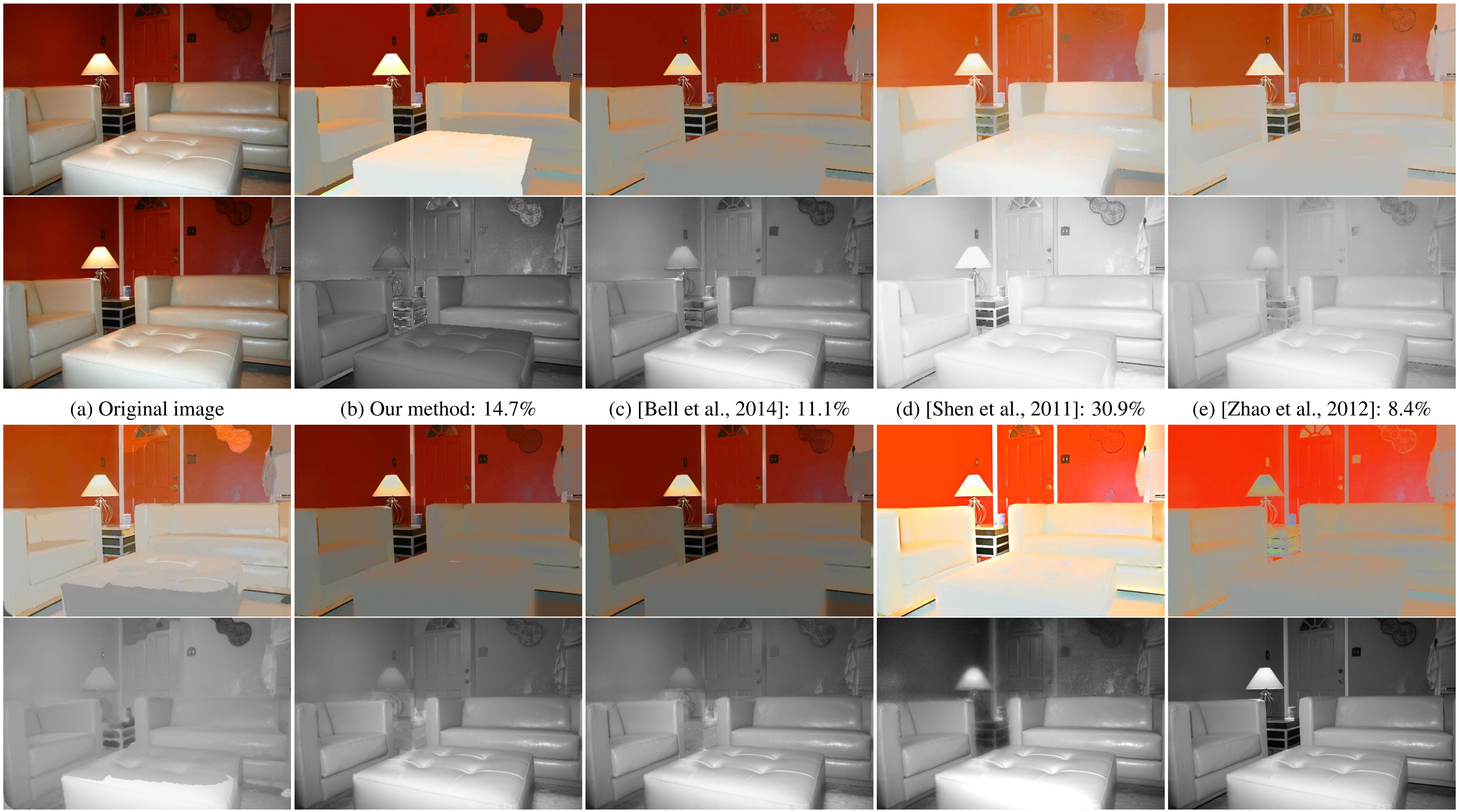
(f) [Garces et al., 2012]: 27.1% (g) Color Retinex: 8.8% (h) Grayscale Retinex: 9.0% (i) [Bonneel et al., 2014]: 17.8% (j) Baseline Reflectance: 22.5%

Figure 30: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 0.8% (c) [Bell et al., 2014]: 3.4% (d) [Shen et al., 2011]: 26.2% (e) [Zhao et al., 2012]: 14.7%

(f) [Garces et al., 2012]: 1.8% (g) Color Retinex: 27.6% (h) Grayscale Retinex: 26.9% (i) [Bonneel et al., 2014]: 26.6% (j) Baseline Reflectance: 32.5%

Figure 31: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



(a) Original image (b) Our method: 14.7% (c) [Bell et al., 2014]: 11.1% (d) [Shen et al., 2011]: 30.9% (e) [Zhao et al., 2012]: 8.4%

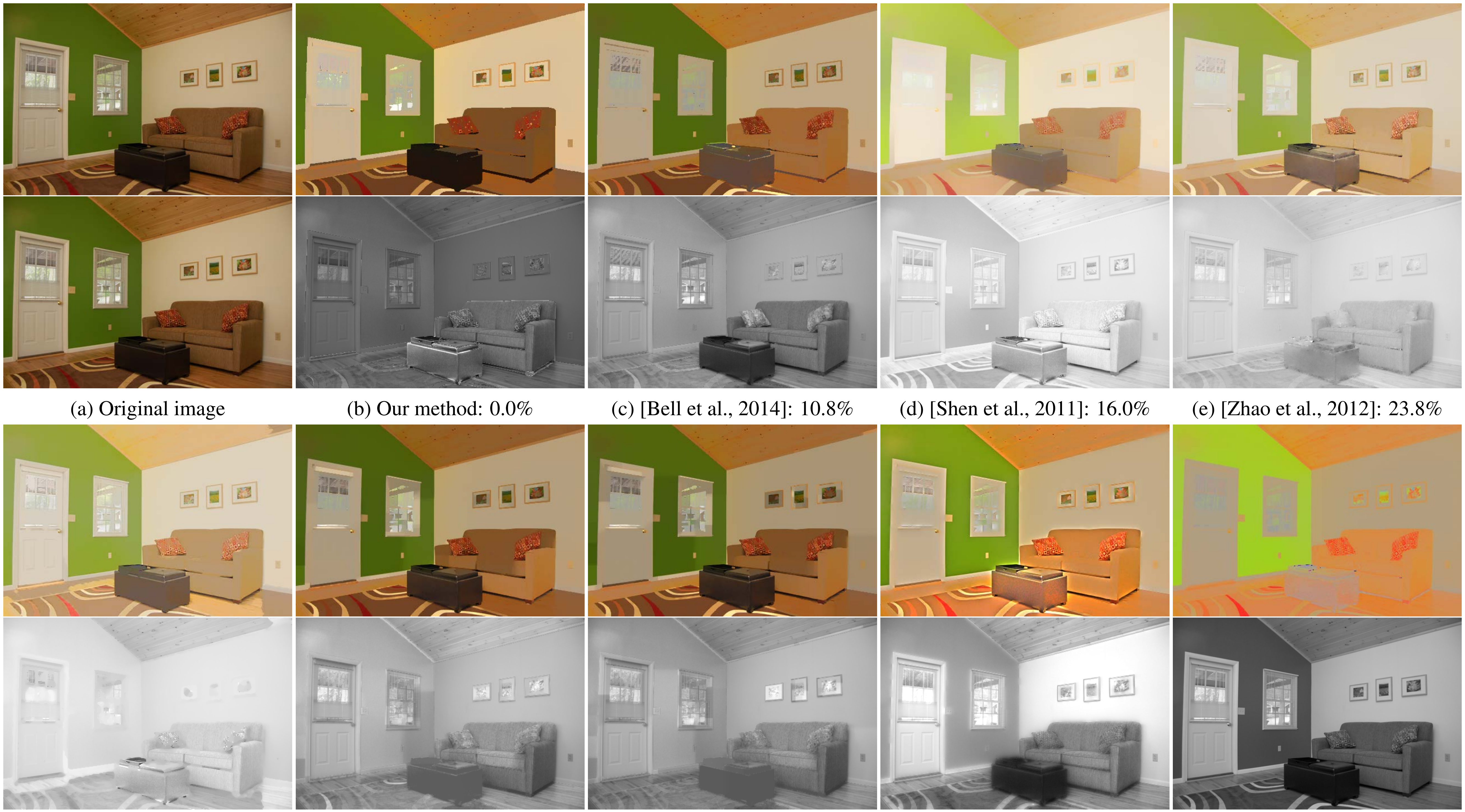
(f) [Garces et al., 2012]: 19.2% (g) Color Retinex: 5.2% (h) Grayscale Retinex: 4.1% (i) [Bonneel et al., 2014]: 6.1% (j) Baseline Reflectance: 9.5%

Figure 32: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 10.4% (c) [Bell et al., 2014]: 12.0% (d) [Shen et al., 2011]: 18.7% (e) [Zhao et al., 2012]: 18.4%

(f) [Garces et al., 2012]: 19.9% (g) Color Retinex: 22.6% (h) Grayscale Retinex: 27.0% (i) [Bonneel et al., 2014]: 23.2% (j) Baseline Reflectance: 41.4%

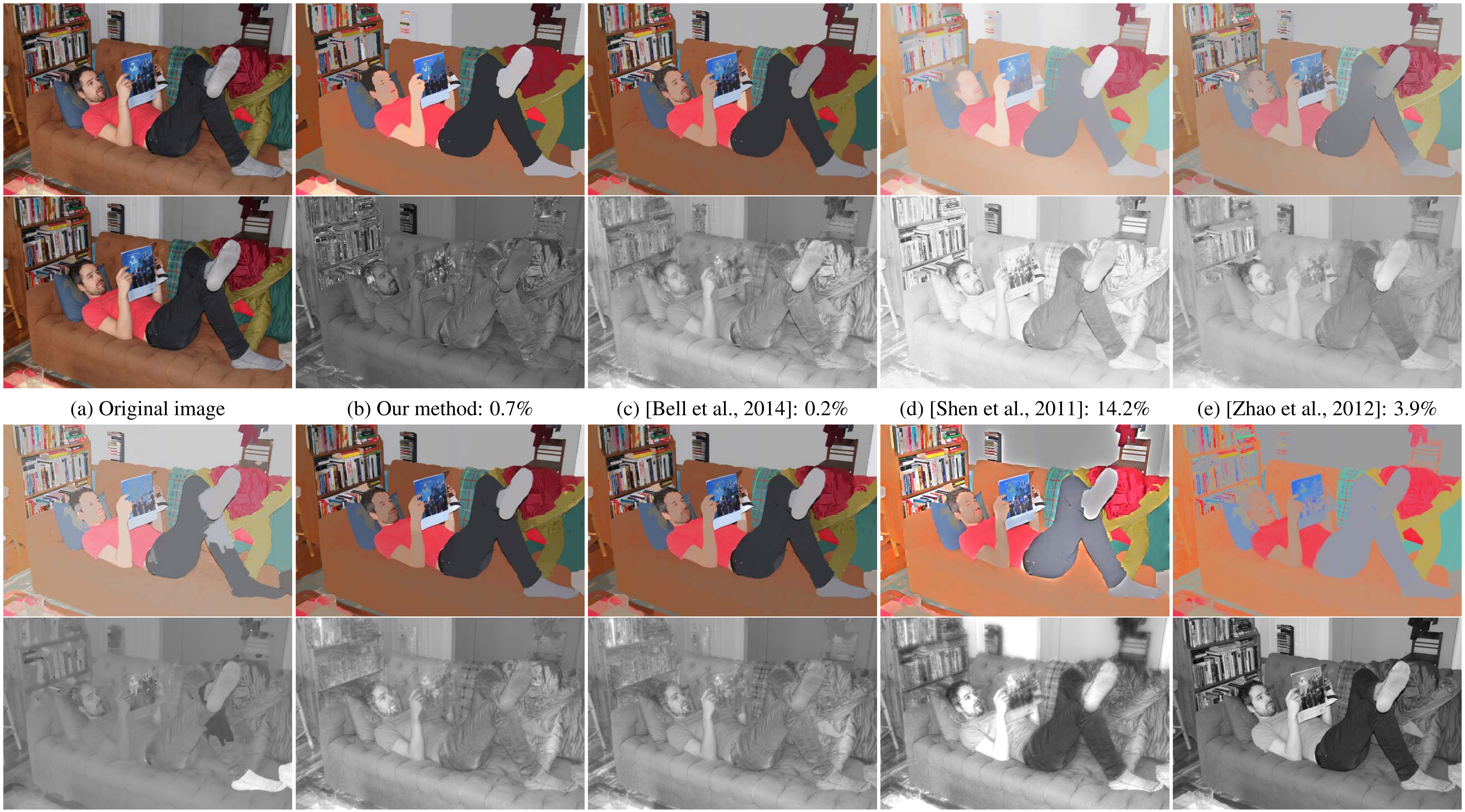
Figure 33: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



(a) Original image (b) Our method: 0.0% (c) [Bell et al., 2014]: 10.8% (d) [Shen et al., 2011]: 16.0% (e) [Zhao et al., 2012]: 23.8%

(f) [Garces et al., 2012]: 13.3% (g) Color Retinex: 20.3% (h) Grayscale Retinex: 42.5% (i) [Bonneel et al., 2014]: 16.3% (j) Baseline Reflectance: 17.7%

Figure 34: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

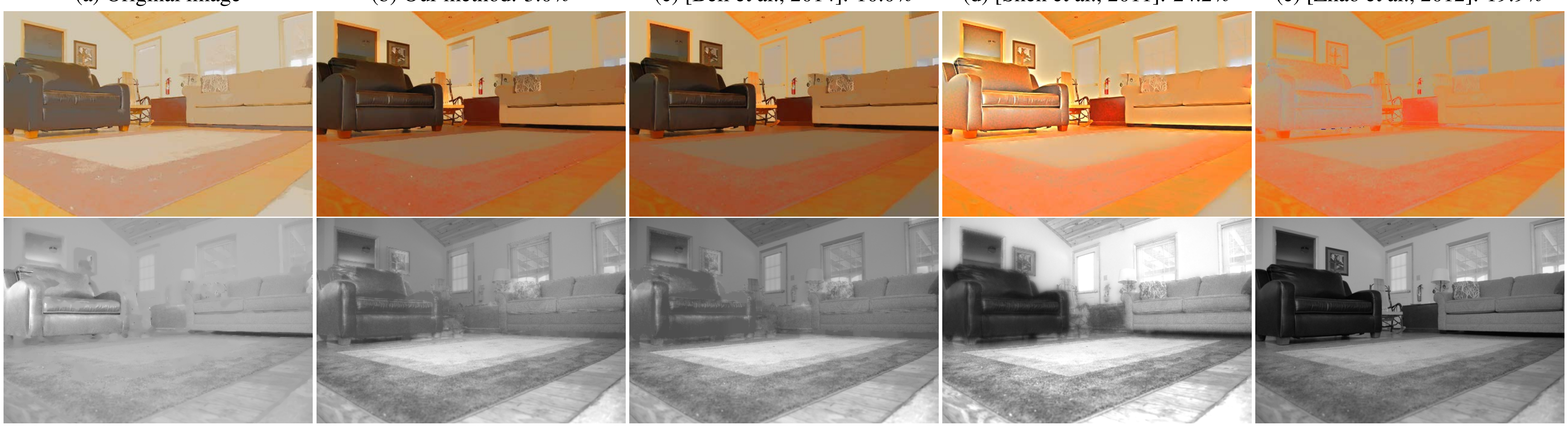


(a) Original image (b) Our method: 0.7% (c) [Bell et al., 2014]: 0.2% (d) [Shen et al., 2011]: 14.2% (e) [Zhao et al., 2012]: 3.9%

