CS676: Computer Vision & Image Processing

Project Report

Image Resizing

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Group No - 15

Resizing:

It means changing the resolution of the original image



Why???

Images are often viewed in many different display devices with a variety of resolutions

Methods:

- **Scaling and Cropping**

Cropped

Scaled

Cons:

- Scaling reduces perceivable details
- Cropping can not be done automatically and it alters the image composition and is not always desirable

Aim:

- Reducing the size of an image by removing pixels that will go unnoticed
- To preserve the contents
- Effective resizing of images should not only use geometric constraints, but consider the image content as well

Solution:

Seam Carving - This resizing method was proposed by S Avidan, A Shamir -***Seam Carving for Content-Aware Image Resizing***

- A seam is an optimal path of pixels on a *single* image from top to bottom, or left to right, where optimality is defined by an image energy function

- By repeatedly carving out or inserting seams in one direction we can change the aspect ratio of an image
- Seam carving can also be used for *image content enhancement* and *object removal*

How to chose the pixels to be removed ???

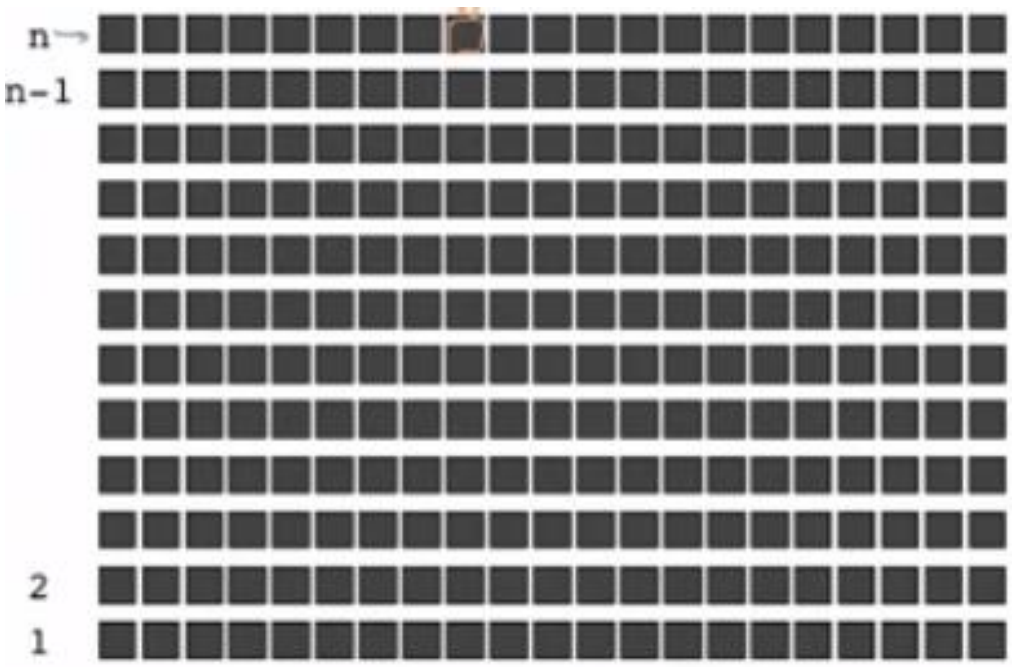
$$e_1(\mathbf{I}) = |\frac{\partial}{\partial x}\mathbf{I}| + |\frac{\partial}{\partial y}\mathbf{I}|$$

- We define a energy function e(I) , and compute it at every pixel of the image.
- The pixels to be removed are determined by finding the path across the image with the lowest total energy, which is the sum of the energy of each pixel along the path.
- Idea is to remove a path not a column, such that only one pixel is removed from each row(vertical seam).

