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# COL 783 : Assignment 3 Report

This assignment is an implementation of the paper ‘Seam carving for content-aware image resizing’ by Avidan Shai & Ariel Shamir.

**Reference:** Avidan Shai, and Ariel Shamir. “*Seam carving for content-aware image resizing.*” *ACM Transactions on graphics (TOG)*. Vol. 26. No. 3. ACM, 2007

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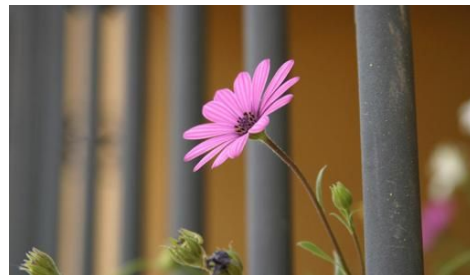
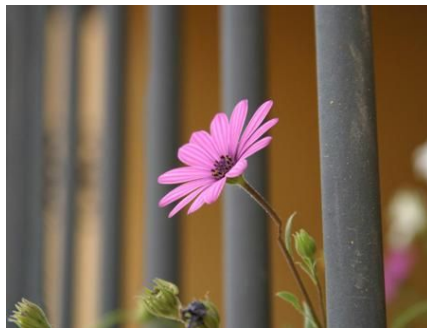
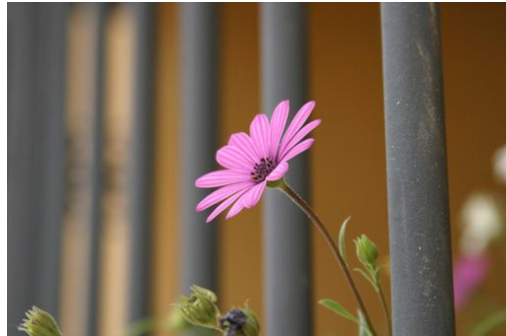
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## EXPERIMENTATION

### IMAGE RESIZING

#### Seam Carving

##### 1. Flower



##### 2. Snow





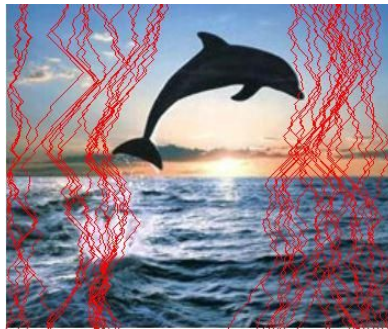
### 3. Toronto Skyline



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## Seam Insertion

### 1. Dolphins







## 2. Landscape





### 3. Rocks





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## Dynamic Programming

In case both horizontal and vertical seams need to be removed, the order of seams matter, like all vertical then horizontal, or some strange permutation of both. For this, Dynamic Programming has been employed, which is  $O(mn)$ .



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## Content Aware Resizing



## Experimentation with Different Energy Functions

For different energy functions, the seam carving results will change due to the varied energy maps, and hence different min energy seam selection.

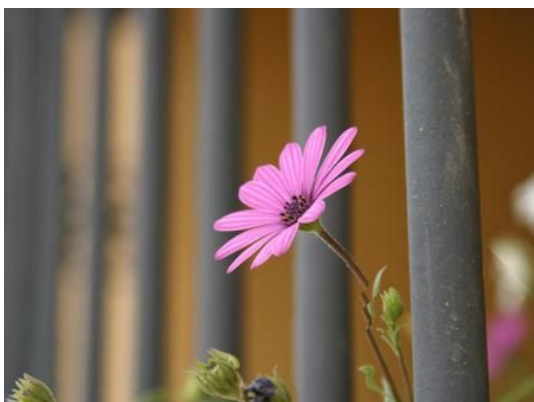
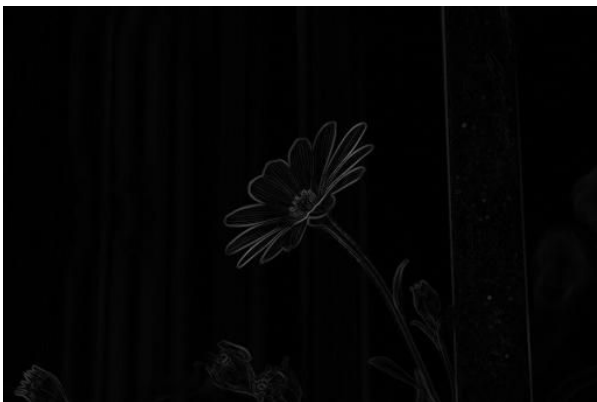
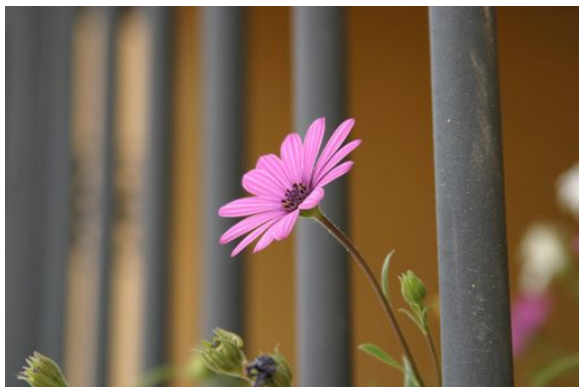






