

## Chapter 12

# Digital Image Splicing Using Edges

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### ABSTRACT

*In this paper, the authors splice together an image which has been split up on a piece of paper by using duplication detection. The nearest pieces are connected using edge searching and matching and the pieces that have graphics or textures are matched using the edge shape and intersection between the two near pieces. Thus, the initial step is to mark the direction of each piece and put the pieces that have straight edges to the initial position to determine the profile of the whole image. The other image pieces are then fixed into the corresponding position by using the edge information, i.e., shape, residual trace and matching, after duplication or sub-duplication detection. In the following steps, the patches with different edge shapes are searched using edge duplication detection. With the reduction of rest pieces, the montage procedure will become easier and faster.*

### INTRODUCTION

Image splicing is very similar to jigsaw puzzles which are very widely known and highly popular. Jigsaw puzzles only take shape matching into consideration, the colour and texture information are not fully taken into account. Image splicing is a computational image restoration technique

which emphasizes automatic stitching and colour matching.

Image splicing has a very important usage in security. Currently, important documents are split and cut by machines such as shredders. Many of these are only shred into regular shapes, such as identical vertical strips. This presents the possibility of analyzing the strips and potentially reconstructing the original document content. Using automatic image splicing it is possible

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to solve this problem of shredding, potentially allowing a shredded document to be accurately reconstructed. This provides an opportunity to improve the current splitting and cutting technology which should cut the paper into much smaller sizes. This would encourage the use of cross-shredders within organizations to minimize the risk of information leaking when it comes to document security and destroying certain types of sensitive documentation.

Our proposed scheme is capable of processing a scanned image that has already been segmented into a number of smaller pieces. We use an edge detection algorithm to determine the edges of each of the pieces. Then, based on this edge detection we splice the pieces of the image together to restore the image to its original composition.

The remainder of this paper is set out as follows: Section 2 details the related work; Section 3 outlines our contribution to image splicing; Section 4 presents our experimental results and finally within Section 6 we draw our conclusions.

## **2 RELATED WORK**

One of the most important parts of image splicing and reconstructing images which have been cut into pieces is edge detection. Edge detection techniques proposed by Canny (1986) and Perona and Malik (1990) allow each of the pieces of the split image to be examined. After the edges have been determined, they can be examined and compared. This involves shape and colour matching in order to appropriately reconstruct the image.

Edge detection has been a topic of great discussion, many, including Ziou and Tabbone (1998) have created algorithms and formulas for specific types of edge detection which have varied results depending on the goal of a particular project. Many edge detection algorithms require blurring and differentiating of the image. This makes it difficult to achieve a number of requirements, specifically

for image splicing, where those edges are required to be joined to rebuild the image.

This is where our edge detection software is different from the current tech- techniques, one of which was proposed by Ma and Manjunath (1997). After those edges have been located, they need to be processed in such a way that allows the matching of an edge to its corresponding pair. This is particularly true when it comes to matching colour images which have been split up. Matching the colour edges successfully, previously examined by Mirmehdi and Petrou (2000) and Deng and Manjunath (2001), while correctly splicing the colour image back together is a very important part of our scheme which should require no blurring or altering of the image. This will allow a more accurate reconstruction of the original image.

Ng and Chang (2004) give an account of image splicing. This research area has been taken into account by numerous researchers, however the main focus has been detecting images that have been spliced (Chen et al., 2007; Hsu & Chang, 2006, 2007; Ng et al., 2004; Shi et al., 2007; Zhang et al., 2008) rather than images which have been split up and then trying to reconstruct them using these splicing techniques.

Techniques that are exploited during this splicing detection process are geometry invariants and camera characteristics consistency. These are typically classification problems in which a training set of data is used to guide the detection algorithm in order for it to determine whether an image is an original or whether it has been spliced together. Manual labeling of the image set was required during their tests. This is known as a semi-automatic detection method.

This work presented by Hsu and Chang (2006) places a restriction, such that, an authentic image must originate from a single camera. The technique attempts to find inconsistencies which exist between different camera models and therefore make it easier to determine if an image is authentic or not.

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