# Week 1 Report: Content-Aware Image Resizing (Seam Carving)

Course: Digital Image Processing (DIP)


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## 1. Core Concept: Content-Aware Image Resizing

Traditional image resizing techniques such as scaling and cropping treat all pixels equally, often leading to distorted or cropped-out important objects. Content-aware image resizing, also known as **Seam Carving**, offers an intelligent solution by considering the *importance of pixels* when resizing.

The key idea is to compute an **energy map** of the image, where high energy corresponds to edges, textures, or important features, and low energy corresponds to relatively unimportant background areas. A **seam** is defined as a connected path of pixels from top-to-bottom (vertical seam) or left-to-right (horizontal seam). Using **dynamic programming**, the algorithm identifies the seam with the lowest cumulative energy and removes it. By repeatedly removing seams, the image can be reduced in size without significantly affecting the main content. Conversely, to enlarge an image, seams can be inserted by duplicating low-energy paths.

This approach has several applications:

- Images can be resized to accommodate new aspect ratios without sacrificing important subjects.
- To get rid of unwanted objects, cut seams through target areas.
- Content amplification, which highlights significant areas.
- Multiple-sized images that instantly adapt to different screen sizes. Finally, seam carving provides a resizing method that balances content preservation. In conclusion, unlike content-blind conventional methods, seam carving offers a content-preserving resizing technique that strikes a balance between geometric adjustment and visual importance.

In summary, seam carving provides a content-preserving resizing method that balances geometric adjustment with visual importance, unlike conventional methods that are content-blind.

## 2. Action Plan (Next Week)

| **Planned Activities** | **Expected Outcomes** |
|---|---|
| 1. Understand seam carving in depth<br>2. Learn how to define seams on an image<br>3. Study how energy maps are computed<br>4. Review research papers and note improvements<br>5. Design workflow/flowchart for the project<br>6. Set up Python environment and required libraries<br>7. Perform basic gradient and energy map experiments | 1. Clear understanding of content-aware resizing<br>2. Knowledge of seam carving algorithm basics<br>3. Initial abstract and literature background<br>4. Finalized problem statement and workflow diagram<br>5. Code environment verification using sample tests<br>6. Energy map gradient visualizations |

Table 1: Action Plan and Expected Outcomes