(f) [Garces et al., 2012]: 10.2% (g) Color Retinex: 0.6% (h) Grayscale Retinex: 10.6% (i) [Bonneel et al., 2014]: 12.0% (j) Baseline Reflectance: 23.2%

Figure 35: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 3.0% (c) [Bell et al., 2014]: 10.0% (d) [Shen et al., 2011]: 24.2% (e) [Zhao et al., 2012]: 19.9%



(f) [Garces et al., 2012]: 12.0% (g) Color Retinex: 40.2% (h) Grayscale Retinex: 29.2% (i) [Bonneel et al., 2014]: 28.2% (j) Baseline Reflectance: 30.7%

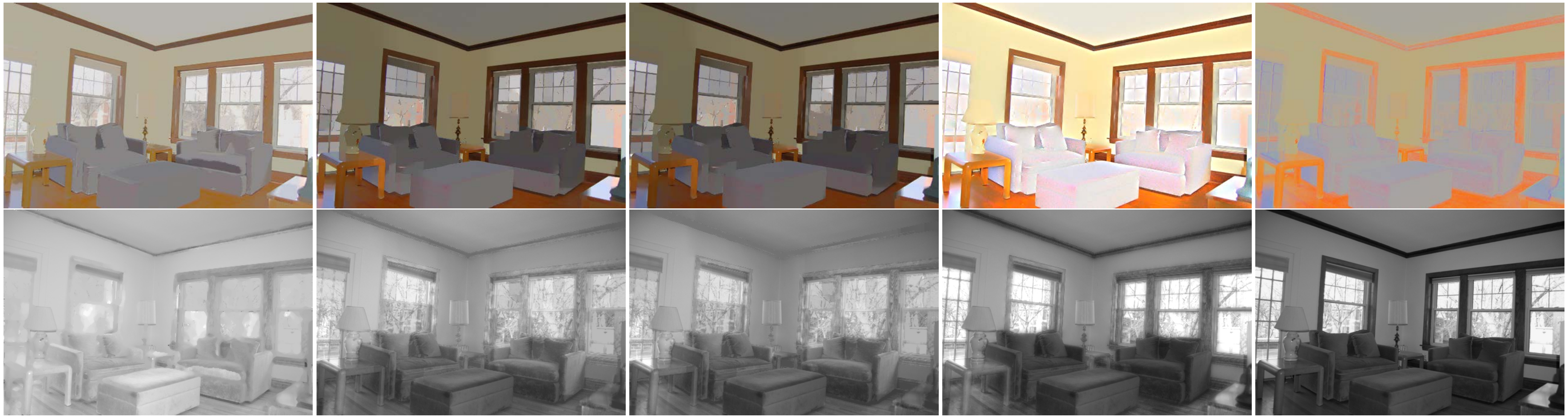
Figure 36: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 9.6% (c) [Bell et al., 2014]: 15.1% (d) [Shen et al., 2011]: 26.4% (e) [Zhao et al., 2012]: 14.3%

(f) [Garces et al., 2012]: 20.3% (g) Color Retinex: 29.0% (h) Grayscale Retinex: 28.5% (i) [Bonneel et al., 2014]: 28.5% (j) Baseline Reflectance: 34.2%

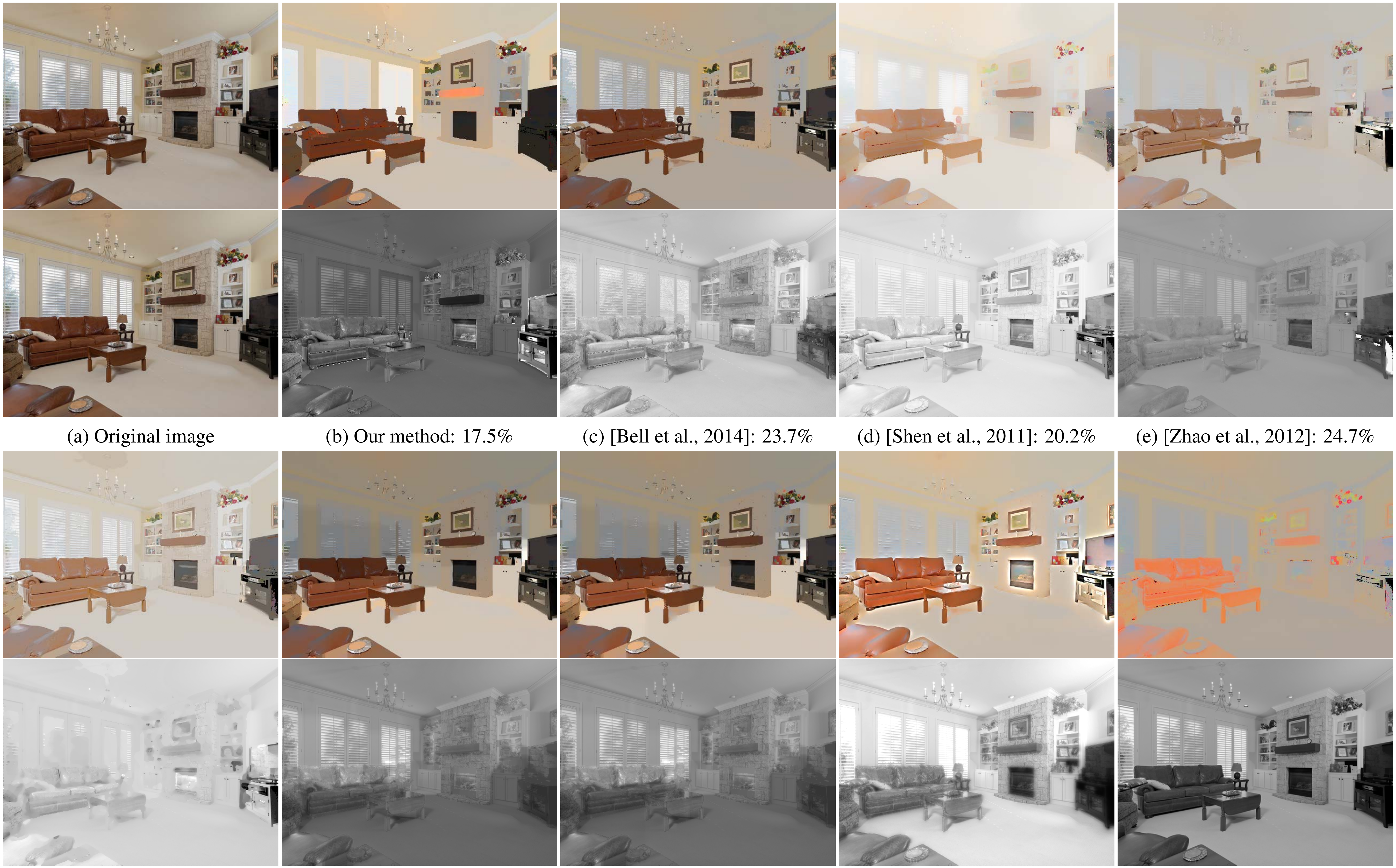
Figure 37: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 11.6% (c) [Bell et al., 2014]: 15.2% (d) [Shen et al., 2011]: 40.6% (e) [Zhao et al., 2012]: 25.2%



(f) [Garces et al., 2012]: 22.4% (g) Color Retinex: 36.3% (h) Grayscale Retinex: 34.4% (i) [Bonneel et al., 2014]: 21.2% (j) Baseline Reflectance: 27.3%

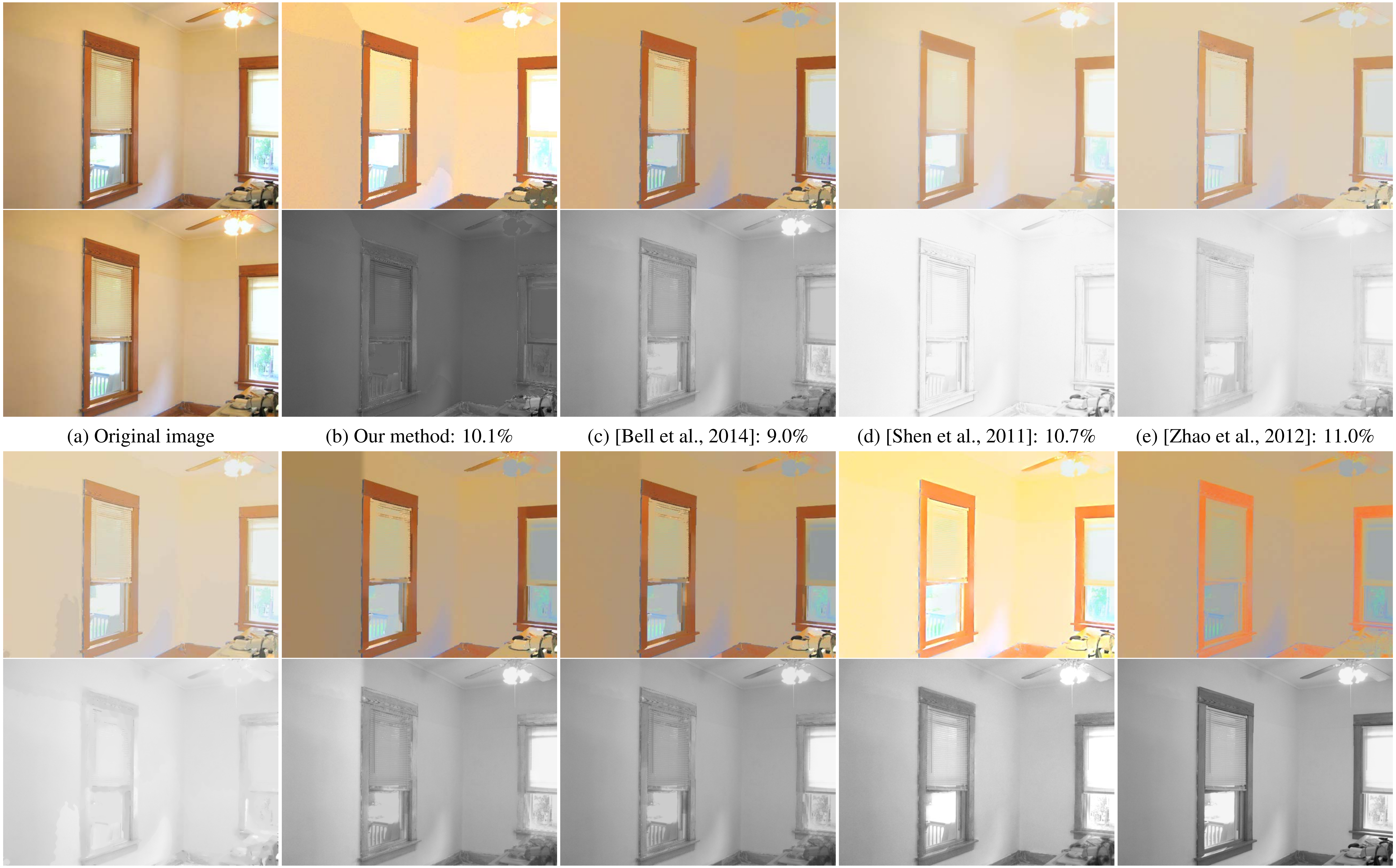
Figure 38: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



(a) Original image (b) Our method: 17.5% (c) [Bell et al., 2014]: 23.7% (d) [Shen et al., 2011]: 20.2% (e) [Zhao et al., 2012]: 24.7%

(f) [Garces et al., 2012]: 24.1% (g) Color Retinex: 19.5% (h) Grayscale Retinex: 19.5% (i) [Bonneel et al., 2014]: 34.7% (j) Baseline Reflectance: 45.9%

Figure 39: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



(a) Original image (b) Our method: 10.1% (c) [Bell et al., 2014]: 9.0% (d) [Shen et al., 2011]: 10.7% (e) [Zhao et al., 2012]: 11.0%

(f) [Garces et al., 2012]: 13.6% (g) Color Retinex: 13.8% (h) Grayscale Retinex: 13.8% (i) [Bonneel et al., 2014]: 11.8% (j) Baseline Reflectance: 11.8%

Figure 40: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 21.7% (c) [Bell et al., 2014]: 17.2% (d) [Shen et al., 2011]: 20.1% (e) [Zhao et al., 2012]: 40.9%

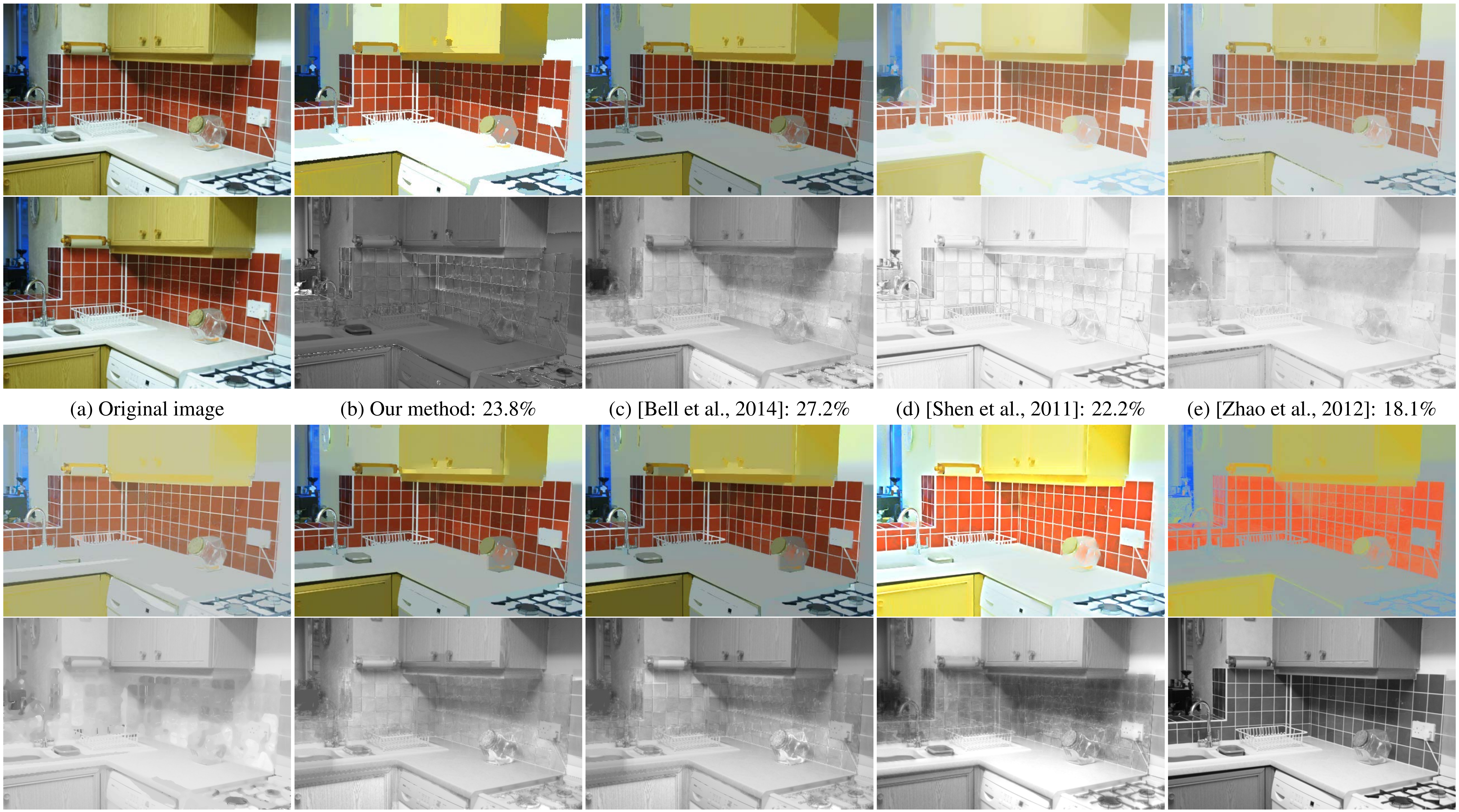
(f) [Garces et al., 2012]: 30.2% (g) Color Retinex: 37.8% (h) Grayscale Retinex: 40.3% (i) [Bonneel et al., 2014]: 40.8% (j) Baseline Reflectance: 37.8%

