Spline-based medial axis transform representation of binary images: Supplementary Material

1 Split-and-merge algorithm

In Sec. 3.2.2 in the paper, we have illustrated the effect of the split-and-merge (SAM) algorithm by comparing SMAT results for a lizard shape when applying the SAM algorithm and not applying it. It turns out that using SAM algorithm not only requires fewer control points, but also fewer splines, which is beneficial to image compression.

Below, we demonstrate this for the 30-image in our benchmark. Figure. 1 compares the average MS-SSIM and compression ratio CR of applying the SAM algorithm (filled dots) and not applying it (hollow dots) in 21 different combinations of parameters σ_0 and γ_0 (actual values shown in Fig. 1). On average, the MS-SSIM score with the SAM algorithm is only 0.0009 lower than the score without this scheme, but the CR is increased by 12.7%. This figure also verifies that the simpler the shape, the higher the MS-SSIM score, and vice versa. Class b in our benchmark with regular geometric contours yields both high quality and high compression ratio.

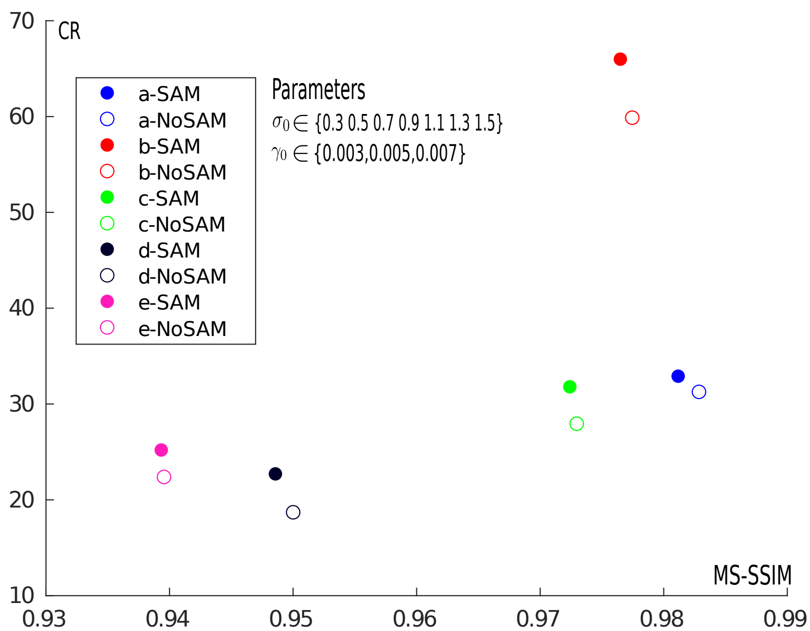

Figure 1: Average MS-SSIM *vs* CR for 5 types in the benchmark with the SAM algorithm used (filled dots) and without this scheme used (hollow dots).

2 Additional evaluation results

Section 4.1 in our paper has shown the statistics and scatterplots for an animal shape of 16 different combinations of parameters σ_0 and γ_0. We add below the same evaluation for all the 30 images in our benchmark.

Figures 2–6 show $\overline{H}$ *vs* CR and MS-SSIM *vs* CR of the same 16 combinations of parameters σ_0 and γ_0 for images from type a – type e. For most images, $\overline{H}$ and CR has a roughly direct correlation, while MS-SSIM and CR show an roughly inverse correlation. However, for some very simple objects, especially for simple regular geometric shapes in type b, this may not be the case. For these shapes, setting σ_0 to 0.1 (blue points) does not necessarily get better similarity than setting it to 1.5 (red dots). The two may get the same results, i.e., the points of the two colors overlap, such as the rectangular shape in Figure 3; it may also be red instead get a better quality, such as the third and the fourth shape in Figure 3. Although there is no certain correlation, one advantage of this is that users can easily judge the optimal result: for (b1), the point in the upper left corner is the optimization while for (b2), the dot located in the upper right corner is the best.

