

Creating Collage using Hybrid Images

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1 Introduction

Given a set of images which may consist of images of various size and aspect ratio; our goal is to create a collage of appropriate size; keeping the following conditions

1. The images aspect ratio remains same
2. No image is cropped (Cropping doesn't refer to overlapping bounding box)
3. The result images maintains the relative order in sizes of original image, the the subimages in the combined collage
4. The collage is not an $m \times n$ matrix where images are just appended

2 Creating Hybrid from two images

To create the hybrid images; a low pass filter i.e. *Gaussian Filter* is applied to bounding area of image 1 and a high pass filter i.e. *Unsharp Filter* to bounding area of image 2.

Then a **2 pass approach** is followed to smoothen the image.

2.1 First Pass

In the *first pass* the original image is added to filtered images with weights which vary accordingly.

The weight for image 1 (left image)

- Weight = 1 for original image at leftmost end of bounding box.
- Weight = 0 for original image at rightmost end of bounding box.
- Weight = 0 for filtered image at leftmost end of bounding box.
- Weight = 1 for filtered image at rightmost end of bounding box.

The weight for image 2 (right image)

- Weight = 0 for original image at leftmost end of bounding box.
- Weight = 1 for original image at rightmost end of bounding box.
- Weight = 1 for filtered image at leftmost end of bounding box.
- Weight = 0 for filtered image at rightmost end of bounding box.

2.2 Second Pass

In the *second pass* weights are added to combined image of left and right.

The weight for hybrid image

- Weight = 1 for combined image 1 at leftmost end of bounding box.
- Weight = 0 for combined image 1 at rightmost end of bounding box.
- Weight = 0 for combined image 2 at leftmost end of bounding box.
- Weight = 1 for combined image 2 at rightmost end of bounding box.

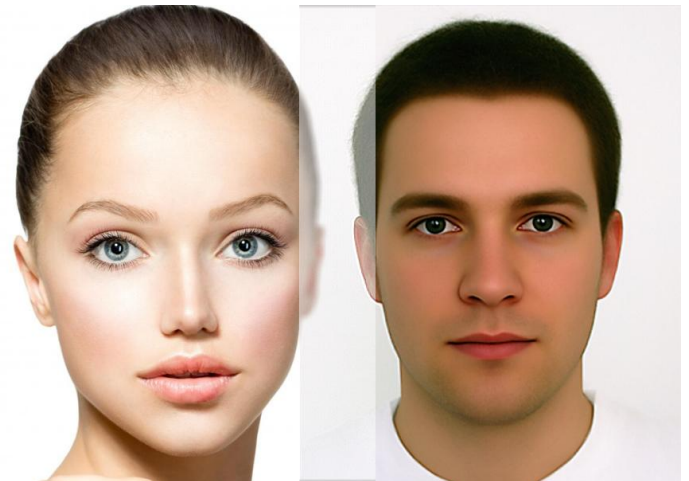


Figure 1: Image before first pass

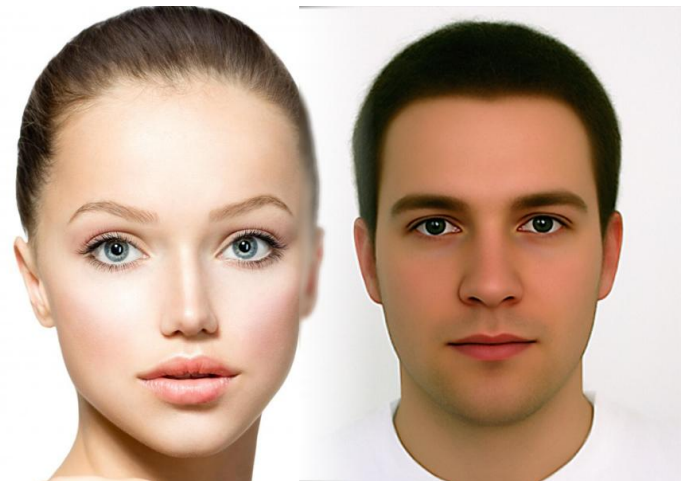


Figure 2: Image after second pass

3 Making Collage

3.1 Approach 1: Using closest matching pair

In this approach of making collage; closest matching pairs are found and merged.

This fulfill all required condition except it makes an $m \times n$ matrix if all images of same size. Since this method scales the images absolutely i.e. all images of same size insatiability are scaled to same size after.