Figure 41: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 5.0% (c) [Bell et al., 2014]: 5.4% (d) [Shen et al., 2011]: 7.8% (e) [Zhao et al., 2012]: 11.7%

(f) [Garces et al., 2012]: 13.9% (g) Color Retinex: 9.7% (h) Grayscale Retinex: 10.8% (i) [Bonneel et al., 2014]: 10.3% (j) Baseline Reflectance: 30.6%

Figure 42: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



(a) Original image (b) Our method: 23.8% (c) [Bell et al., 2014]: 27.2% (d) [Shen et al., 2011]: 22.2% (e) [Zhao et al., 2012]: 18.1%

(f) [Garces et al., 2012]: 16.0% (g) Color Retinex: 24.9% (h) Grayscale Retinex: 27.9% (i) [Bonneel et al., 2014]: 14.2% (j) Baseline Reflectance: 26.1%

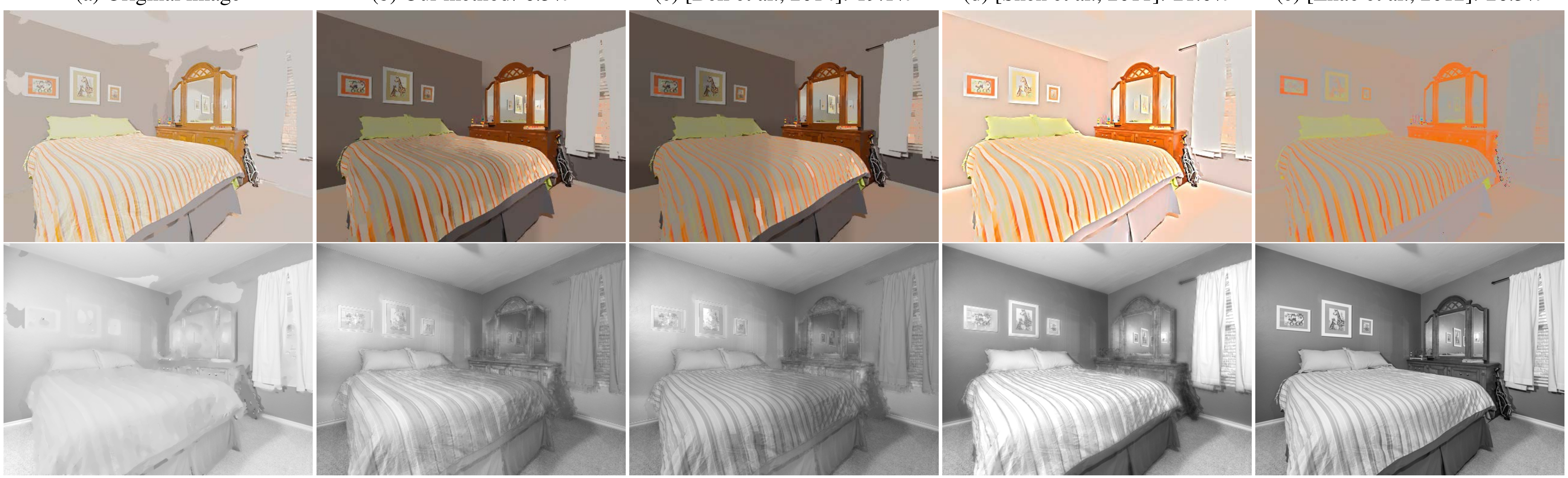
Figure 43: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 8.8% (c) [Bell et al., 2014]: 17.9% (d) [Shen et al., 2011]: 29.7% (e) [Zhao et al., 2012]: 8.9%

(f) [Garces et al., 2012]: 19.8% (g) Color Retinex: 15.3% (h) Grayscale Retinex: 15.3% (i) [Bonneel et al., 2014]: 18.7% (j) Baseline Reflectance: 24.3%

Figure 44: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

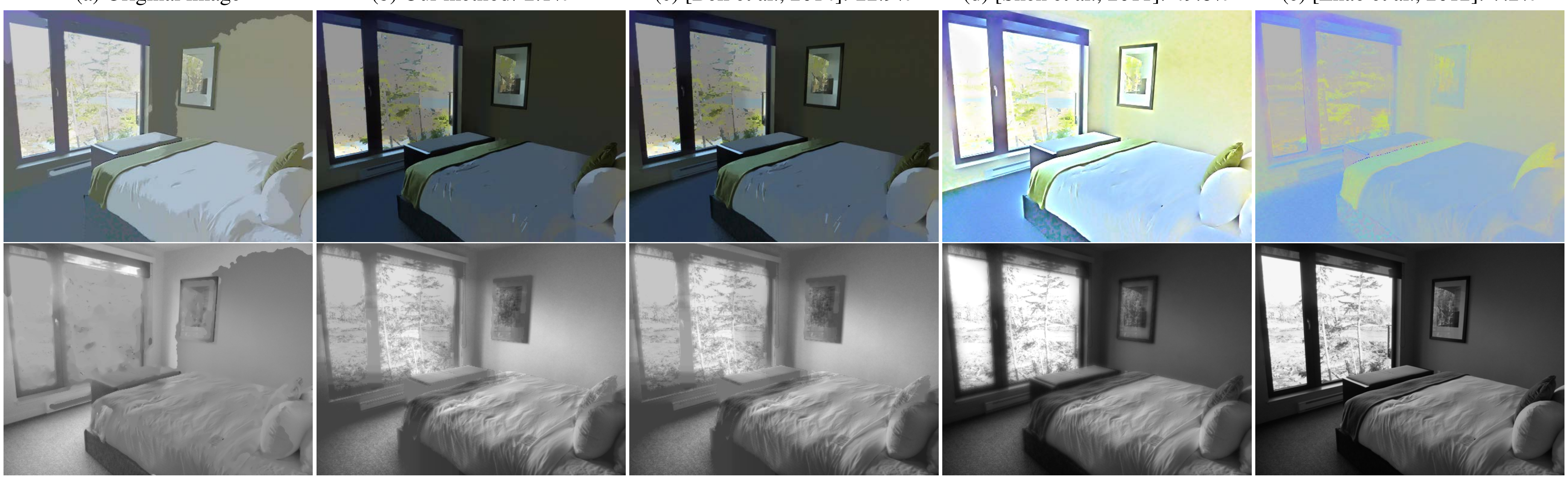
(a) Original image (b) Our method: 6.5% (c) [Bell et al., 2014]: 19.1% (d) [Shen et al., 2011]: 21.0% (e) [Zhao et al., 2012]: 26.3%



(f) [Garces et al., 2012]: 18.9% (g) Color Retinex: 16.4% (h) Grayscale Retinex: 14.0% (i) [Bonneel et al., 2014]: 50.1% (j) Baseline Reflectance: 49.6%

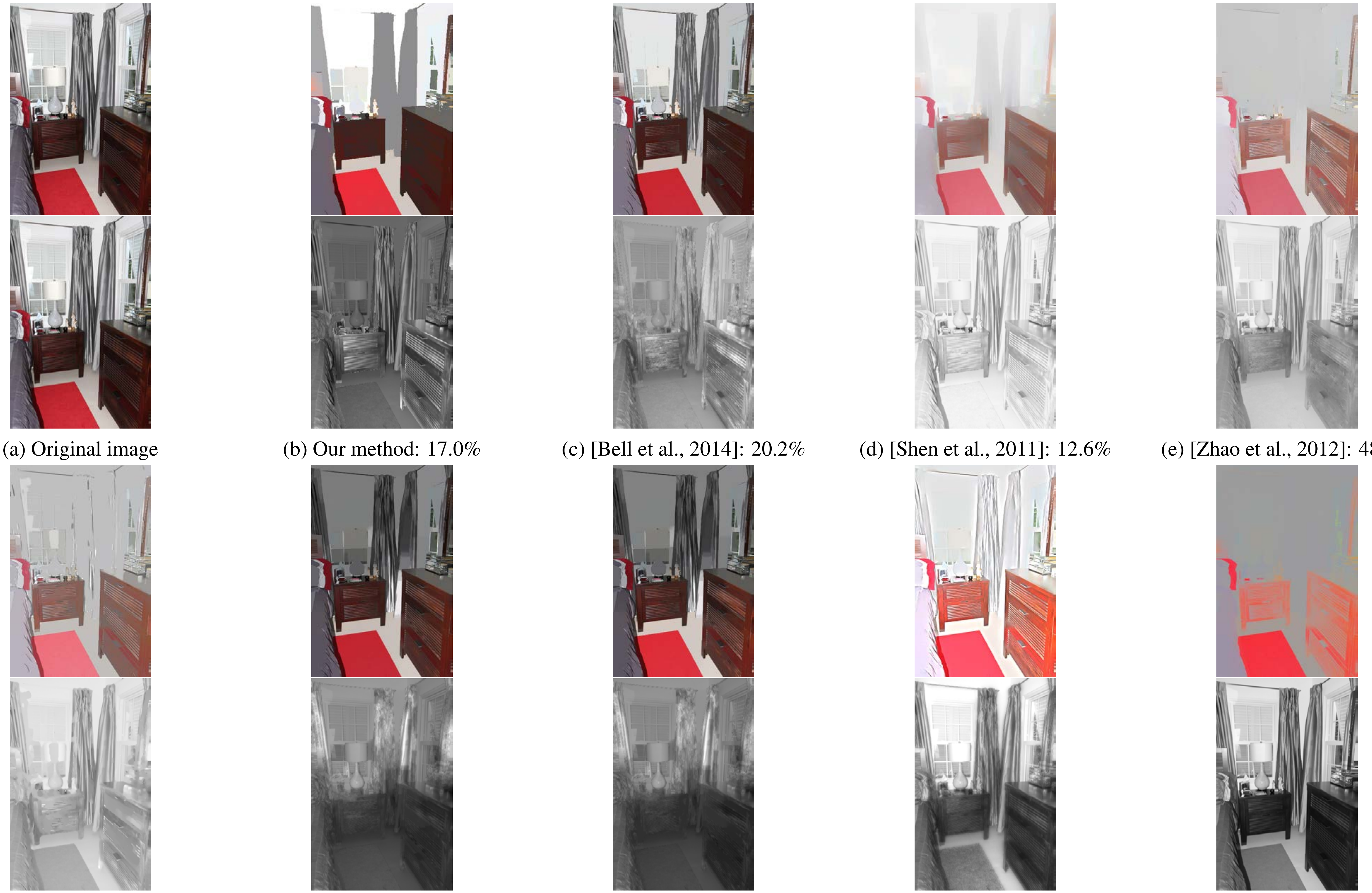
Figure 45: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 2.1% (c) [Bell et al., 2014]: 22.9% (d) [Shen et al., 2011]: 49.8% (e) [Zhao et al., 2012]: 7.2%



(f) [Garces et al., 2012]: 28.0% (g) Color Retinex: 22.1% (h) Grayscale Retinex: 20.4% (i) [Bonneel et al., 2014]: 19.8% (j) Baseline Reflectance: 28.3%

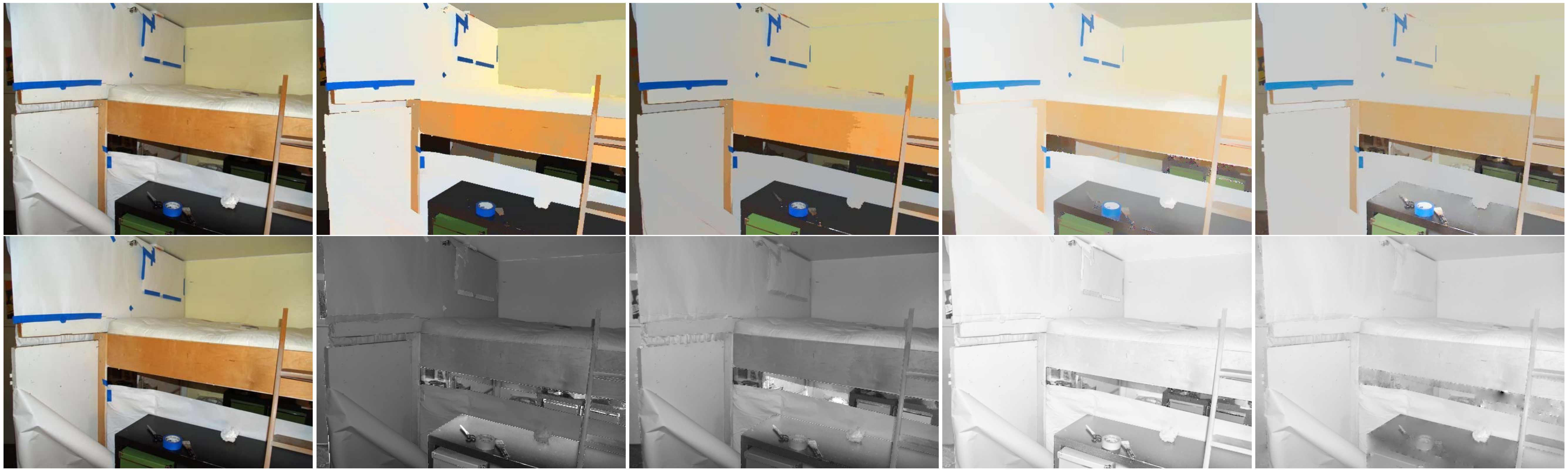
Figure 46: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



