Application of Face Recognition to a Seam-Carving Algorithm for Content-Aware Image Resizing

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1   Abstract

Current algorithms which retarget and change the aspect ratio of images using seam-carving can run into issues when applied to images of faces. At present, the most common way of dealing with this problem is requiring the algorithm's user to manually tag faces in image data by hand, a time consuming process. Clearly, for application of such an algorithm to batch groups of images or, eventually, full motion video, would be time consuming and tedious. As the currently existing algorithm performs well on the majority of non-face data, my project will use recently developed seam-carving libraries to perform image resizing, and will focus on face recognition.

2   Introduction

The goal of my project is to implement a successful face recognition algorithm, and apply it to a seam-carving algorithm, in order to improve the effectiveness of the current algorithm, as well as reduce the amount of required user interaction. Such technology would have a wide range of practical applications. As the current iteration requires far too much user interaction to change the aspect ratio of images which contain faces, it is not suited

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to application to video. An algorithm which was capable of changing the aspect ratio of video using seam carving while performing face recognition to preserve significant data not preserved by seam carving (faces), would be immensely useful in the field of high-definition video and content delivery.

3 Background

There are a wide vareity of techniques for image resizing. Among the most common are cropping and scaling. Cropping as a method of retargeting has the potential to remove significant data in changing the aspect ratio, and scaling an image always lowers its quality, while at the same time generally stretching and distorting all data, not just the insignificant data. Seam-carving algorithms do not suffer from these shortcomings. Seam-carving finds seams of low-energy (and therefore insignificant) pixels in an image, expanding or reducing its size in the horizontal or vertical dimension by duplicating or removing these seams.

There are already several algorithms which use seam-carving to perform content-aware image resizing. These algorithms have problems dealing with image data which contains human faces, generally distorting them when resizing them automatically. The authors of the original seam-carving algorithm, Shai Avidan and Ariel Shamir, who presented it at the 2006 SIGGRAPH conference, designed a novel solution to this. They added a system to their sample application which allowed users to tag portions of an image (such as faces) as highly significant, preventing the algorithm from removing the data contained therein. The problem with such a system, however, is that it is tedious and time consuming, requiring a large amount of human-computer interaction.

4 Development

My project is written in C. Currently, it has code which reads in pgm-formatted images. It is capable of accessing the individual rows and columns of pixels in these images, and includes methods for bright pixel finding, edge detection, and other various types of image manipulation. Recently, an open source library was released which performs seam-carving. Using this library,

my code will be modified to allow it to perform image retargeting and aspect ratio changing using seam carving, allowing me to focus on face recognition. I will then begin the implementation of code for face recognition. It will start out as a simple UI which allows users to tag regions of images which include faces and other significant data, and then write this data out to an XML container format. Eventually, code will be written to allow it to perform this face recognition automatically.

5 Results

The application of face-recgnition would allow web browsers or other content display programs to dynamically resize images to fill the available space and aspect ratio, without requiring the manual tagging or marking of faces and other complicated content in pictures in order to preserve them. It would also have applications in video distribution, where such an algorithm would allow a video file to be distributed in a single aspect ratio, allowing the video player to dynamically change the aspect ratio.