Fig. **(1)** Gradient Energy Map **(2)** HOG Energy Map **(3)** Entropy Energy Map

Observation: Histogram-of-Oriented-Gradients (HOG) Energy Map performs really bad.



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Fig. (1) Gradient Energy Map (2) HOG Energy Map (3) Entropy Energy Map

Observation: Histogram-of-Oriented-Gradients (HOG) Energy Map performs really bad here as well. Also, the entropy energy map also causes irregularities in the stem..

## TEMPLATE MATCHING

### Rotation Invariant Template Match

#### 1. Beach & Pigeon



Fig. (1) Original Image (2) Rotated Template (3) Mask

#### 2. Balloons



Fig. (1) Original Image (2) Rotated Template (3) Mask

### Multiscale Template Match

#### 1. Beach & Pigeon





Fig. (1) Original Image (2) Resized Template (3) Mask

## 2. Balloons



Fig. (1) Original Image (2) Resized Template (3) Mask

## Object Removal

1. **Castle:** We observe an easy removal of woman from the picture, which is done by seam insertion, to correct the deformation.

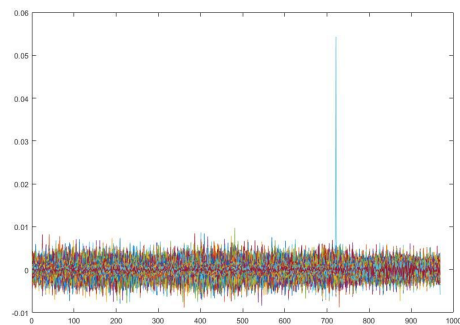


Fig. (a) Original (b) Template (c) Mask over Template (d) ~120 seams removed (e) CannyEdge Mask (f) Final (g) Plot for Inverse Fourier Transform

## 2. Beach:

- a) Remove 'Girl':