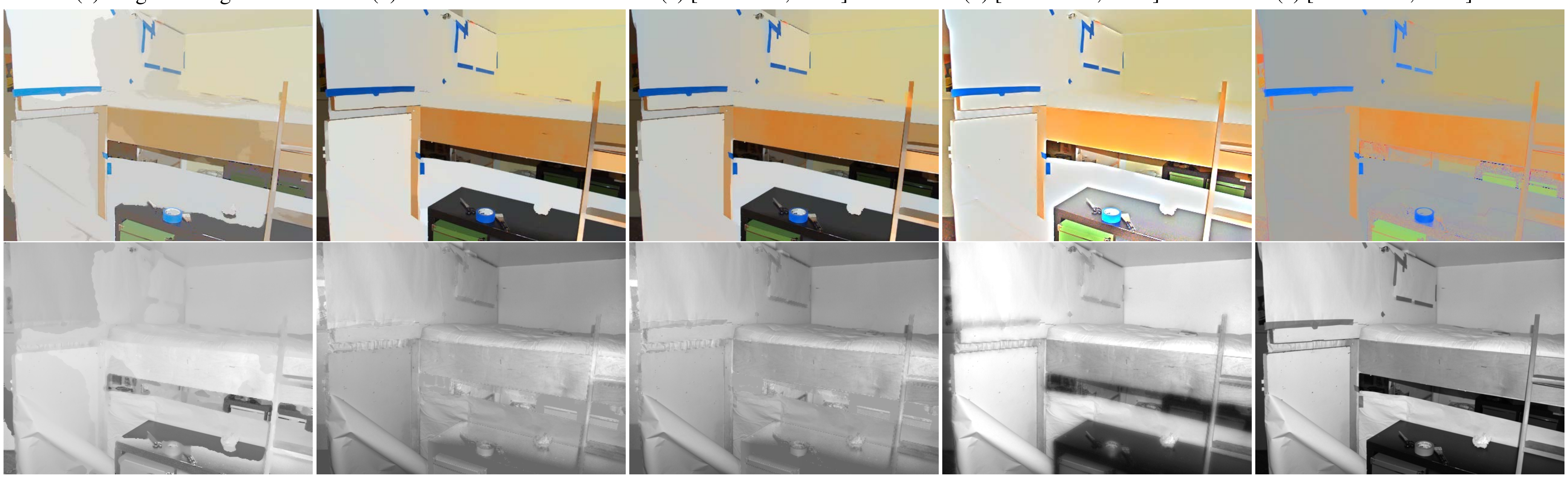
(a) Original image (b) Our method: 17.0% (c) [Bell et al., 2014]: 20.2% (d) [Shen et al., 2011]: 12.6% (e) [Zhao et al., 2012]: 48.5%

(f) [Garces et al., 2012]: 37.0% (g) Color Retinex: 25.5% (h) Grayscale Retinex: 27.5% (i) [Bonneel et al., 2014]: 24.3% (j) Baseline Reflectance: 58.7%

Figure 47: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



(a) Original image (b) Our method: 4.8% (c) [Bell et al., 2014]: 8.6% (d) [Shen et al., 2011]: 11.6% (e) [Zhao et al., 2012]: 12.9%



(f) [Garces et al., 2012]: 28.4% (g) Color Retinex: 10.3% (h) Grayscale Retinex: 14.5% (i) [Bonneel et al., 2014]: 8.0% (j) Baseline Reflectance: 21.2%

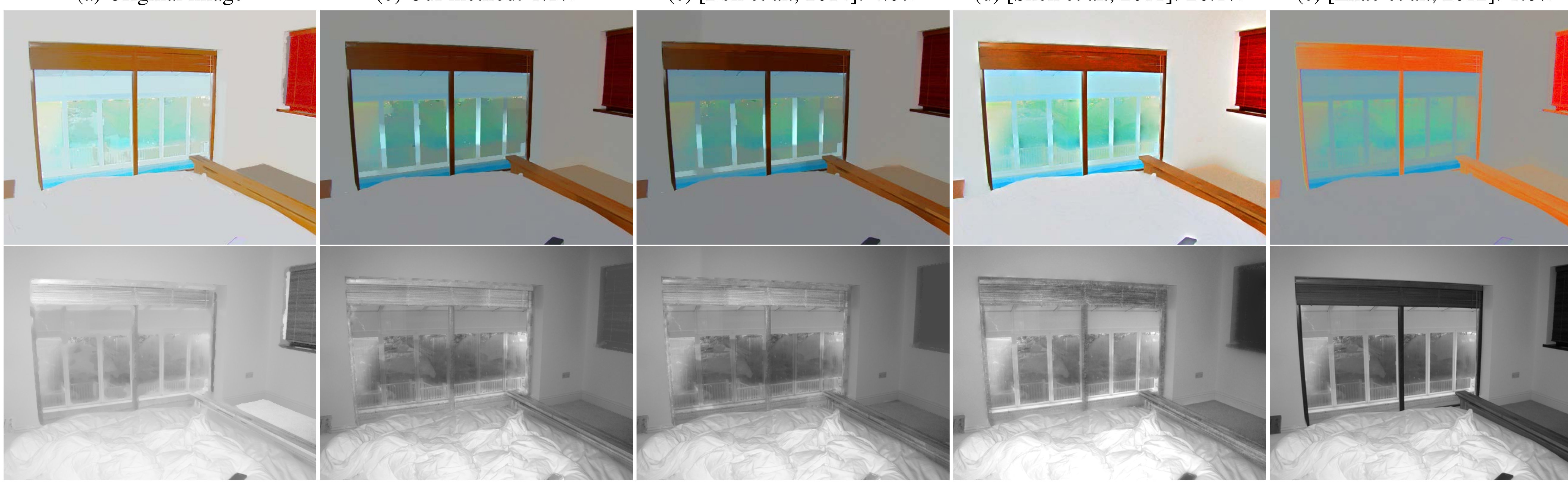
Figure 48: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 17.3% (c) [Bell et al., 2014]: 18.1% (d) [Shen et al., 2011]: 17.4% (e) [Zhao et al., 2012]: 23.5%

(f) [Garces et al., 2012]: 14.9% (g) Color Retinex: 30.1% (h) Grayscale Retinex: 35.0% (i) [Bonneel et al., 2014]: 32.5% (j) Baseline Reflectance: 34.1%

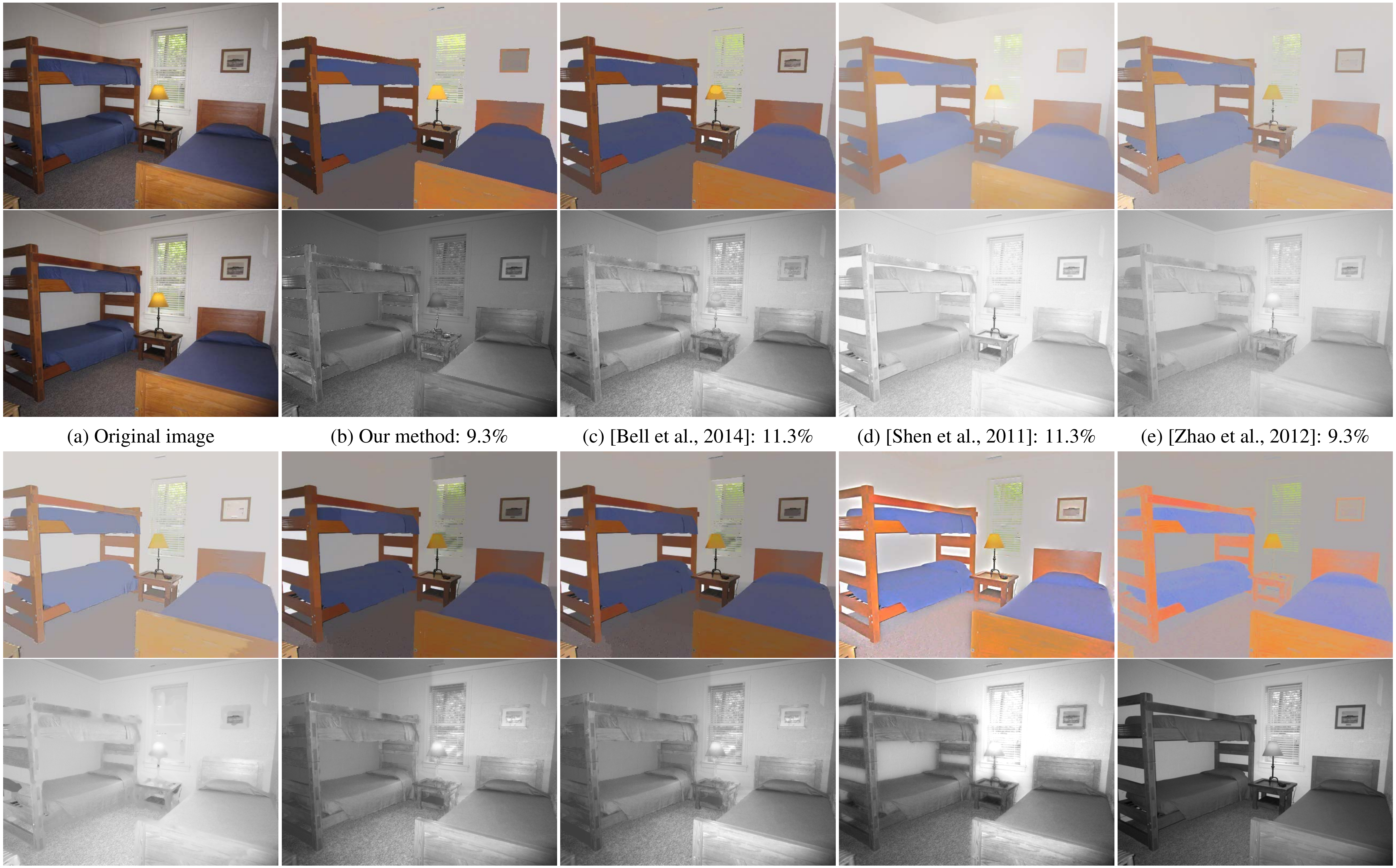
Figure 49: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 1.1% (c) [Bell et al., 2014]: 4.0% (d) [Shen et al., 2011]: 26.1% (e) [Zhao et al., 2012]: 1.8%



(f) [Garces et al., 2012]: 4.0% (g) Color Retinex: 6.2% (h) Grayscale Retinex: 10.7% (i) [Bonneel et al., 2014]: 12.9% (j) Baseline Reflectance: 11.0%

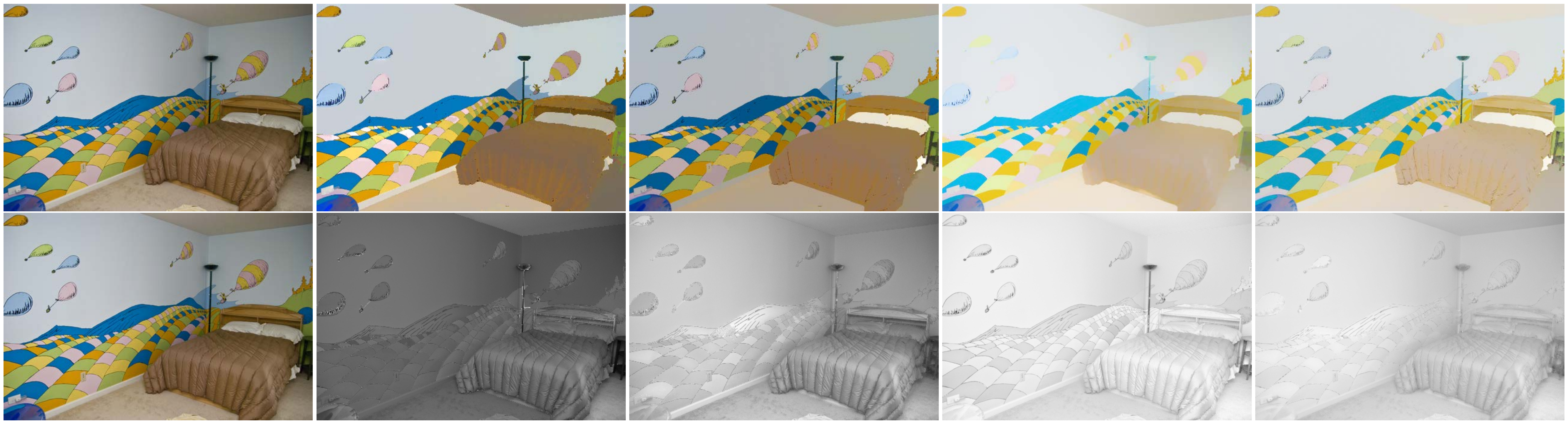
Figure 50: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



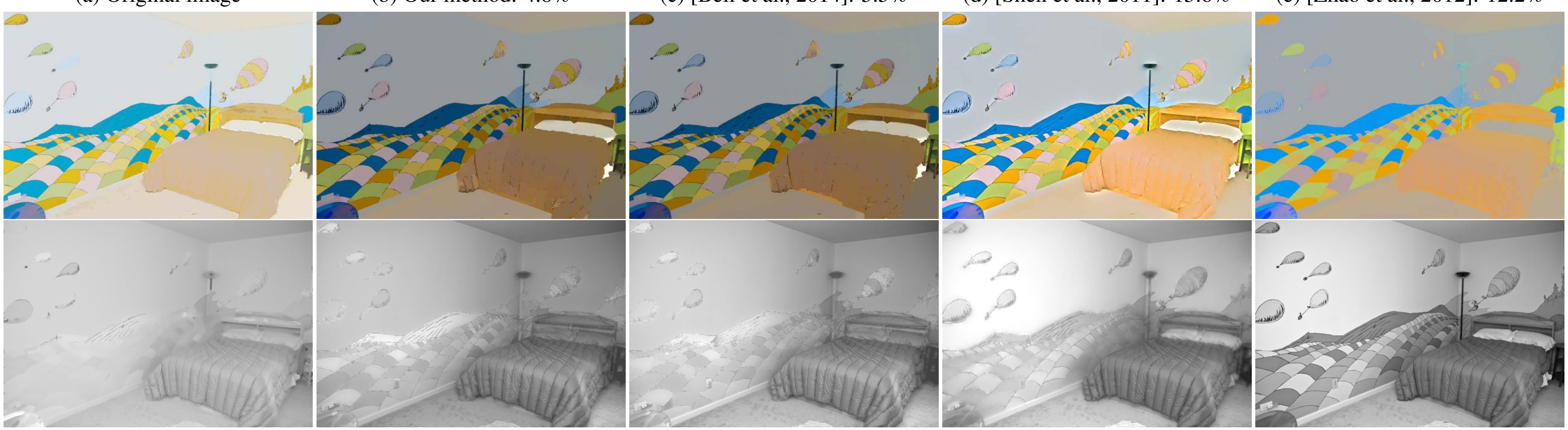
(a) Original image (b) Our method: 9.3% (c) [Bell et al., 2014]: 11.3% (d) [Shen et al., 2011]: 11.3% (e) [Zhao et al., 2012]: 9.3%

