

Intrinsic Images in the Wild: Supplemental Material

Sean Bell Kavita Bala Noah Snavely
Cornell University

1 Algorithm variants

Here, we describe some of the algorithm variants described in Table 1 of our paper. These variants either do not help or perform worse than the final algorithm described in the paper.

1.1 Add reflectance prior

In real-world scenes, not all surface colors appear with equal frequency. For example, in indoor scenes, pastel colors and medium grays appear much more frequently than bright neon colors. We can encode this knowledge in our model with a prior on reflectance colors. Specifically, we take all surfaces from OpenSurfaces [Bell et al. 2013] and collect the diffuse reflectance color intensity. Since we have over 40,000 samples, we store the samples in a tabulated probability distribution p_r (a histogram with 100 bins) and blur the counts with $\sigma = 3$ bins. Our energy term is simply the negative log probability:

$$E_r(x) = - \sum_i \log p_r(\mathcal{R}(x_i)) \quad (1)$$

This is similar to the absolute reflectance prior used in SIRFS [Baron and Malik 2013], but with a histogram instead of a spline.

Exploring different weights for this term, the best training error is $\text{WHDR}_{10\%} = 21.0\%$. This is achieved by setting the weight to 0, so we exclude this term. Giving E_r more weight increases the error by a few tenths of a percent.

1.2 Add chromaticity prior

Since we are labeling pixels with RGB reflectances (\mathcal{R}), we initially assumed that it would be important to constrain the chromaticity of the reflectance to match that of the input image. This can be encoded in one of two ways: (1) encourage the chromaticity of the chosen label to match its image pixel, or (2) compute a colored RGB shading channel and encourage it to be grayscale. Mathematically, the former is:

$$E_c(x) = \sum_i \left\| \frac{\mathcal{R}(x_i)}{\sum_c \mathcal{R}^c(x_i)} - \frac{\mathbf{I}_i}{\sum_c I_i^c} \right\|_1 \quad (2)$$

A similar term can be written for the latter.

Exploring different weights for this term, the best training error (excluding zero weight) is $\text{WHDR}_{10\%} = 21.1\%$. This is achieved by setting the weight as small as possible, so we exclude this term. Giving E_c more weight increases the error.

1.3 Equation 19: Different window sizes

In Equation 19, we only constrain neighboring pixels to have similar shading. We tried expanding the set B by connecting pixels in wider windows, such as connecting pixels k above/below and k left/right. We also tried downweighting longer connections by $1/d_{ij}^2$ where d_{ij} is the distance between pixels i and j .

We find that increasing the window size makes no change (but makes the algorithm run much slower), as long as we downweight connections by $1/d_{ij}^2$. Using the same weight for all types of connections increases the error.

1.4 Other variants

The remaining variants are smaller changes and described in Table 1 of the paper. For example, we experimented with both L^1 and L^2 norms for most terms. We varied every parameter including the number of iterations. We tried different initialization methods, such as initializing the shading channel with the input image, with the solution from Retinex, with a constant, and by omitting the term. We tried deleting different energy terms and removing the final cluster splitting step (Stage 2, Section 4.3 of the paper).

2 Validation: Varying lighting conditions

As discussed in the paper (Section 3.6), we further validated our judgements using 11 photographs across 4 scenes from [Boyadzhiev et al. 2013]. These scenes have with identical camera viewpoint and varying lighting conditions, so any disagreement in judgements between the different viewpoints is incorrect in at least one of the photos. The scenes are shown in Figure 1 and included on our website (<http://intrinsic.cs.cornell.edu>). Experimental results are included in the paper (Section 3.6).

3 Additional visual comparisons

Figures 2 through 101 show example visual comparisons between our algorithm and [Zhao et al. 2012], [Garces et al. 2012], Retinex [Grosse et al. 2009], and [Shen et al. 2011].

The photos are sorted by decreasing number of judgements, so these are the 100 best sampled photos in terms of human judgement.

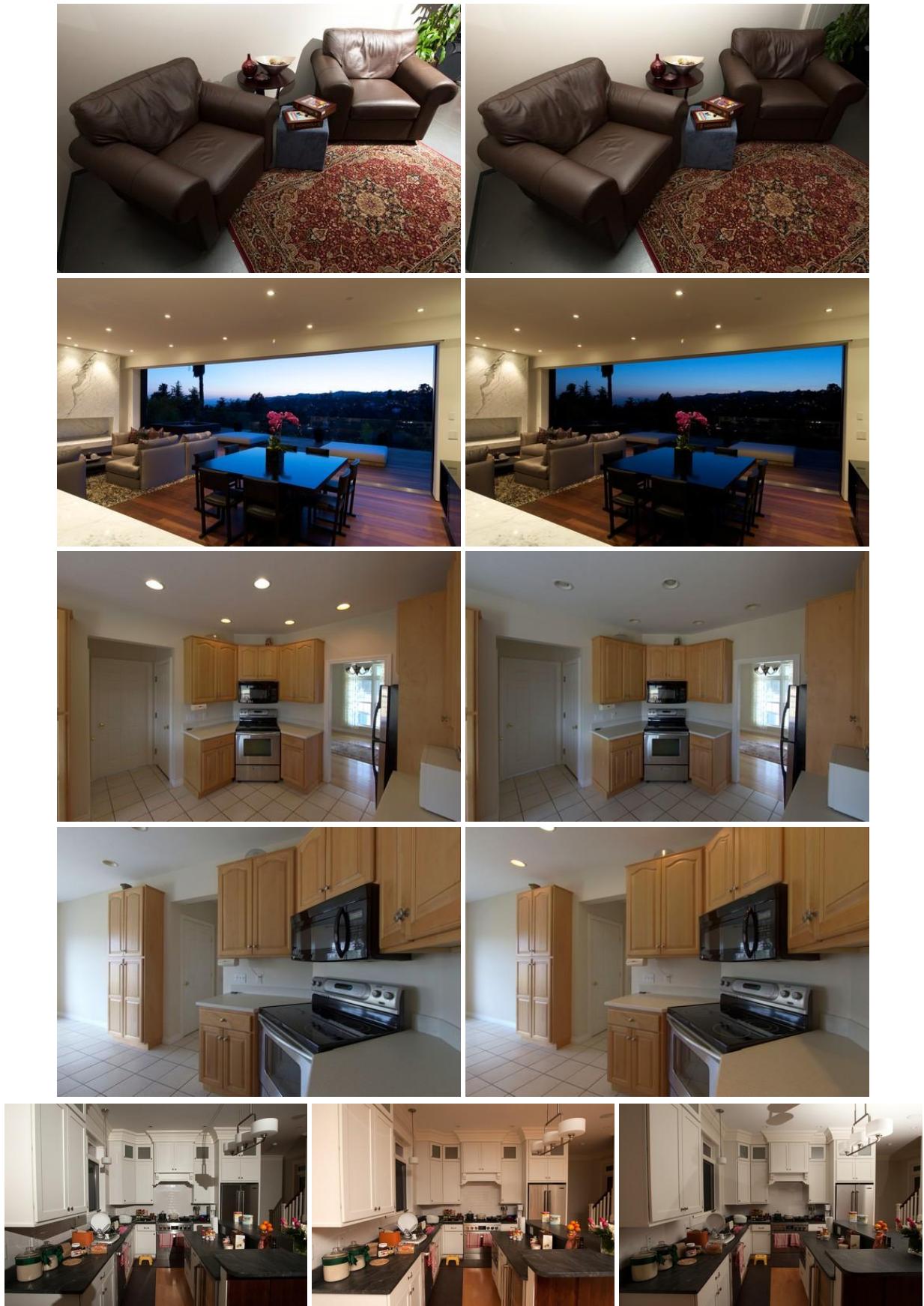


Figure 1: Scenes with identical viewpoint but varying lighting conditions [Boyadzhiev et al. 2013]. The photos in the second row are provided by a professional photographer (© Michael Kelley).

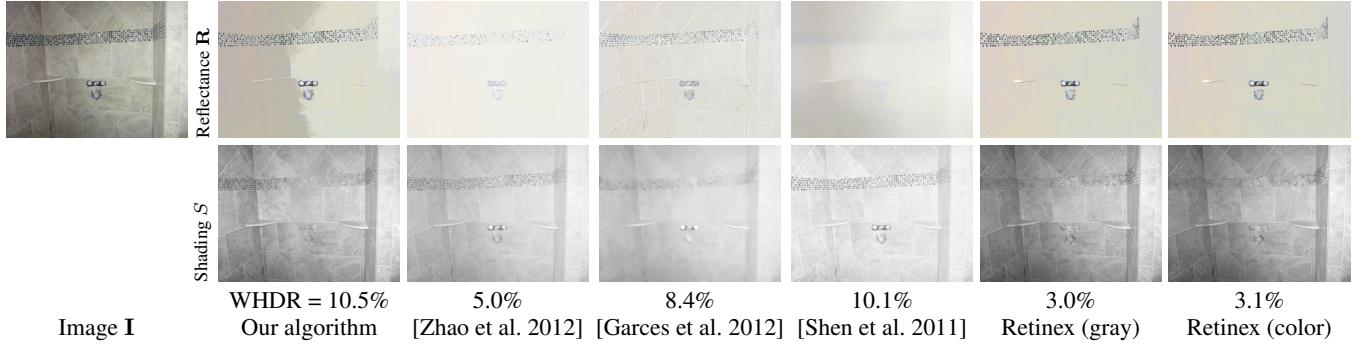


Figure 2: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 16594.

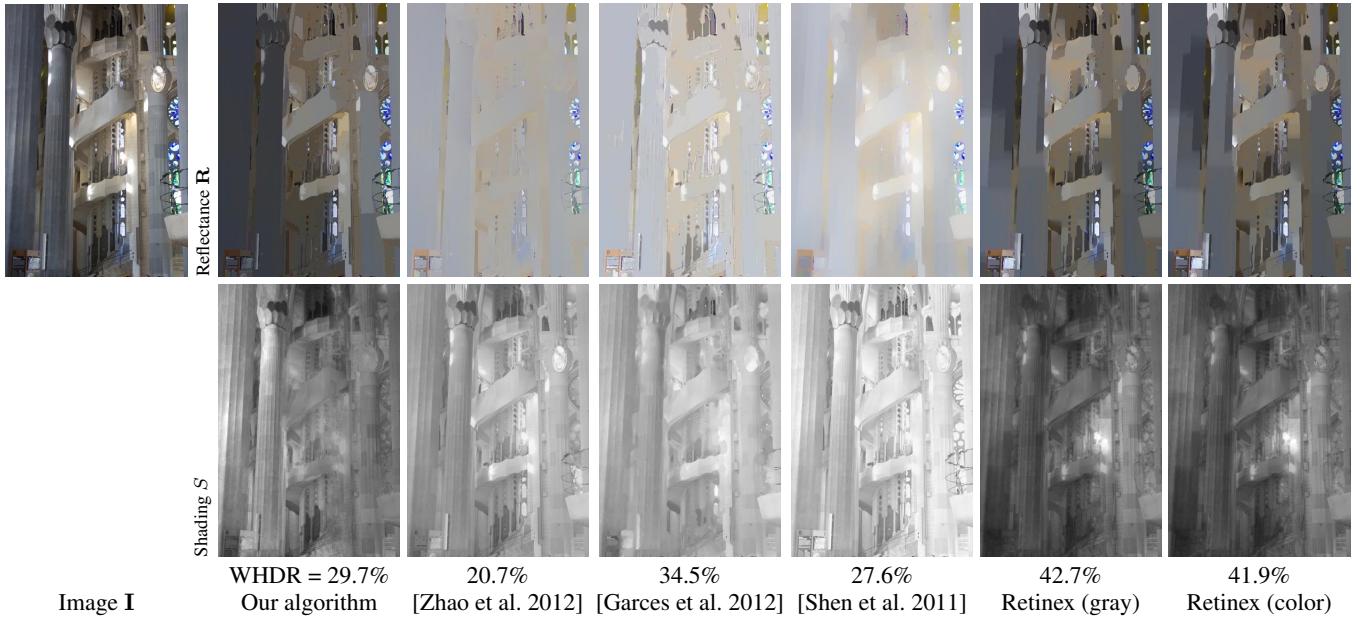


Figure 3: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 22774.



Figure 4: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 83120.

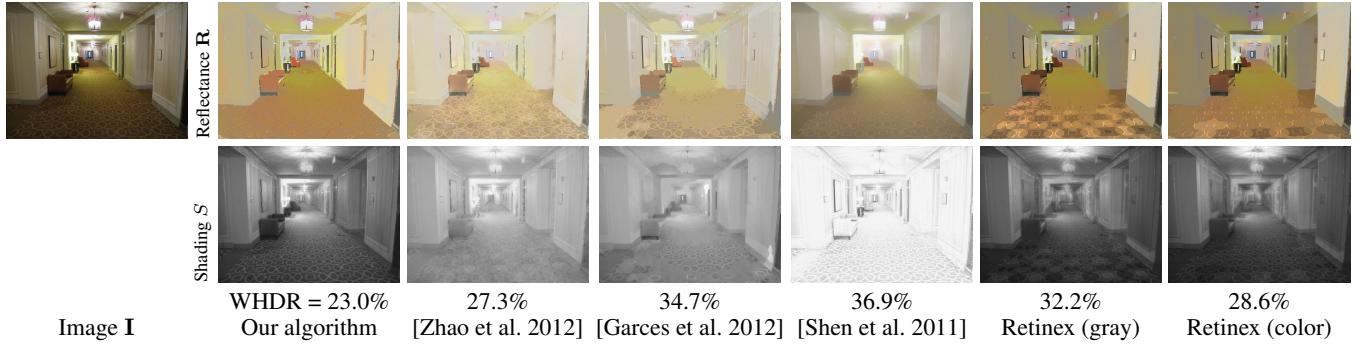


Figure 5: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 109510.

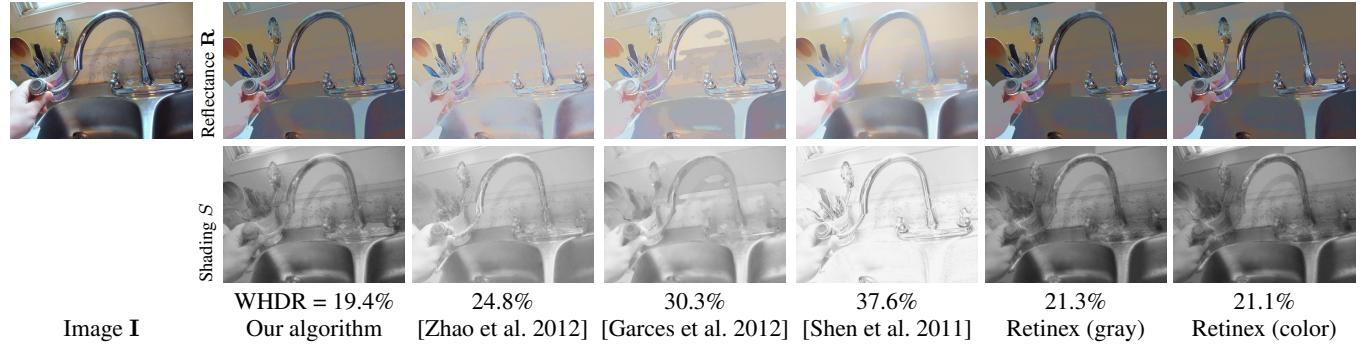


Figure 6: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 85613.

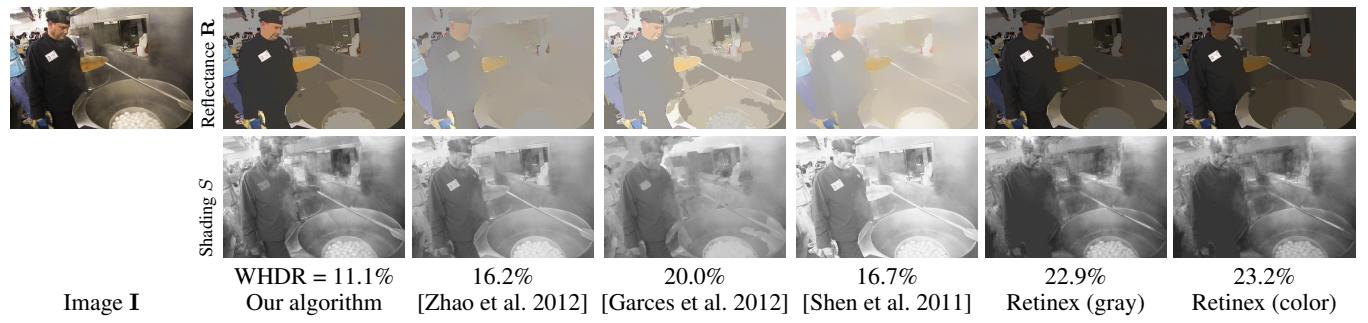


Figure 7: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 56756.



