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Intelligent responsive image cropping

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ABSTRACT

Images and the screens on which they are to be displayed can vary widely in size and aspect ratio. A common challenge is the optimal use of a display screen without cropping out important features in the image. This disclosure describes techniques for intelligent image cropping and introduces the concept of maximum crop bounds that represent the maximum percentage by which an image can be cropped from an edge without cropping out important content. Prior to display, an image is cropped such that the aspect ratio of the cropped image is close to that of the screen, with a constraint that the crop amount does not exceed that of the provided maximum crop bound. The techniques allow an image to be displayed on screens of various sizes such that important features of the image are included in the displayed portion while limiting cropping to less important features.

KEYWORDS

- Image cropping
- Aspect ratio
- Display screen
- Image resizing
- Crop bounds

BACKGROUND

A common challenge when displaying an image on a screen is that the image and screen on which the image is to be displayed have different aspect ratios and/or sizes. Users view content on various types and sizes of display platforms such as mobile phones, tablets, desktop computer monitors, and web browsers. The devices may also sometimes be positioned in different orientations. Also, it is preferable display images such that they occupy a majority of the screen area.

Images can also vary widely, e.g., due to capture in various modes such as portrait, landscape, square, panorama, etc. Such variation results in images of many different aspect ratios and orientation. For example, viewing a panorama on a smartphone in vertical orientation causes the panorama is displayed as a small horizontal strip in the middle of the phone, substantially underusing the available space. Better utilization of available screen space without cropping out important information from the images is a common challenge.

DESCRIPTION

This disclosure describes techniques for intelligent cropping and displaying of images that accounts for varying screen dimensions and image properties. A parameter - the maximum crop bound - is defined and stored for each image. The maximum crop bound represents the maximum percentage by which the image can be cropped from each edge without cropping out important content. The maximum crop bounds are set such that important image features such as human faces, text, flowers, animals, etc., are clear of the bounds, and thus excluded from cropping. Less important features are within the bounds and can be cropped, if necessary, prior to image display. For images without an explicit subject, the maximum crop bounds can represent ideal crop dimensions.

In intelligent image cropping, automatic image cropping is performed such that the aspect ratio of the cropped image is close to that of the screen, within the imposed constraint that the crop amount does not exceed the maximum crop bounds. Cropping is performed proportional to the maximum amount of crop permissible on each edge. Thus, resizing the image is smooth.

For example, consider an image that is to be cropped by 15% of its width. Further, for the image, the maximum crop bound is defined as follows - the maximum permissible crop from the left edge is 10% and the maximum permissible crop from the right edge is 20%. To attain the 15% total crop, 5% from the left edge and 10% from the right edge are cropped.