(f) [Garces et al., 2012]: 11.3% (g) Color Retinex: 11.4% (h) Grayscale Retinex: 12.2% (i) [Bonneel et al., 2014]: 11.3% (j) Baseline Reflectance: 31.4%

Figure 51: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

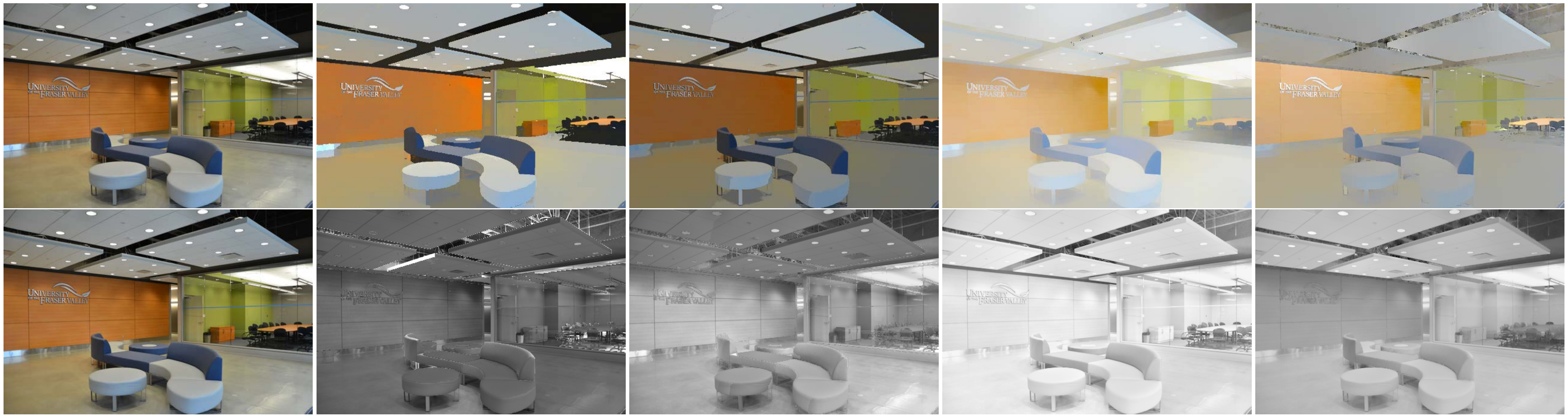


(a) Original image (b) Our method: 4.8% (c) [Bell et al., 2014]: 5.5% (d) [Shen et al., 2011]: 15.6% (e) [Zhao et al., 2012]: 12.2%

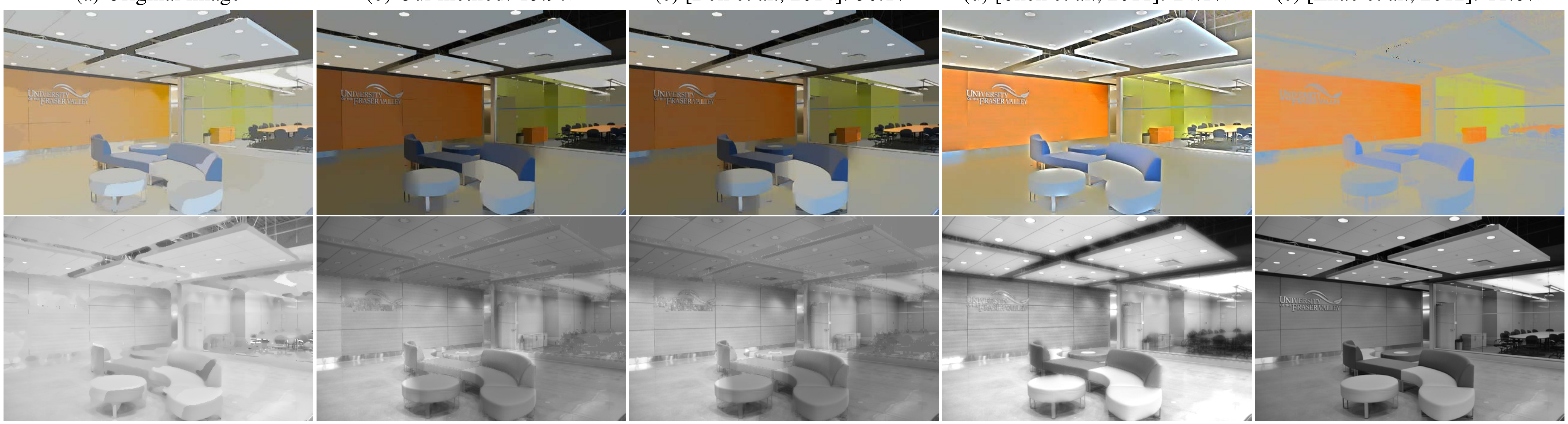


(f) [Garces et al., 2012]: 11.3% (g) Color Retinex: 10.5% (h) Grayscale Retinex: 10.4% (i) [Bonneel et al., 2014]: 17.7% (j) Baseline Reflectance: 16.9%

Figure 52: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



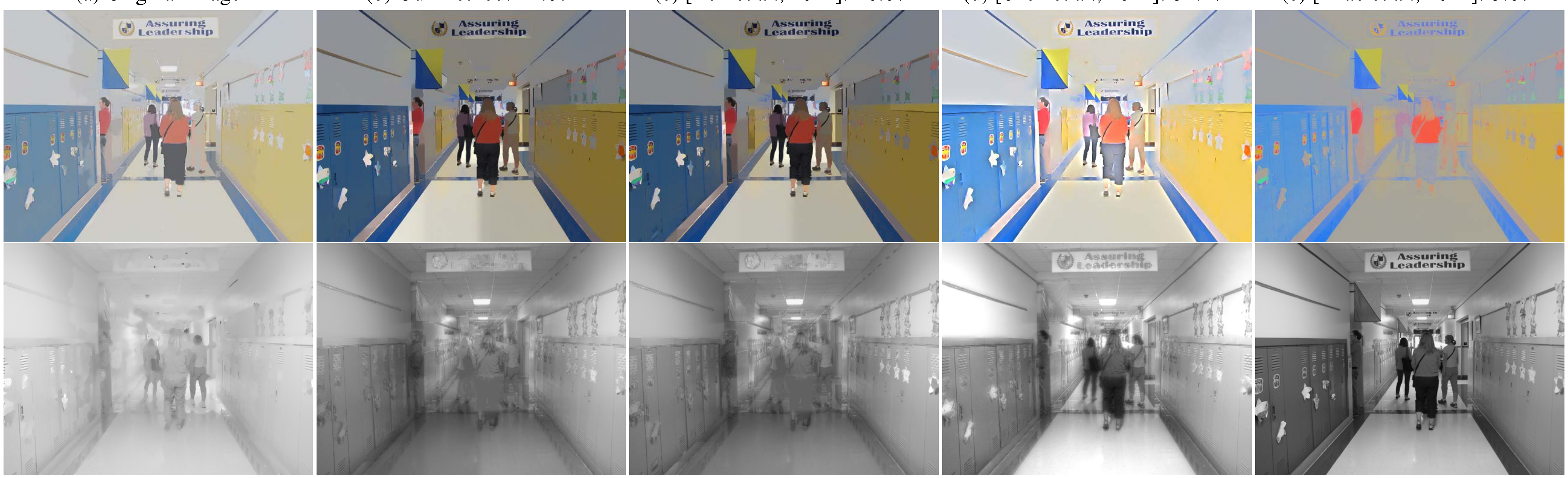
(a) Original image (b) Our method: 13.9% (c) [Bell et al., 2014]: 30.1% (d) [Shen et al., 2011]: 24.1% (e) [Zhao et al., 2012]: 11.8%



(f) [Garces et al., 2012]: 16.9% (g) Color Retinex: 26.4% (h) Grayscale Retinex: 23.8% (i) [Bonneel et al., 2014]: 26.4% (j) Baseline Reflectance: 24.5%

Figure 53: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 12.0% (c) [Bell et al., 2014]: 20.0% (d) [Shen et al., 2011]: 31.4% (e) [Zhao et al., 2012]: 5.6%



(f) [Garces et al., 2012]: 9.9% (g) Color Retinex: 32.0% (h) Grayscale Retinex: 28.9% (i) [Bonneel et al., 2014]: 18.1% (j) Baseline Reflectance: 31.7%

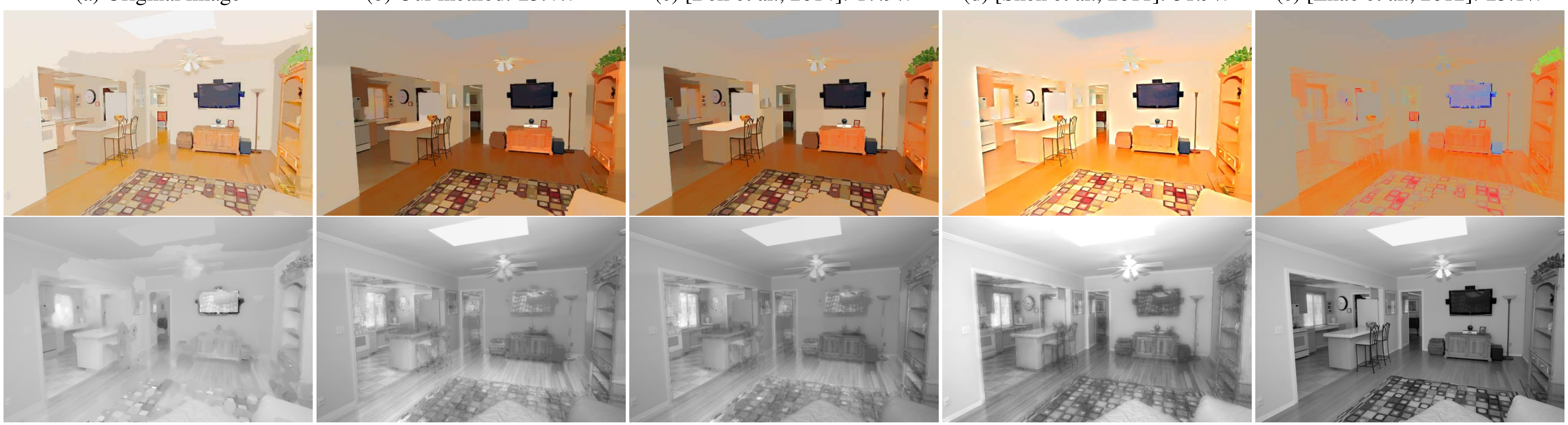
Figure 54: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 13.7% (c) [Bell et al., 2014]: 15.7% (d) [Shen et al., 2011]: 26.1% (e) [Zhao et al., 2012]: 26.5%

(f) [Garces et al., 2012]: 28.4% (g) Color Retinex: 26.8% (h) Grayscale Retinex: 29.7% (i) [Bonneel et al., 2014]: 33.6% (j) Baseline Reflectance: 43.1%

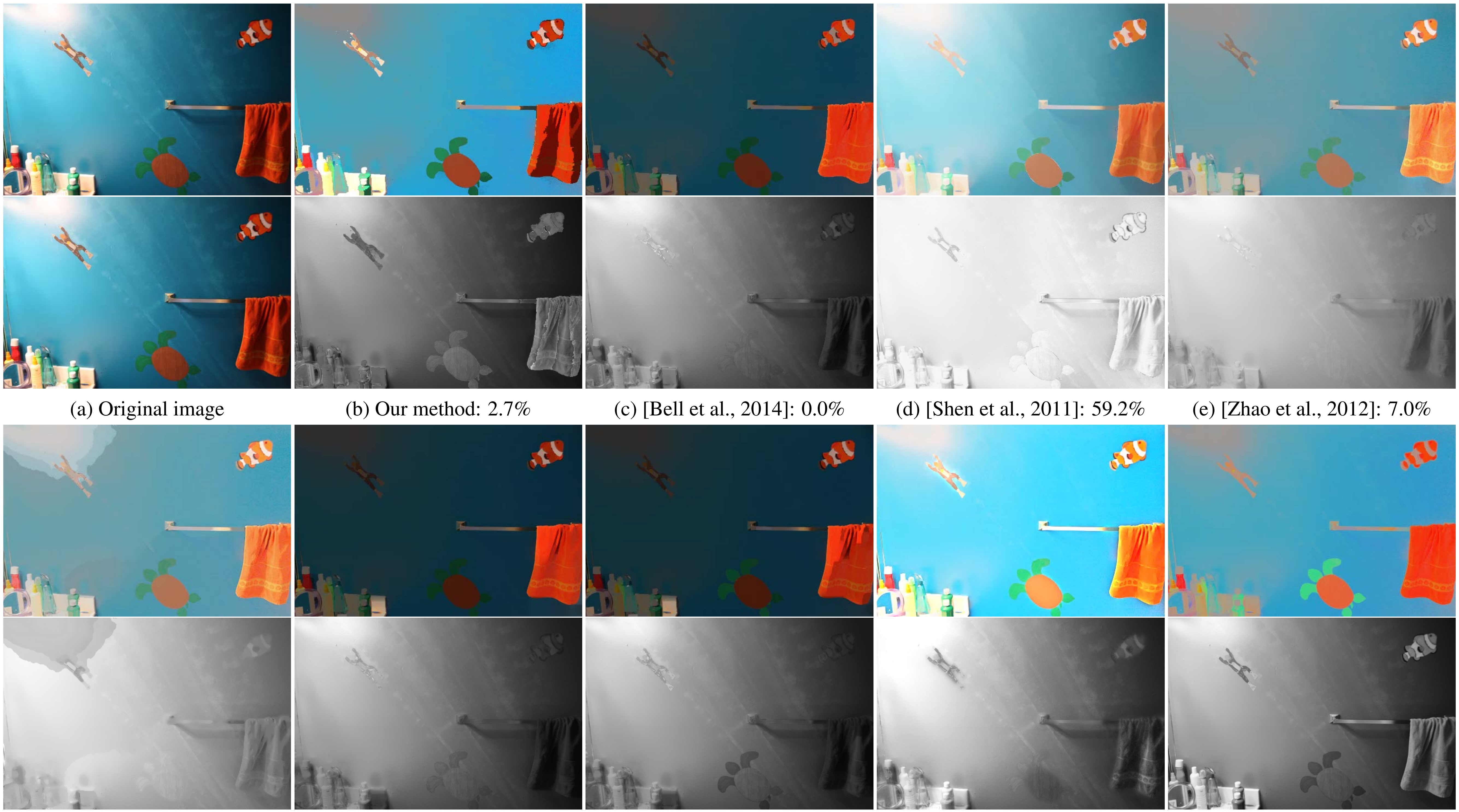
Figure 55: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 23.4% (c) [Bell et al., 2014]: 17.9% (d) [Shen et al., 2011]: 31.9% (e) [Zhao et al., 2012]: 23.1%



(f) [Garces et al., 2012]: 40.7% (g) Color Retinex: 26.9% (h) Grayscale Retinex: 24.5% (i) [Bonneel et al., 2014]: 16.3% (j) Baseline Reflectance: 18.8%

