Implementation Mechanisms Autostereograms in Scalable Architectures

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Abstract

There is a technique for presenting of stereograms, where full information, for the two eyes, is contained in a single image. These images are known as "Autostereograms", they may contain a wide variety of forms of depth with some limitations. The images are generated in multiple planes and in turn front or behind the physical plane. In order to perceive 3D shapes in autostereograms, is necessary to separate the visual processes , between focusing and convergence, linked under normal vision. Thus, we propose to implement a method of generating autostereograms in scalable architectures using GUANE, a supercomputing platform with 128 GPUs NVIDIA TESLA FERMI M2075.

Problem

The use of autostereograms allow observe information that no could be obtained from normal images. The autostereograms can be used as encryption method for the transmission of short messages. In turn, the use of other methods to induce depth has a high monetary cost and extensive processing time.

For these reasons it has undertaken the development of this project to solve the possible problematic of generating autostereograms using high resolution images, reducing the use of computational resources.

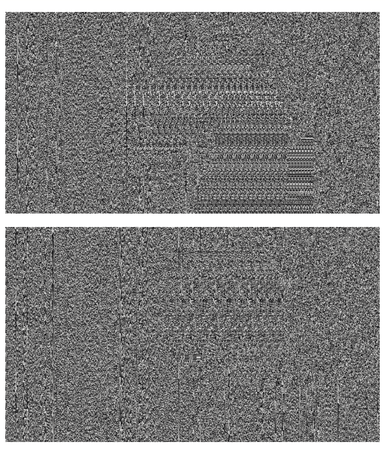


Fig 1. Example of autostereograms. a) Autostereogram of a dragon. b) Autostereogram of a helmet.

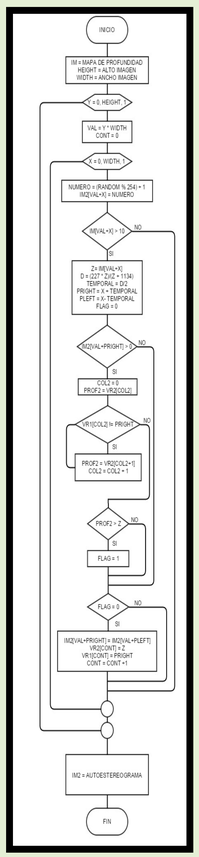


Fig 2. flowchart algorithm implemented

Autoestreogram Generation

The algorithm implemented, calculated the autostereogram based on a model of arbitrary geometry. Initially is provided a picture depth map, as an initial pattern for Autostereogram generation. Fig 3.

Fig 3. Depth map of an image of a pony [1].

To print the autostereogram is correct, the maximum depth of the scene should be bounded by background plane. Thus, the plane that covers the entire visible region of the scene is placed at a distance z(P) Fig 4.

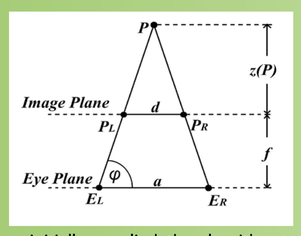


Fig 4. Relationship between two pixels with a focal length and a constant eye distance assumed [2].

From the depth map initially supplied, the algorithm to generate autostereograms, transform the initial pattern iteratively until the final autostereogram is built. Starting on the left side of the map deep, in each step, the properties of depth and representation apply in subsequent rows of the image.

In each iteration step, the pixel of the image is projected on the plane for the left eye in the opening scene geometry, and is projected back into the plane for the right eye. This produces a line autostereogram that does not vary under the subsequent iteration steps, unless it finds echoes in generating the autostereogram and correct eliminating giving priority the pixel more brightly. The depth range of the scene must have a minimum distance, in this project the value 11 as minimum depth range I was taken, from the back of the image. It follows that the minimum distance% of one point in the scene, it is non-zero.

