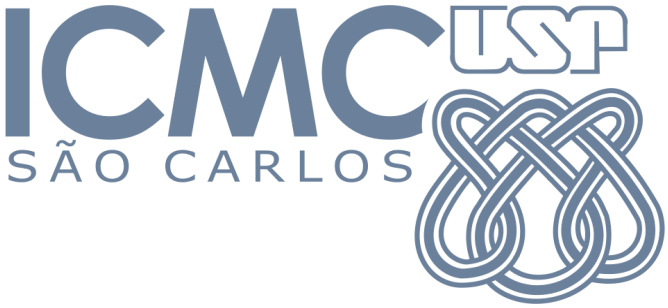

UNIVERSITY OF SÃO PAULO

INSTITUTE OF MATHEMATICAL AND COMPUTER SCIENCES

DEPARTMENT OF COMPUTER SCIENCE

SCC0251 – IMAGE PROCESSING

Alex Sander Ribeiro da Silva 9779350
Danilo Marques Araujo dos Santos 8598670

Implementing and Comparing Anti-aliasing Algorithms – Partial Report

Prof. Dr. Moacir Antonelli Ponti

São Carlos
2019

Index:

1. Introduction **2**

2. Input Images **2**

3. Supersampling **3**

3.1. Results obtained 3

4. Planned for the Final Report **5**

1. Introduction

Anti-aliasing is a technique designed to add greater realism to a digital image by smoothing jagged edges on curved lines and diagonals. It is largely used in games. Aliasing manifests itself as jagged or stair-stepped lines (otherwise known as jaggies) on edges and objects that should otherwise be smooth.[1]

The objective of this project is to implement and compare different anti-aliasing algorithms regarding their effectiveness. One of the algorithms that we have decided to implement and analyze is the supersampling.

2. Input Images

Any image in the RGB space can be used by these algorithms, but we are mainly aiming at games. Therefore, most of the images are screen captures of the game itself. To provide better comparisons, multiple images of the same game are taken while looking at the exact same spot, avoiding any moving particles and disabling animations if possible. All the game settings are also maintained, except resolution and built-in AA.

Usually, three to five images are used per game:

- One at the target resolution and without any AA, either as a base for comparison or input for some of our algorithms.
- One at the target resolution and with built-in FXAA, if available, for comparison.
- One at the target resolution and built-in 4x MSAA, if available, for comparison.
- One at the target resolution and both built-in FXAA and MSAA, if available (which is rare), for comparison.
- One at a higher resolution, to be used as input for some of our algorithms.

[1] "What is Antialiasing? - Definition from Techopedia." https://www.techopedia.com/definition/1950/antialiasing. Accessed 27 May. 2019.

3. Supersampling

Supersampling (SS) or postfiltering is the process by which aliasing effects in graphics are reduced by increasing the frequency of the sampling grid and then averaging the results down. This process means calculating a virtual image at a higher spatial resolution than the frame store resolution and then averaging down to the final resolution. It is called post-filtering as the filtering is carried out after sampling.[2]

The two steps in the post-filtering process are[3]:

1. Sample the scene at n times the display resolution. For example, suppose the display resolution is 512x512. Sampling at three times the width and three times the height of the display resolution would yield 1536x1536 samples.

2. The color of each pixel in the rendered image will be an average of several samples. For example, if sampling were performed at three times the width and three times the height of the display resolution, then a pixel's color would be an average of nine samples. A filter provides the weights used to compute the average.

We are implementing a simulated version of the Supersampling algorithm. It's "simulated" because we are only implementing the second step of process, which is the image processing part, and using images already sampled at higher resolutions as the input. This is done mainly because we aim to achieve anti-aliasing on already existent images, which could then be applied to, for example, games that do not have that feature available.

3.1. Results obtained

We've coded our own simulation of a supersampling algorithm and have applied it to a 1440p image of a game, generating a 720p supersampled image in 1 minute and 37 seconds.

The figures 2.1.1., 2.1.2. and 2.1.3. show the original image (without anti-aliasing), the image generated by our algorithm and and the image generated with the Fast Approximate Anti-Aliasing algorithm (FXAA) provided by the game:

---

[2] "Antialiasing methods." https://web.cs.wpi.edu/~matt/courses/cs563/talks/antialiasing/methods.html. Accessed 28 May. 2019.

[3] "Overview of Aliasing in Computer Graphics: Part 2." 4 Oct. 1999, https://www.siggraph.org/education/materials/HyperGraph/aliasing/alias2b.htm. Accessed 28 May. 2019.