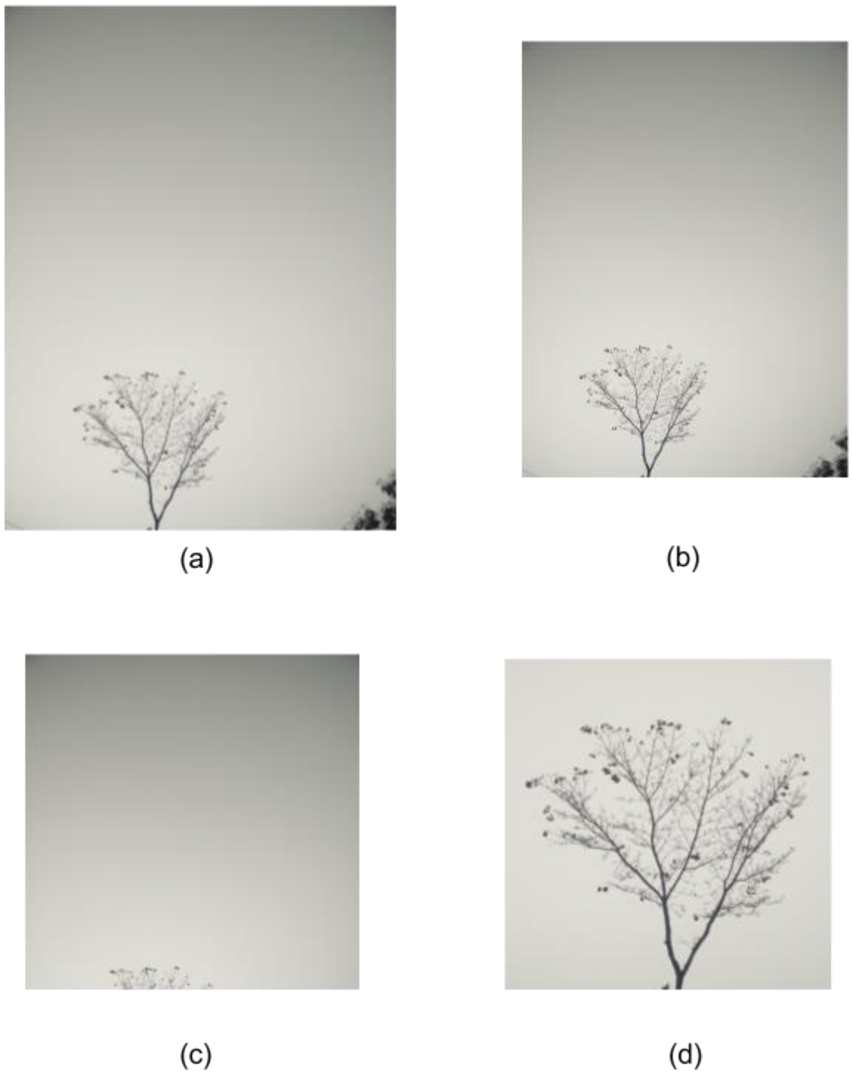

Fig.1: Original image and example cropped images

Fig. 1 (a) depicts an example original image, that has not been cropped or resized. As can be seen in the figure, an important feature in the image is the main tree in the lower left portion of the image. The rest of the image includes additional features that may be considered less important, e.g., the sky in the top half of the image, and a part of the foliage from another tree in the lower right corner of the image.

Fig. 1(b) depicts the image resized to fit a smaller screen of a same or similar aspect ratio. All the important features are present, e.g., the main tree; however, the image is scaled to a proportionally smaller dimension.

Fig. 1(c) depicts the image cropped without consideration of a maximum crop bound. For example, the image is cropped from a bottom edge of the image to a square shape suitable for a square screen. In this example, large parts of the important feature in the image has been cropped out.

Fig. 1(d) shows cropping of the image per the techniques described herein, to a square shape suitable for a square screen. As can be seen in the figure, maximum crop bounds are utilized to crop the image. In this example, the maximum crop bounds are defined such that a large amount of cropping is permissible from a top edge of the image, while only a small amount of cropping is permissible from the bottom edge. Thus, the cropped image includes the main tree, while portions of the image that depicts less important features are cropped out. The cropped image provides a better visual experience for the viewer. The original image is retained and users are provided with options to view the entire image.

