Mandelbrot Explorer Guide

Introduction:

What is the mandelbrot?

The mandelbrot is a set of complex numbers which when displayed creates a fractal. What is a complex number? It is basically a 2 dimensional number that consists of two parts the real part (normal numbers) and the imaginary part (multiples of i = square root(-1)). You can think of this in terms of x and y or real and imaginary coordinates. The mandelbrot follows a recursive formula:

$$z_{n+1} = (z_n)^2 + c \quad (1)$$

where, z_{n+1}, is the next value in the sequence, z_n, is the current value and c, is the value you are checking is in the mandelbrot, z_0 = 0, for the mandelbrot set. c, is in the mandelbrot set if the recursive formula stays bounded which means that the magnitude (the size of the complex number) will never approach infinity as n approaches infinity.

Obviously the program cannot run to infinity so the program by default does 1000 iterations and checks if the magnitude passes 2 if it does then it is not in the mandelbrot set. If it does not pass 2 then it is probably in the mandelbrot set and gets coloured black. Anything in between will be coloured by the number of iterations it got to before passing two.

Installation:

To install the mandelbrot simply extract from the zip file the folder containing the mandelbrot_x.x.x.exe, MandelLauncher.exe and config.ini to anywhere on your computer.

Setup:

To setup your mandelbrot program you simply need to run the MandelLauncher.exe it will open a window containing settings for the program. If a config is not present it will give you a warning that you need to save a new config otherwise the program will not launch properly. See figure 1 below for an explanation of the launcher.

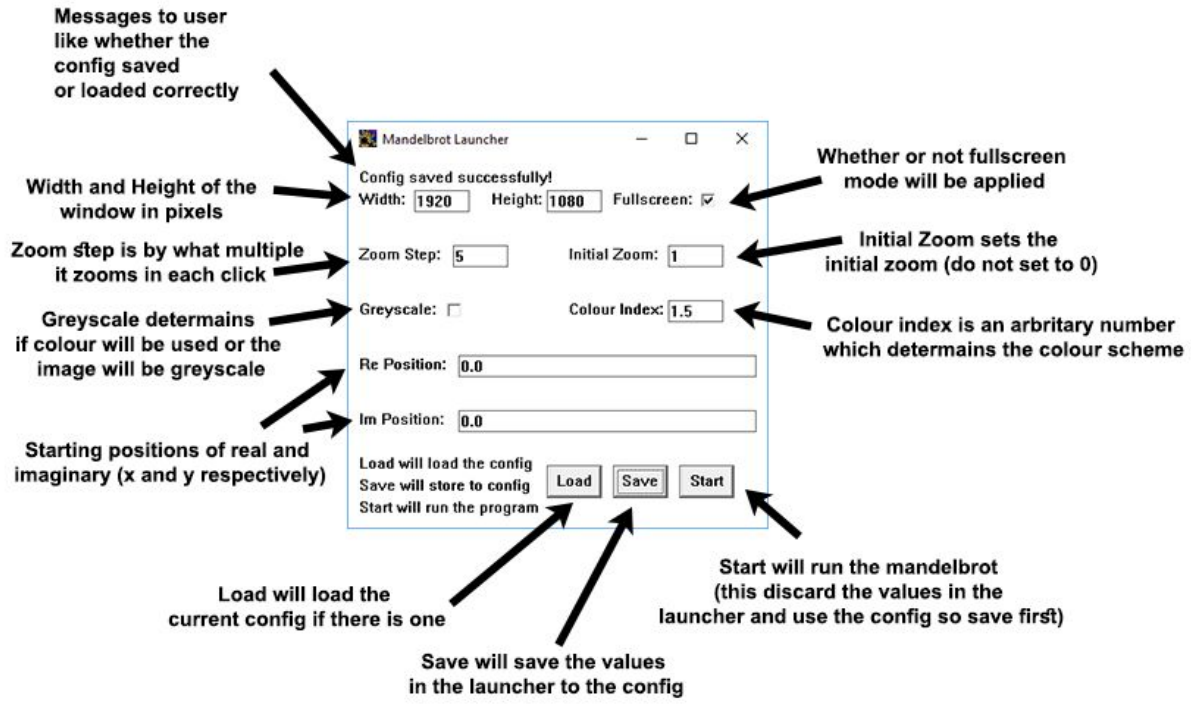

Figure 1: Explanation of Mandelbrot Launcher

Width and height can either be set to the size of the monitor with the fullscreen option checked or less than the size of the monitor with the fullscreen option unchecked.
Zoom step is the amount by which the program will zoom in every click so 5 will zoom in by 5 times each click.
Initial zoom is the amount the program starts zoomed in higher numbers are more zoomed in (unfortunately this does not accept standard form).
Greyscale will render the image in black and white when checked and in colour with a special filter when unchecked.
Colour Index is an arbitrary number which decides the colour scheme this can be changed while the program is running.
Re and Im position are the real and imaginary (x and y respectively) starting coordinates.
Load loads the config from file.
Save saves the current entered values to the config.
Start starts the program (be aware it will **not** save the current entered values in the window. It also requires elevated privileges to create screenshots and edit coordinate file).

Usage:

Left mouse to zoom in and right mouse to zoom out. The program will zoom in and out on your cursor. Every time you click the program will zoom in and display information about current zoom level, coordinates and render time on a console window, if you are full-screen you can not see this unless you have two monitors.

You can keep zooming until you hit the floating point limit which is where your computer's ram becomes too inaccurate to calculate the values correctly. At this point it will appear to become pixelated.

As of present there is no kind of anti-aliasing so it is advisable to force FXAA on for this program in your graphics card settings. This will improve the quality of the image.

Controls:

Left and Right Mouse Buttons: left button zooms in by the zoom step amount on the cursor and right button zooms out by the zoom step on the cursor.
Left and Right Arrow Keys: increases and decreases the colour index which in turn changes the current colour scheme.
Up and Down Arrow Keys: increases and decrease the number of iterations for the calculation the mandelbrot by 1.5 times. Each time you press the arrow key it has to re-calculate the image so try to be patient.
Space: saves a screenshot of screen to bmp file and saves the coordinates of the screenshot to a coordinate file.