LINE DRAWING ALGORITHM: A Comparative Analysis of DDA, Bresenham, and Wu Algorithms

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Abstract: The report discusses some of the most popular methods of this process, namely line rasterisation using the DDA-line algorithm, Bresenham's line algorithm and the Xiaolin Wu's line algorithm as examples. The text describes the characteristics of each of the methods and gives their action structures in a step-by-step format. It shows that Bresenham's algorithm remains the standard due to its speed and agility, while Xiaolin Wu's algorithm is the basic method when antialiasing is required. The main purpose of the article is to describe in simple words complex computer graphics algorithms, without which it is difficult to imagine simple things: from basic graphic editors to GPS maps.

Key words: algorithm, rasterization, digital differential analyzer, Bresenham's line algorithm, Xiaolin Wu's line algorithm.

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The process of converting mathematical equations into graphic images has become a basis for different applications from our daily life. Rasterization is used for rendering a text character, drawing digital pictures, as well as creating navigational maps. It is a vital part that connects vector graphics and pixel-based displays, which is based on efficient algorithms.

Every day, without noticing, we encounter graphics. For example, when printing text, each letter is a separate object. The computer models the scene and then generates a final image that can be printed or displayed on a monitor. It is logical that first we work with vector graphics and then with raster graphics, i.e. with pixels. Methods of image conversion from vector graphics to raster (further rasterization) is a very important algorithm when working with computer graphics.

As with other methods, it is easier to start with a simple case. In the case of rasterization, it is the rasterization of a line. When working with horizontal, vertical and 45° inclined lines, the choice of raster elements is obvious. Otherwise, selecting the right pixels is already a complex and important task.

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