Development of a Fractal Dimension Calculator

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Abstract

Fractal dimension is used as an index of complexity in many research applications. Currently, researchers calculate fractal dimension from raster graphics. This project introduces an alternative method by calculating fractal dimension from vector graphics. In addition, a display screen will show the user all of the steps in the calculation.

Background

The term "fractal" was first coined by Benoit Mandelbrot. Used to describe geometric figures that exhibit self-similarity, fractals are now used in myriad applications. Every fractal has a numeric fractal dimension that can be used to indicate how complex the fractal is. Multiple methods for calculating fractal dimension have been formulated. The box dimension method is most commonly used in research applications.

Raster graphics are images that assign numeric values to every pixel. The values determine the color of each pixel. Vector graphics contain object types like paths and shapes to show images. In research applications, box dimension is calculated from raster image. This project describes how to calculate box dimension from vector images. It also describes how to display the step-by-step calculations so that users can understand every step of the process.

Procedures

Using the SVG language, images are created. These images include fractals and non-fractal shapes.

In the Processing environment, the SVG file is uploaded. Using the get() method, the coordinates and attributes of the SVG file's objects are imported into an array. The SVG image is displayed on the screen.

Now, the grid is superimposed. Starting with a large grid size, grid boxes are shown on the screen. Using a for-loop, the program goes through the object array and tallies how many grid boxes cover objects. Then, smaller grid sizes are used. A hash table keeps track of data: grid size, s, is stored in the keys, and number of grids, $N(s)$, is stored in the values.
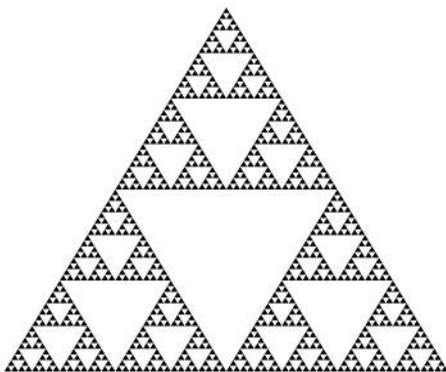
Sierpinski Triangle,
created by SGV code
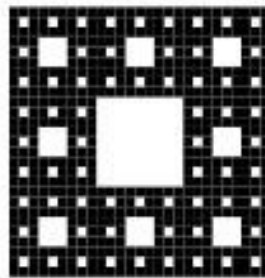
Sierpinski Carpet,
created by SVG code