

# A Survey on Image Summarization Algorithms

Sreelakshmi S <sup>[1]</sup>, Mr. Paul P Mathai <sup>[2]</sup>

Department of Computer Science and Engineering  
Federal Institute of Science and Technology  
Mookkannoor, Ernakulam  
Kerala – India

## ABSTRACT

Photo collage is a method to summarizing and exhibiting collection of photos. From the geometric point of view, the generation of collage is considered as a region partition problem such that each image is displayed in its corresponding region partitioned from the canvas. There are picture collage, video collage, 3D collage etc. Also there are some puzzle like collages which gives entertaining art works. The core of this is an efficient power-diagram-based locally optimized circle packing (LOCP) algorithm that arranges a series of circles assigned to input photos compactly in the canvas. To favour important photos, the circles are associated with image importance determined by an image ranking process. With the new formulation, each factor influencing the state of a photo is optimized in an independent stage, and computation of the optimal states for neighbouring photos are completely decoupled. This improves the scalability of collage results and ensures their diversity. It also devise a co-saliency/saliency - based image fusion scheme to generate seamless composite collage. Co-saliency based method will help to create the collage with common salient objects from group of images. This approach can generate the collages on non-rectangular canvases and supports interactive collage.

**Keywords:-** Co-saliency, Circle packing

## I. INTRODUCTION

A picture is said to be worth a thousand words. Very often, people compose pictures to convey ideas. Collages have been a common form of artistic expression since their first appearance in China around 200 BC. Recently, with the advance of digital cameras and digital image editing tools, collages have gained popularity also as a summarization tool. Collage is a work of the visual arts, made from an assemblage of different forms, thus creating a new whole, often having a purposeful incongruity. With the prevalence of smart-phones equipped with high resolution cameras and the emergence of widely popular photo management and sharing websites, like Flickr and Photobucket, people have access to digital photo collections more often than before. Photo collage, as an important means for summarizing and exhibiting a collection of photos, has received considerable attention recently. It aims to create a compact, informative, and visually pleasant single-image representation by sticking together the pictures from a photo collection. Since, manually creating such a collage is time-consuming and generally requires professional image editing skills, automatic solutions have been intensively studied in the research community.

With the rapid growth of digital image content, it becomes more and more of a challenge to browse through a huge amount of images, such as hundreds of vacation photos in a home directory or thousands of images returned for a query on the internet. To make browsing process more efficient, image summarization is often needed to address this problem. A photo-collage can be used for art as well as for summarizing a photo collection, such as a news event, a family occasion, or a concept (album cover).

The prevailing photo collage tactics can be crudely systematized into two groups according to different presenting styles of the collages produce. A representative style is to impersonate how real pictures are disposed on a given canvas with slender size. Some locale on the coverlet, orientation, proportion as well as layer ratio are solved by optimizing a dispassionate function, which integrates certain precedent such as saliency expansion, orientation assortment, blank slot minimization, and so on. Since image superimpose is allowed, conspicuous information of some photos can be occluded by less significant regions of other photos, depleting precious canvas space.

On the other hand, digital photomontage instigated another style of collage where uneven salient regions distinguished from photos are combined in the collage in a topic-based way [5]. To achieve seamless composites, the nearby subregions from different photos are often blended. Some methods that follows in this category are autocollage [7], digital tapestry [6], and the most common method called puzzle like collage [8] and so on. Most classic approaches for photo collage build on an optimization structure. The objective function entitles the criteria for a visually pleasing collage.

Generally, traditional approaches on photo collage are built on a well-defined optimization framework. The main objective is on building a photo collage which makes visually pleasing. Traditional optimization techniques have so many intrinsic cons. Each photo in the collage is uniformly treated, and photo scaling parameter is considered as the important factor in hand. By considering the importance of photos and user control over the collage, results a better summarized view according to his/her preference.

In this algorithm, use a circle to approximate the salient region each image expects to display, and photo collage is formulated as a circle packing problem that aims at tightly arranging multiple circles with given radii in a fixed container. A new variational approach is thus developed to solve this problem based on power diagrams. The circle packing result provides the canvas partition such that each photo can be displayed in the subregion of the corresponding circle. To favor important images, the circle radii are associated with photo importance yielded by an image ranking process. The circles thus obtained are fed into the packing algorithm, producing a content-aware photo collage result.

Solve the problem of circle packing based on power diagram, which is a kind of weighted Voronoi diagram. It is noted that Voronoi diagram has been used in successfully to partition the thumbnail area into regions for browsing large image data sets effectively.

For arranging images in a topic based way, the important region for displaying in the canvas is done with the help of cosaliency property. Here a cluster based cosaliency detection [3] is used.

## II. LITERATURE SURVEY

Collage creates a compact and visually delectable summary of a photo collection by occluding the

unimportant regions of each photo with other photos or letting them out of the canvas, so only the salient and informative part of each photo can be visible on the canvas. Apart from photo collage, some researches extended available collage techniques to video.