Figure 56: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



(a) Original image (b) Our method: 2.7% (c) [Bell et al., 2014]: 0.0% (d) [Shen et al., 2011]: 59.2% (e) [Zhao et al., 2012]: 7.0%

(f) [Garces et al., 2012]: 8.5% (g) Color Retinex: 8.9% (h) Grayscale Retinex: 0.0% (i) [Bonneel et al., 2014]: 3.8% (j) Baseline Reflectance: 0.0%

Figure 57: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

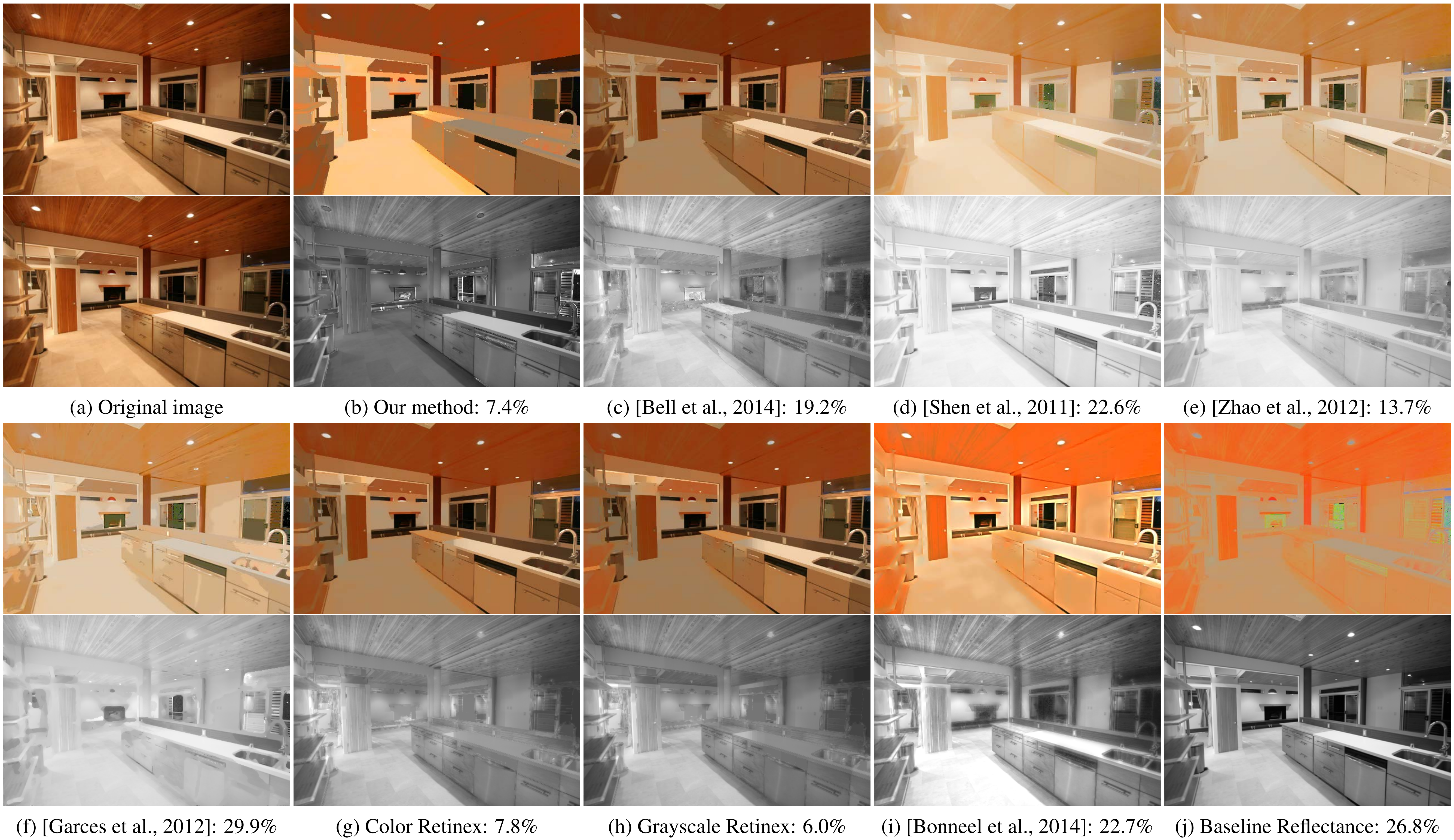
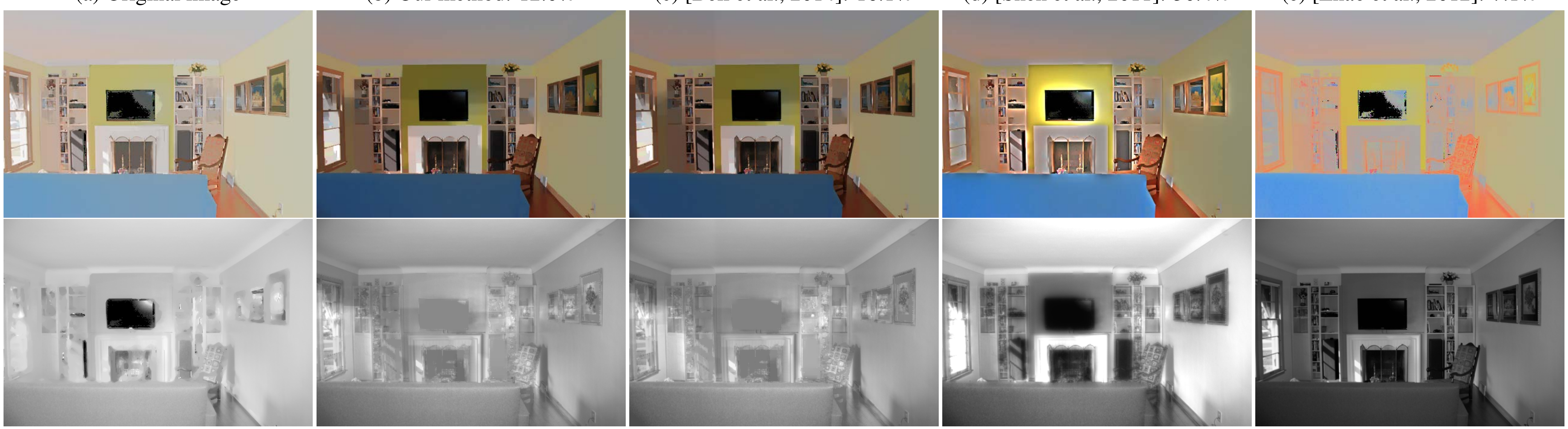


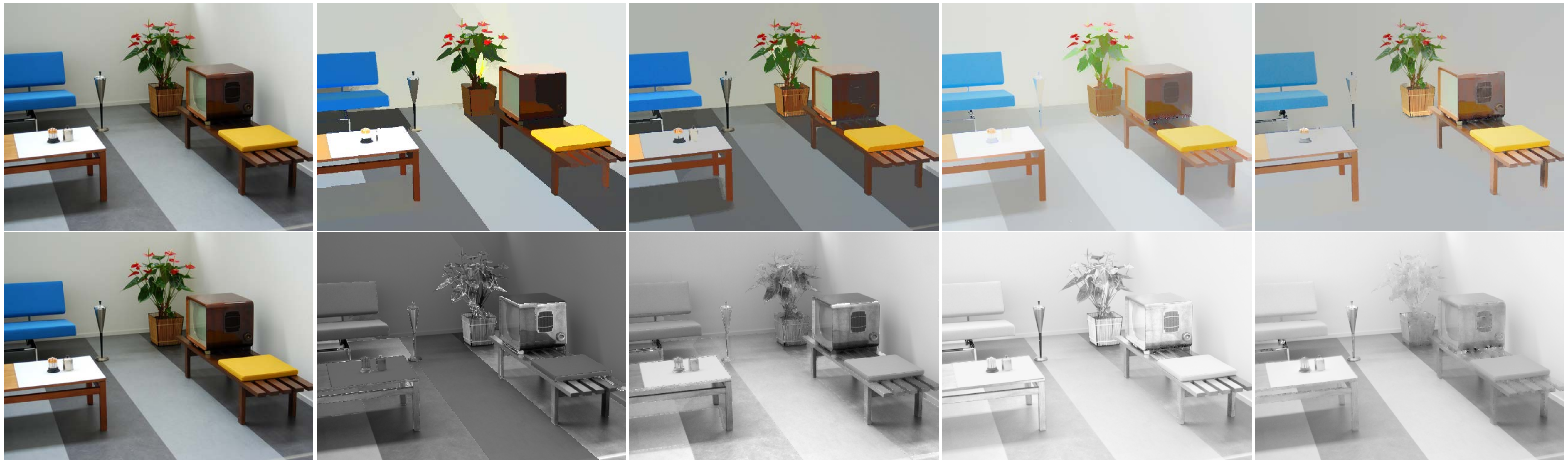
Figure 58: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 12.0% (c) [Bell et al., 2014]: 16.1% (d) [Shen et al., 2011]: 30.4% (e) [Zhao et al., 2012]: 7.1%

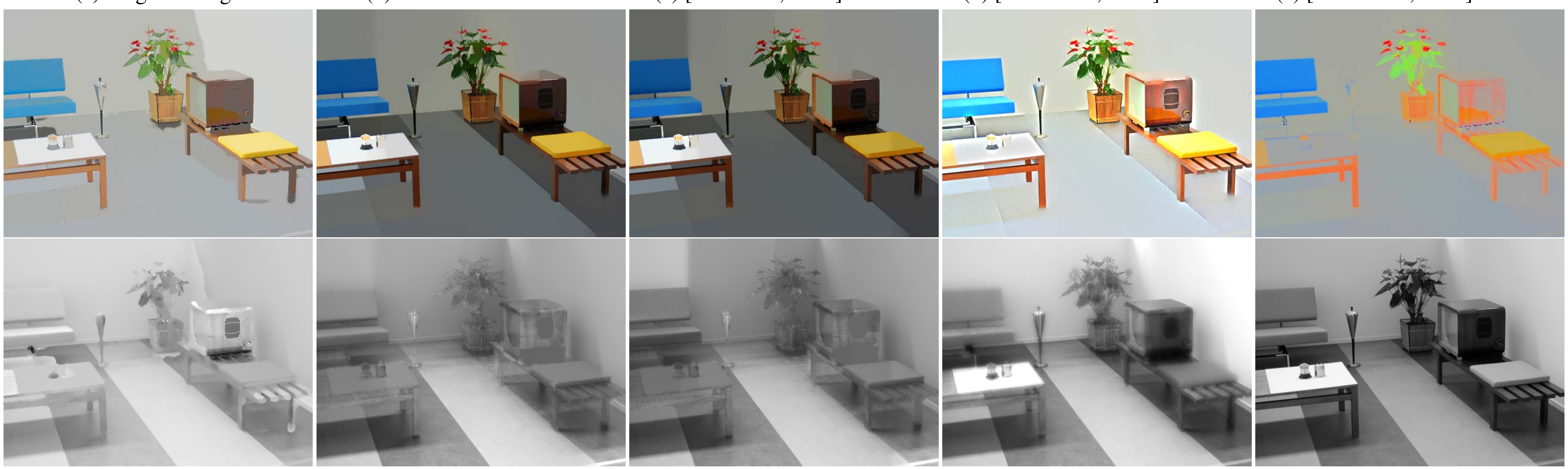


(f) [Garces et al., 2012]: 8.7% (g) Color Retinex: 16.8% (h) Grayscale Retinex: 15.9% (i) [Bonneel et al., 2014]: 23.1% (j) Baseline Reflectance: 27.1%

Figure 59: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



(a) Original image (b) Our method: 11.3% (c) [Bell et al., 2014]: 16.5% (d) [Shen et al., 2011]: 17.1% (e) [Zhao et al., 2012]: 23.2%



(f) [Garces et al., 2012]: 21.7% (g) Color Retinex: 18.3% (h) Grayscale Retinex: 20.7% (i) [Bonneel et al., 2014]: 23.0% (j) Baseline Reflectance: 29.1%

Figure 60: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 8.5% (c) [Bell et al., 2014]: 8.6% (d) [Shen et al., 2011]: 26.3% (e) [Zhao et al., 2012]: 14.6%

(f) [Garces et al., 2012]: 9.6% (g) Color Retinex: 16.3% (h) Grayscale Retinex: 17.3% (i) [Bonneel et al., 2014]: 9.6% (j) Baseline Reflectance: 48.2%