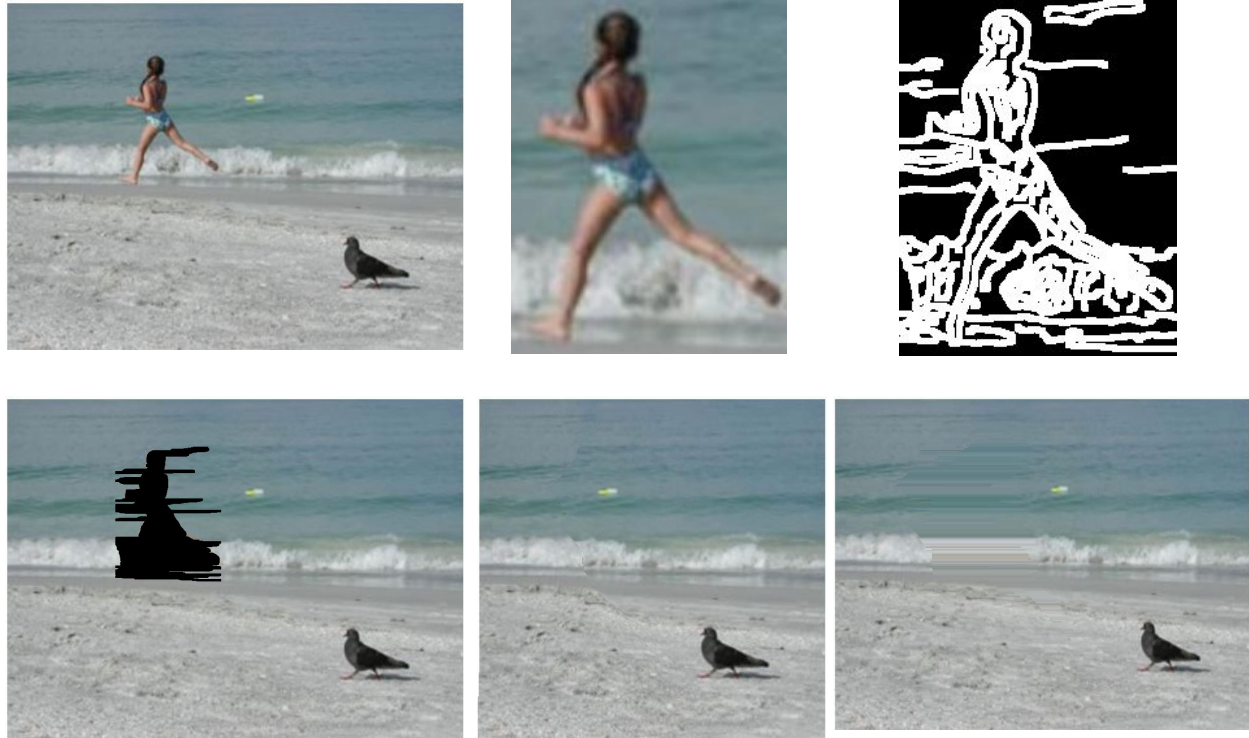


Fig. (a) Original (b) Template (c) CannyEdge Mask (d) Mask over Template (e) ~250 seams removed (f) Final

b) Remove 'Pigeon'

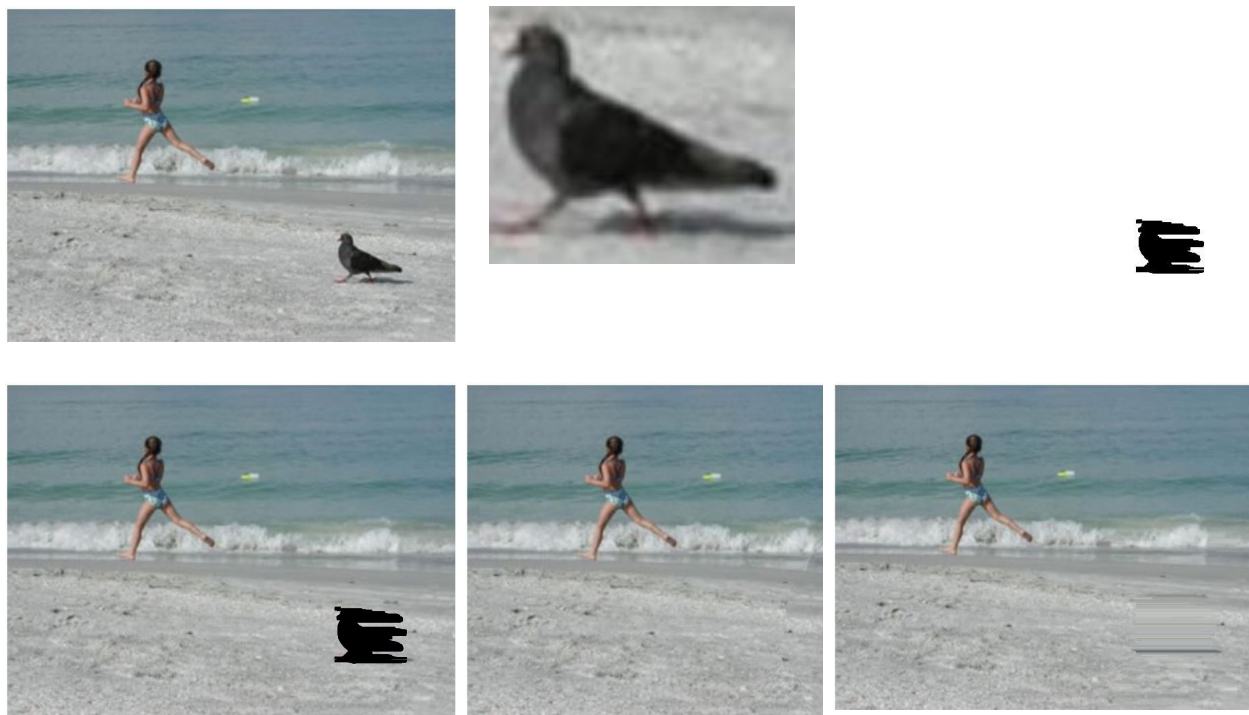




Fig. (a) Original (b) Template (c) Mask (d) Mask over Template (e) ~150 seams removed (f) Final

