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Using Boosted Haar Cascades To Detect Rectangular Picture Frame-Like Regions In Images

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ABSTRACT

A machine learning system and method with boosted Haar cascades for automatically detecting a rectangular region to replace it by an ad or contents from another image are disclosed. The required features and the logic for detecting rectangular regions are learnt by the system in a suitable machine learning implementation. The method follows the steps of running the pattern recognition algorithm using a Haar transformation on the pixels of an image. The algorithm identifies a first pair of parallel lines separated by a distance, and looks for a second pair of lines in a perpendicular direction to define a rectangular region, which is marked out. The marked rectangular region is then replaced by an ad or contents from another image.

BACKGROUND

There are many online photograph and video sharing and storage services available and many social networking sites also allow sharing of photographs and videos. The photo and video sharing services allow generating a new image from an existing image. A new image is generated by detecting a rectangular region in the image and replacing it by an ad or contents from another image. Examples of rectangular regions include regions of an image with picture frames, billboards etc. Detecting the rectangular region normally would require computing of the lines in the image using line segment detectors (LSD) or Hough transforms and then deciding which sets of lines correspond to the same rectangular region.

Traditional methods for detecting a rectangular region normally demand substantial manual effort. The traditional methods require robust models that will decide which sets of line segments can be considered to represent the same rectangular region, which is difficult to do

without manual intervention. Haar cascades were proposed by Paul Viola and Michael Jones and successfully implemented in face detection technology. Haar cascades are based on boosted trees of 2D Haar transforms, which are of the form (for the 2x2 case) [1 1; 1 1] or [1 1; -1 -1] or [1 -1; 1 -1]; or [1 -1; -1 1] etc. Higher order cascades could be constructed depending on the resolution required. Haar cascades are weak detectors for classifying vertical and horizontal lines and some diagonal lines. There is therefore need for a scalable machine learning approach to automatically learn classification into rectangular regions correctly.

DESCRIPTION

Disclosed herein is a machine learning system and method with Haar cascades for automatically detecting a rectangular region to replace it by an ad or contents from another image. The required features and the logic for detecting rectangular regions are learnt by the system in a suitable machine-learning implementation. The system is initially provided with learning examples using data sets with positive (images with picture frame regions marked with a bounding box) and negative examples (without any rectangular regions).

The system is then configured to implement the following steps for detecting rectangular regions:

1. running a pattern recognition algorithm on the pixels of an image, where the algorithm comprises using a Haar transformation

2. identifying a first pair of lines separated by a distance

3. identifying a second pair of lines in a perpendicular direction to the first pair, to define a rectangular region

4. marking out the rectangular region in the image

5. replacing the space framed by the rectangular region by an ad or contents from another image.

The system and method could alternatively be implemented for detecting restricted sets of corners (|_, _|, |□) in images as well, and can be boosted to learn complex geometrical rules.

Advantages of the system and method include reliable elimination of most non-picture frame regions in an image as the natural form of Haar transforms is well suited for detecting vertical and horizontal lines. The picture frames like regions are not very frequent in most images and Haar transforms are useful in quickly eliminating irrelevant portions of the image.