Figure 8: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 3438.

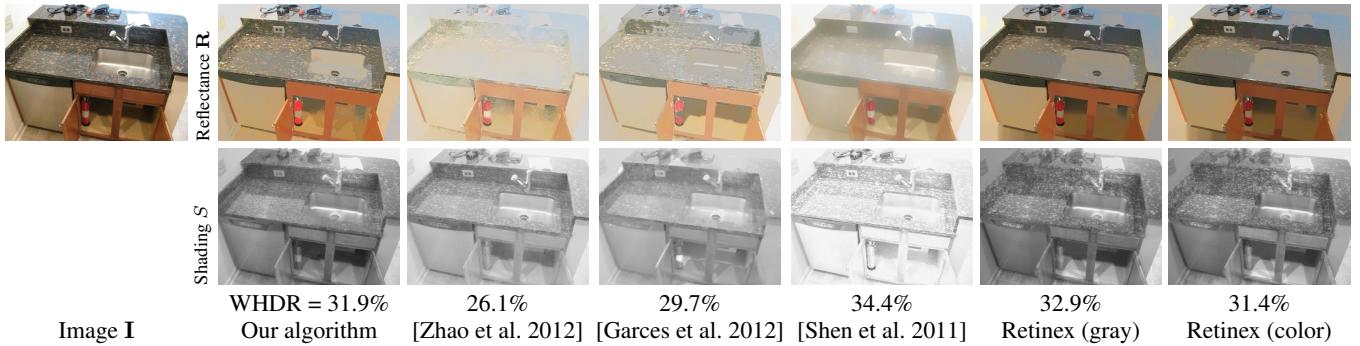


Figure 9: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 94020.

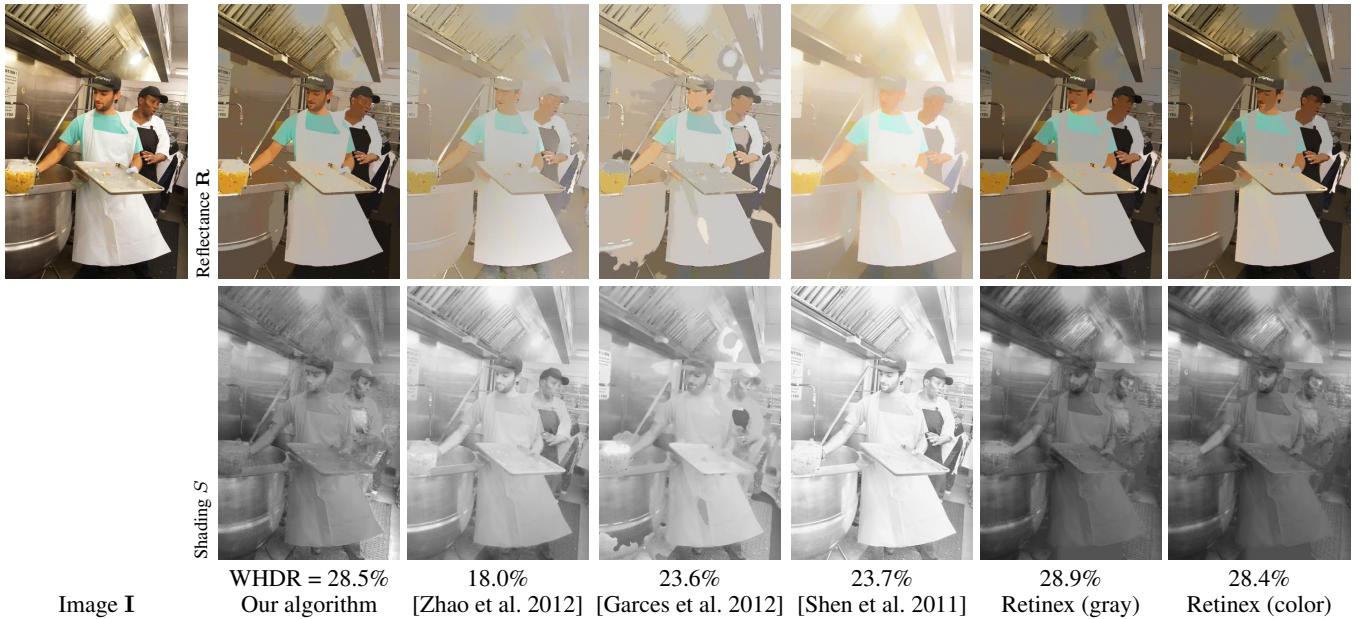


Figure 10: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 57242.

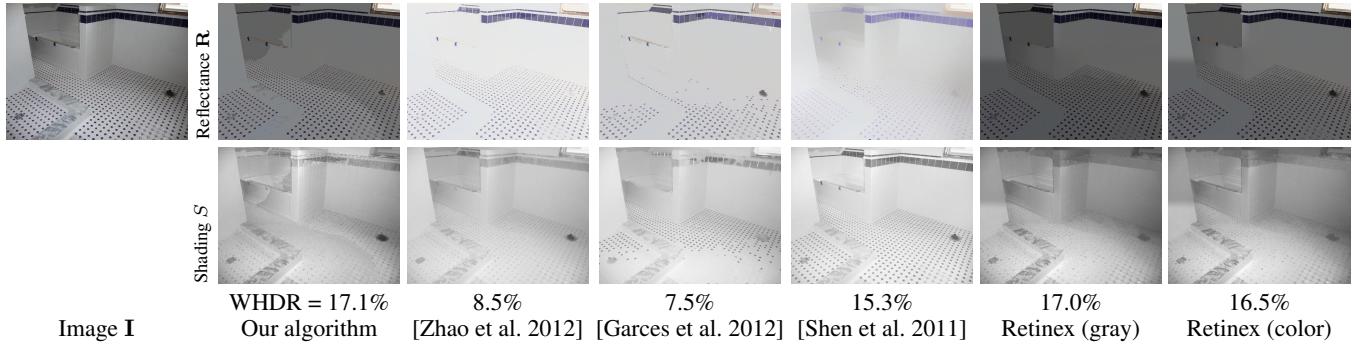


Figure 11: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 6114.

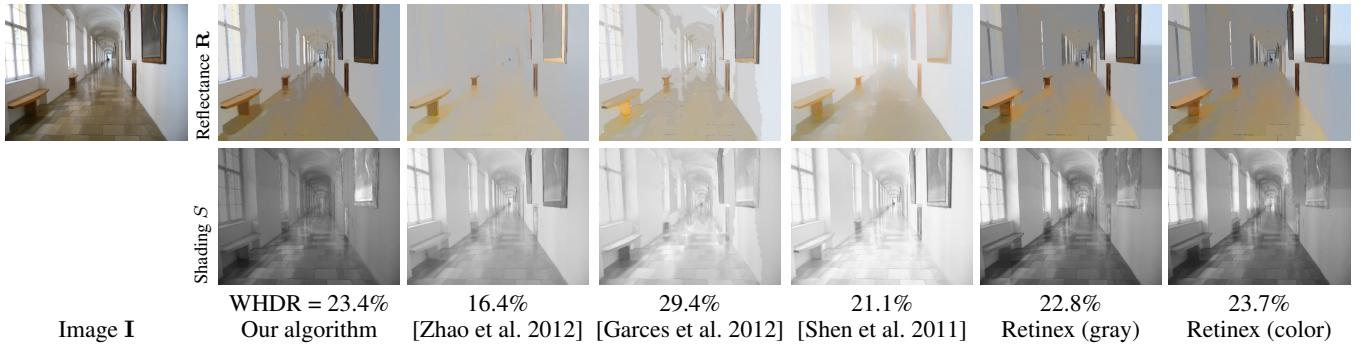


Figure 12: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 108943.

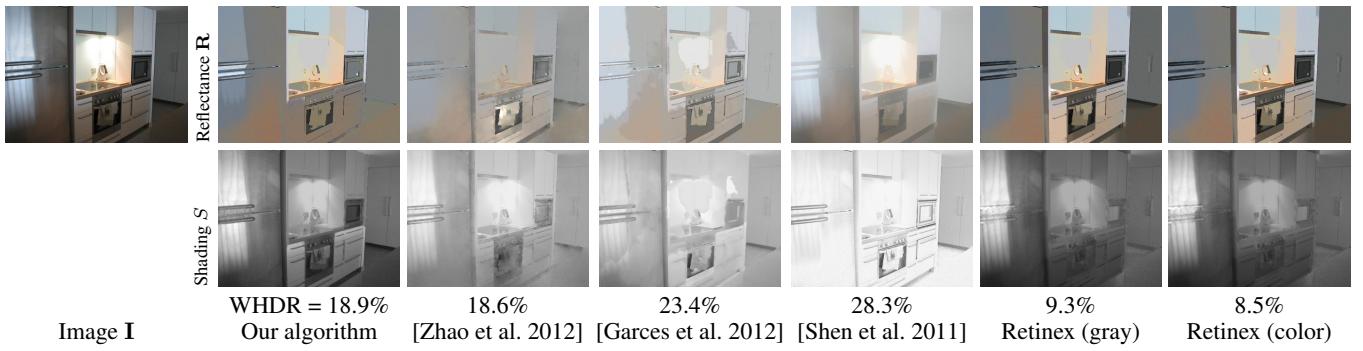


Figure 13: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 83619.



Figure 14: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 97286.

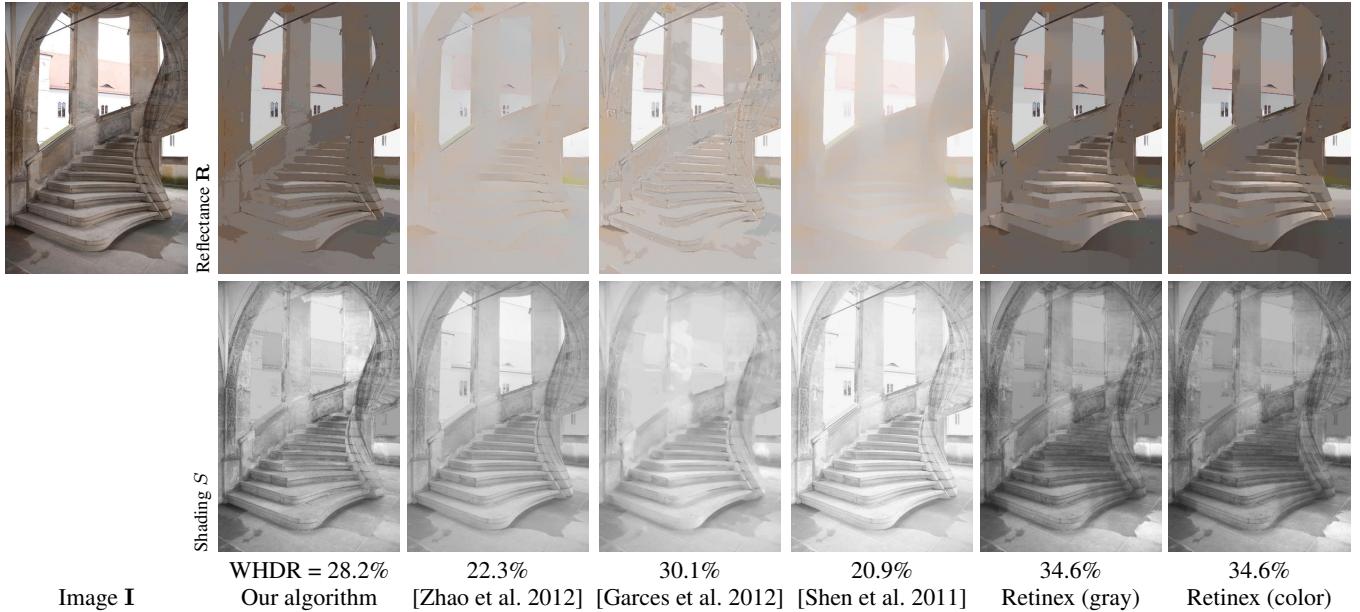


Figure 15: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 24537.

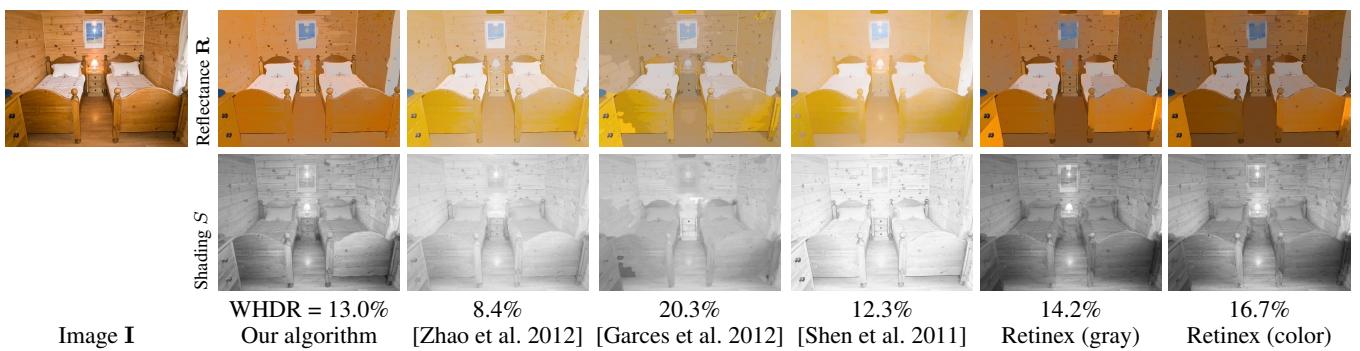


Figure 16: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 98173.

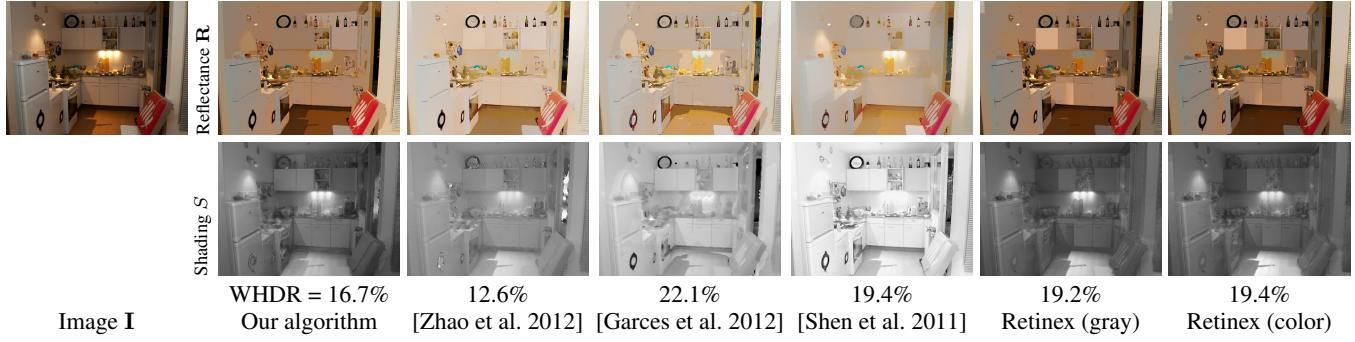


Figure 17: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 82358.

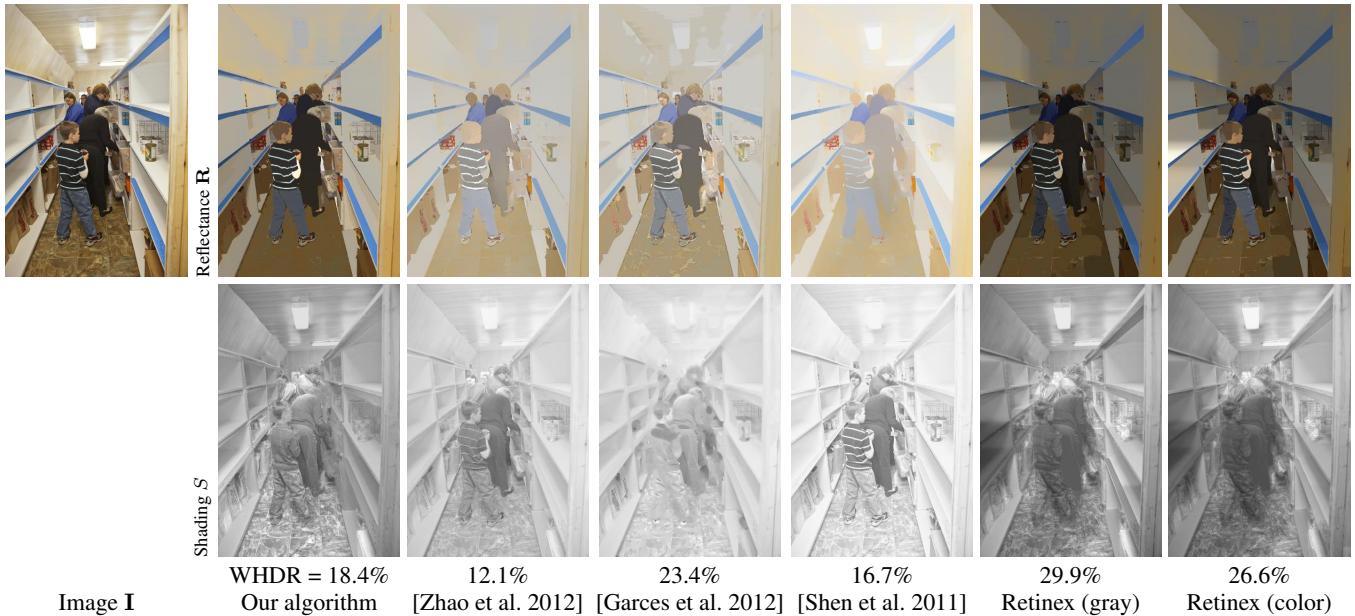


Figure 18: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 55472.