### A. Photo Collage

Photo collage is a kind of visual image summary to arrange all input images on a given canvas, allowing overlay, to maximize visible visual information. Photo collage creation problem in a conditional random field model, which integrates image salience, canvas constraint, natural preference, and user interaction. Each image is represented by a group of weighted rectangles, which indicate the salient regions. Figure 1 shows an example for picture collage using rectangular packing.

### B. Photo Collage

Picture collage is related to the rectangle packing problem, which is known to be NP-complete. Picture collage is a more challenging problem because of the placement order, and the efficiency is also a key point for such a challenging optimization. Some other design challenges are:

- Image overlay is allowed.
- Salient information of some photos can be occluded by less important region of other photos.
- Wasting precious canvas space.

Typical collage is Picture collage which imitates physical arrangement and layout fashion of real pictures by allowing overlay on the limited space. A Bayesian framework which incorporates the requirements such as salience maximization and blank space minimization a nice collage should meet. An efficient Markov chain Monte Carlo method is designed for the optimization. Figure 2 shows an example for picture collage.

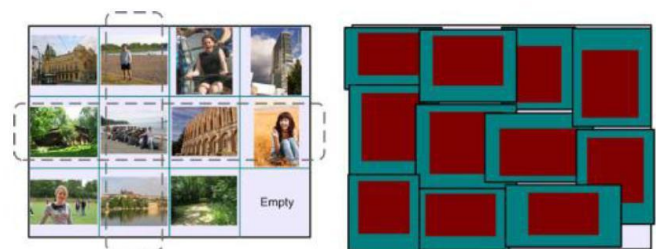


Fig. 1 Picture collage using rectangle packing



Fig. 2. Image collection



Fig. 3. Picture collage

Jingdong Wang et al. in the paper titled Picture collage [2] address a novel problem of automatically creating a picture collage from a group of images. Picture collage is a kind of visual image summary to arrange all input images on a given canvas, allowing overlay, to maximize visible visual information. It formulate the picture collage creation problem in a Bayesian framework. Tie Liu et al. in [4] discuss about the same subject picture collage. In this paper, it address a novel problem of automatically creating a picture collage from a group of images. Picture collage is a kind of visual image summary to arrange all input images on a given canvas, allowing overlay, to maximize visible visual information.

For users who relish the compact representation of collage and also wish to browse massive photo collections, the paper [5] proposes method, called dynamic collage. Dynamic collage maintains the benefits

of traditional collage while providing a framework to dramatically extend the scalability, which is demonstrated in its application for browsing massive photo collections. This paper presents a new photo browsing technique, dynamic collage. Although previous photo collage techniques have innate advantages for viewing several photos collectively, they only focus on a static two-dimensional arrangement of photos so that the scalability is limited.

Digital tapestry is another concept by et al [6]. In this work, it addresses the novel problem of automatically synthesizing an output image from a large collection of different input images. The synthesized image, called a digital tapestry, can be viewed as a visual summary or a virtual 'thumbnail' of all the images in the input collection. The problem of creating the tapestry is cast as a multi-class labeling problem such that each region in the tapestry is constructed from input image blocks that are salient and such that neighboring blocks satisfy spatial compatibility.

AutoCollage by Carsten Rother et al [7] is another concept. Auto collage is a collage of representative elements from a set of images. It is able to detect faces and recognize objects. It is an automatic procedure for constructing a visually appealing collage from a collection of input images. The aim is that the resulting collage should be representative of the collection, summarizing its main themes. It is also assembled largely seamlessly, using graph-cut, Poisson blending of alpha-masks, to hide the joins between input images. Auto collage makes several new contributions.

Puzzle-like Collage is proposed by Stas Goferman et al in [8]. This paper proposes an approach for automating collage construction, which is based on assembling regions of interest of arbitrary shape in a puzzle-like manner. It shows that this approach produces collages that are informative, compact, and eye-pleasing. This is obtained by some artistic principles and assembling the extracted cut-outs such that their shapes complete each other. It focuses on photo-collages, which assemble a collection of photographs by cutting and joining them together.

Junhwan Kim et al [9] proposes Jigsaw Image Mosaics. This paper introduces a new kind of mosaic, called Jigsaw Image Mosaic (JIM), where image tiles of arbitrary shape are used to compose the final picture. The generation of a Jigsaw Image Mosaic is a solution to the following problem: given an arbitrarily-shaped container image and a set of arbitrarily-shaped image tiles, fill the container as compactly as possible with tiles of similar

color to the container taken from the input set while optionally deforming them slightly to achieve a more visually pleasing effect. This framework has three major advantages.

Hua Huang et al [10] proposes a method to create collage from internet images. In this work, it present a novel approach for creating a fantastic collage art-form, namely Arcimboldo-like collage, which represents an input image with multiple thematically-related cutouts from the filtered Internet images. Due to the massive data of Internet images, competent image cutouts can almost always be discovered to match the segmented components of the input image. The selected cutouts are purposefully arranged such that as a whole assembly, they can represent the input image with disguise in both shape and color; but separately, individual cutout is still recognizable as its own being. This algorithm can effectively produce the entertaining Arcimboldo-like collages.