Listing 1: Collage using closest matching pair

1. Initialize a set of all images.
2. Find 2 closest matching pairs separately using height and width.
3. Select to combine in height or width using merges so far.
4. Create hybrid of 2 selected images.
5. Replace 2 selected images with hybrid.
6. Repeat steps 2 to 5 until single image in set

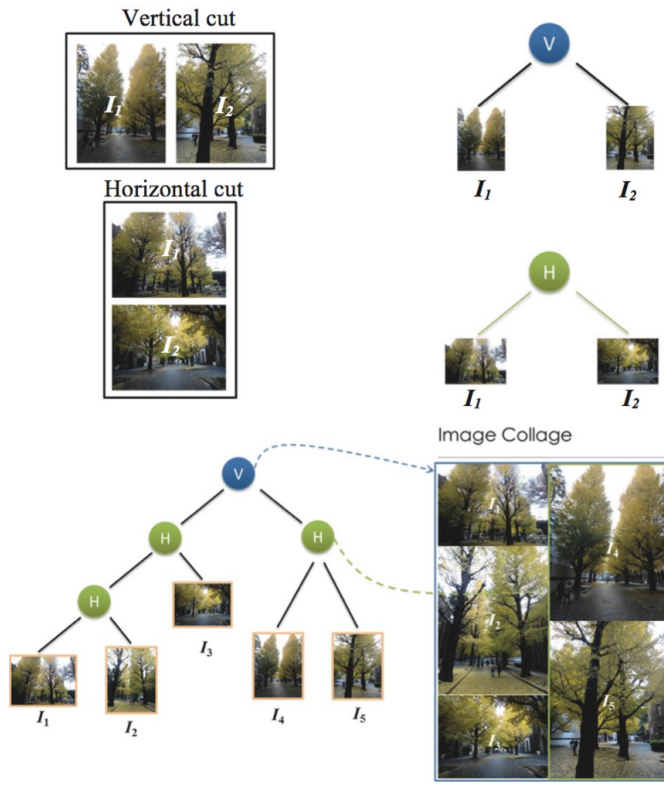


Figure 3: Full binary tree approach

3.2 Collage Approach 2: Using full binary tree

A full binary tree with n external nodes can represent an collage where.

External Nodes - Original Images

Internal Nodes - A vertical/ horizontal join on the child nodes

The task it to

1. Find a full binary tree - not too skewed not too balanced
2. Assign images to external nodes
3. Assign either vertical or horizontal cut to internal nodes

3.2.1 Find a full binary tree - not too skewed not too balanced

We can generate a full binary tree recursively where internal nodes in left child and right child follow a truncated distribution in $(0, n - 1)$.

3.2.2 Assign images to external nodes

We sort images based on area. Then assign start assigning form largest image to closest external node (form root) and shortest image to farthest external node (form root).

This is done to maintain relative size ordering in images in merged image. Since the image assigned to shortest external node (from root) shall be largest in final output and vice versa.

3.2.3 Assign either vertical or horizontal cut to internal nodes

If the child node are external node to horizontal/vertical cut based on different in heights and width.

Else try to assign a value different form cut stored at child nodes.

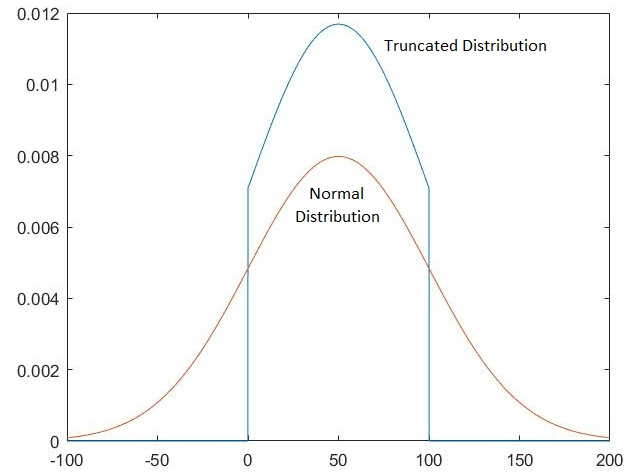


Figure 4: Truncated distribution from $(0, n - 1)$ to a generate a full binary tree

Listing 2: Collage using full binary tree

1. Generate full binary tree - not too skewed not too balanced
2. Assign images to external nodes - based on size
3. Assign either vertical or horizontal cut to internal nodes based on child
4. Build the final output image

4 References

- [1] Zhipeng wu and Kiyoharu Aizawa *Very fast generation of content-preserved photo collage under canvas size constraint* 2014.



Collage Using closest matching pair for images of same size

More like $m \times n$ matrix



Collage Using full binary tree for images of same size