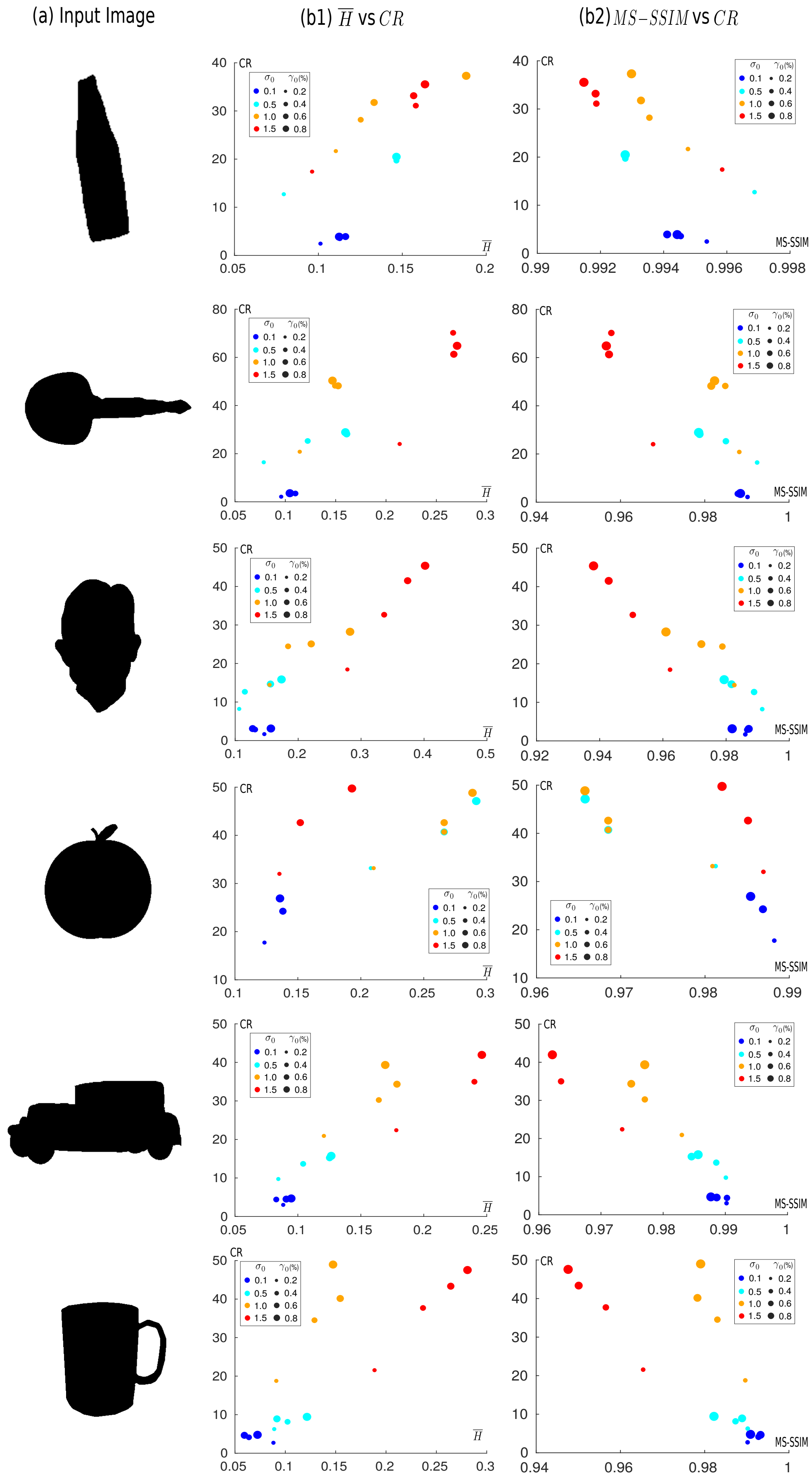

Figure 2: $\overline{H}$ *vs* CR (b1) and MS-SSIM *vs* CR (b2) for input images (a) from type a.

