Programming (ERIM)

3. Exercise

Deadline for submission: 2013-11-13 23:59 CET

Instructions

This week we will compute membership in the mandelbrot set and visualize it. Mandelbrot set is the most well-known fractal set. It is defined as the set of numbers c in the complex plane (i.e. plane with the real- and imaginary parts of complex numbers) for which the absolute value of applying infinitely the iteration

$$z_{n+1} = z_n^2 + c\,,$$

starting with $z_1 = 0$, remains bounded. For more information on the Mandelbrot set, see `http://en.wikipedia.org/wiki/Mandelbrot_set`.

Exercise

Implement a 2-d visualization of the Mandelbrot set with a resolution of 500 x 500 evaluation points so, that the x-axis is the real component of the complex number within the range [-2.1, 0.6], and the y-axis its imaginary component within the range [-1.1, 1.1]. That is, you should have two nested for-loops so, that in the inner loop you compute the membership for the given coordinate.

For each pixel in the resulting graph, iterate up to 100 times starting from $z_1 = \mathit{complex}(x, y)$. The iteration should stop when the absolute value of $z_n$has exceeded 2. Now, for each point in the plot, store the minimum $n \in \{1, \ldots, 100\}$ required for $|z_n| > 2$, or 101 in case the series is bounded. Plot the membership values (the evaluated coordinate belongs to the set if, for $n \in 1, \ldots, 100$, $|z_n| \leq 2$) with `imagecs` (Matlab) or `image` (R) which automatically chooses a colormap according to the range of the values to plot.