

CS4365 - Applied Image Processing

Seam-Carved Vectorization

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[Link to GitLab](#)



Figure 1: Example with 30 vertical and 30 horizontal carved seams highlighted

Deriving costmap to guide Seam Carving

The combined costmap to guide seam carving is derived by weighing the resulting costmaps of three approaches:

1. Running the pre-trained VGG19 CNN for image classification and performs Grad-Cam to produce a heatmap highlighting important regions in the image for predicting the concept. The user can then modify the obtained heatmap by interactive negative/positive painting.
2. Calculating the energy map using convolution to highlight areas of high gradients in both x and y. Areas of higher gradients represent important parts of the image.
3. Running the pre-trained MiDaS CNN for monocular depth estimation. Closer to the camera means higher cost, therefore the foreground is less likely to be carved.

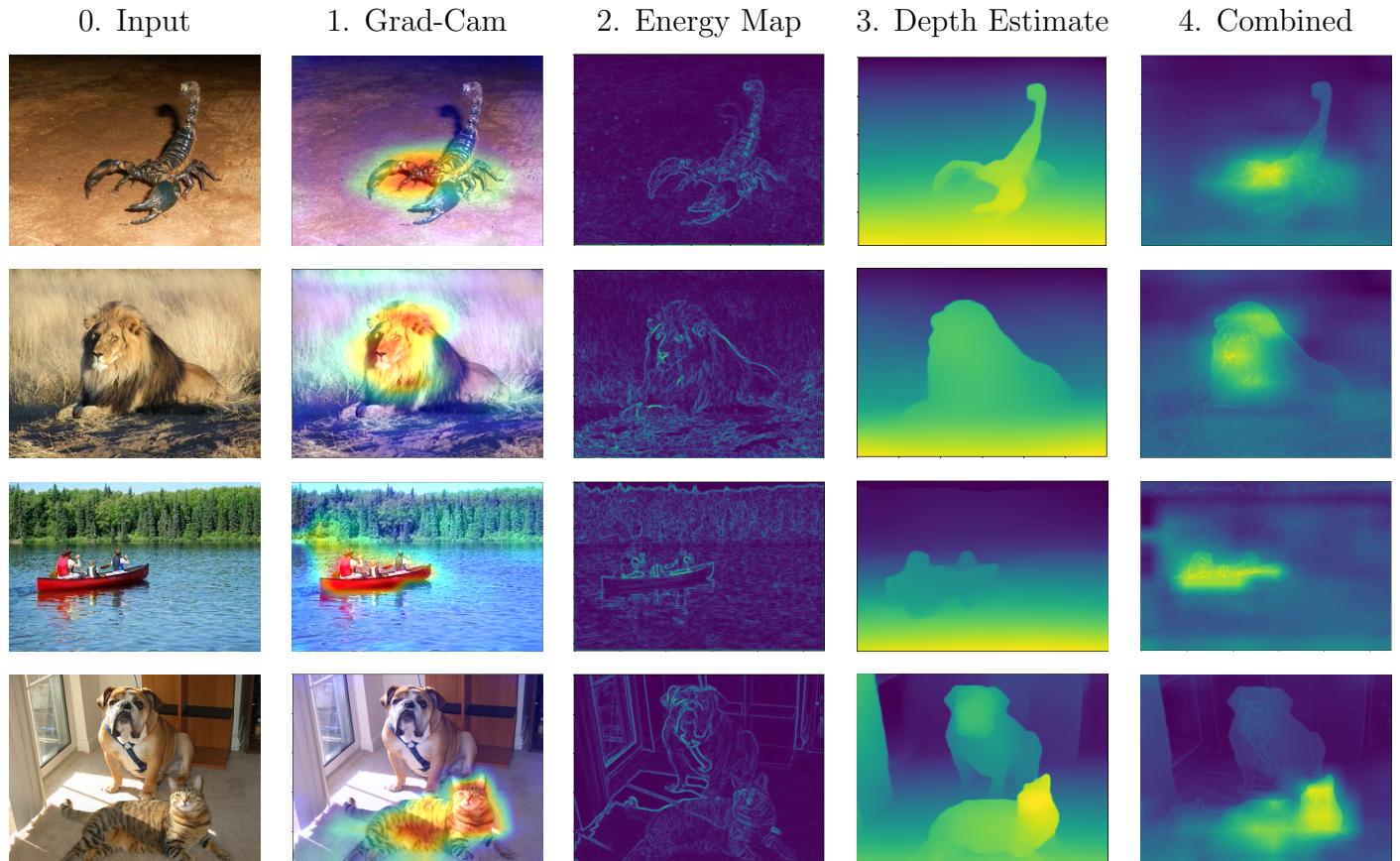


Table 1: Examples of the derivation of the combined cost map that guides seam carving

Seam Carving and Vectorization

Based on the combined costmap, the algorithm removes a specified number of vertical and horizontal seams of least importance. Subsequently, the image is vectorized with triangles, the vectors are moved back to their old positions and the stretched vector graphic is rasterized back to obtain the final image.