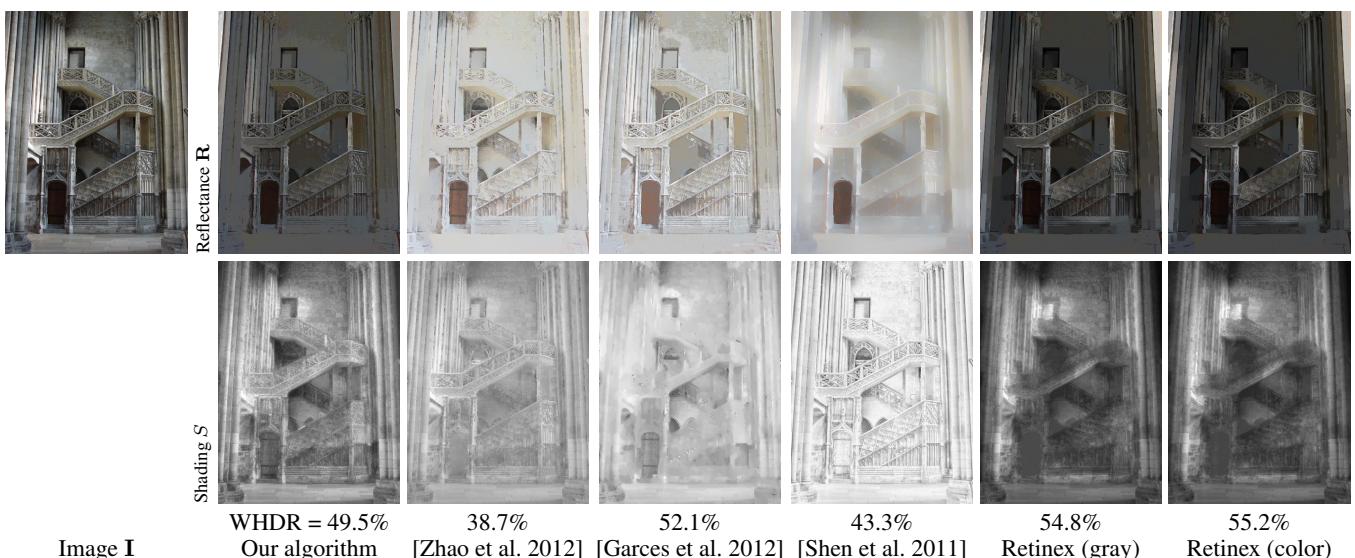


Figure 19: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 22754.

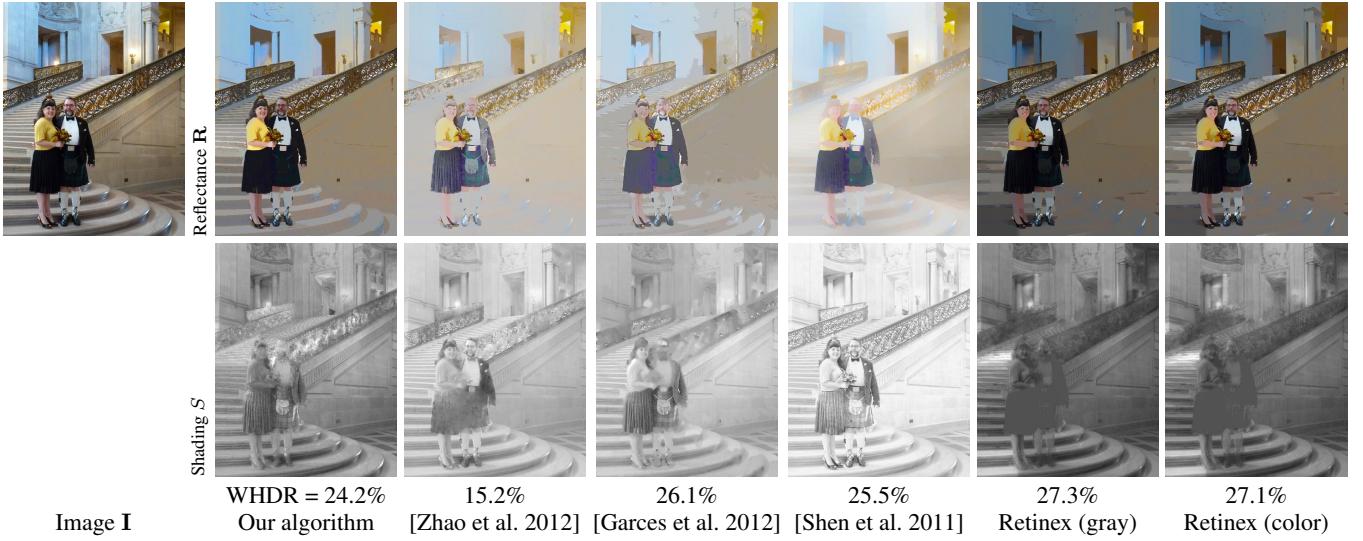


Figure 20: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 24637.



Figure 21: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 88857.



Figure 22: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 88648.



Figure 23: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 89829.



Figure 24: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 118146.

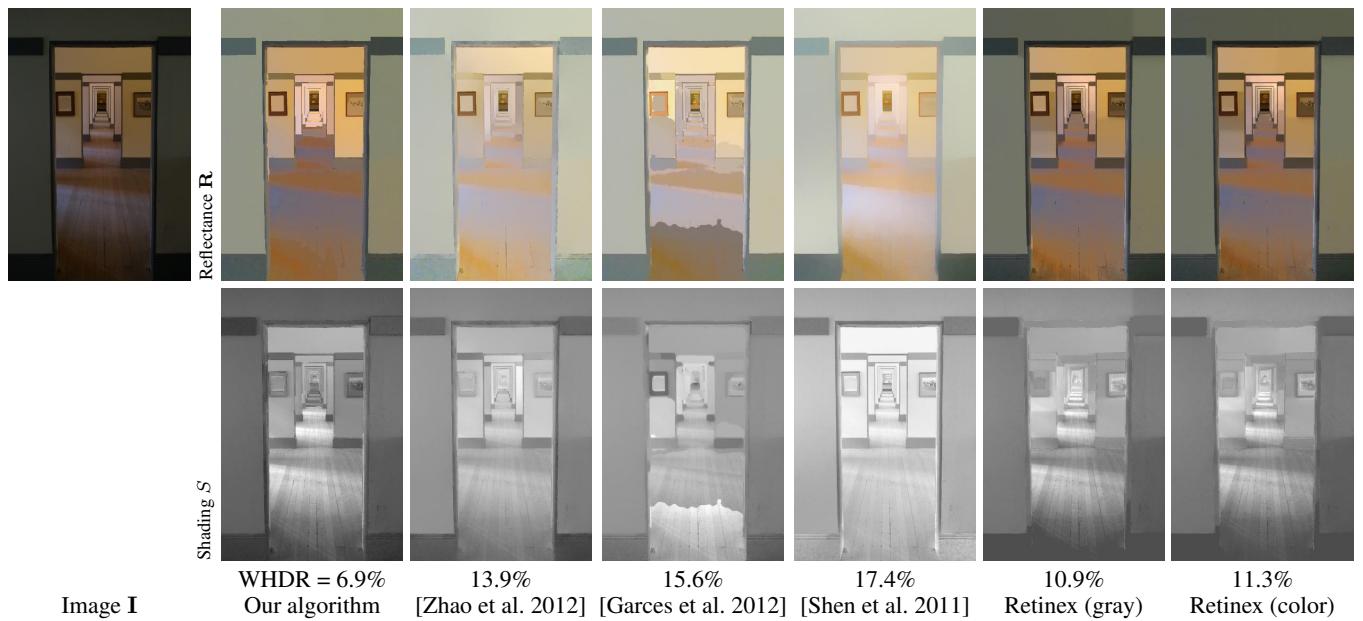


Figure 25: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 108963.



Figure 26: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 84900.

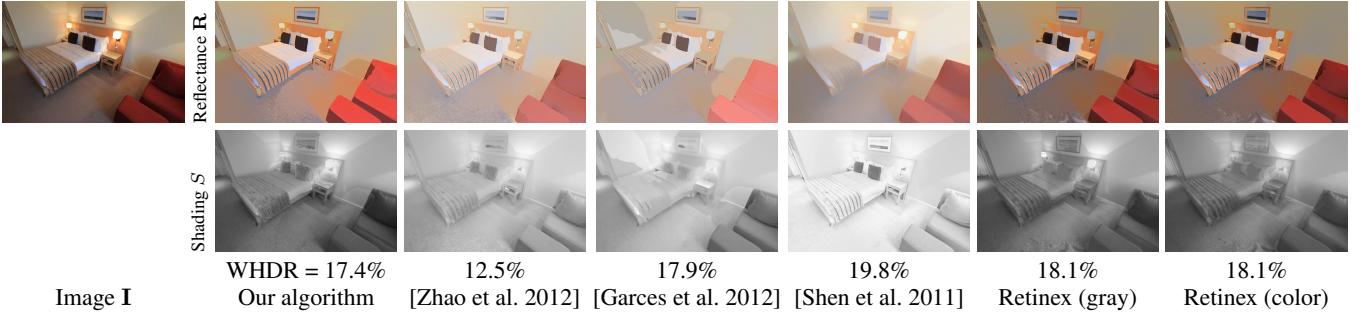


Figure 27: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 97071.



Figure 28: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 85917.

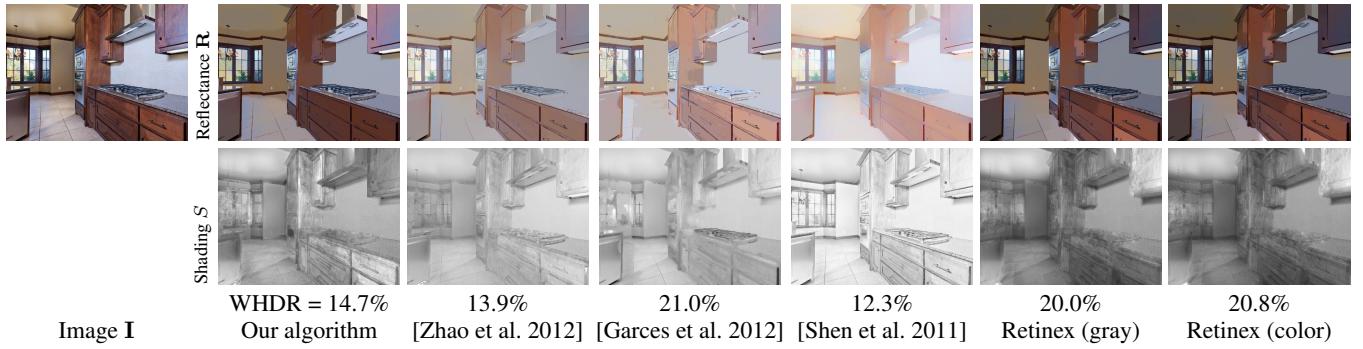


Figure 29: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 116883.



Figure 30: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 97315.



Figure 31: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 101511.

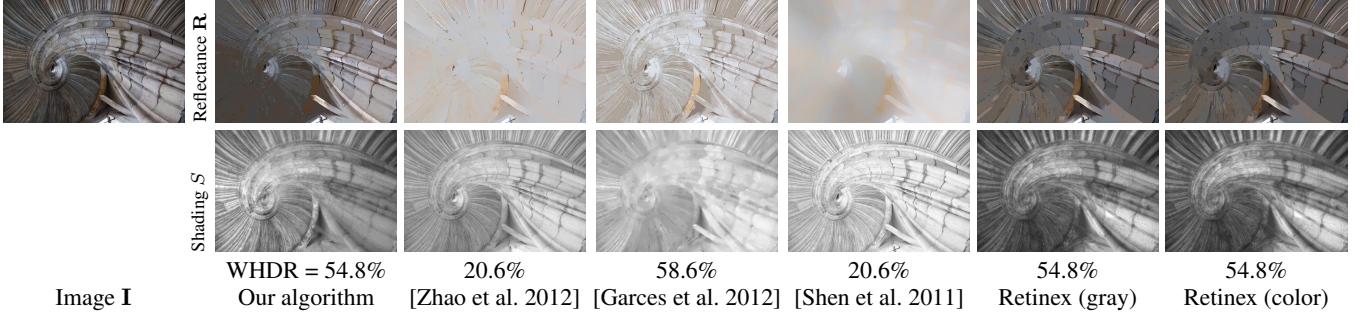


Figure 32: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 23535.



Figure 33: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 84210.



Figure 34: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 87598.

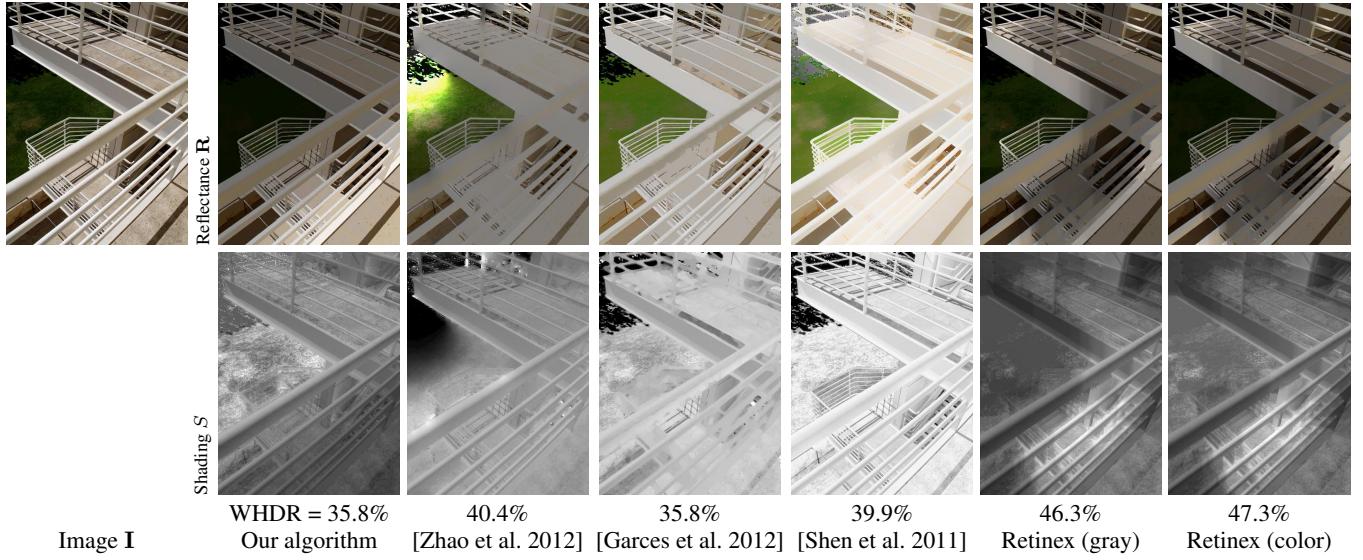


Figure 35: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean WHDR_{10%} across all photos). OpenSurfaces Photo ID: 26386.