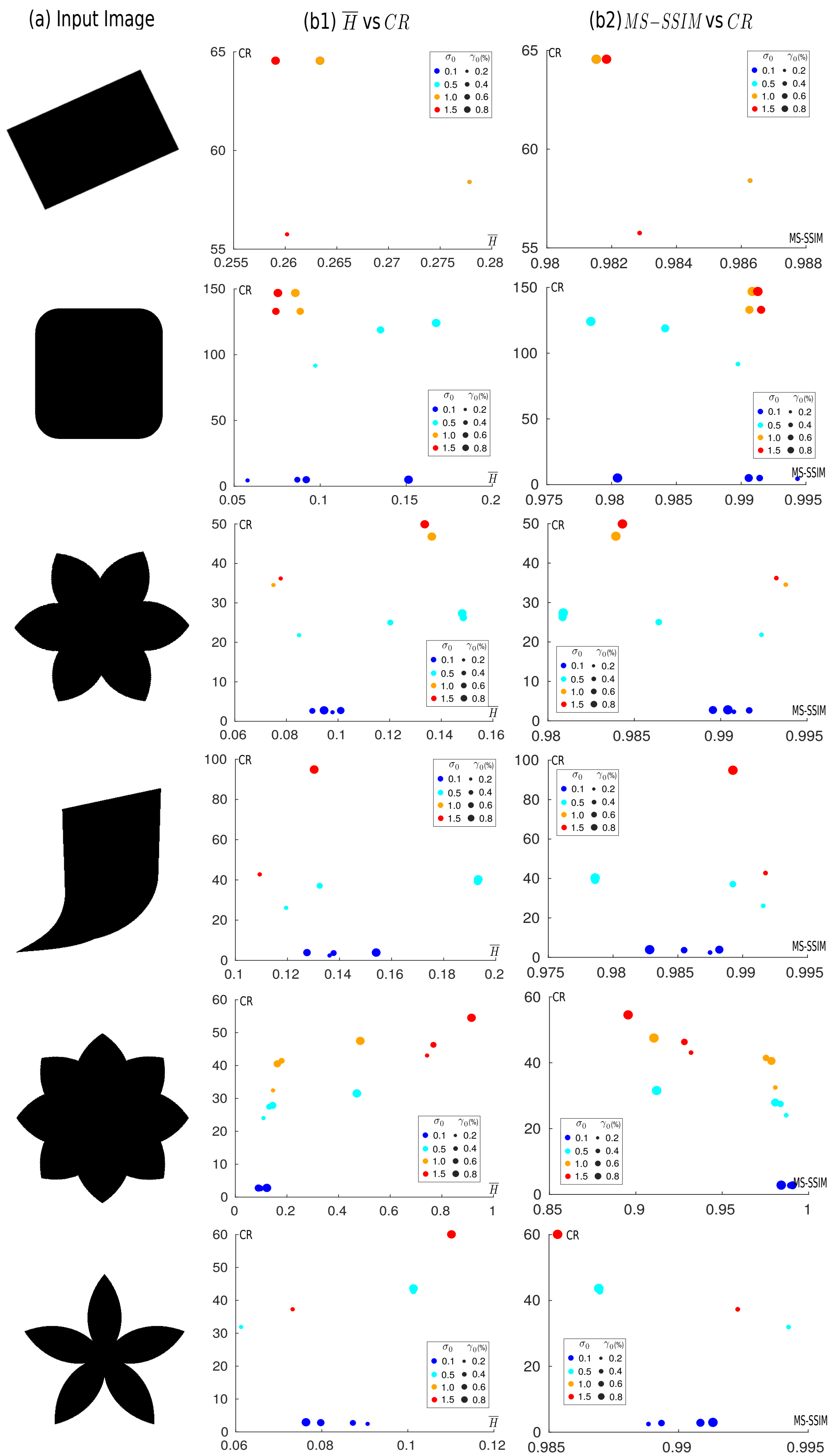

Figure 3: $\overline{H}$ *vs* CR (b1) and MS-SSIM *vs* CR (b2) for input images (a) from type b.