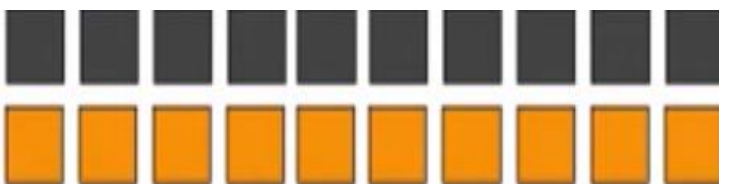
How to find the seam with lowest energy???

- Dynamic Programming can be used to find the desired seam .

Lets say the given below is our image n x m



Step:1



Step:2

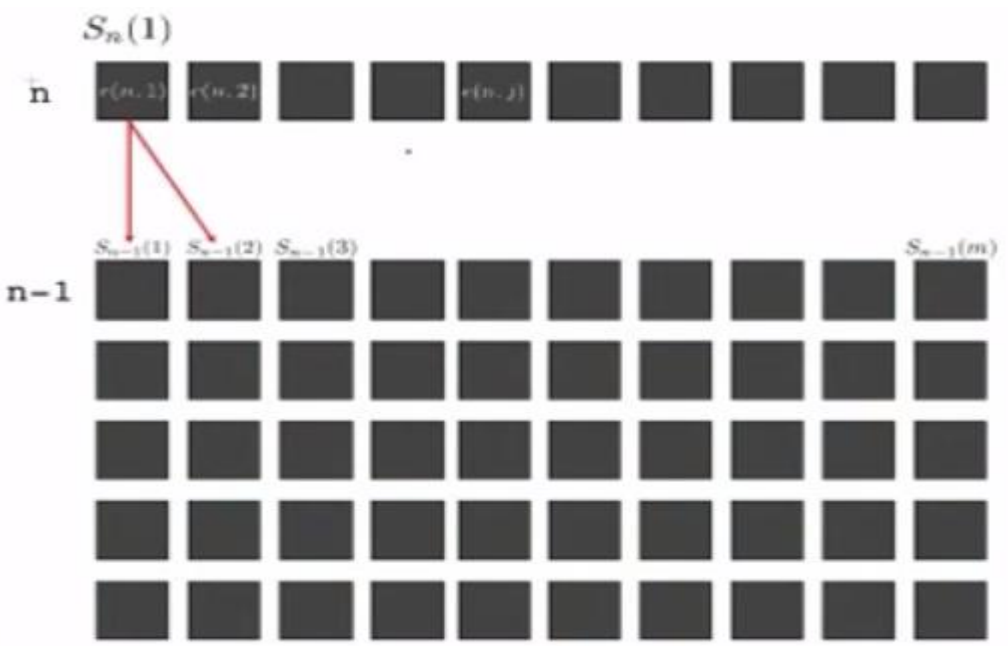
1 Compute M(1,j) = e(1,j) for the first row

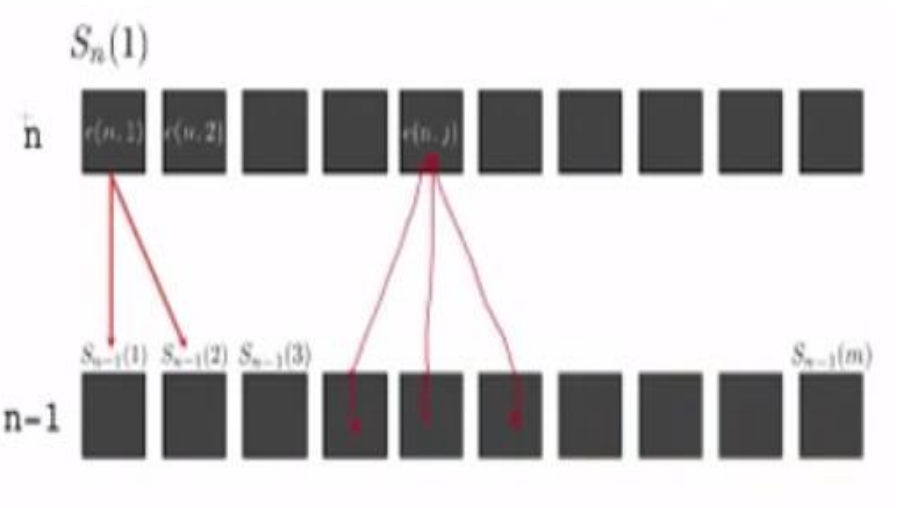
2 For i=2 compute M(2,j) using the formula,