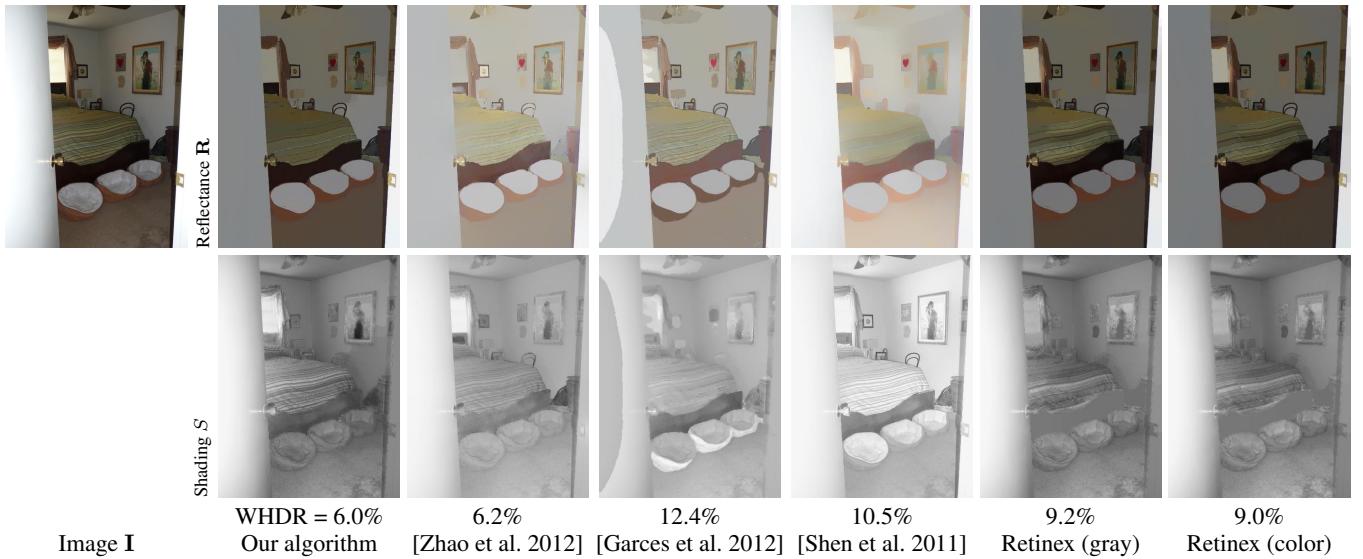


Figure 36: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean WHDR_{10%} across all photos). OpenSurfaces Photo ID: 100318.

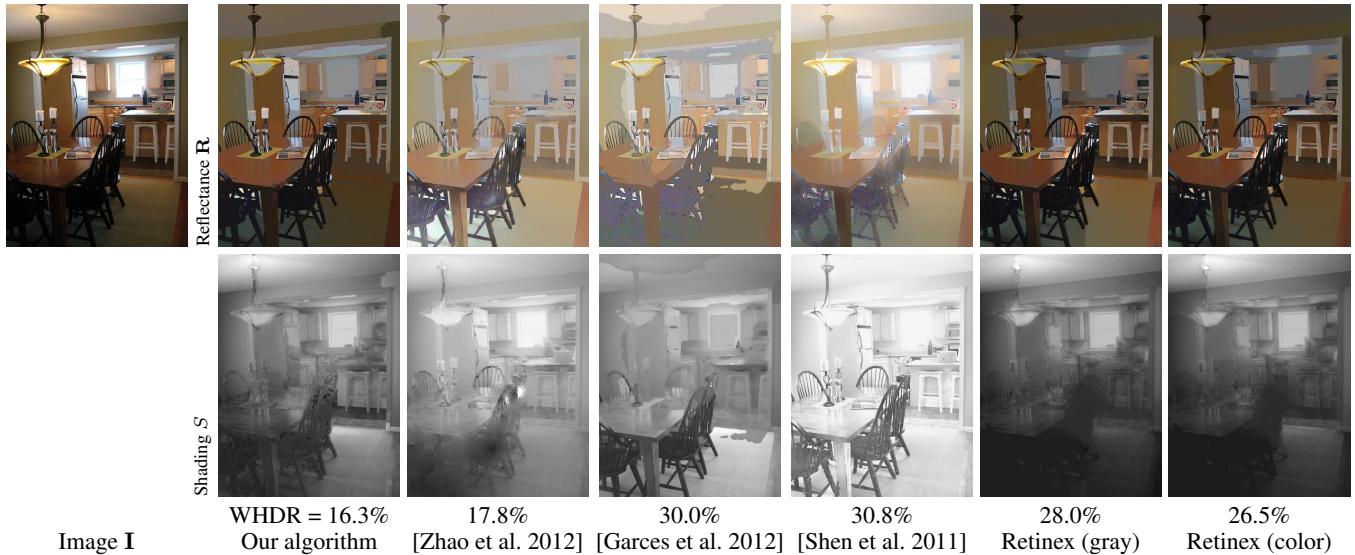


Figure 37: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean WHDR_{10%} across all photos). OpenSurfaces Photo ID: 11907.



Figure 38: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 100629.

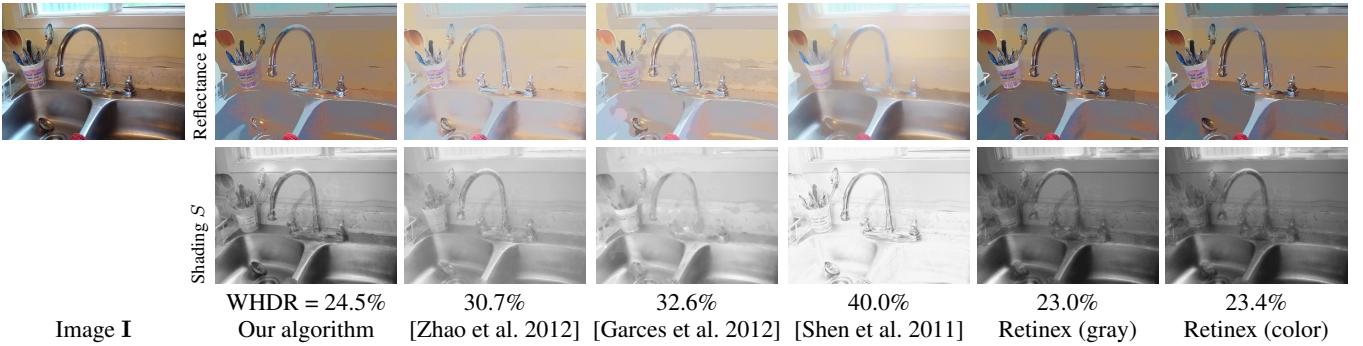


Figure 39: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 74024.



Figure 40: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 118512.

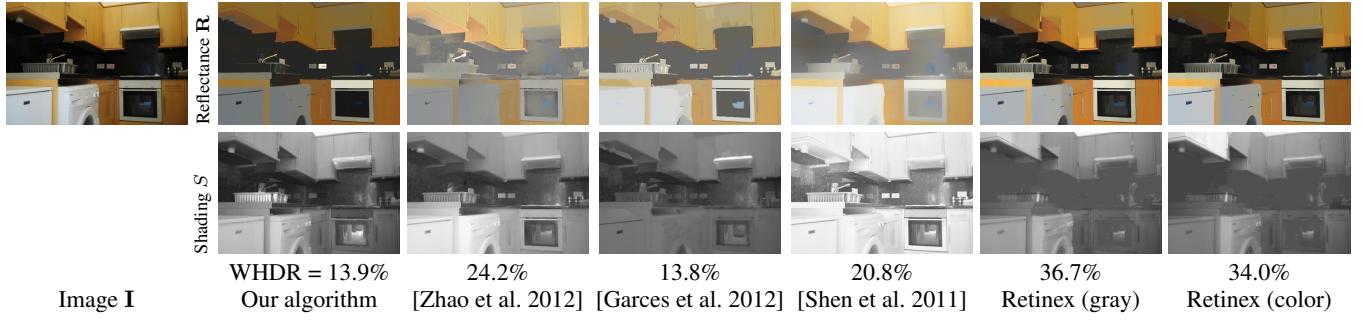


Figure 41: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 83267.



Figure 42: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 118511.



Figure 43: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 97316.



Figure 44: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 82623.



Figure 45: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 34942.



Figure 46: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 105838.

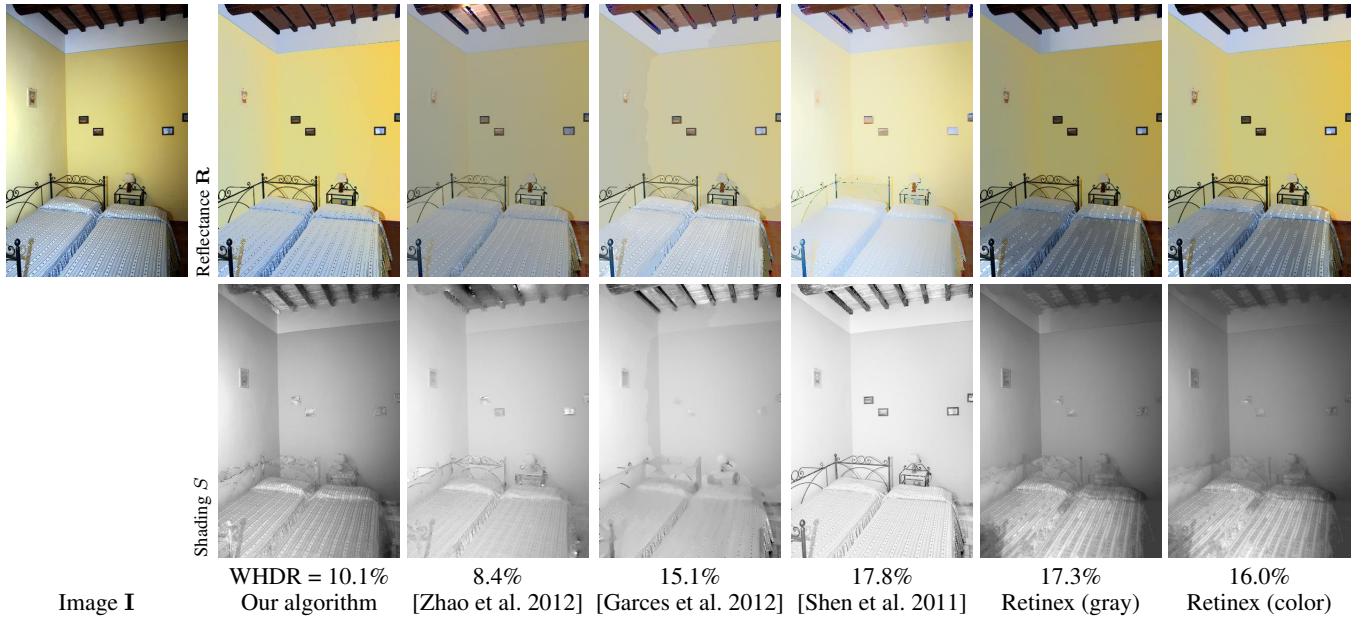


Figure 47: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 100313.



Figure 48: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 9843.

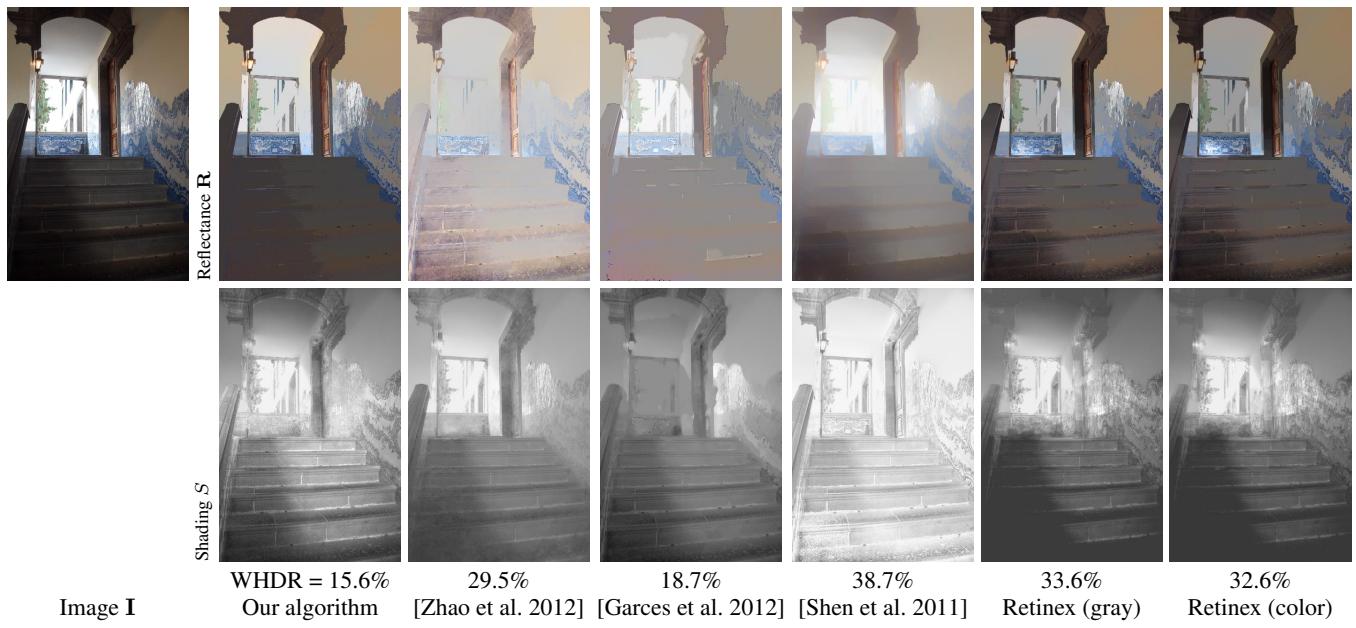


Figure 49: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 26776.



Figure 50: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 57389.



Figure 51: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 118510.



Figure 52: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 118509.

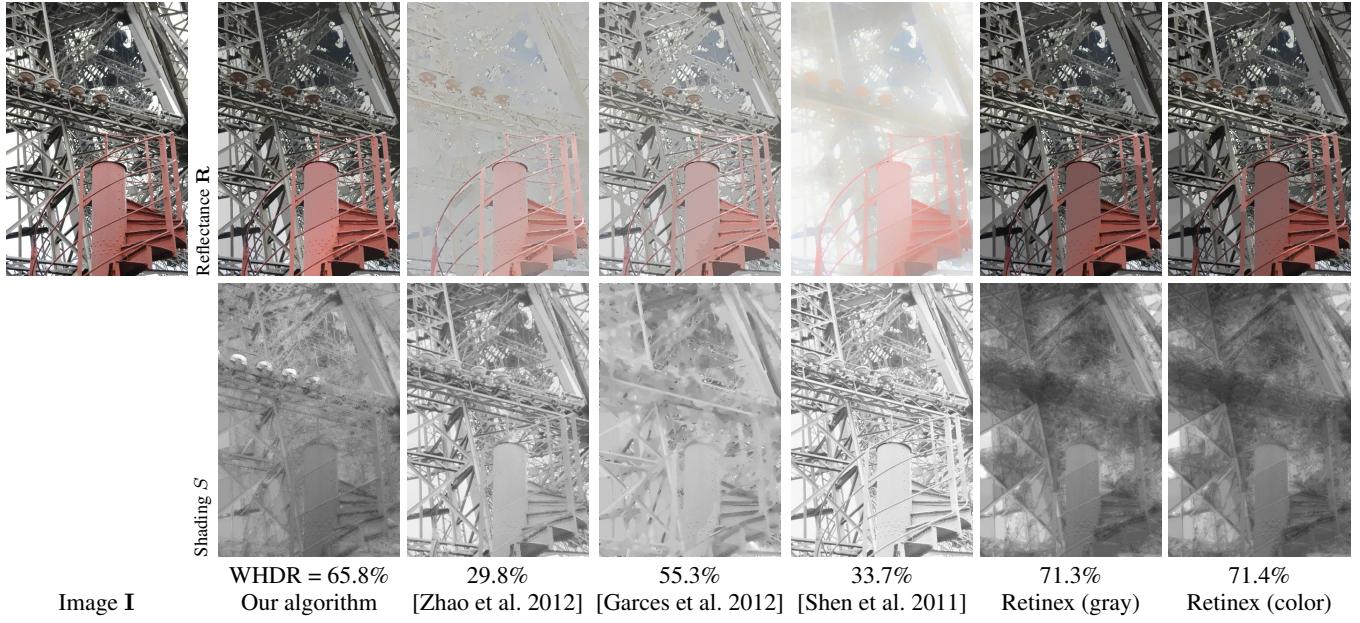


Figure 53: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 25172.



Figure 54: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 60889.