### 3. Balloons



Fig. (a) Original (b) Template (c) Mask (d) Mask over Template (e) ~150 seams removed (f) Final

### 4. Single Balloon





Fig. (a) Original (b) Template (c) Mask (d) Mask over Template (e) 300 seams removed (f) Final

## Dilation Effect



Fig. (1) Without dilation (2) With Dilation

## BAD RESULTS

### Object Removal

#### 1. Couple



Fig. (a) Original (b) Template (c) Mask (d) Mask over Template (e) ~250 seams removed (f) Final

We observe that removal of around 250 seams creates an image without the mask pixels, but when the image correction is introduced via seam carving, we find the pixels to be stretched across. This is because the energy of each seam being added is also very high, though being the lowest among others. This is because of the high amount of details and contrast in the image.



## 2. Shoes

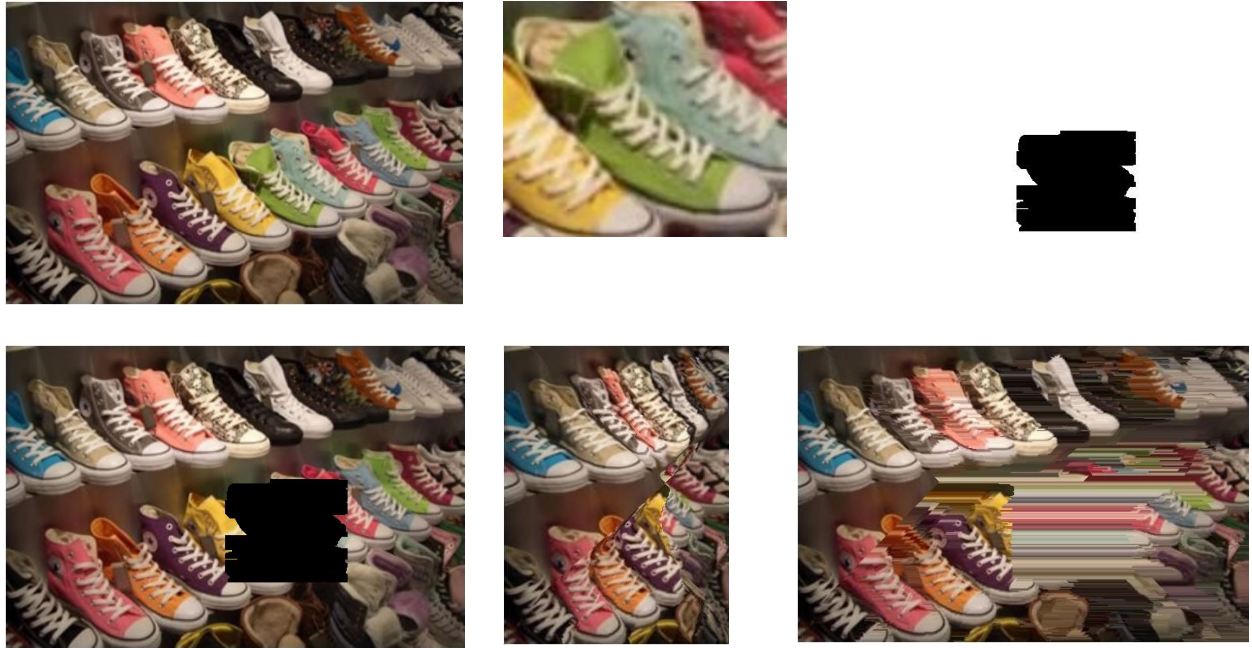


Fig. (a) Original (b) Template (c) Mask (d) Mask over Template (e) ~300 seams removed (f) Final

We observe that removal of around 300 seams creates an image without the mask pixels, but again when the image correction is introduced via seam carving, we find the pixels to be stretched across. This is again because the energy of each seam being added is also very high, though being the lowest among others. This is because of the high amount of details and contrast in the image. Also, we observe that the object in the mask is surrounded by different objects, not giving a perfect boundary for the shoe to be removed.