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Review of algorithms changing image size

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Abstract. Improvement in imaging technology, such as recording and showing the images, has occurred everywhere. To see them, different types of screens, like HD monitors or cell phones with LD screens, are used and images often should be resized, to be in accord with different screens. In recent years, there is special attention paid to the methods of resizing which are employed to better show the images in various applications. This article surveys and studies the methods of image resizing (organized images, content-aware techniques of image organization, seam carving, multi-operator method, multi-layer image pointing, sufficient capacity imaging method, and image retargeting).

Keywords: Image resizing, organized image, seam carving, image targeting, multi-layer image

1. INTRODUCTION

The purposes of retargeting images are to create effective visualization of the images from different sources in different screenings. The main purpose in image resizing is to maintain the main contents of the images, while resizing the less-important parts of the images, so that image features remain in the contents without undergoing any changes at all. Improvement in using multimedia tools, knowledge of image resizing, or rescaling the images are among the important, appropriate, and fast parts of the research. Wide usage of different screening tools with various solutions increase the needs for image estimation techniques which consider the visual capacity during scaling process.

Standard estimation techniques which only consider geometrical area, such as scaling, can only be used for image resizing (width and height) with a constant percentage in accordance to the main size. With the recent improvements in image technology, a variety of display terminal can be employed for images or videos that are organized from high television scenes to low mobile equipments. Since existing images possess higher resolution and fixed proportions for compatibility with big scenes such as cinema screen or television, they should be estimated for being used in scenes with less compatibility or different proportions. This problem introduces the need for estimating sufficient capacity images for estimated usage which is usually known as image targeting. Image targeting technique should keep important parts such as general purposes in the original image, reducing visual deviations. Recent improvements in imaging technology have turned digital images to an important part of broadcasting. Images are often used in the news; moreover, people share their pictures via online posts, demonstrating them to others. These images usually have one usage but sometimes they need to be changed for using in different conditions. For example, in order to print images on pieces of paper with different sizes that may differ from the original image's size, it is required to make some changes on the original picture. In the layout of web pages and browsers that are supposed to share texts and

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pictures, images ought to be altered in accordance with the pages' sizes. Images, indicating their own content, should be organized attentively and loyally so that the users can understand them correctly.

2. OFFERED METHODS

2.1. Organized Image

Image improvement should be in a way that keeps the important information unchanged while deleting the parts without any suitable content. An efficient algorithm to solve this problem should pay attention to areas of the image with more energy, keeping them for the final image creation and the original structure should not be deformed from its main shape.

Supposing that the size of input image I is m×n whereas the size of output image I' is equal to m'×n', image resizing algorithm should meet the following conditions:

Important content of the original image must be maintained in the resultant image.

Important structure of the original picture must be kept for the resultant picture.

It should be away from any artificial effect.

The problems, encountered in this method, are that by having complicated images, taken outside, have different features from the ones, taken inside. Also presence of elements such as face or text may have different meanings in specific parts of the image. Busy and complicated images are sample errors, resulting from the released algorithms. A vital element of image resizing techniques to keep them for the creation of the final image is to estimate important parts of the image are located in which section. To keep important parts (produced from salience map), simultaneously compensating limitation structures, often has opposing purposes and resizing operators try to find a balance between both of them. Furthermore, some techniques {1, 2} perform an initial image categorizations (to categories such as face, landscape, etc.) prior to preparing the resizing process. Using automatic real-time image resizing algorithms for informal usages such as dedicating web pages is quite a hard work. All the same, issues can possess a heavy computational load. To calculate the amounts of important parts of an image can turn out to be complicated depending on the extraction of several features along with utilization of object detection plan. The quality of the important estimation map directly affects the final result which is a balance between choosing an important part (such as gradient's energy) that can be quickly calculated, though it is not accurate sometimes (for example when the contrast is low or the image is with noises), as well as a very complicated part that takes a lot of time to be calculated. Moreover, the issue of image resizing is often related to as an optimization matter.

In this part, some resizing methods are applied on the original image and the output is demonstrated (Picture 1-1).

Resizing with Cropping Method: In this method only one part of the image is selected (Picture 1-2).

Resizing with Scaling Method: In this method the image has differed from its original shape (Picture 1-3).

Resizing with Scene's Content-Aware Method: In this method, the image's original content has remained in its original shape after resizing and parts of the image with less energy were deleted (Picture 1-4).

Picture 1-1. Original image.