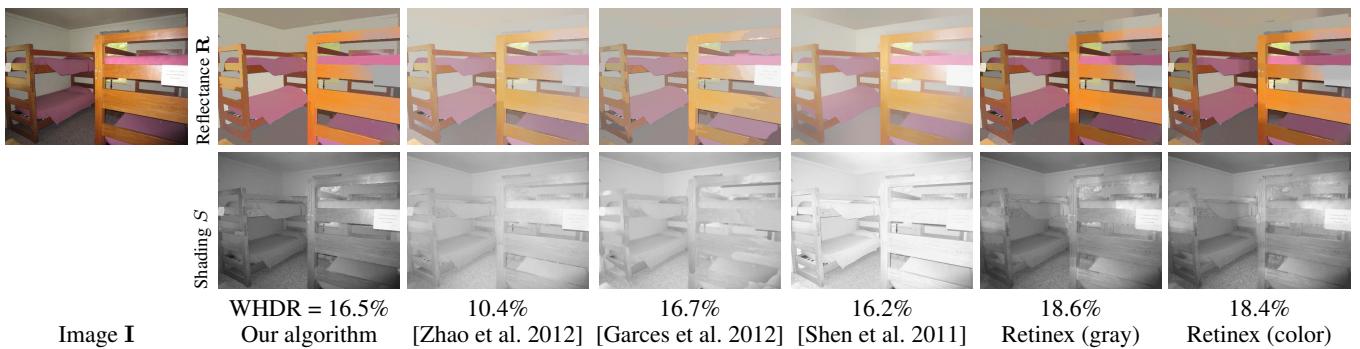


Figure 55: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 98498.

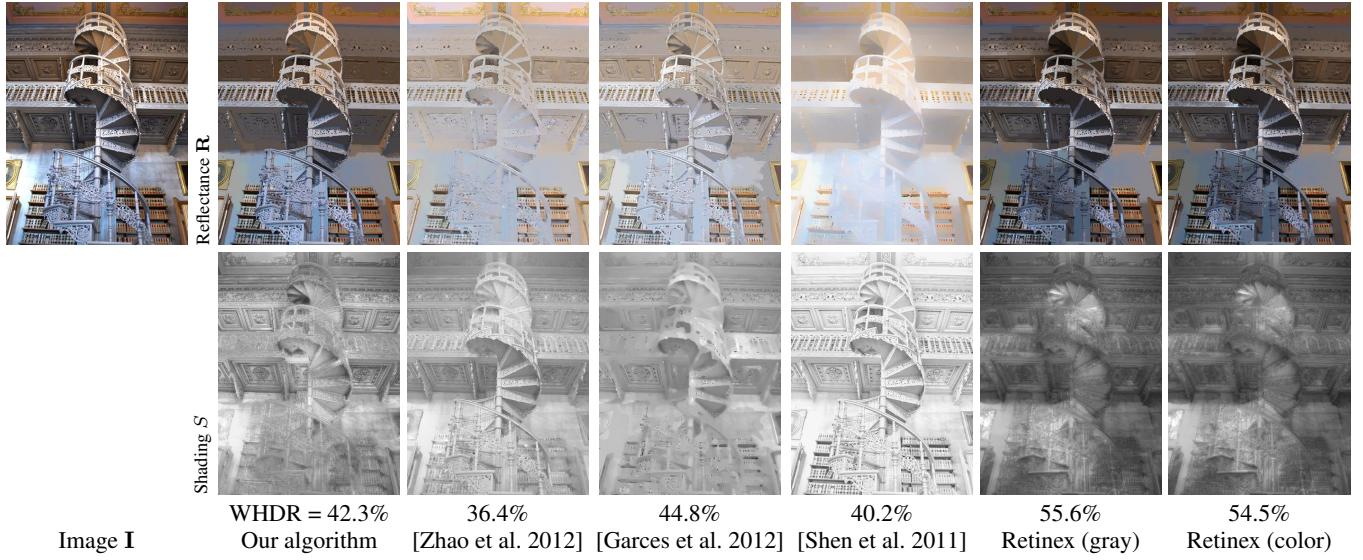


Figure 56: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 9438.



Figure 57: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 107243.

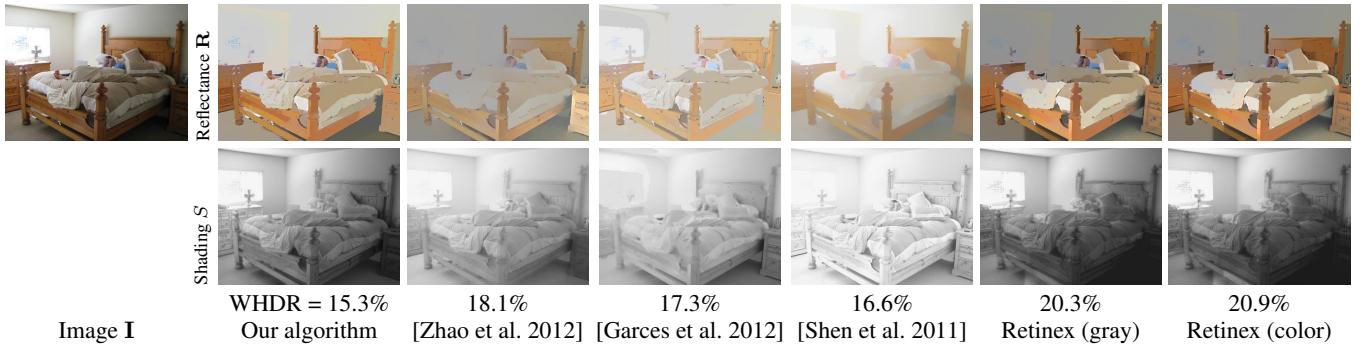


Figure 58: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 105788.

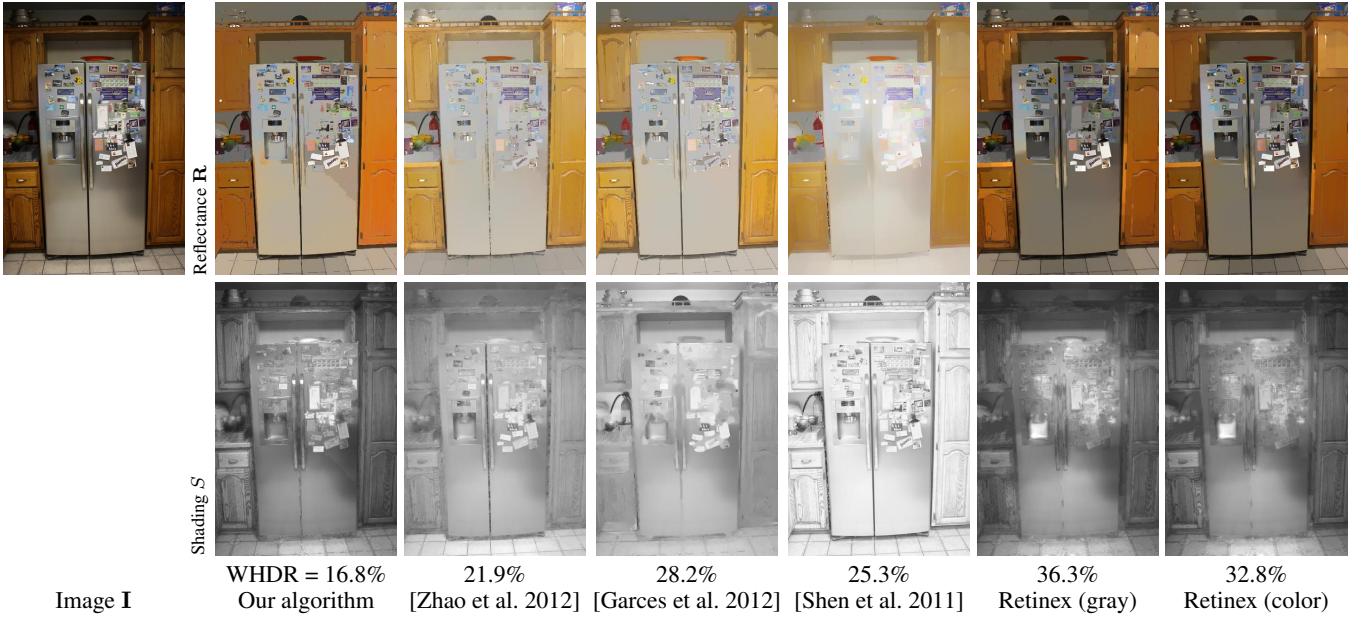


Figure 59: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 86846.



Figure 60: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 89875.



Figure 61: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 108975.



Figure 62: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 3446.

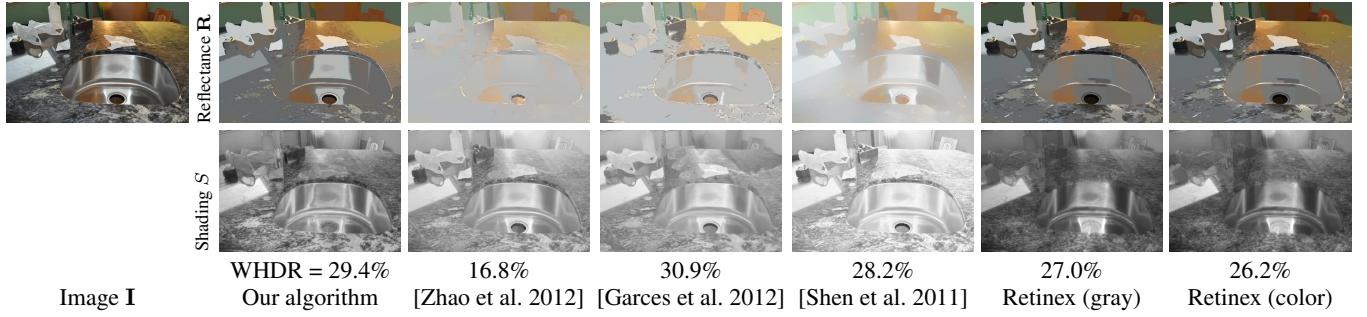


Figure 63: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 83586.

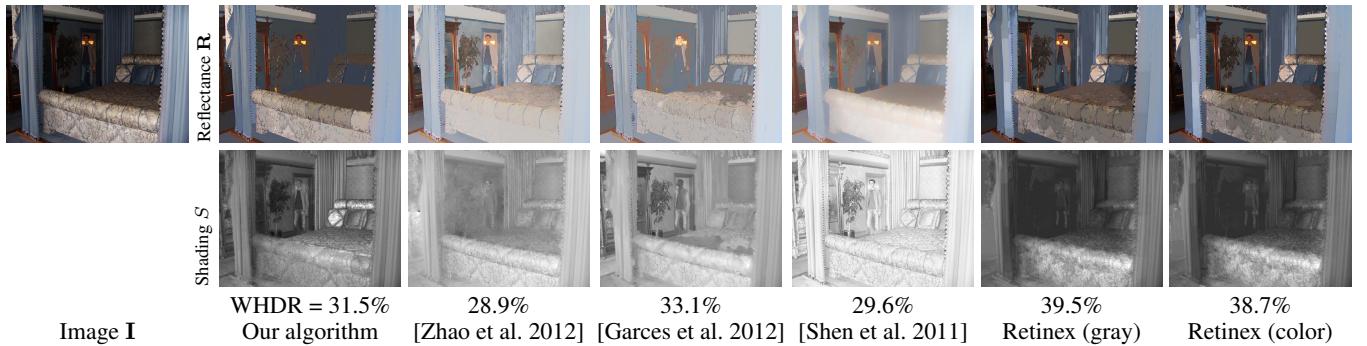


Figure 64: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 103319.

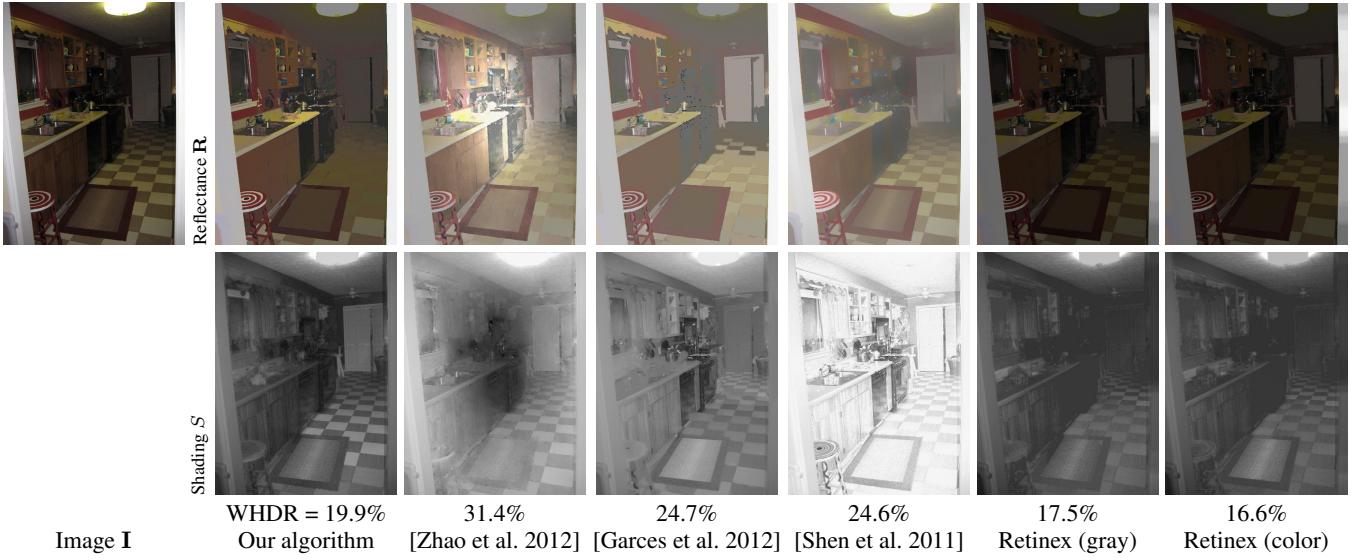


Figure 65: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 82917.

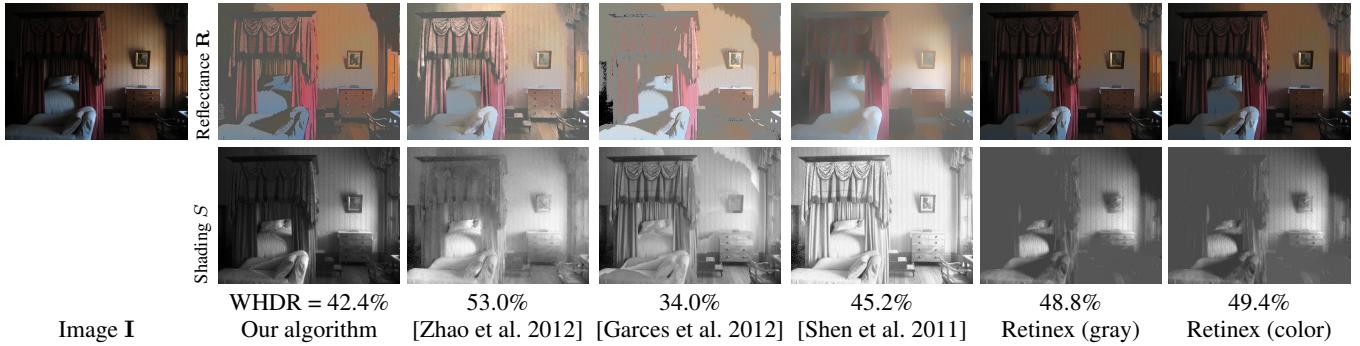


Figure 66: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 101573.

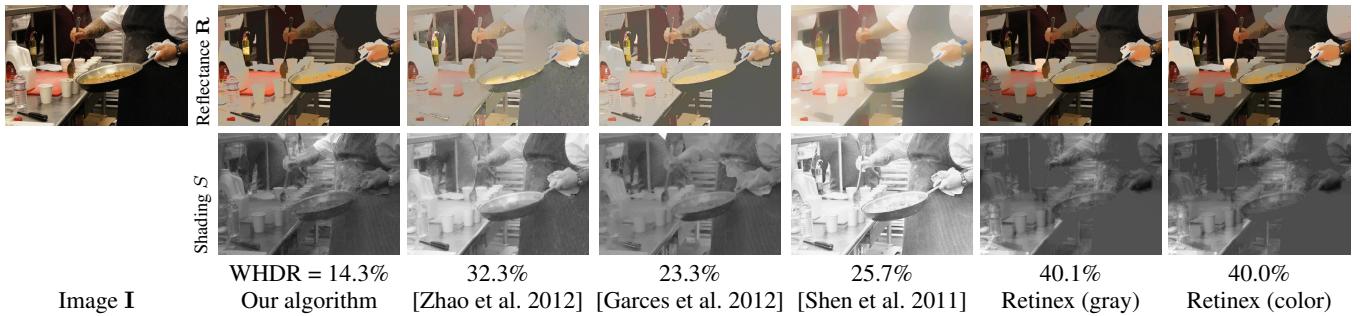


Figure 67: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 57204.

