RaveGrid: Raster to Vector Graphics for Image Data

Introduction

RaveGrid is software that efficiently converts a raster image to a scalable vector image comprised of polygons whose boundaries conform to the edges in the image. The resulting vector image has good visual quality and can be displayed at various sizes and on various display screen resolutions. The software can render vector images in the SVG (Scalable Vector Graphics) format or in EPS (Encapsulated Postscript) with additional gzip compression.

The ubiquity of image data in graphics, on the Web, and in communications, as well as the wide range of devices, from big screen TVs to hand held cellular phones that support image display, calls for a scalable and more manipulable representation of imagery. Moreover, with the growing need for automating image-based search, object recognition, and image understanding, it is desirable to represent image content at a semantically higher level by means of tokens that support computer vision tasks.

Algorithm Overview

RaveGrid is based on VISTA [1] (US Patent No. 7,127,104), a broad algorithmic framework for performing image segmentation that exploits both region and edge cues inherent in images. Perceptual organization of regions and edges into polygonal segments is modeled using the proximity-based regional relationships between edges established by Delaunay triangulations. More precisely, a digital image is processed to extract edge pixel chains and a constrained Delaunay triangulation of the edge contour set is performed to yield triangles that tile the image without crossing edge contours. Each triangle is attributed a color by sampling pixels within it. A combination of rules, each of which models an elementary perceptual grouping criterion such as proximity, continuity, etc., determines which adjacent triangles should be merged. A grouping graph is formed with vertices representing triangles and edges between vertices that correspond to adjacent triangles to be merged according to the combination of grouping rules. Connected components of the grouping graph then yields collections of triangles that form polygons segmenting and vectorizing the image.

Current Implementation

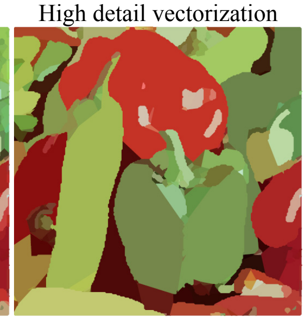
RaveGrid v2.5 takes as input a digital raster image (JPEG or PNG) comprised of pixels and an optional quality parameter—the level of detail that controls the hysteresis thresholds in a Canny edge detector. The steps of the algorithm sketched above are efficiently implemented in C, and a GUI displays both the raster input image and the vector output image. The details of the vectorization can be compared by synchronous zoom and pan functionalities. The SVGZ files may be viewed using Adobe SVG Viewer.

The purpose of shareware version 2.5 of RaveGrid is to showcase some basic capabilities such as handling complex real-world images of over 20 megapixels at an average processing rate of 0.5 megapixels per second[1], and rendering them into vector images with good visual quality and economy of representation, with three different levels of detail to choose from. At the lowest quality setting, it serves as an image segmenter, while at higher quality settings it renders high visual quality vector images. RaveGrid is work in progress of which this is an early glimpse.

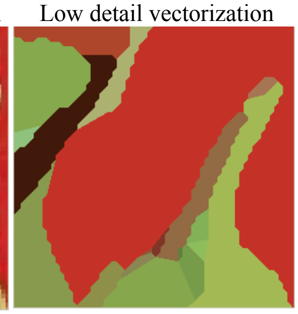

Raster image


High detail vectorization


Medium detail vectorization


Low detail vectorization


Raster regional detail


Vector regional detail at low

The shareware is designed to be limited in functionality to prohibit unauthorized commercial use. Full functionality and enhancements can be obtained through licensing: http://www.lanl.gov/orgs/tt/license/

References

[1] L. Prasad, A. Skourikhine, Vectorized Image Segmentation via Trixel Agglomeration. *Pattern Recognition* **39**, 501–514. 2006

[2] S. Swaminarayan, L. Prasad, Rapid Automated Polygonal Image Decomposition. *Proceedings of 35th AIPR 2006 Workshop*. Oct. 11-13 2006, Washington D. C.

[3] L. Prasad, A. Skourikhine, Raster to vector conversion of images for efficient SVG representation, *Proceedings of SVG Open 2005*, Enschede, The Netherlands, August 2005.

1 *tested on a Dell Precision laptop computer with an Intel ® Pentium ® 2.13 GHz M processor and with 2 GB of RAM*