3 Similarly, we can compute Si(j) up to the last row n .

$$M(i,j) = e(i,j) + \min(M(i-1,j-1), M(i-1,j), M(i-1,j+1))$$

Backtracking:





Results: Reducing the size of the image
IMAGE#1

Original Image: 885 x 386

Resized Image: 485 x 286

Objects of ***Interest*** or ***Concern***

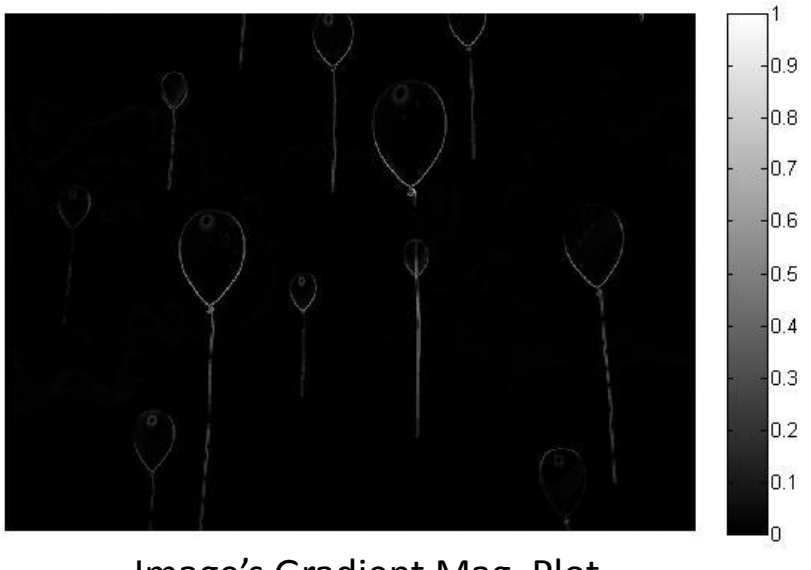
Seams

Image's Gradient Mag. Plot

IMAGE #2

Original Image: 800 x 600

Resized Image: 600 x 400



Image's Gradient Mag. Plot

Image Enlarging

Insert new artificial seams to the image

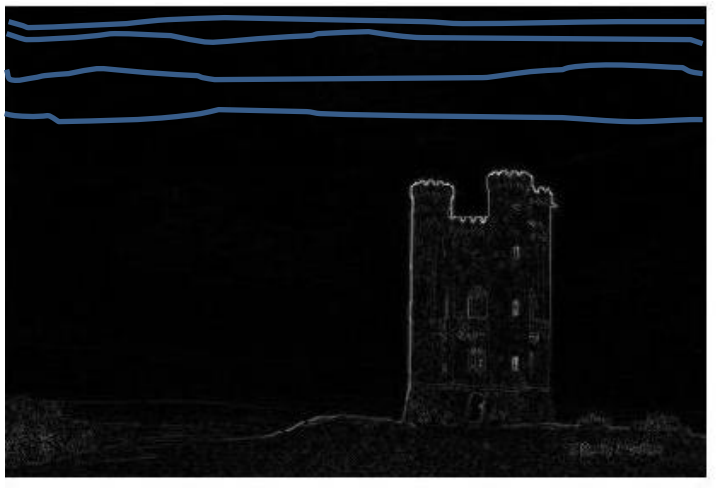
To enlarge the size of an image I by one

- Compute the optimal vertical (horizontal) seam**s** on **I**
- Duplicate the pixels of **s** by averaging them with their left and right neighbours (top and bottom in the horizontal case).