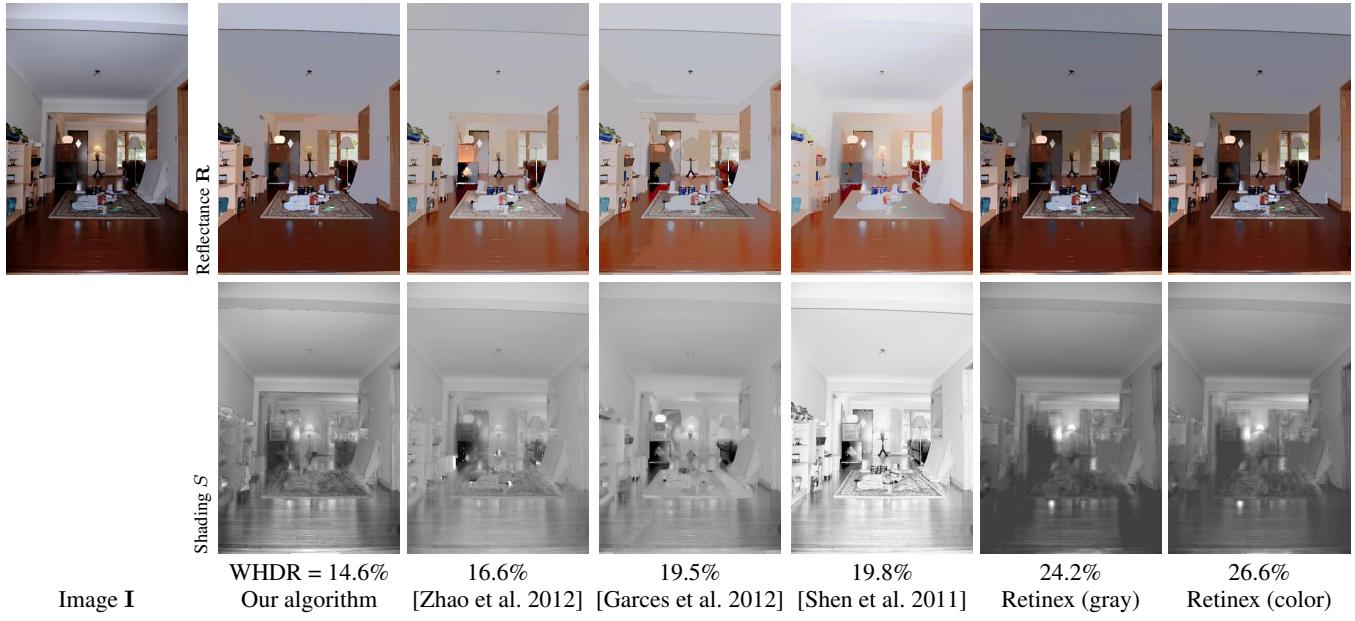


Figure 68: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 109759.

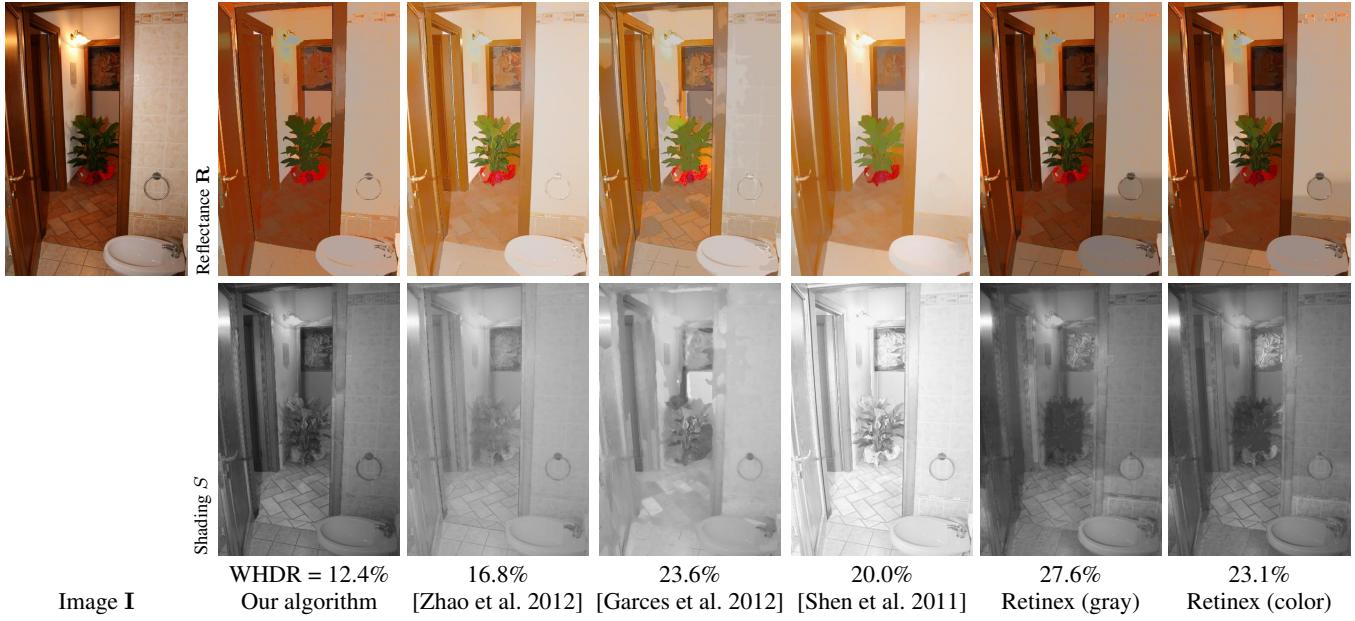


Figure 69: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 15554.

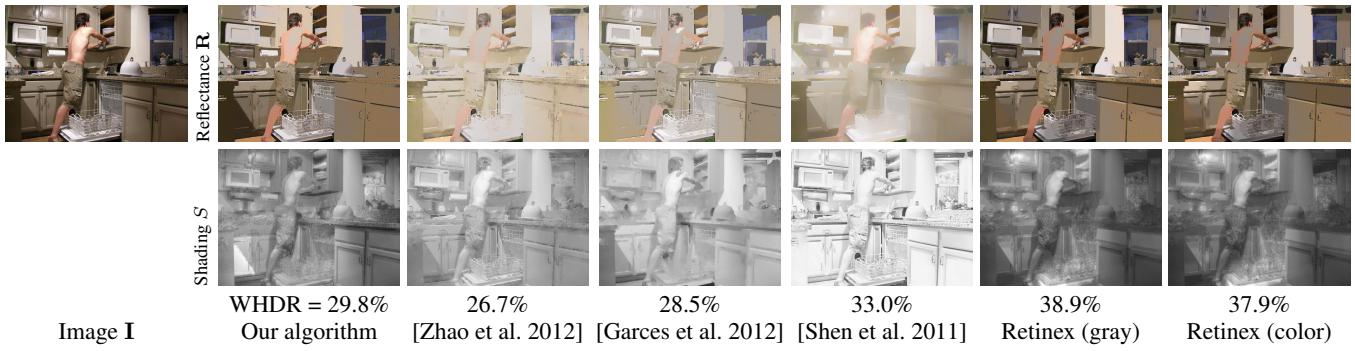


Figure 70: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 69278.



Figure 71: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 83161.

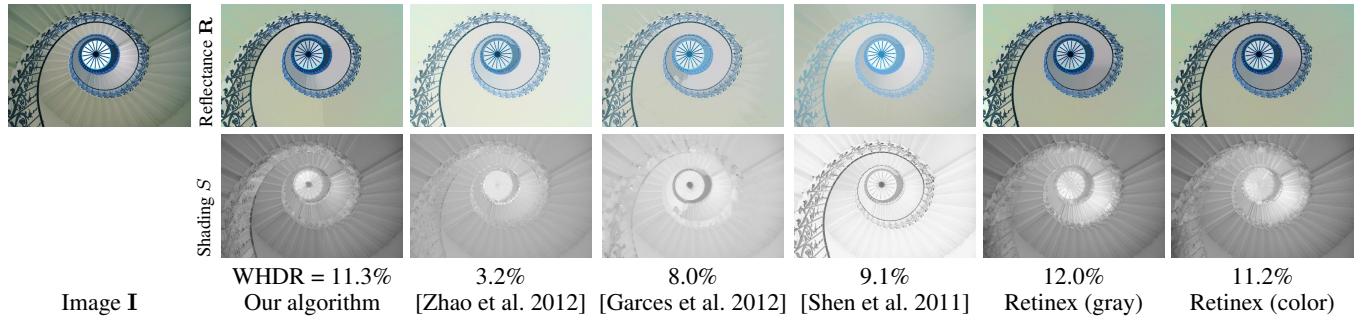


Figure 72: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 24947.

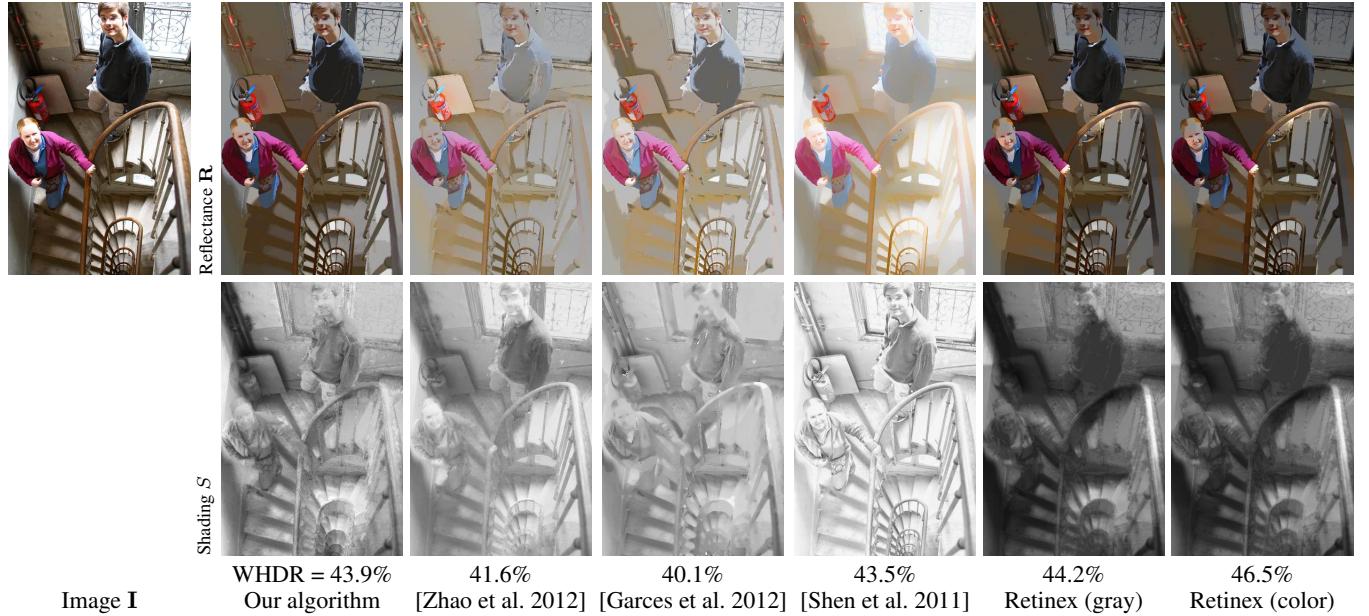


Figure 73: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 24564.

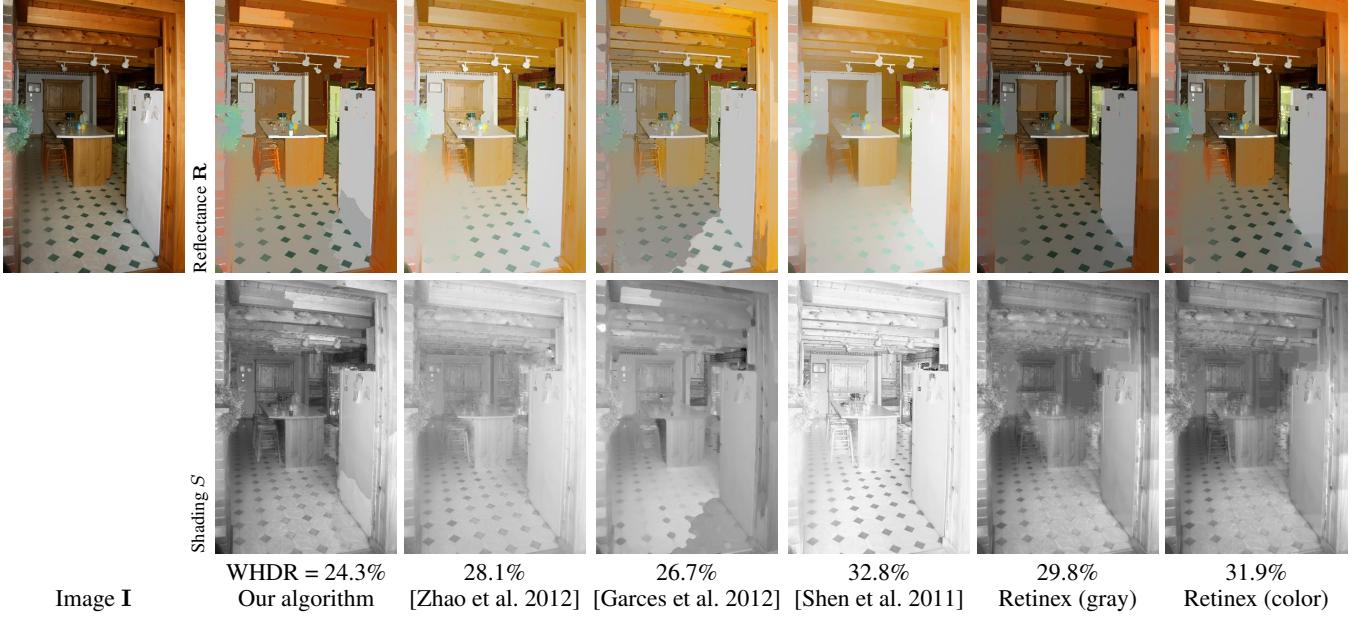


Figure 74: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 62855.



Figure 75: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 117613.



Figure 76: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 26128.

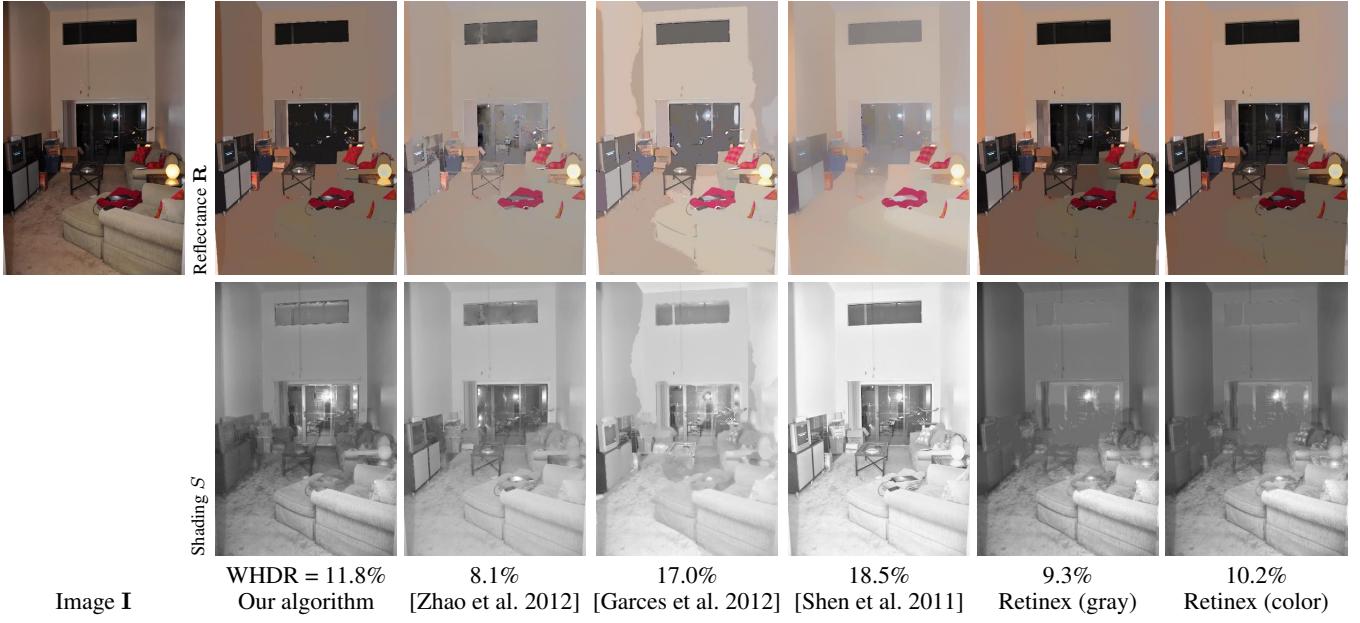


Figure 77: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 35918.