Figure 61: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

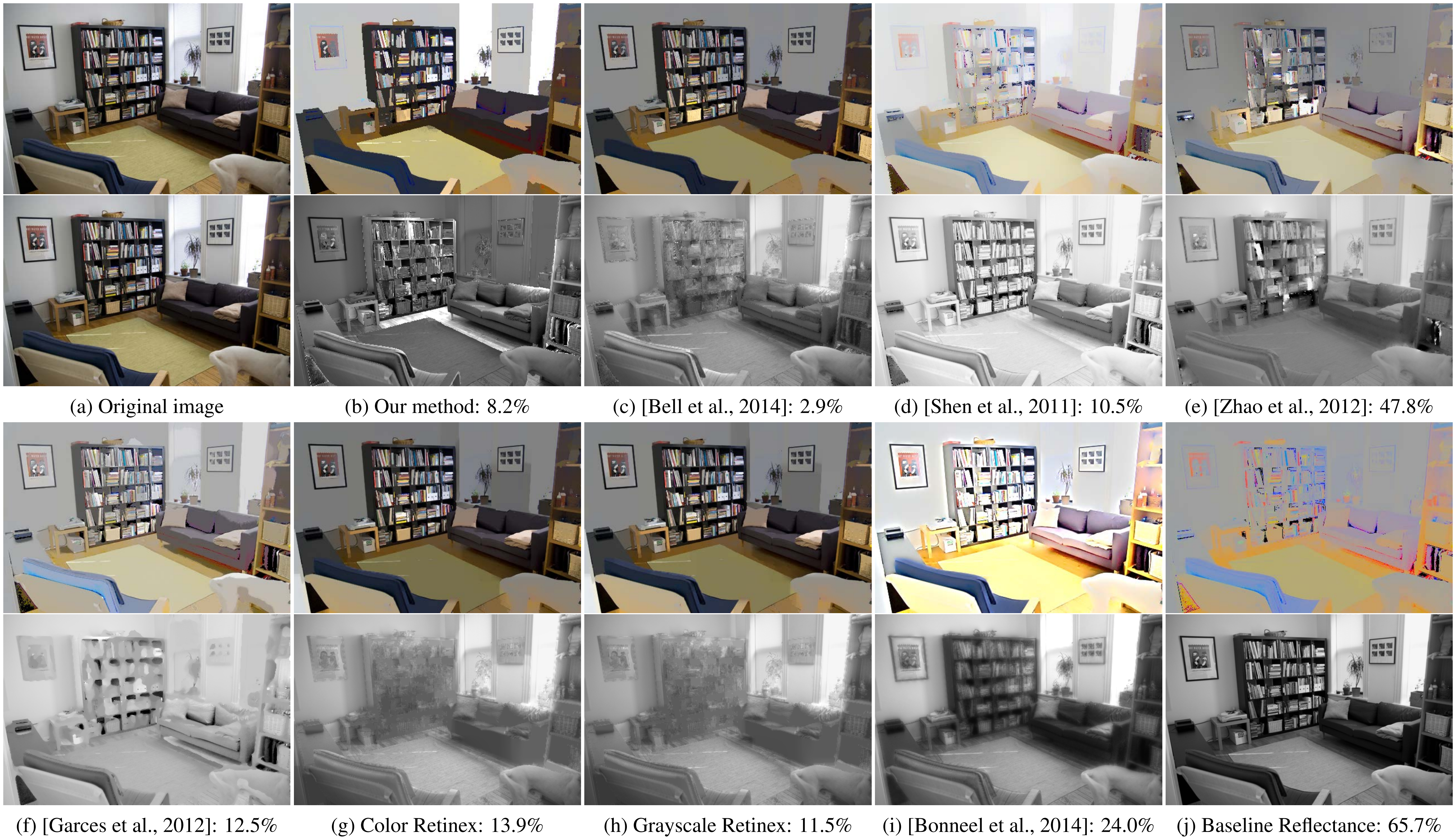
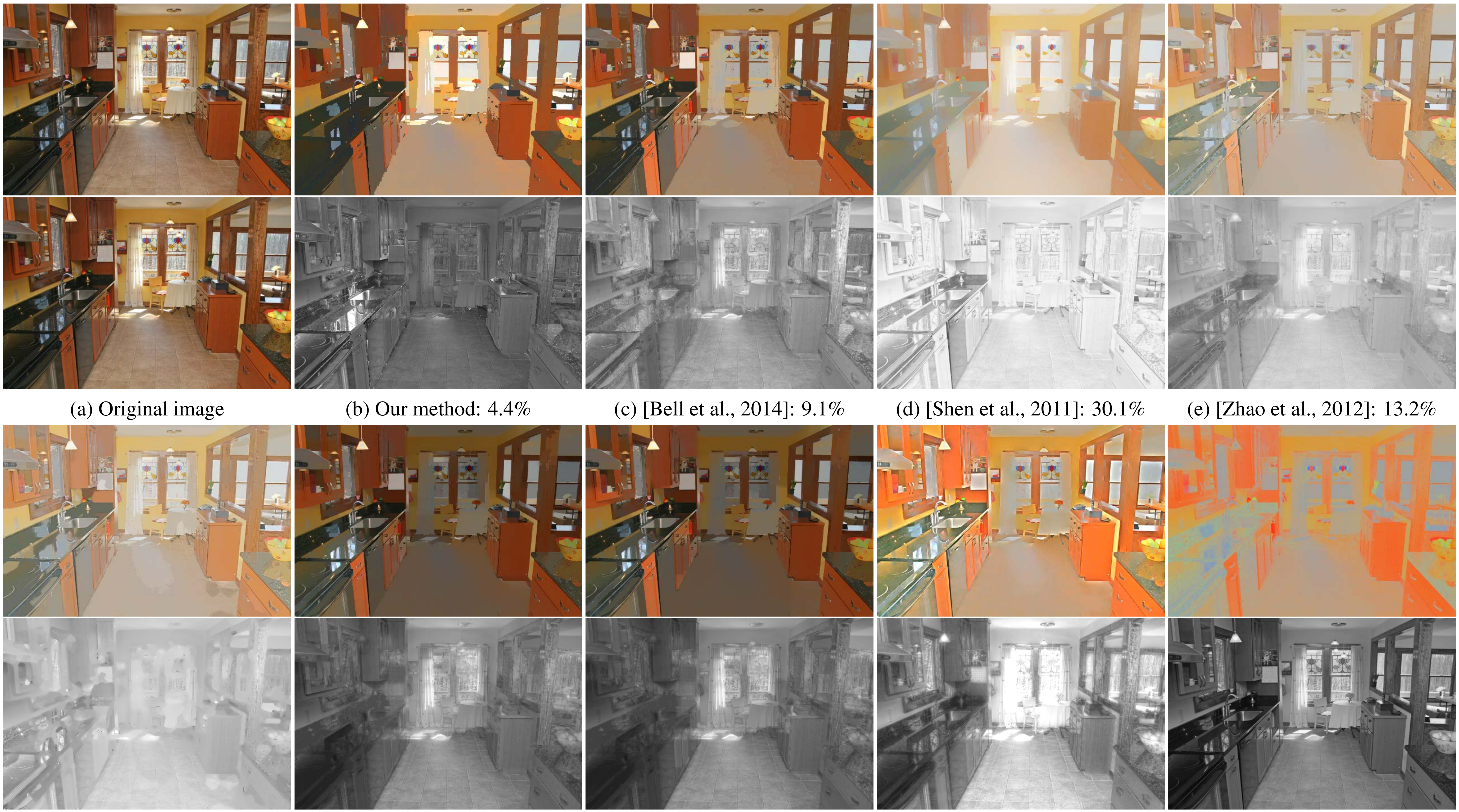


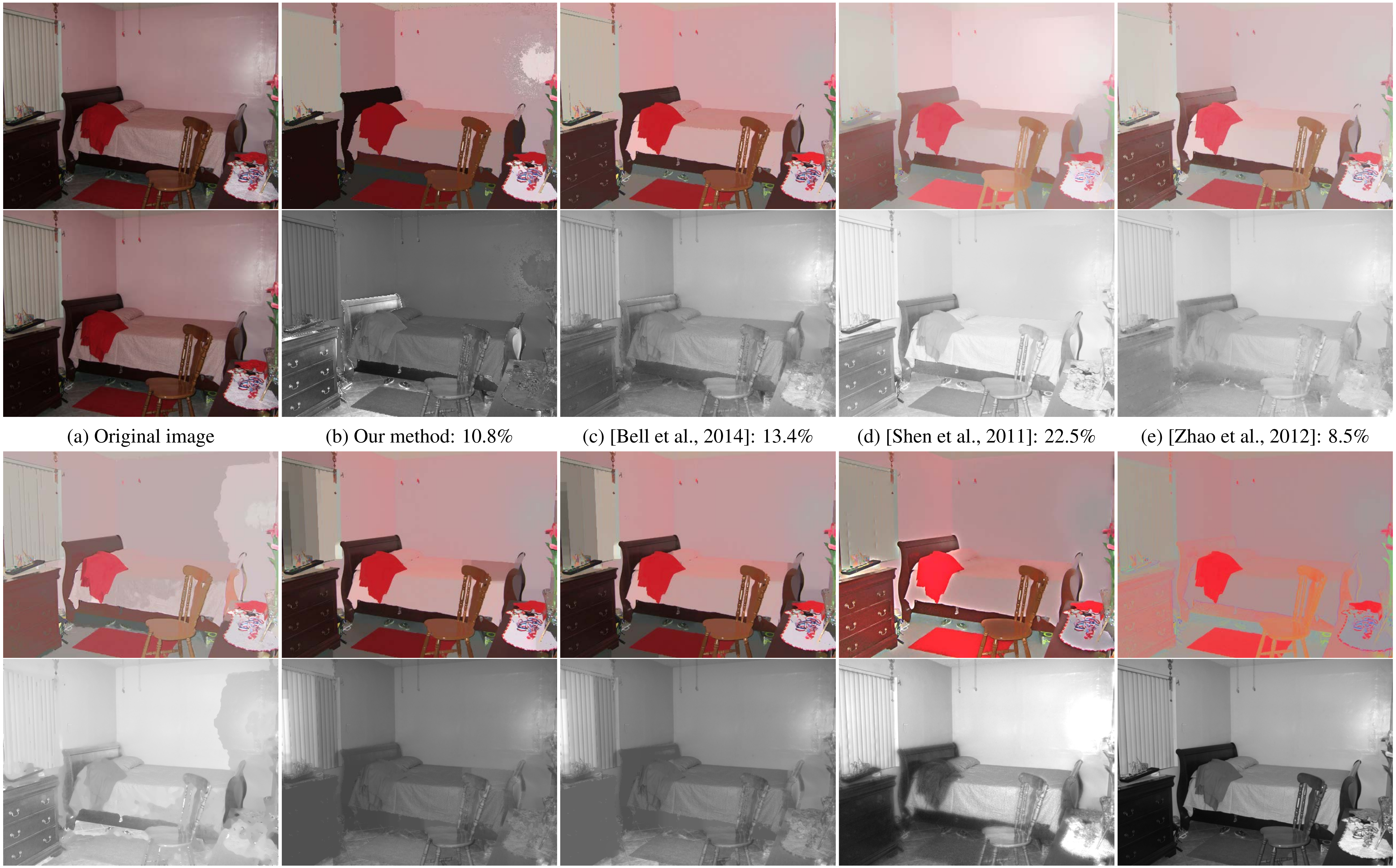
Figure 62: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



(a) Original image (b) Our method: 4.4% (c) [Bell et al., 2014]: 9.1% (d) [Shen et al., 2011]: 30.1% (e) [Zhao et al., 2012]: 13.2%

(f) [Garces et al., 2012]: 29.2% (g) Color Retinex: 21.5% (h) Grayscale Retinex: 25.8% (i) [Bonneel et al., 2014]: 29.4% (j) Baseline Reflectance: 52.1%

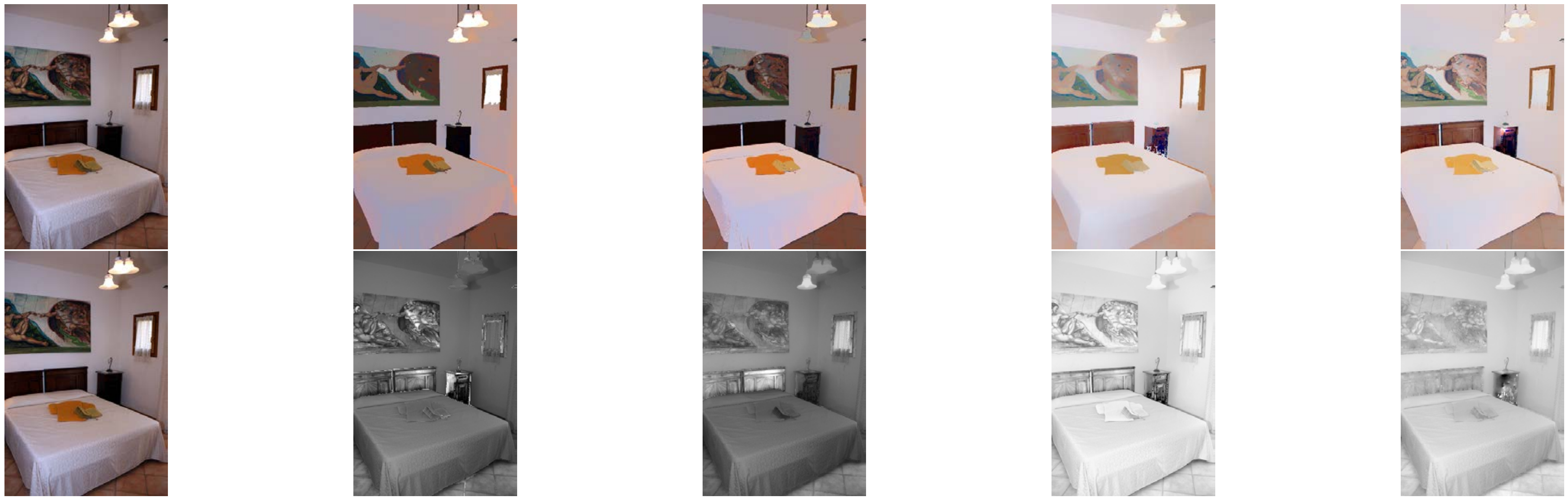
Figure 63: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



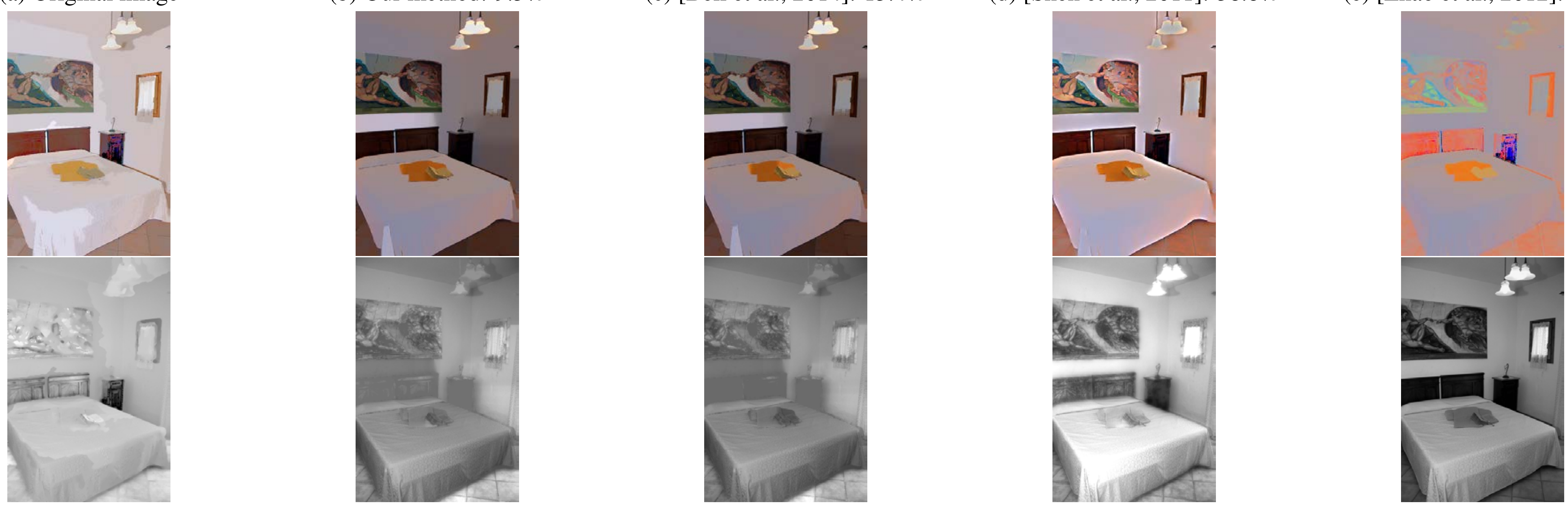
(a) Original image (b) Our method: 10.8% (c) [Bell et al., 2014]: 13.4% (d) [Shen et al., 2011]: 22.5% (e) [Zhao et al., 2012]: 8.5%

(f) [Garces et al., 2012]: 26.4% (g) Color Retinex: 27.4% (h) Grayscale Retinex: 25.9% (i) [Bonneel et al., 2014]: 16.7% (j) Baseline Reflectance: 15.2%

Figure 64: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



(a) Original image (b) Our method: 9.5% (c) [Bell et al., 2014]: 15.4% (d) [Shen et al., 2011]: 38.8% (e) [Zhao et al., 2012]: 8.2%



(f) [Garces et al., 2012]: 23.6% (g) Color Retinex: 21.4% (h) Grayscale Retinex: 22.8% (i) [Bonneel et al., 2014]: 18.3% (j) Baseline Reflectance: 21.9%