The difference between the minimum and maximum distance of two representations in the plane of the autostereogram corresponds to the minimum and maximum depth observable in the scene. These distances are rounded to the nearest pixel position on the screen. As a result, depth discontinuous steps are displayed.

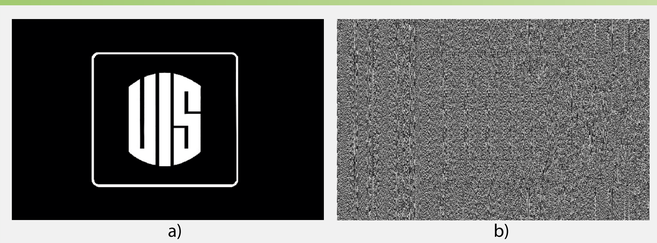


Fig 5. a) Depth map of an image of uis logo. b) Autostereogram generated based on the depth map of an image of uis logo

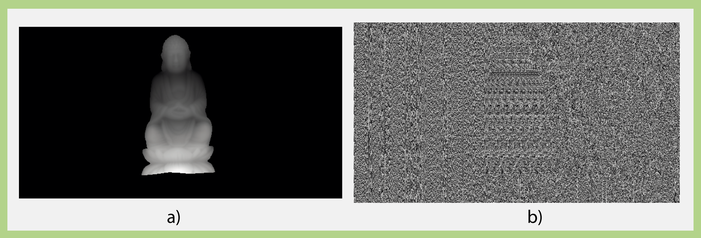
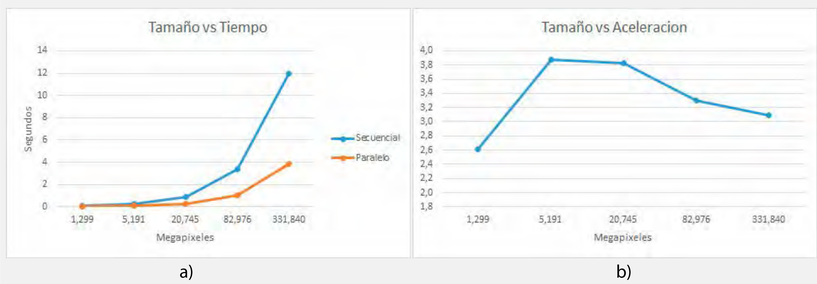


Fig 6. a) Depth map of an image of Buddha [3]. b) Autostereogram generated based on the depth map of an image of Buddha.

For the implementation in scalable architectures, was identified that in the process of generating there is dependency between each pixel in a row, but in turn there is no dependence between rows of pixels, achieving parallelized to generate sequences of pixels of each row and the projection of the points left eye and right eye, to get the final autostereogram, using only the amount of threads and blocks required for their generation.

CONCLUSIONS AND FUTURE WORK

As a result of this project, it is concluded that the objective was met, achieving minimize runtime, with an acceleration of 3 times. Getting the following results.



a) b)

Fig 7. a) Graphical results execution times . b) Graphical results acceleration

It is also concluded, that this project allows future work, as would facilitate the generation of autostereograms on video, which requires a more demanding computational work depending on the frames per second, as is the case in the generation of real time autostereograms. Requiring a single call to the kernel and further reducing the execution time.

MORE INFORMATION

For more information, visit the website: "http://www.cs3.uis.edu.co/parallel-sirds"

References

1. Deviantart, «Depth map». [On line]. Available: http://harmonex.deviantart.com/art/3D-Rarity-Depth-Map-273720163
2. P. Christoph, G.Bastian y M.Marcus, «Hardware-accelerated Autoestereogram Rendering for Interactive 3D Visualization,» Max-Planck-Institut für Informatik, p. 8.
3. The university of Wisconsin, «Depth map». [On line]. Available: http://pages.cs.wisc.edu/~lizhang/courses/cs766-2008f/projects/phs/students/barnard/results/buddha/depthMap.png

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