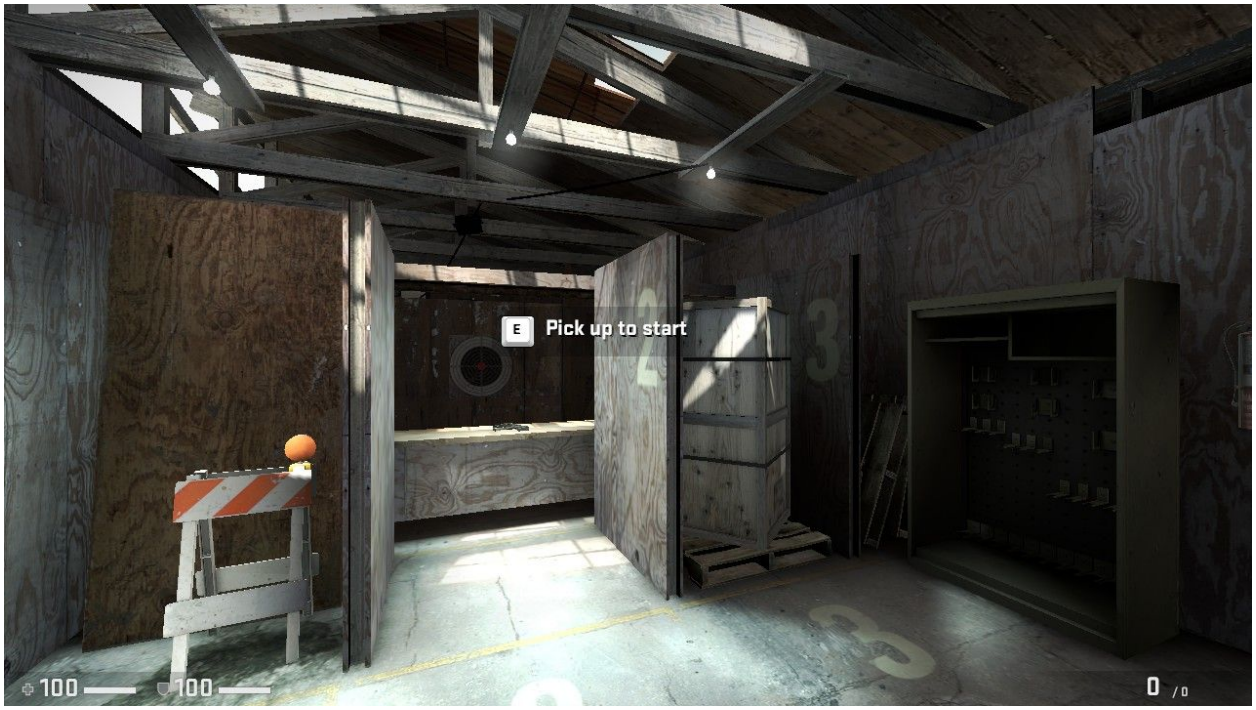

Figure 2.1.1. – original image. CSGO at 720p, no AA, captured from the game.