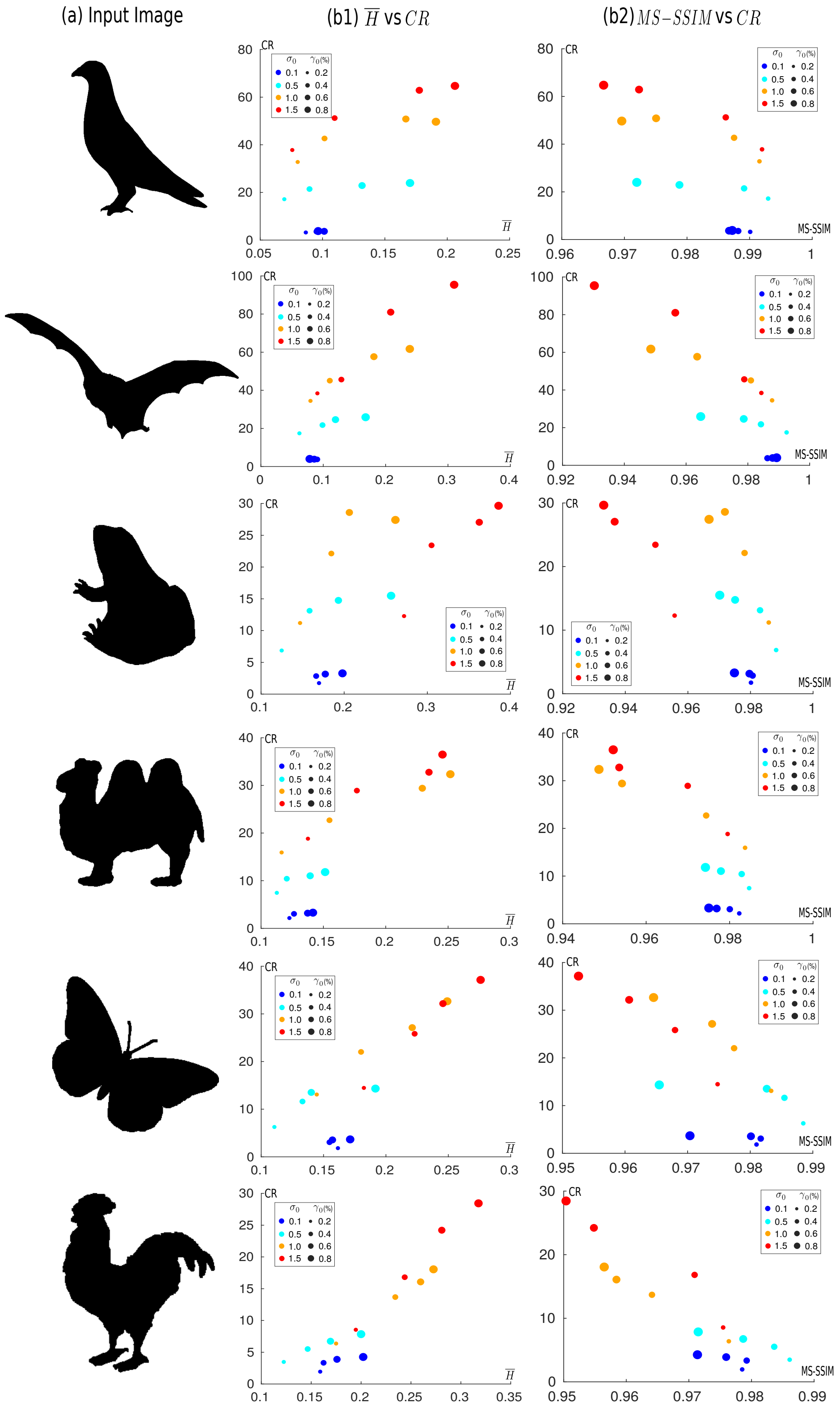

Figure 4: $\overline{H}$ *vs* CR (b1) and MS-SSIM *vs* CR (b2) for input images (a) from type c.