To enlarge an image by *k*

- Find the first *k* seams for *removal*.
- Duplicate them in the same order

Results : Enlarging



Further Applications:

- **Content Amplification:**

Seam carving can be used to amplify the content of the image while preserving its size.

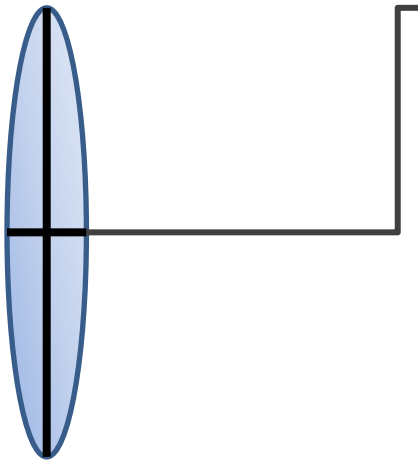
Seam carving + Scaling

- Use scaling to enlarge the image.
- Then seams are removed from the image until all marked pixels are gone.

Object Removal

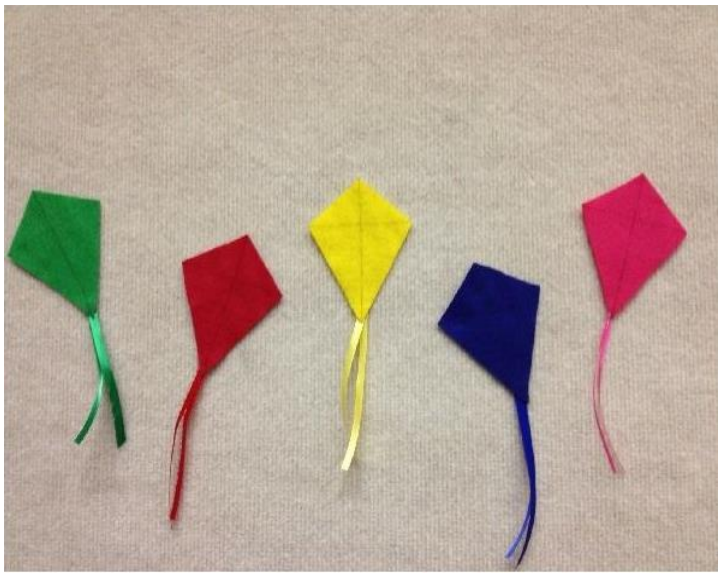
- Suppose the user marks the target object to be removed
- Seams are removed from the image until all marked pixels are gone

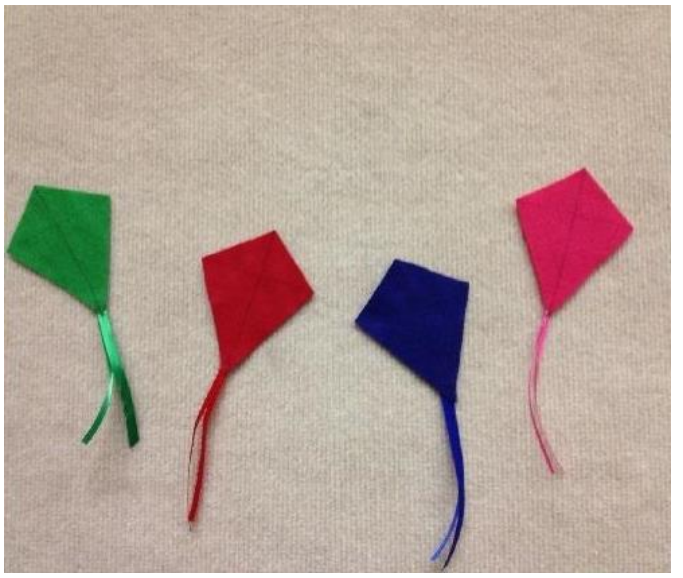
- Calculate the smaller of the vertical or horizontal diameters (in pixels) of the target removal region and perform vertical or horizontal removals accordingly