Picture 1-2. Resizing with Cropping Method

Picture 1-3. Resizing with Scaling Method

Picture 1-4. Resizing with Content-Aware Method

2.2. Aware Techniques of Image Organizing

Simple automatic resizing operators or flaking the fixed removal window and letterboxing (uniform image in accordance to the scale with black and white margins to the target area's fit) often succeed to produce satisfactory results in the image content. When the changes can include the creation of blockiness products and important objects become discernible, in accordance with the volume change, it can be defined by flaking. Removal by means of predefined criterion may involve important areas and, as a result of letterboxing, optimum usage of the new image shows real estate photos. Techniques that pay attention to image content and then deal with image resizing features, applying the mentioned method, where the endeavor to keep important parts of the image and maintain an image's beauty are among their important characteristics are called aware techniques of image organizing.

2.3. Seam Carving

Seam carving with Avidan and Shamir Method (2007) is a popular one to resize content-aware images. The general idea to reduce the width or height of an image is based on one pixel per time by removing the seam is of the least account. Defined seam is a path of 8 connected pixels (from the image's top to bottom or from its left to right, depending on the dimension to reduce) in which there is only one pixel in each row (or column).

If the gradient importance map is in way that the first seam is deleted and is equal in the area, the image compensates the deleted seam, which is a unit smaller, in either the width or the height. Image changes occur only in the seam area while the rest remain unchanged. Gradients are the calculated convenient seams which by means of dynamic programming and using energy gradient as the importance map, offer satisfactory results.

2.4. Multi-Operator Method

Retargeting operators try to offer non-operator advantages and disadvantages. The recent methods include using different operators for images in order to attract the best aspects of each. As long as the seam energy is removed, it is greater than the threshold of successive seams. Flaking is then applied to reduce the image to the targeted size. Importance map is a combined usage of low-level grafts of face detection. Rubinstein et al. (2009) gave three suggestions to combine several operators (efficient seam carving, removal, and flaking when applying them).

The goal is to find the operators with maximum similarity between input image and the final retargeted one. There occurs an optimization, which is performed with Ming Software and is guided based on calculation similarity image.

2.5. Targeting Multi-Layered Image

The performance of pixel area methods for targeting sufficient capacity image face limitations as they distort important objects when the image is much cleared. To determine this problem image targeting of new 3D area is introduced and expanded which re-organizes the objects with blockages, reshaping the targets. With this method the image is modeled as a semi-3D space. Instead of optimizing the situation and its shape, targets are closed by shortening the space between them and, as a result, they are reshaped, which contains some parts of them. This method can spread problems such as targeting multi-perspective image since for optimizing a semi-3D space it needs the input to be ordinary images or more complicated ones such as video pictures.

2.5.1. Optimization

The aim is to optimize path sets yet this needs optimization process very much. To meet this problem a level is introduced for the layers to be vertical, which is shaped essentially, emerging from a connected path in the image but can reshaped based on the reshaping law. This law is simple. For each layer there should be choice, whether the crossing line for each area outside the target one is proper or not. This problem is solved by mixed optimization of the attached path in the image and the reshaping choices, diving each layer. Since both the path and the choices use several pixels, including the cleared or blocked areas, the costs of this set is mentioned as costs of these pixels' disappearance. Energy paths are provided which describe pixel disappearance costs like the choice combination. Therefore, this problem can be easily solved similar to path-finding problem with minimum costs in total energy paths via a dynamic program.

2.5.2. Energy Path

This section describes the way energy paths are expressed. The suggested action, expresses a set of pixels that include the cleared areas or the ones, blocked by others areas in the upper layer which are unseen in the image. In order to keep the scene's sustainability in this method, the following requirements are imposed:

Similar to other targeting methods, invisible pixels are needed for the unimportant ones.

Invisible pixels are needed for non-significant ones which become gaps and mix with their surrounding environment in gap separation process.

Pixels of the targeted area are tested by the second requirement, also indicating the third one which presupposes that the second requirement cannot prevent new constant artifacts. Owing to the impacts these artifacts take from illegal neighboring pixels, when a separated invisible pixel stops, the third requirement involves obstructions to shape the intended target. Energy paths are planned according to these requirements' bases, the first of which confirms the importance of the pixel.

2.6. Sufficient Capacity Method

When sufficient capacity image is estimated it results in an effective technique that intends to estimate the visual content of the image in a process of estimation. The original opinion of these algorithms is to estimate the image while considering horizontal or vertical pixel paths which are the contents of outstanding information. In this method Gradient Vector Flow (GVF) of the image is extracted to create paths, considered during the estimation. The relation of each path arises from the salience map, itself resulting from considering GVF greatness, related to the presupposed image. The suggested technique is tested both qualitatively and quantitatively by considering image-targeting set which is labeled in accordance with the outstanding objects.