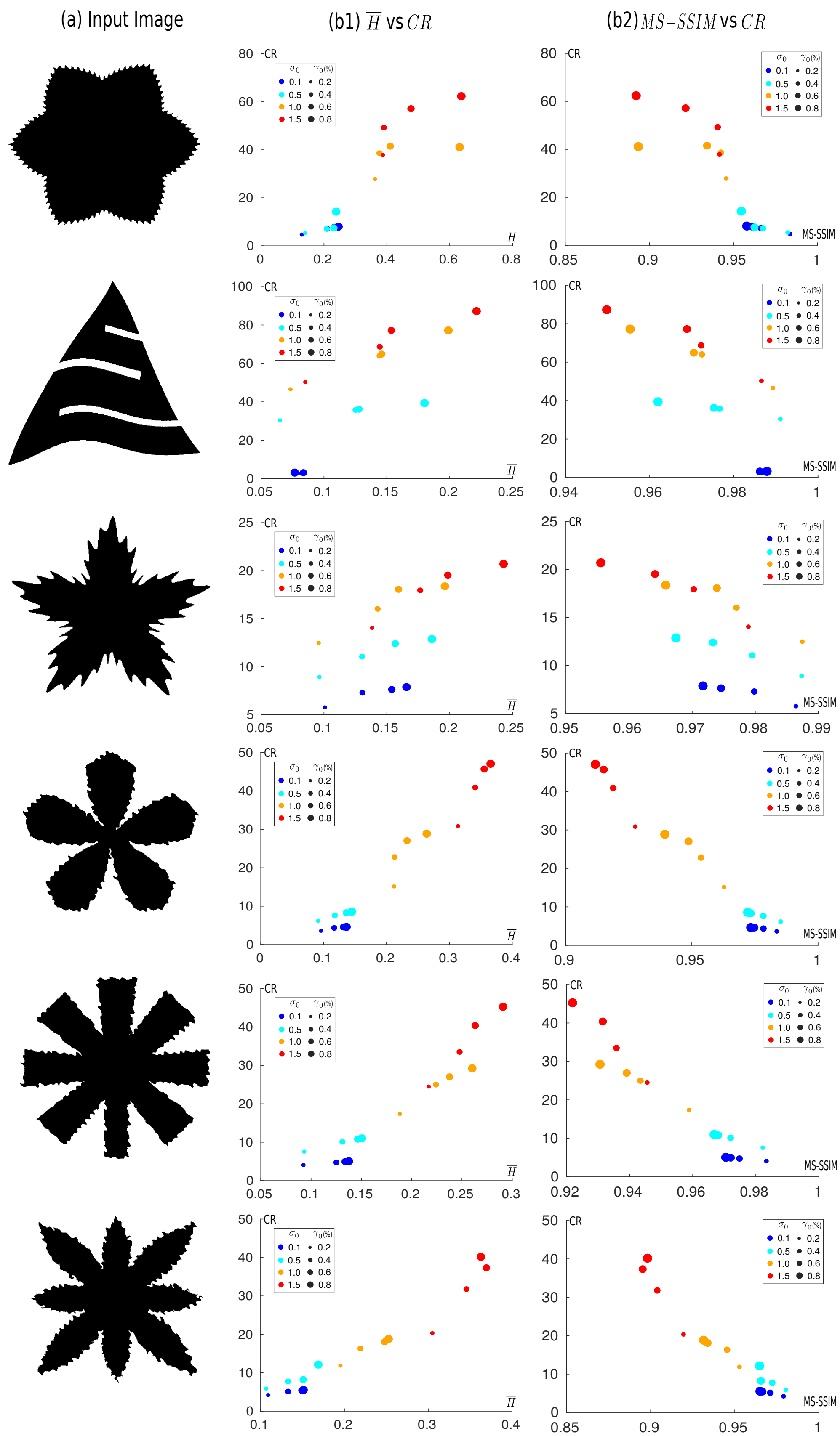

Figure 5: $\overline{H}$ *vs* CR (b1) and MS-SSIM *vs* CR (b2) for input images (a) from type d.