Results: Object Deletion

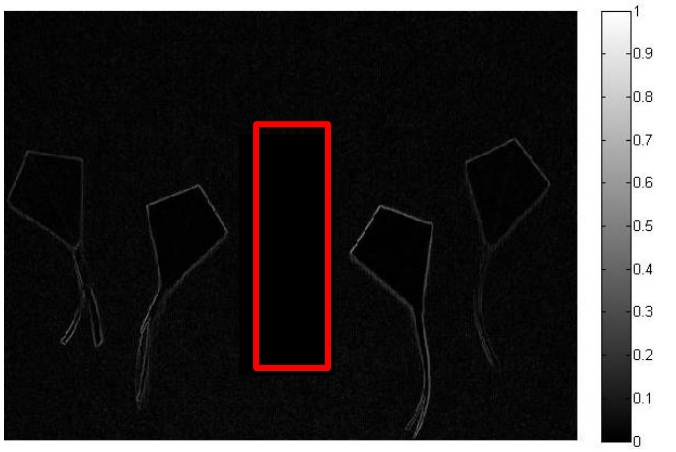
IMAGE #1





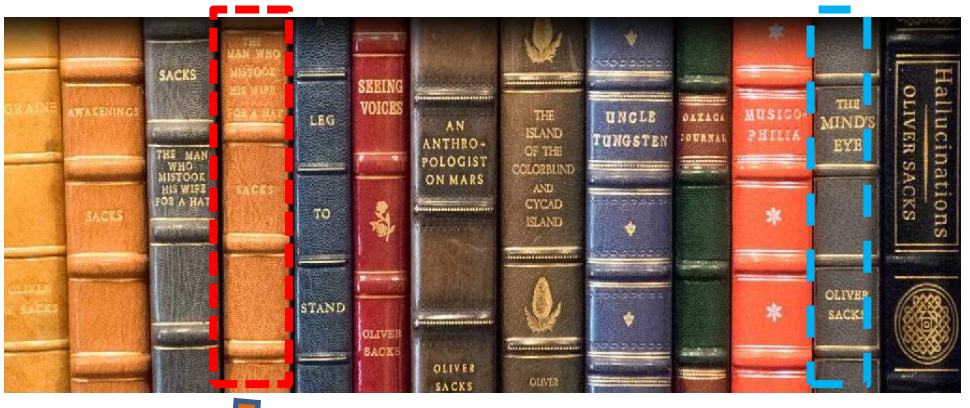
Original Image:

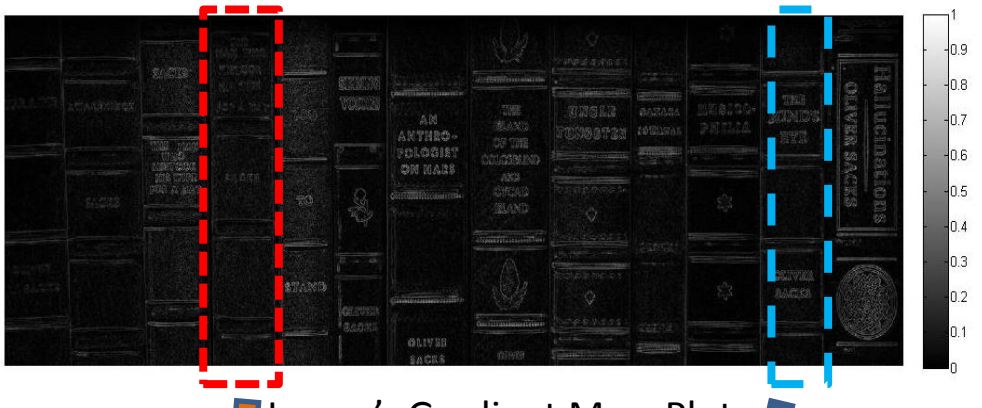
Reducing the energy of the marked kite



Image's Gradient Mag. Plot

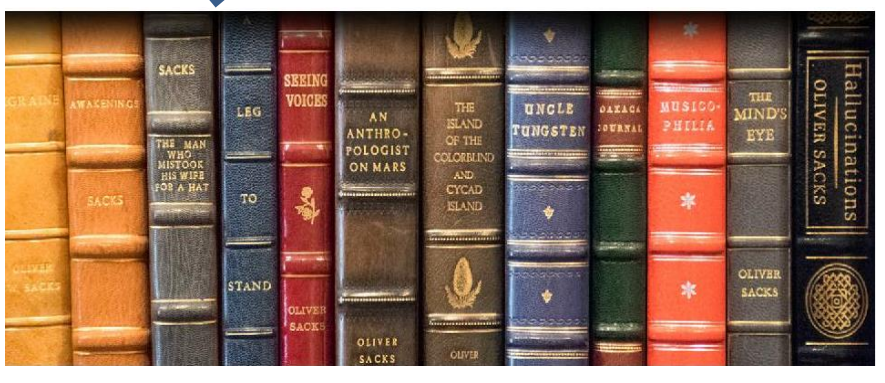
IMAGE #2

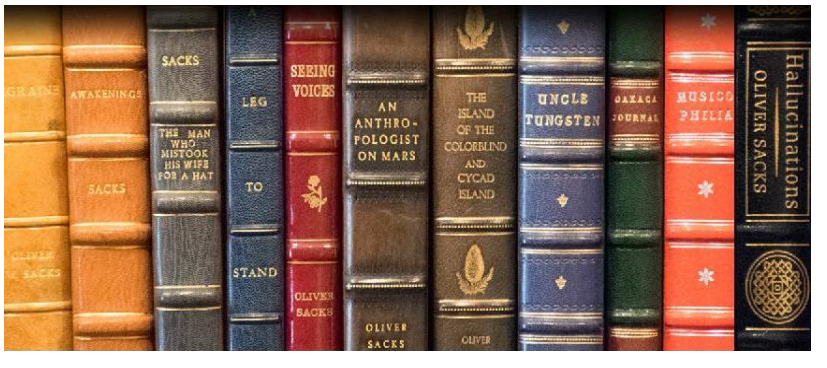




Original Image:

Image's Gradient Mag. Plot





Modified Seam-Carving Algorithm

- *Faces and skin* of the humans are objects of concern and interest in images
- Sometimes we encounter *flat faces* and *skin* in the images and the gradient value at those face or skin pixel have less magnitude causing seam pass through those pixels.
- Normal seam carving is not effective here causing distortion in the faces and skin parts

Normal seam carving for reducing the size of image

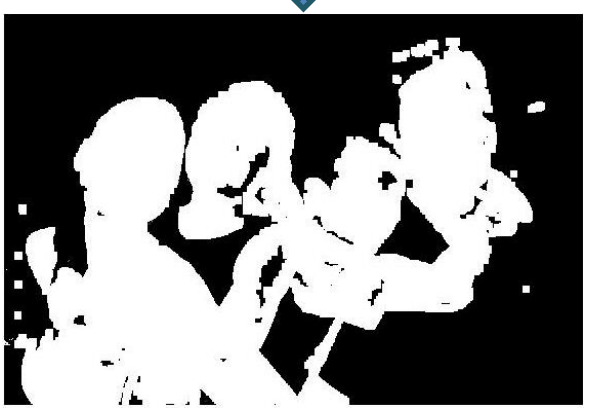
- Gradient's magnitude value at faces and skin are very low
- Seams are passing through interest objects

- Faces and skins are distorted

solution: Seam-Carving + Skin Detection Algo.

Step1. Apply *skin detection* algorithm to detect faces and skins.

Step2. Increase energy of the faces and skin's pixels and their neighbourhood pixels



Step1. Apply normal seam carving and reduce the size of the image

- Faces and skins are well preserved
- Better than normal seam carving