1. Highlighted Seams



2. Seams removed



3. Stretched/vectorized



4. Rasterized

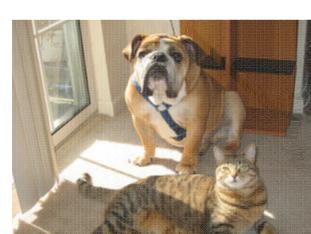


Table 2: Examples of seam removal (10 vertical, 10 horizontal) and Vectorization, Reinsertion and Rasterization

Triangle Stretching and diagonal orientation

The triangle diagonals for vectorization are chosen based on the cost map of the carved image that takes into account Grad-Cam feature map, depth estimate, and energy map (gradients in x,y). The function evaluates which diagonal orientation has the lowest cumulative cost and chooses that orientation for the triangle in the output mesh.

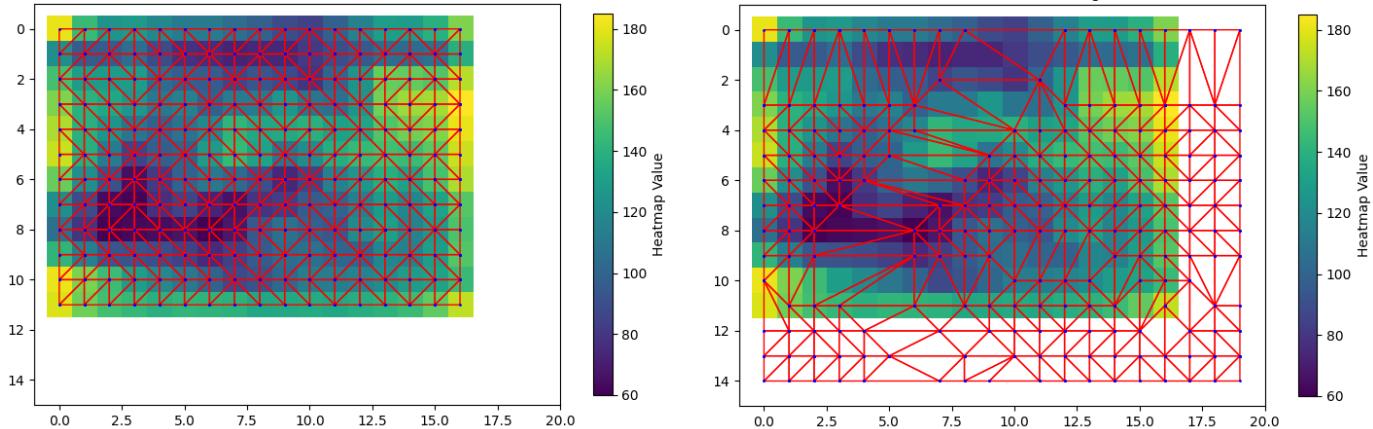


Figure 2: Vectorized triangles, before (left) and after (right) uncarving 3 vertical and 3 horizontal seams on a debugging image (original size 20x15). The grid is overlaid, with the combined costmap taking Grad-Cam feature map, depth estimate, and energy map (gradients in x,y) of the carved image into account.

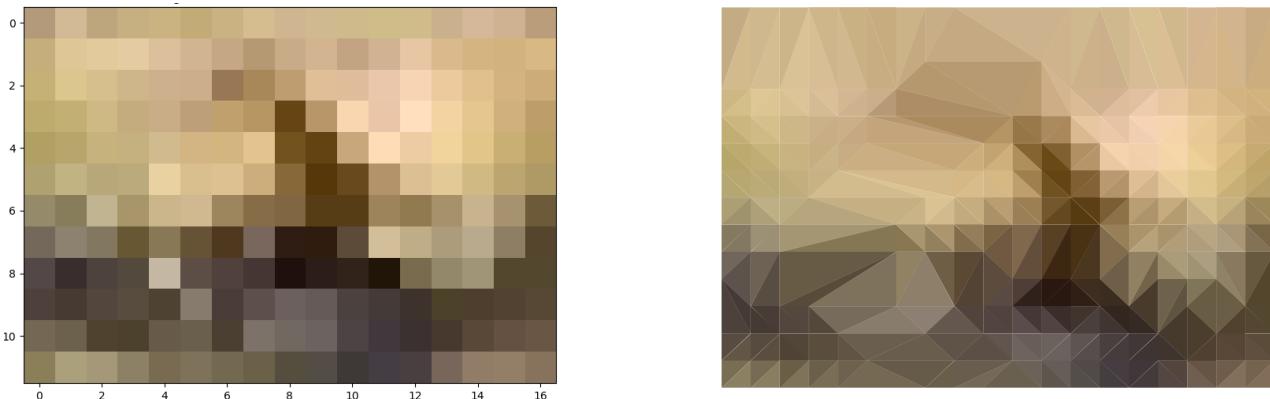


Figure 3: The corresponding carved debug image on the left (17x12, since 3 seams were removed in both directions) and the stretched and interpolated vector graphics on the right (20x15).

Examples with higher number of seams removed (50 in both directions)