This method extracts the technique of Gradient Vector Flow features in order to appropriately select the gaps until they stop without introducing the artifacts in the estimated image. GVF is used to create the vector background for keeping the outstanding information. The suggested method both generally and qualitatively is tested and compared in accordance with the condition of industry methods. Effectiveness results of the suggested method emphasize keeping the outstanding areas. Also, in order to estimate the image gap with lower ck costs is stopped in each repetition. GVF is updated too with algorithm repetition, filling the gap. It is noteworthy to state that the abovementioned algorithm repeats for each gap until it stops. Particularly if the gaps stop, the algorithm has been repeated for n times. The function of the estimation algorithm of sufficient capacity image depends on the compatible energy path which pictures the outstanding areas of the image. Using GVF is recommended for creating and selecting the gaps. In order to evaluate this method's results, it is presented according to gap-separation algorithm, suggested by Avidan.

2.7. Image Retargeting

This method determines some cases of the important object in the image. The section of image retargeting algorithms in an area determines the important parts, deletes them, and resizes the remaining image, again including the important areas. This method tries to make the limited topological summary in the image based on the visual attention model, which is both comprehensive and different in terms of the size.

2.7.1. Retargeting Processes

In this method a map is used to select a series of important ROT areas for final magnification. Afterwards by means of the algorithm, the near areas are mixed from color/intensity based on their spatial distribution.

In order to identify important areas, the map is drawn from the source image by using the face part. If the determined size involves all important areas, the source image can be easily be made. Otherwise, important areas are deleted from the image and the remaining gaps are filled via background-creation techniques. Afterwards the background is resized to fill the input features and in the next stage the important areas of the background are updated and are pasted based on their importance. If all important areas cannot suit among the new image, these areas are resized in reverse in accordance to their importance.

2.7.2. Image Fragmenting

In order to identify the important areas in the image, firstly the image should be fragmented. Change image division is used to dissect the given image to neighboring areas. Regular issues of fragmentation are regarded as the parameters which involve spatial radius hs, color radius hr, and minimum number of the pixels M, all of which making an area. Afterwards the image is re-divided by using some amounts, less than hr and M. Near areas are combined based on their color distribution in the uniform color space of CIE-LUV. Then the estimation of similar color, called histogram division, is calculated so that the color similarity among the areas is determined and area simplification is performed via mixing combination areas.

2.7.3. Image-Attentive Model

The image-attentive model is used according to the totality that makes the first feature of map importance. The total model is taken to adapt the intended places in complicated scenes based on the visual low-level model, using color, intensity, etc. as visual indicators. This technique employs Gaussian Pyramid to calculate several map features for three low-level features: color C, intensity L, and direction O that show the visual scene. Such a feature is obtained by linear filtering for the type of the feature, itself, which aims at the surrounded operation in the center. This operation pursues the lack of local spatial rotation for each kind of feature. Non-rotational spatial places are then combined with the single general map.

2.7.4. Face-Attentive Model

Famous people's images are useful in many areas. The levels are correctly discernible. Famous faces in images certainly attract the audience's attention.

2.7.5. Calculating Rol Importance Areas

Pixel amounts are normalized from output images of attention model, adding them up in re-normalization to create an important combined map. Instead of using a lot of researches to find the best Rol importance areas, greedy algorithm is used.

2.7.6. Background Creation

When the Rol is determined, the background is generated by deleting it from the source image which saves Rol centers, filling the resultant maps. Saving Rol central positions helps minimizing visual images in tinkering process. Internal coloring is needed since Rol may cover its initial image area, when the sampled background is tinkered.

2.7.7. Tinkering Stage

The key stage in this method is tinkering which is performed when Rol is applied to the newly-created background. This stage is a new algorithm, added to the existing techniques above in retargeting process. The algorithm is designed to keep the related Rol positions since they are important for identification capability. Greedy Algorithm connects to each Rol which starts with one of their most important ones. The process of important objects' best proportion in the sized background can maximize this Rol's function. It also can impose specific limitations of the position and size of Rol on the resized background so that it keeps indications of a particular concept, drawn in the image. To prepare imaging for a series of screens; it is the first step to be

taken in automatic retargeting. Algorithms show that they let the work to automatically do the imaging. Afterwards it makes it possible for the image to be used in categorization of the screening tools. Results of this method are to minimize the details and failures.

3. RESULTS

This article dealt with introduction of image resizing methods, aiming to survey those keeping the features of images' high and low level and delete the unimportant places. Thus the article reviewed organized image method, aware image organization techniques, seam carving, multi-operator method, multi-layer image targeting, sufficient capacity, and image retargeting, mentioning the presented models' procedure and advantages.

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