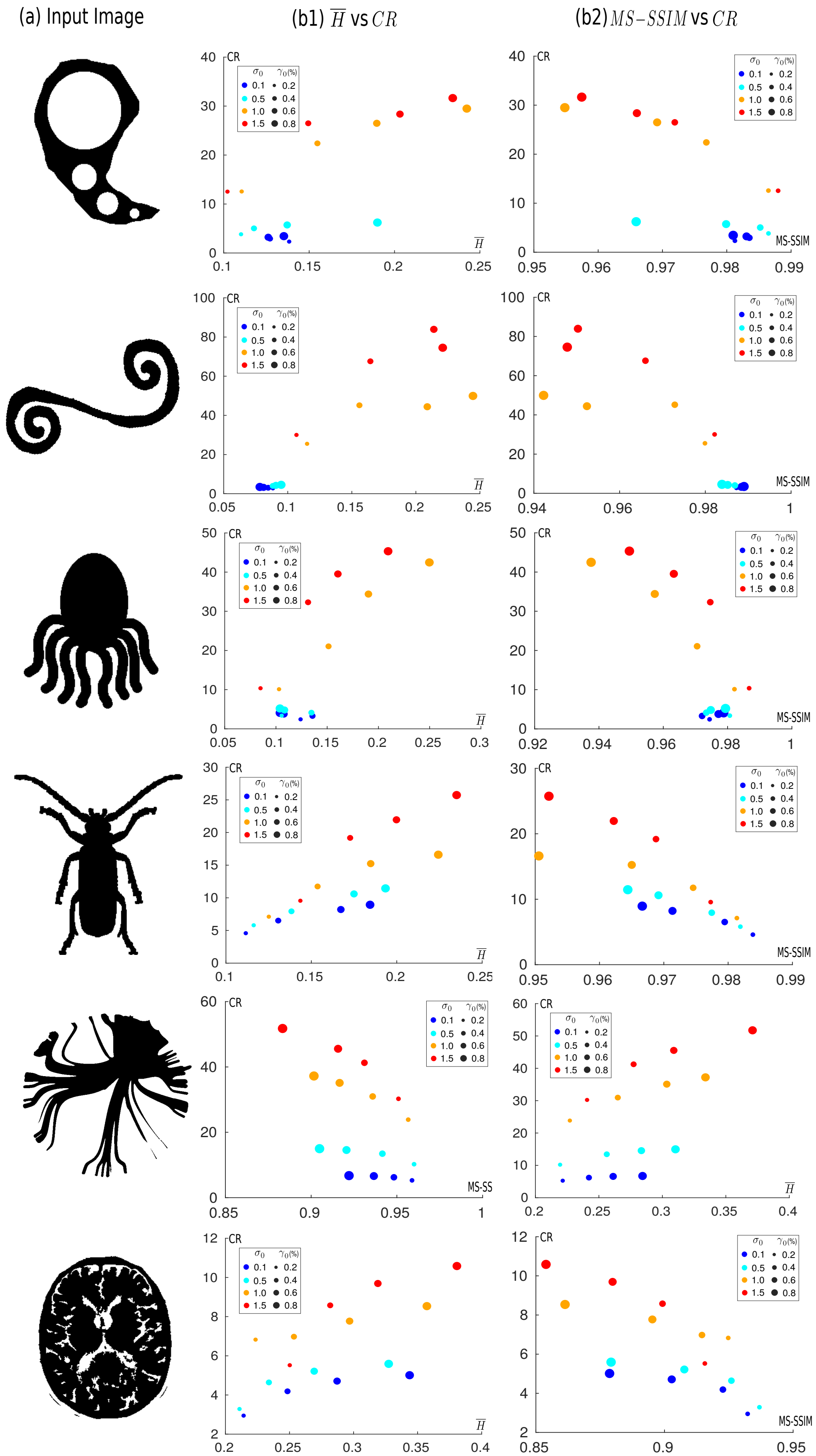

Figure 6: $\overline{H}$ *vs* CR (b1) and MS-SSIM *vs* CR (b2) for input images (a) from type e.