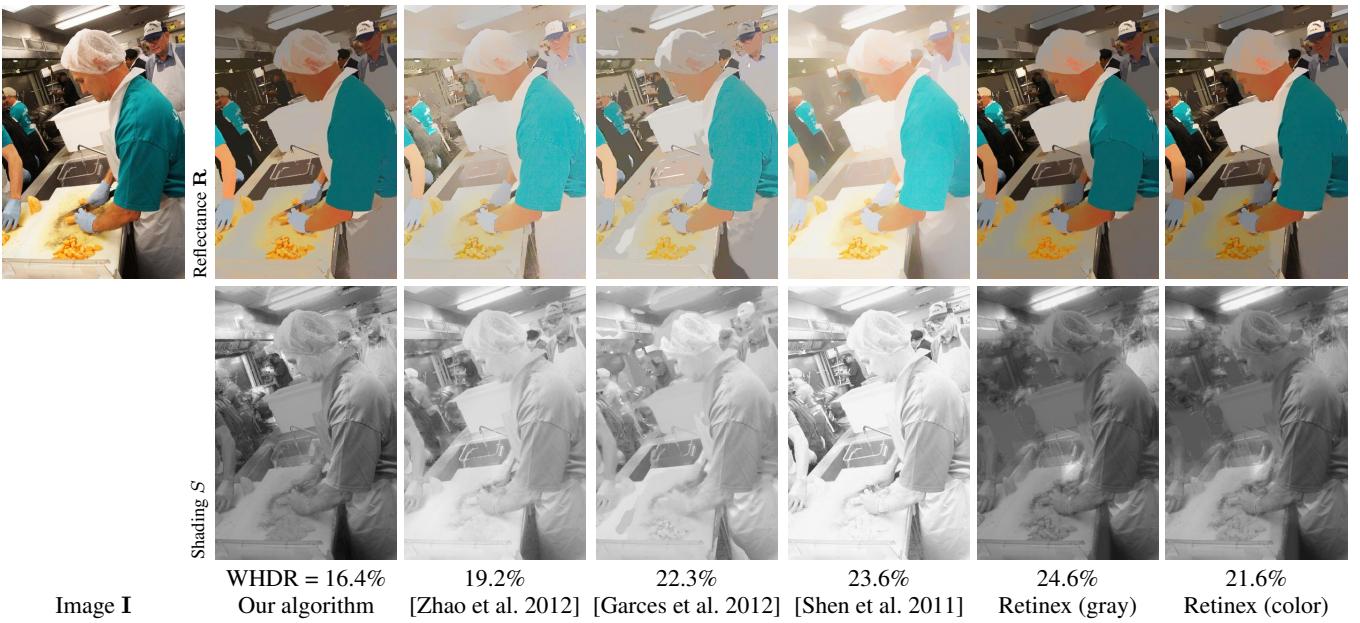


Figure 78: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 56665.

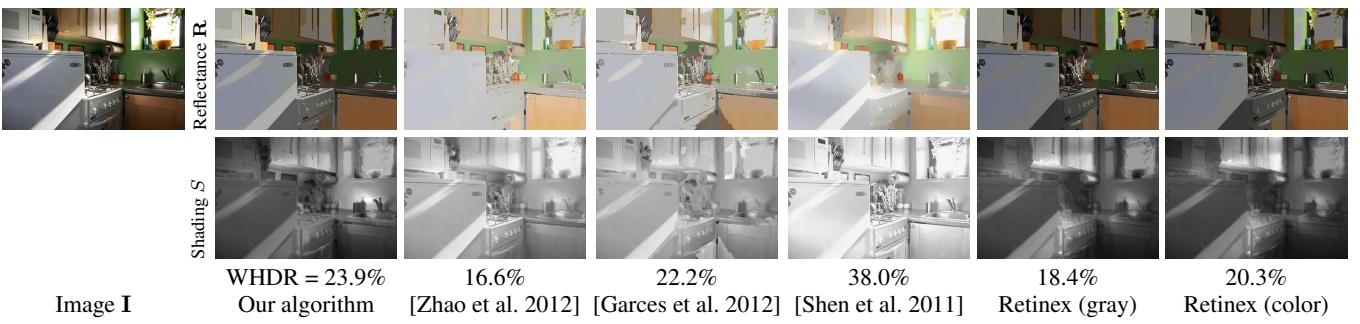


Figure 79: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 83285.



Figure 80: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 84040.



Figure 81: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 35804.

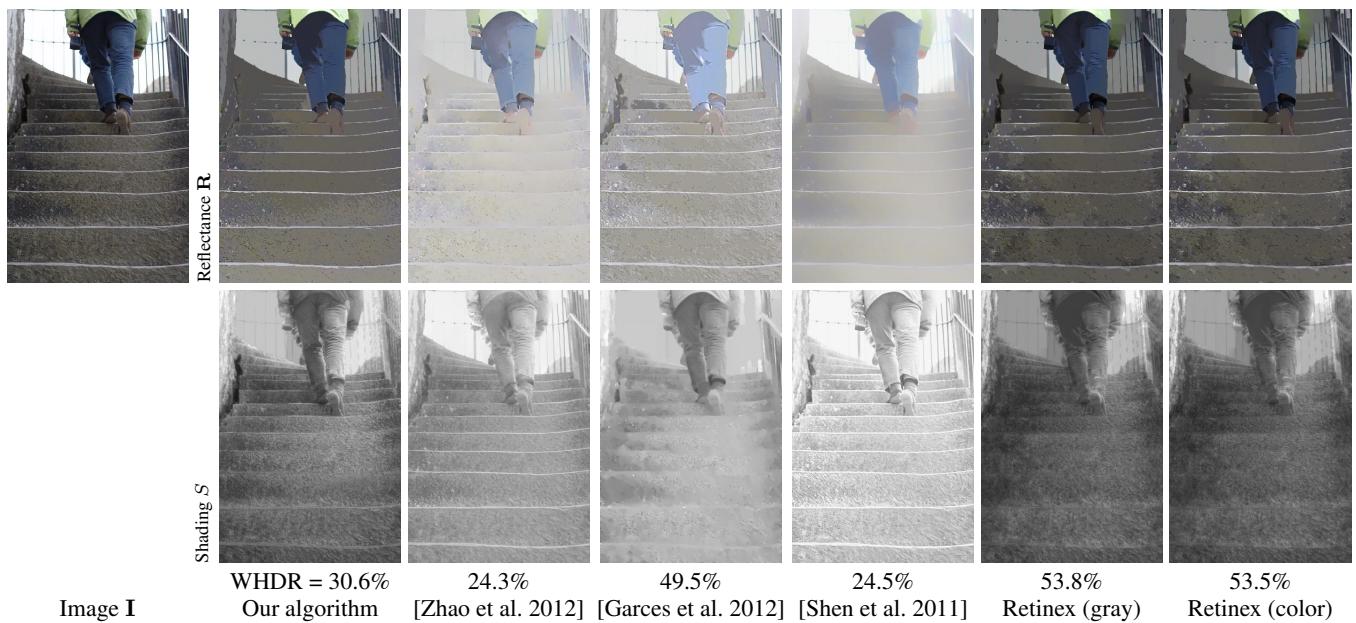


Figure 82: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 22645.

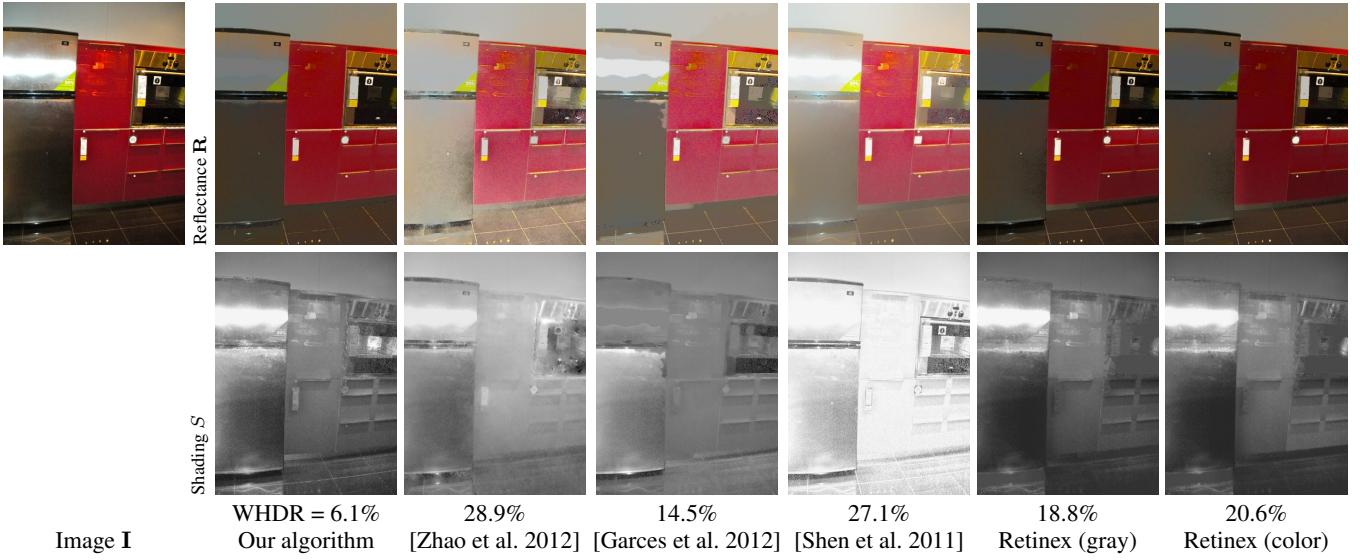


Figure 83: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 68084.



Figure 84: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 116213.



Figure 85: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 66411.



Figure 86: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 69088.



Figure 87: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 83252.



Figure 88: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 59157.

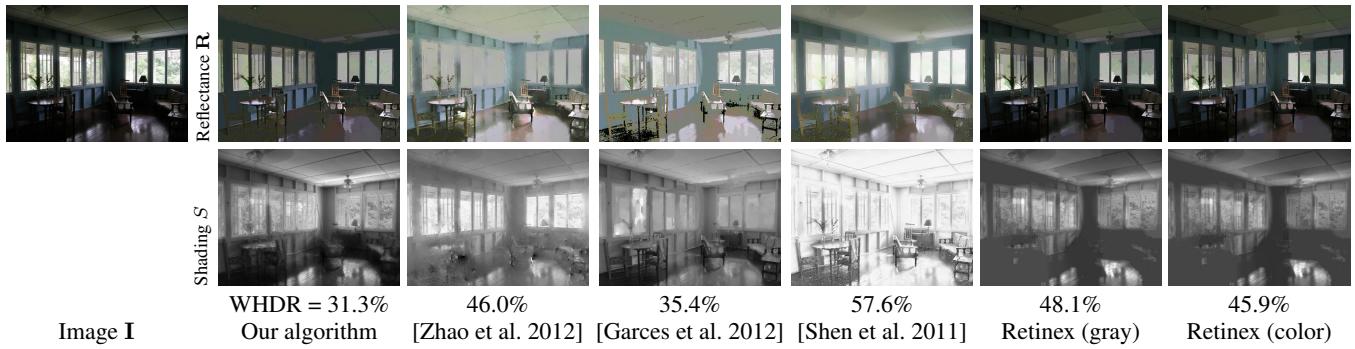


Figure 89: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 11877.

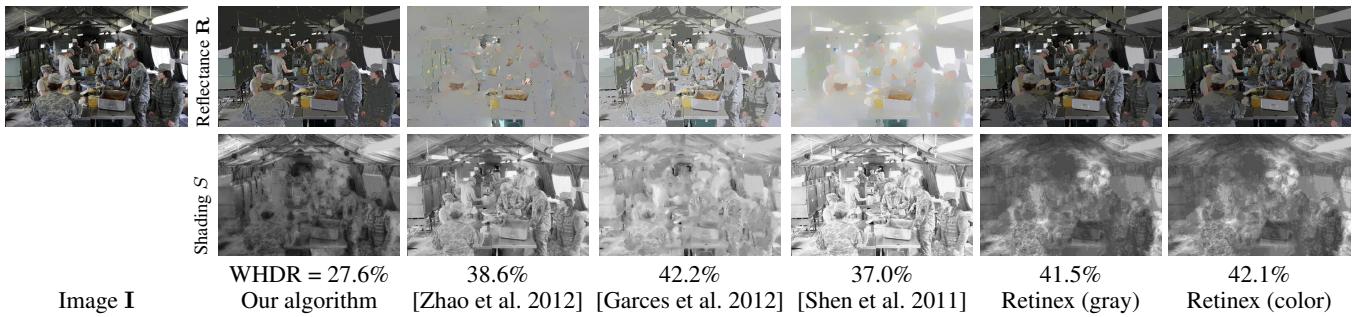


Figure 90: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 82342.



Figure 91: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 11902.



Figure 92: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 97331.

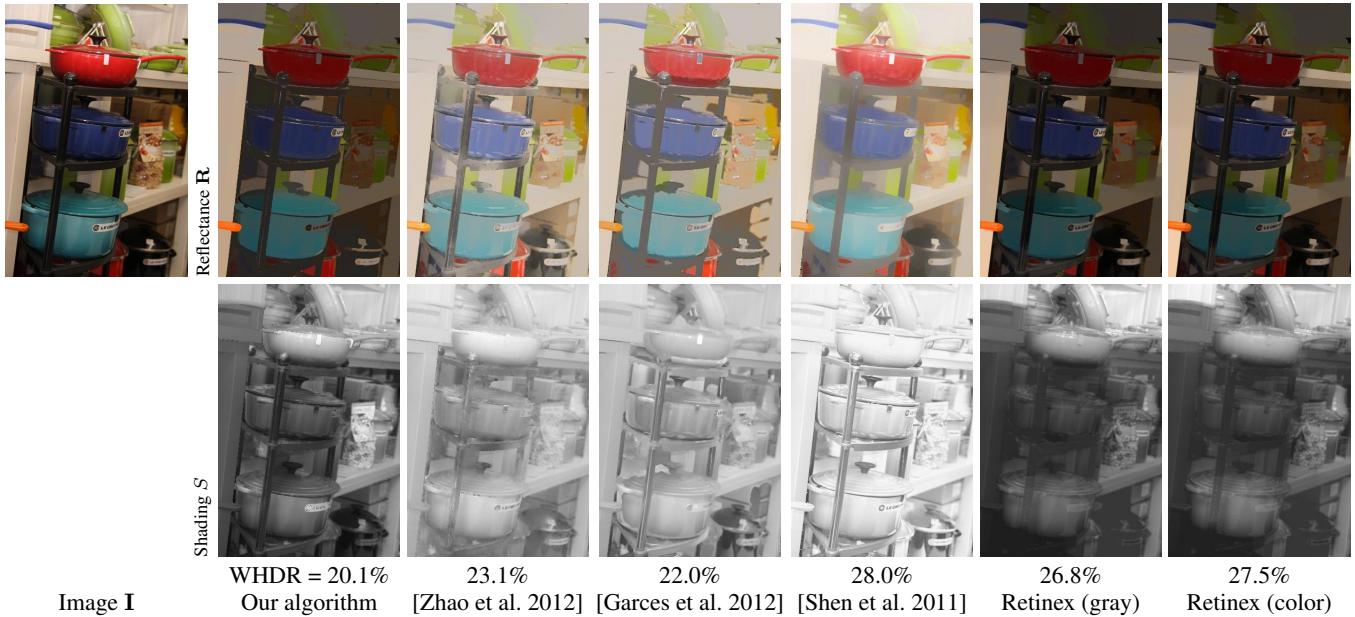


Figure 93: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 74588.