Sketch2Photo is a concept by Tao Chen et al [11]. It propose the combination of sketching and photomontage for realistic image synthesis. The user provides a simple freehand sketch, where each scene item is tagged with a text label. The goal is to convert this sketch into a photo-realistic image. To achieve this, they search online for each scene item, and the background, using the text label. During filtering, each image is segmented to find scene elements matching items in the sketch. Then optimize the combination of the filtered images to seamlessly compose them, using a novel image blending technique. Several compositions are automatically generated and ranked according to estimated quality.

### **C. Video Collage**

Unlike photo collection, video is an information-intensive media with much more redundancy and with better-organized temporal structure like scene and shot. This distinctiveness between photo collection and video sequence brings the following challenges which make it unsuitable to directly apply the techniques used in photo collage into video data:

- The selected key-frames are representative of the video content and with high-quality as well.
- The ROI extracted from key-frames should be efficiently packed: the most salient ROI should be enlarged to emphasize the meaningful highlights; all the ROI should be seamlessly arranged; and the transition between ROI should be visually smooth.

- The temporal structure of video content is preserved in terms of the layout in collage.

The synthesized image, called Video Collage, is a kind of static video summary to select the most representative images from video, to extract salient regions of interest (ROIs) from these images, and to seamlessly arrange ROIs on a given canvas with the temporal structure of video content preserved.

Allison W. Klein et al [12] developed a concept called Video Mosaics. It present a method for creating a video mosaic, a two dimensional arrangement of small source videos (tiles) that suggests a larger, unified target video. They develop a distance measure to assess the match between source and target based on average color and also three-dimensional wavelet decomposition signatures in the YIQ color space. It also introduce a dynamic programming algorithm that automatically chooses the smaller tiling sub-sequences from a large collection of candidate source video sequences to best match the target video.

Another concept of video collage is by Tang Wang et al [13]. This paper presents an automatic procedure for constructing a compact synthesized collage from a video sequence. The synthesized image called Video Collage, is a kind of static video summary to select most representative images from video, to extract salient regions of interest (ROI) from these images and resize them according to their saliency, and to seamlessly arrange ROI on a given canvas with the temporal structure of video content preserved.

Free shaped collage is by Bo Yang et al [14]. Video Collage as a kind of static summary which selects the most representative regions-of-interest (ROI) from video and seamlessly arranges them on a synthesized image. Unlike Video Collage in which both the shapes of ROI and final collage are fixed as rectangle, it support arbitrary shapes of ROI and a set of collage templates in FS-Collage (Free Shaped-collage).

Tao Mei et al in [15] discuss about another approach for video collage. The explosive growth of video data demands the video presentation technique which supports fast browsing of video content. In this paper, it present an automatic procedure for constructing a compact synthesized collage from a video sequence. It starts from the basic setting of Video Collage in which both the shape of ROIs and collage are fixed as rectangular, and then show how it can support arbitrary shapes of ROIs, as well as a variety of collage templates and region of interest (ROI) arrangement layouts (i.e., book, diagonal, and spiral).

Hong-Wen Kang et al [16] discuss about a novel space-time video summarization method which we call space-time video montage. The method simultaneously analyses both the spatial and temporal information distribution in a video sequence, and extracts the visually informative space-time portions of the input videos. The informative video portions are represented in volumetric layers. The layers are then packed together in a small output video volume such that the total amount of visual information in the video volume is maximized. To achieve the packing process, they develop a new algorithm based upon the first-fit and Graph cut optimization techniques. It produce compact and informative. It sometimes produces unsatisfactory results due to the lack of an image understanding scheme. Also it is computationally expensive.

#### **D. 3D Collage**

Ran Gal et al. in [17] proposes 3D collage method. The ability of computer graphics to represent images symbolically has so far been used mostly to render existing models with greater clarity or with greater visual appeal. In this work, it present a method aimed at harnessing this symbolic representation power to increase the expressiveness of the 3D models themselves. They achieve this through modification of the actual representation of 3D shapes rather than their images. The creation of compound 3D shapes is extremely taxing. Thus, this expressive but technically challenging artistic medium is a particularly good candidate to address using computer graphics methods. It is an interactive algorithm for creating expressive 3D compound shapes, or 3D collages. Given a target input shape, these collages convey that shape by accentuating and abstracting its salient features. The collage model is comprised of elements taken from a database of (possibly simple) shapes.

### **III. CONCLUSIONS**

The content aware circle packing algorithm generate photo collages by assembling the salient contents of photos directly onto the partitioned subregion of the given canvas. This approach discuss a novel insight into the photo collage problem from the geometric point of view, and the core is a variational circle packing algorithm for efficient region division. Circle packing determines the optimal region for each image to display. Although the circle packing algorithm runs very fast, this consumes a lot of unnecessary computation and is a

limitation of this approach. As an extension, to expedite the response to such operations it can apply a scheme for locally optimizing the circle packing result. Under Circle Packing (CP) framework, optimizations of the states for different photos are decoupled and independent. This will help to improve the collage process with more flexibility. Furthermore, here also proposes an improved algorithm for getting more visually appealing effect, it can add up a cosaliency model based ROI approximation. So that it will summarize similar objects from a group of images and gives the result in a topic based way.

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