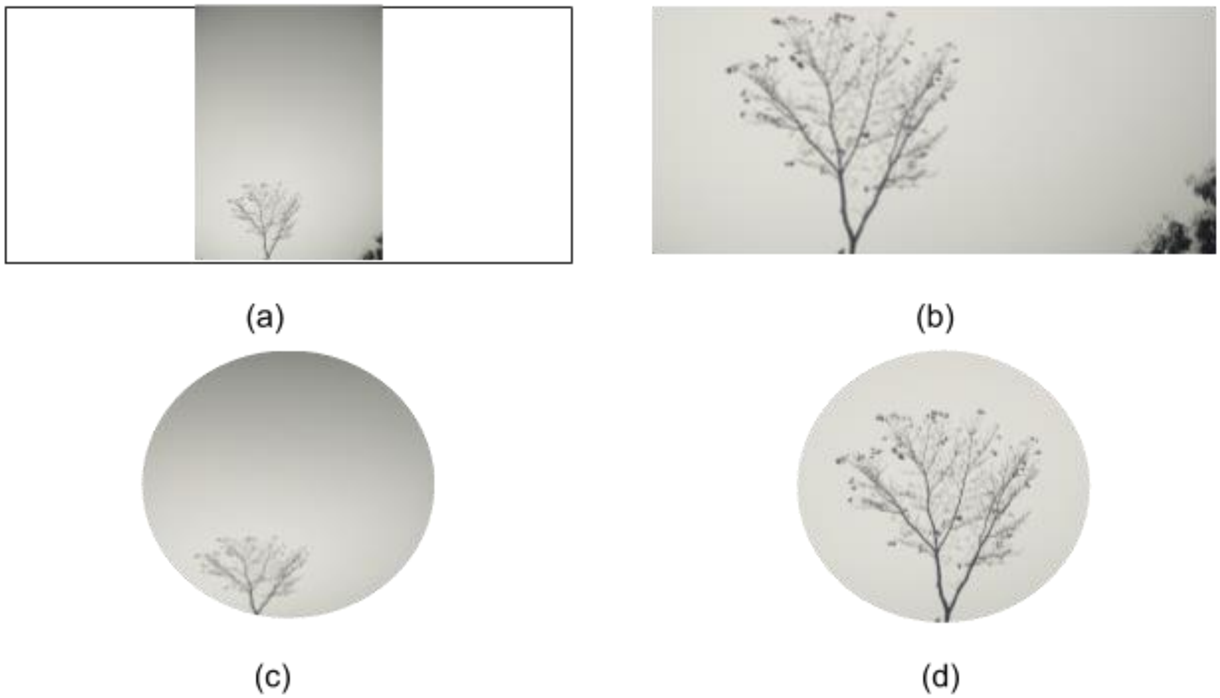

Fig. 2: Resized and cropped images for screens with different aspect ratios

Fig. 2 illustrates additional examples that illustrate benefits of the use of maximum crop bounds to display images on screens with different aspect ratios.

Fig. 2(a) depicts an uncropped image resized to fit a horizontal display screen. As can be seen in the figure, as the image is displayed a large part of the viewable screen is unused. Fig. 2(b) depicts the image, cropped with the use of maximum crop bound, and displayed on the same screen size. The cropped image, that has important feature preserved, now occupies the screen.

Fig. 2(c) shows the image adjusted to fit a smaller, circular display, e.g., a smartwatch. Without the use of the maximum crop bounds, the display screen is dominated by a less important feature in the image, the sky. In Fig. 2(d), the image is cropped with the use of maximum crop bounds. Thus, a majority of the display screen now displays the important feature in the image.

Maximum crop bounds and cropping based on the defined maximum crop bounds allows important features in an image to be displayed on display screens of different aspect ratios and sizes. Further, by defining maximum crop bound values appropriately, the techniques can incorporate different preferences. For example, “contain” is a special case where all the crop bounds are set to 0% while “cover” is the special case where all bounds are set to 100%.

The maximum crop bounds can be determined through multiple techniques. For example, photographers or the image creators can define the bounds, which provides them control over the display of their images. Some applications may always set the bounds to 0% or 100%. Image processing and machine learning techniques can be used to identify important portions of an image and to determine maximum crop bounds based on the identified portions.

Maximum crop bounds can be incorporated in image management, image editing, messaging/ social media, and camera applications. Maximum crop bounds can also be included in image metadata. The described techniques can also be used for video. For example, video content providers can suitably crop videos such that they are displayed without cropping out important information.

CONCLUSION

This disclosure describes techniques for intelligent image cropping using maximum crop bounds that represents the maximum percentage by which an image can be cropped from each edge without cropping out important content. Prior to display, the image is cropped such that the aspect ratio of the cropped image is close to that of the screen, with a constraint that the crop does not exceed the maximum crop bound. The techniques allow an image to be displayed on screens of various sizes such that important features of the image are included in the displayed portion while limiting cropping to less important features.