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# Real-time video photomosaics with optimized image set and GPU

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**Abstract** We propose a real-time approach to automatically generate photomosaic videos from a set of optimized images by taking advantage of CUDA GPU acceleration. Our approach divides an input image into smaller cells—usually rectangular cells—and replaces each cell with a small image of an appropriate color pattern. Photomosaics require a large set of tile images with a variety of patterns to create high-quality digital mosaic images. Because a large database of images requires longer processing time and larger storage space for searching patterns from the database, this requirement causes problems in developing a real-time system or mobile applications that have limited resources. This paper deals with a real-time video photomosaics using genetic feature selection method for building an optimized image set and taking advantage of CUDA to accelerate pattern searching that minimizes computation cost.

**Keywords** Non-photorealistic rendering · Photomosaics · Real-time · Genetic feature selection · CUDA

## 1 Introduction

One of the important research goals in computer graphics is non-photorealistic rendering, shortly NPR, as well as photorealistic rendering. While photorealistic rendering techniques simulate physical phenomena such as light reflection and refraction, water flow and flames in a natural way, NPR is inspired by artistic touches such as drawing and painting. In the beginning, scientific visualization researchers used NPR techniques to express complicated scientific information more effectively with an image [18]. The main purpose of NPR is to transmit the meaning or the impression of the objects in a scene to viewers by effectively expressing the salient features of them.

Digital mosaic technique is one of the NPR techniques. A number of different approaches have been developed to implement various mosaic techniques using mathematical and algorithmic models. Digital mosaic technique became one of the most important research topics in the non-photorealistic rendering due to its popularity [3].

Key techniques in digital mosaic generation are crystallization mosaics, ancient mosaics, and photomosaics. The crystallization mosaics adopted smart strategies using computational geometry techniques such as Voronoi diagram combined with image processing techniques [11]. This technique will generate mosaic images that simulate typical effects of the stained glasses. Dobashi et al. [7] suggested an advanced approach based on Haeberli's approach that preserved the edges of the original image.

Ancient mosaics are artworks which are constructed by composing small colored tiles. According to the edge information of the background image, the information of an image is enough expressed by arranging of a tile as the various size and the various directions. Hausner [12] reproduced a realistic ancient mosaic using centeroid Voronoi diagram (CVD).

Photomosaic is a most common technique for digital mosaics. It consists of many smaller individual tile images and constructs an entirely different image that we can see at a distance (Fig. 1). Various photomosaics approaches have

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