Figure 65: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

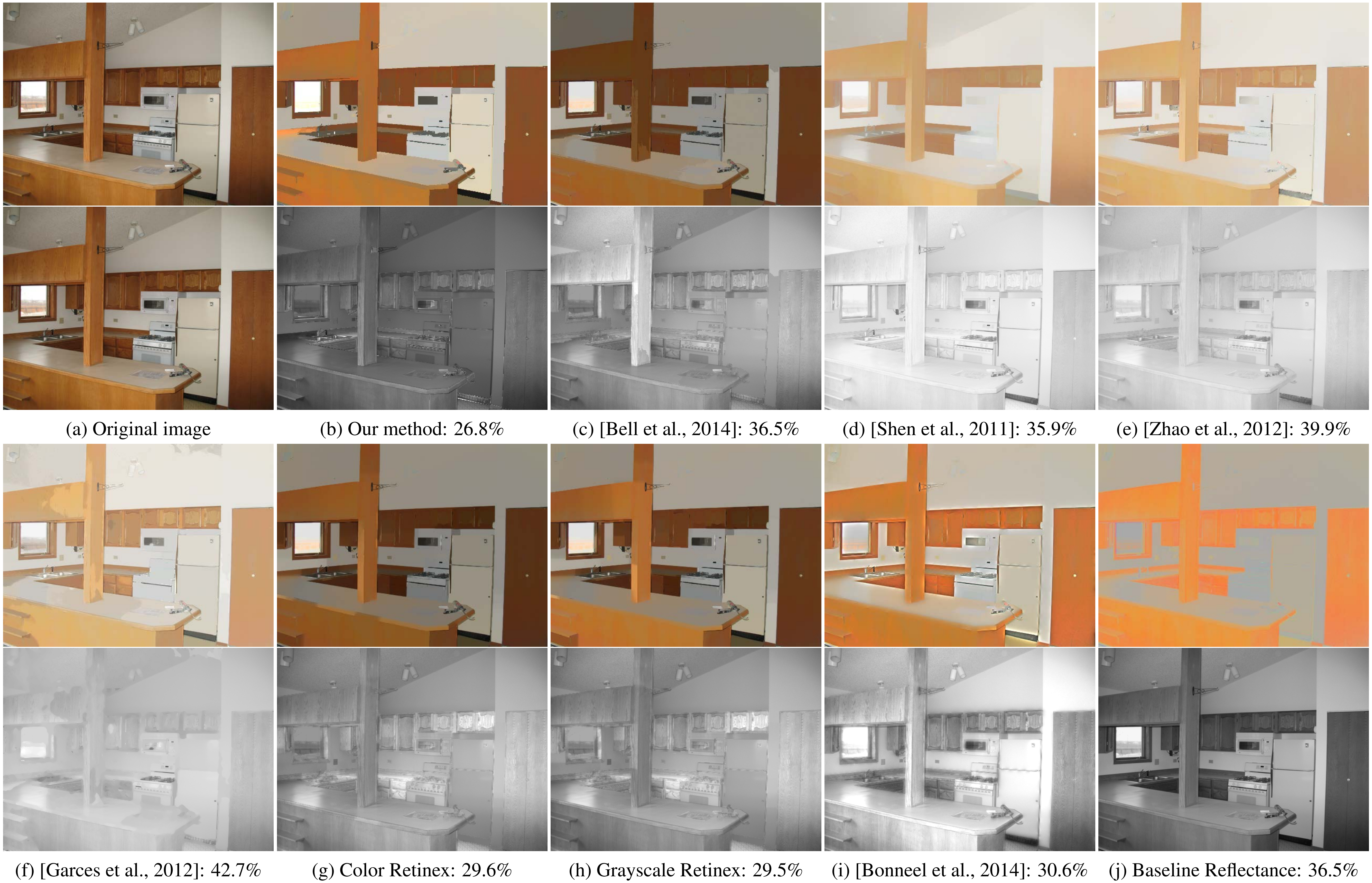
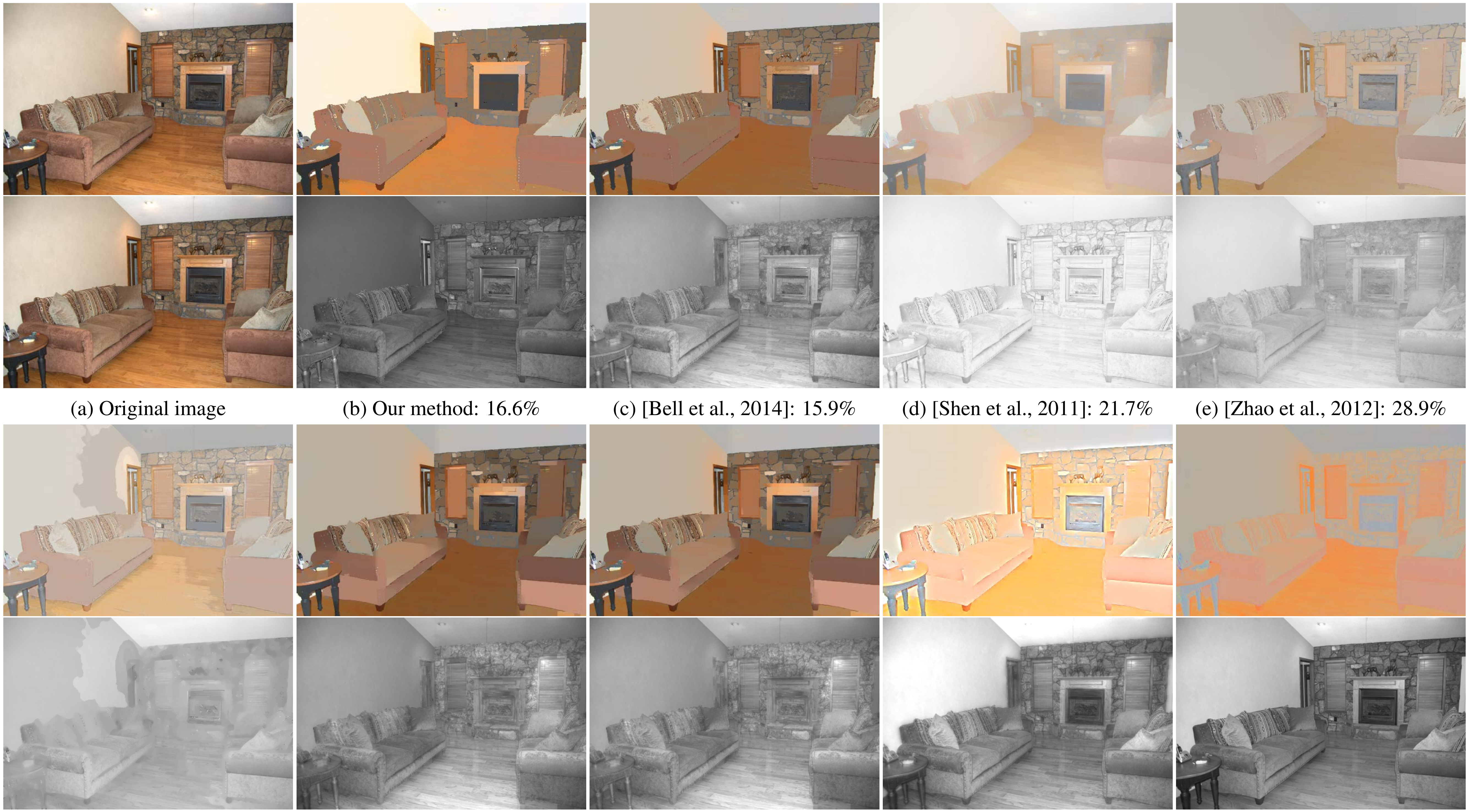


Figure 66: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image (b) Our method: 5.9% (c) [Bell et al., 2014]: 25.5% (d) [Shen et al., 2011]: 18.8% (e) [Zhao et al., 2012]: 21.7%

(f) [Garces et al., 2012]: 15.4% (g) Color Retinex: 36.4% (h) Grayscale Retinex: 36.2% (i) [Bonneel et al., 2014]: 37.0% (j) Baseline Reflectance: 49.2%

Figure 67: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



(a) Original image (b) Our method: 16.6% (c) [Bell et al., 2014]: 15.9% (d) [Shen et al., 2011]: 21.7% (e) [Zhao et al., 2012]: 28.9%

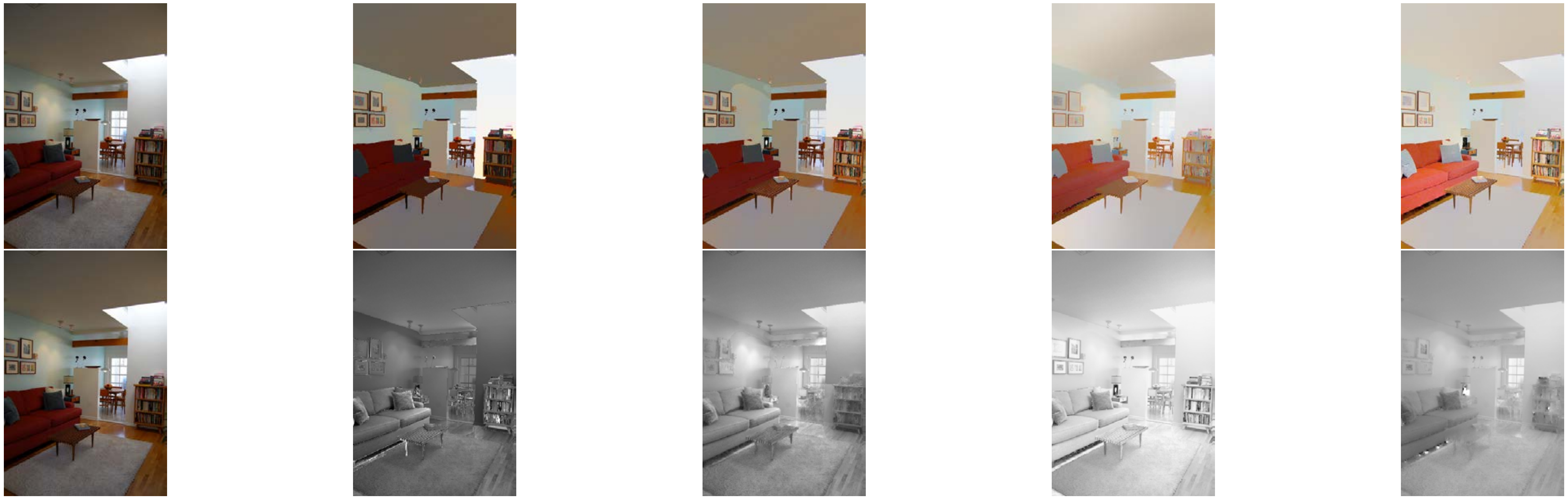
(f) [Garces et al., 2012]: 40.9% (g) Color Retinex: 22.0% (h) Grayscale Retinex: 22.0% (i) [Bonneel et al., 2014]: 36.1% (j) Baseline Reflectance: 41.9%

Figure 68: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

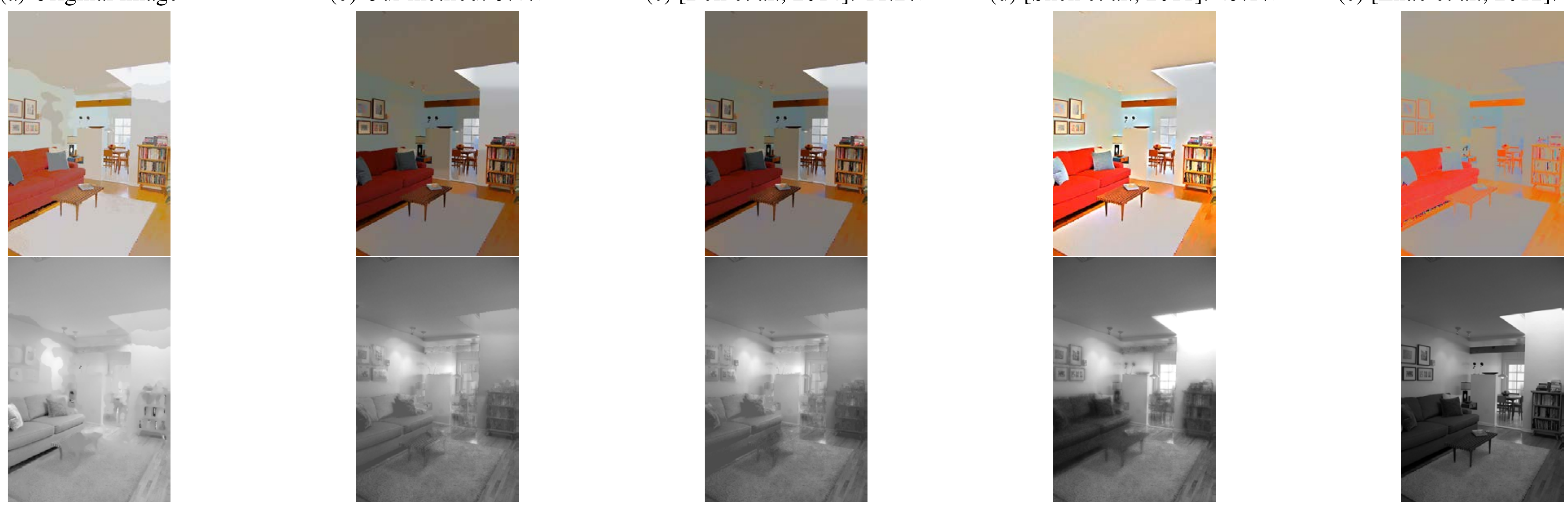
(a) Original image (b) Our method: 23.3% (c) [Bell et al., 2014]: 21.0% (d) [Shen et al., 2011]: 39.9% (e) [Zhao et al., 2012]: 29.9%

(f) [Garces et al., 2012]: 35.8% (g) Color Retinex: 33.6% (h) Grayscale Retinex: 36.9% (i) [Bonneel et al., 2014]: 17.3% (j) Baseline Reflectance: 24.6%

Figure 69: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.



(a) Original image (b) Our method: 3.4% (c) [Bell et al., 2014]: 11.2% (d) [Shen et al., 2011]: 45.1% (e) [Zhao et al., 2012]: 10.0%



(f) [Garces et al., 2012]: 24.9% (g) Color Retinex: 17.4% (h) Grayscale Retinex: 14.7% (i) [Bonneel et al., 2014]: 22.8% (j) Baseline Reflectance: 17.4%

Figure 70: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

(a) Original image
(b) Our method: 0.0%
(c) [Bell et al., 2014]: 0.0%
(d) [Shen et al., 2011]: 29.1%
(e) [Zhao et al., 2012]: 21.1%
(f) [Garces et al., 2012]: 2.9%
(g) Color Retinex: 0.6%
(h) Grayscale Retinex: 0.6%
(i) [Bonneel et al., 2014]: 28.9%
(j) Baseline Reflectance: 48.1%

Figure 71: Comparison of intrinsic image decomposition between our method and other state-of-the-art methods.

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