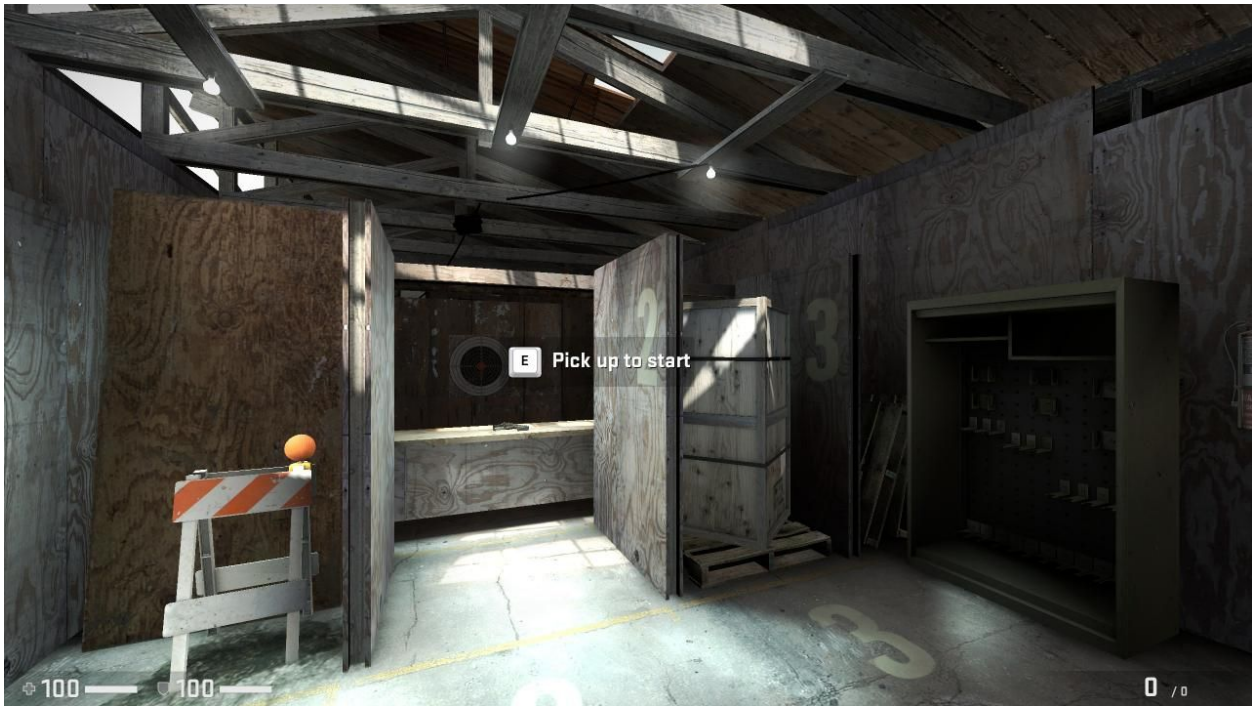

Figure 2.1.2. – image generated by using figure 2.1.1 as input for our SS algorithm (RMSE = 8.45).

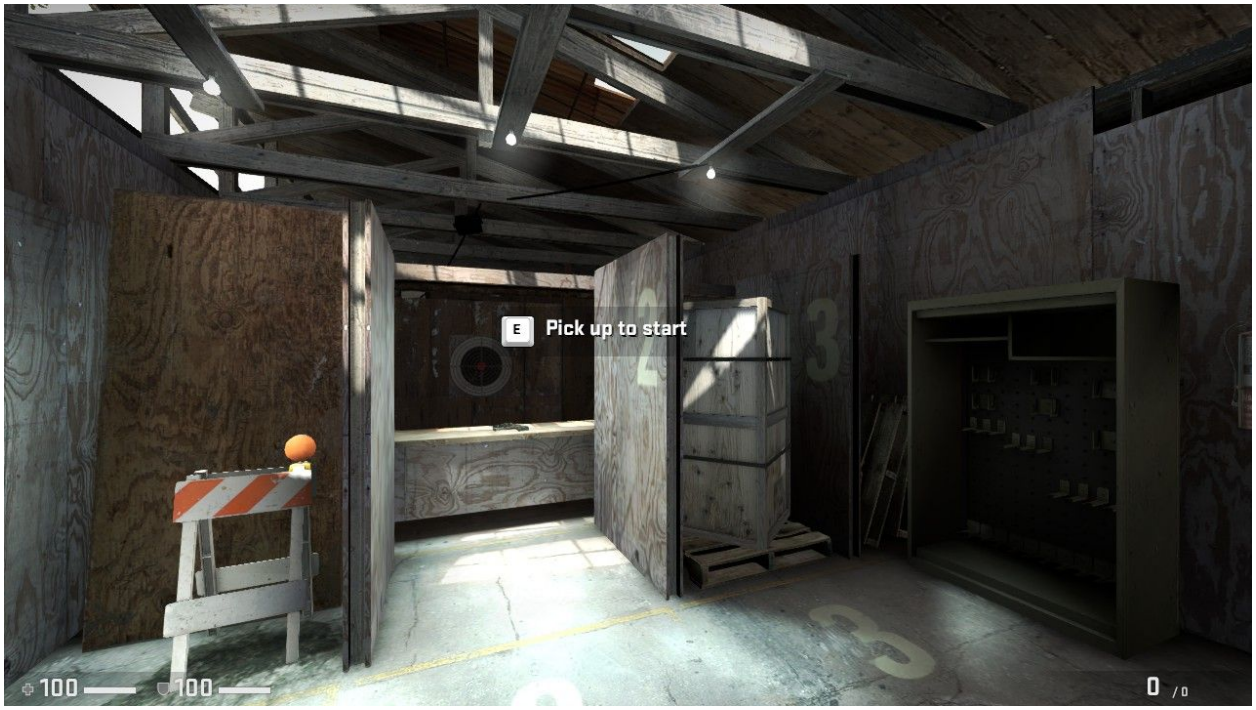

Figure 2.1.3. – comparison image. CSGO at 720p, built-in FXAA, captured from the game (RMSE = 5.012).

Of course, these images have a limited resolution on this page, but some differences can already be seen. The full sized images, as well as the results of two other games, can be found at https://github.com/dsantos-1/DIP_FinalProject/tree/master/Images.

4. Planned for the Final Report

- Other AA algorithms
- Better methods to show the difference between images
- Time comparison between algorithms
- Conclusions about comparison the algorithms results