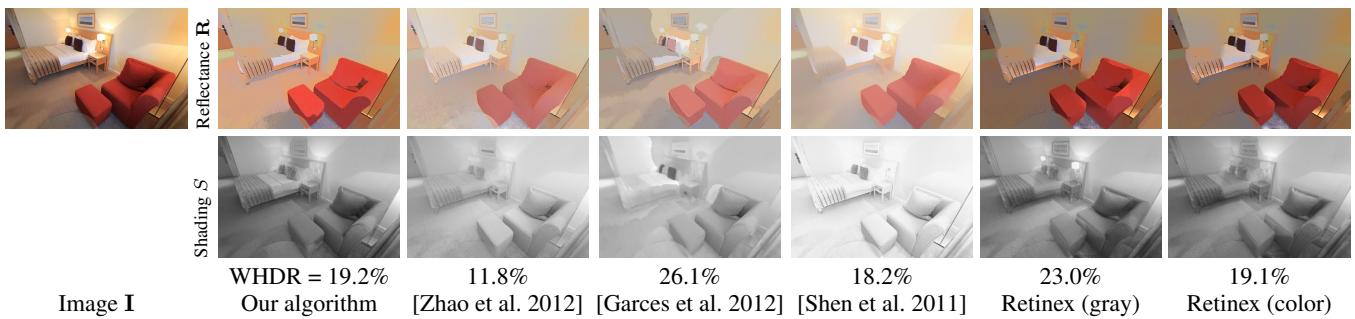


Figure 94: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 105618.

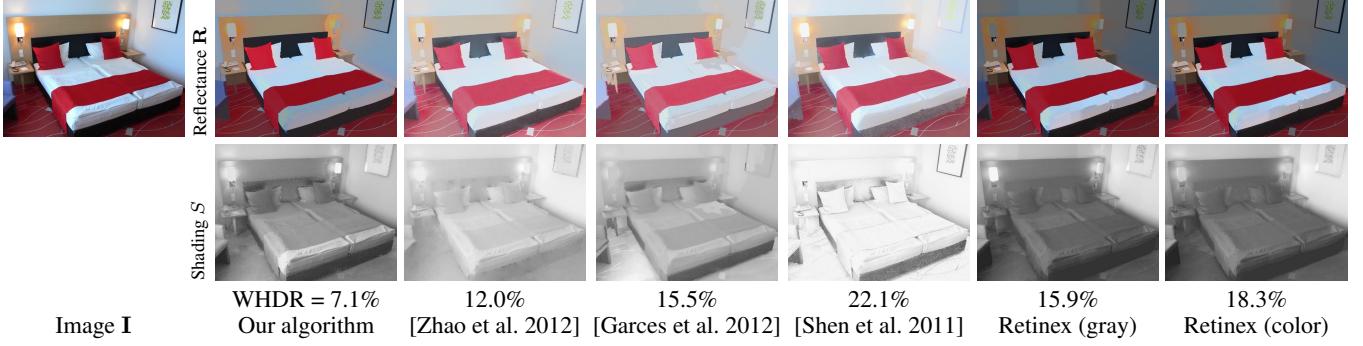


Figure 95: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 97664.

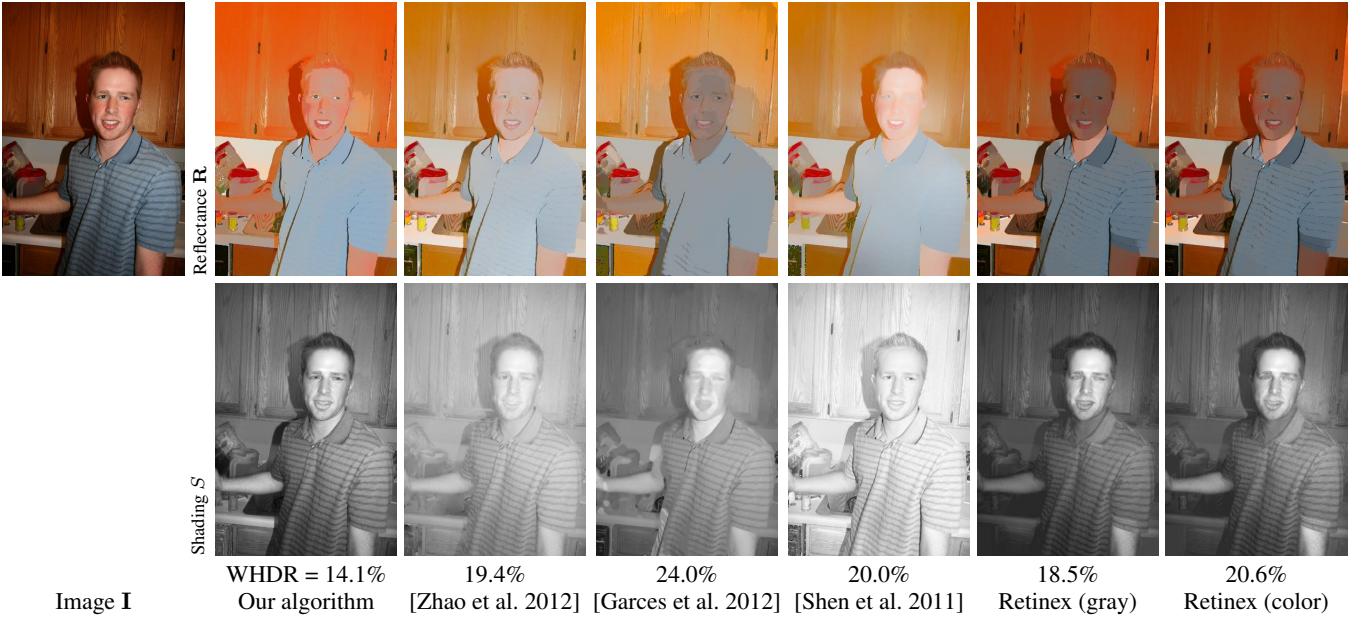


Figure 96: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 57372.



Figure 97: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 108117.

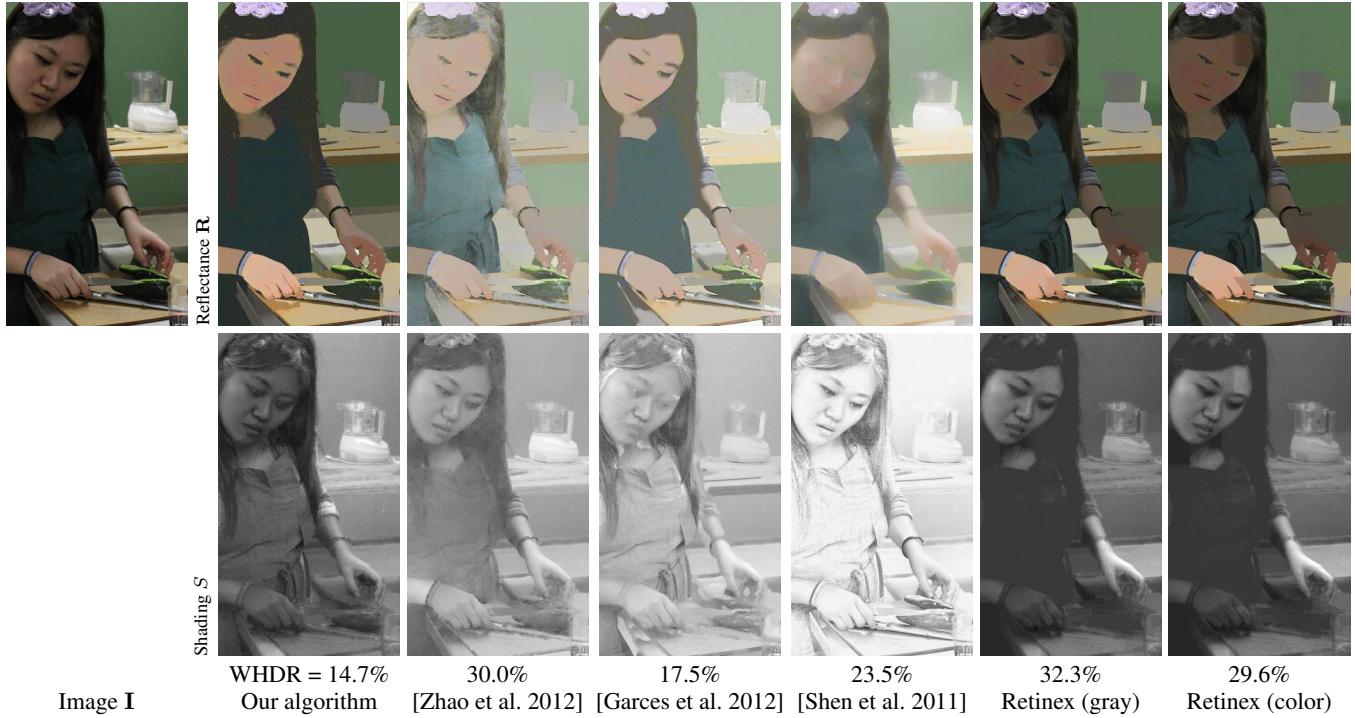


Figure 98: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 114659.

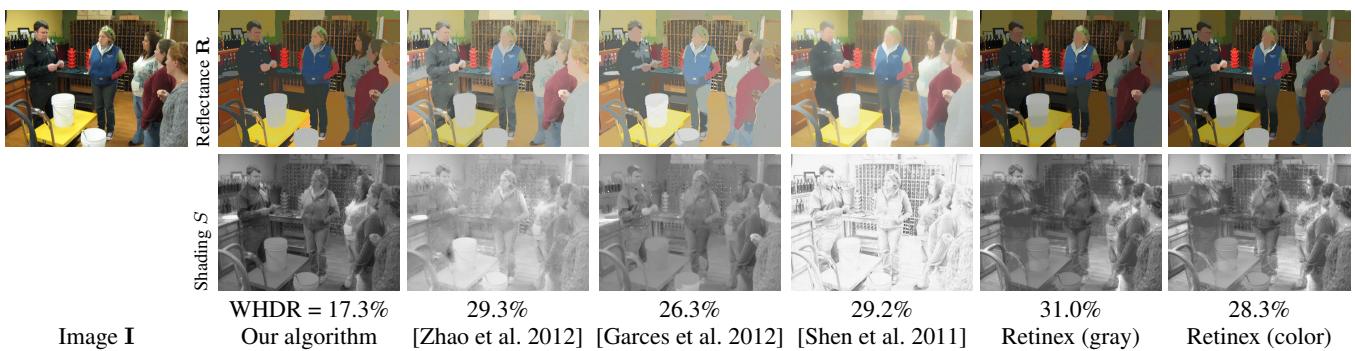


Figure 99: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 56068.

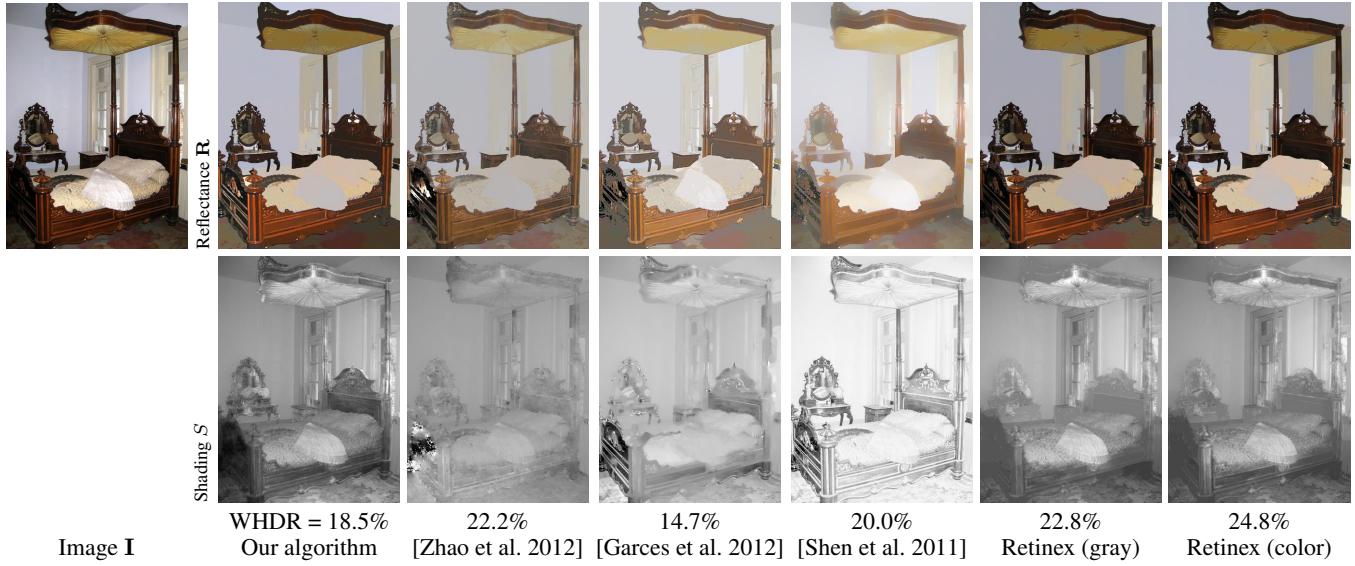


Figure 100: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 105479.



Figure 101: Visual comparison of our algorithm against several recent open-source algorithms. Each algorithm uses the best parameters found from training (i.e., minimizes mean $WHDR_{10\%}$ across all photos). OpenSurfaces Photo ID: 112291.

4 Additional acknowledgments: Flickr users

Finally, we would like to thank the following Flickr users (by User ID) for releasing their images under a creative commons license. This work would not be possible without their contributions:

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12394349@N06 13128823@N06 15132846@N00 15481483@N06
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henofthewoods herry heschong hiddenloop hisgett hitchster

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paul_white pavdw pawlowski pedronet perspective petercastleton peterhess peterlong petruniak pftqg phalinn phelyan philliecasablanca photofarmer picken pinguino pinkmoose pinksherbet pixelchecker pjgardner plindberg plong pluto poisonbabyfood pong popiet porchswing porsche-linn portobaytrade powerbooktrance precision primejunta probabilistic proimos proxyindian psd pugno_muliebriter punktoad puroticorico puukibeach qmnonic quiltsalad quinet quirky qwrrty rachelmargaret raeallen randalldegges randysonofrobert rasmusknutsson rayb777 raybouk razvanorendovici rbereteig rbitting rbowen rdmey rdrpr rduta realcsi realstatezebra reizzil respres restlessglobetrotter rexroof rhadad rhinman richardmoross riebart riggenransom rimesparse rjshade rkramer62 rlerdorf rob-young robandstephanielevy robcock robertluna3 robertpaulyoung rocketboom rocketjim54 roguelazer roland roughgroove royluck rrunaway rsutphin rtadlock rubbermaid russelljsmith rutlo ryanboren ryanfrost ryanready saboten sackerman519 salanki salvadonica santafeegret saragoldsmith sarchi savannahcorps scissorfighter scott1723 scottfeldstein seat850 sebrenner seedkeeper seier seligmanwaite sellis selmer sergemelki sethwoodworth sgt_spanky shalbs shaneglobal shankbone shawnhargreaves shazbot sheepbackcabin sheila_sund shilad shimercollege shirokazan shokai shortfatkid shreveportbossier shutterbc siberianluck sidelong sidewalk_flying sightrays simoncook simondee simononly sirmildredpierce sixteenmilesofstring skellysf sketch22 slgc slightlyeverything slightlywinded smomashup1 snaks snapdragonmedia snowangel1967 snre so_p sodexousa soltenviva sonofgroucho southernfoodwaysalliance sparragus spd_sh speculummundi spencersbrookfarm spidere spigoo spilt-milk srgbog srslyguys staceyhuggins starrett sterlingcollege stevensnodgrass stevier stewart stp striatic stublag studiobeachhorst suavehouse113 sue_elias suecan sundaykofax sunny_johns superdeluxe superfantastic supermac suzanneandsimon swimphoto syverson tachyondecay tamra tanais taylorandayumi tazza tdd tedandjen terryballard terwilliger911 tfduesing thbernhardt theaterderkuente theco_operative thedanafiles thedelicious thefadedpast theogeo therealhershey theresasthompson therichbrooks thescottclan thetalesend thomaspix thomasrstegeleman tim_uk timgillons timmccune tinali778 tinkerszone tinyfroglet tircb toolmantim topgold topsteph53 tpavel tranztec travelingotter trec_llit trevorandmarjee trishhhh tristanf trix_smith tryberg tsakshaug tulanesly twak twohungrydudes tylerkaraszewski uberculture ubergombie ubrayj02 ucdaviscoo ufv uggboy uitdragerij ukanda uncorrectedproofs upsand usagapg usaghumphreys usarak usarmyafrica usdagov usnavy vagueonthehow valerioevo variationblogr vasenka vastateparksstaff vax-o-matic veganfeast veusto veni vialbst virtualcourtney visitfingerlakes viucsr vix_b vmiramontes vox_efx vxla w00kie wakxy wallslide wandrus wasaw wastes webdiva weinelt wengs wfyurasko wheany wien_vienna wisley wkharmon wlcutler wm_archiv wneuheisel wolfe_mkeel wolfsavard wonderferret wonderlane wordridden wwarby wwworks xshamethestrongx yakobusan yama2k yarhargoat yellowbookltd yeowatzup yimmy149 yinghai83 yourbartender zamkov zappowbang zeimke zombieite zric zzscape

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