# Acceleration Structures and Multithreading

To implement multithreading, I used the OpenMP library, in which each thread was responsible for rendering one line of the final image at a time. The hardware used was an ideapad320 notebook (from Lenovo), with an Intel Core i7-8550U processor, which works with 4 physical cores and a number of 8 threads.

The acceleration structure chosen to be implemented was a BVH. To help with the implementation the "Ray Tracing Deformable Scenes Using Dynamic Bounding Volume Hierarchies" paper was used. To partition the scene, I used the Surface Area Heuristic, given that it is capable of generating good trees estimating the computational expense of performing ray intersection tests each time a new node is created.

Bellow, we can see the informations about the generated image and the times taken through each technique, as well the combination of both.

**Number of primitives:** 1972 triangles
**Number of samples per pixel:** 20 samples

```
ryuugami@ryuugami-station:~/Codes/ray-tracer-university-project-master$ ./swpathtracer
  progress .........................: 100.00%
Buffer saving started... finished!
Time spent to render image: 0 horas 38 minutos 8 segundos
```

***No multithreading or acceleration structures***

```
ryuugami@ryuugami-station:~/Codes/ray-tracer-university-project-master$ ./swpathtracer
  progress .........................: 100.00%
Buffer saving started... finished!
Time spent to render image: 0 horas 8 minutos 18 segundos
```

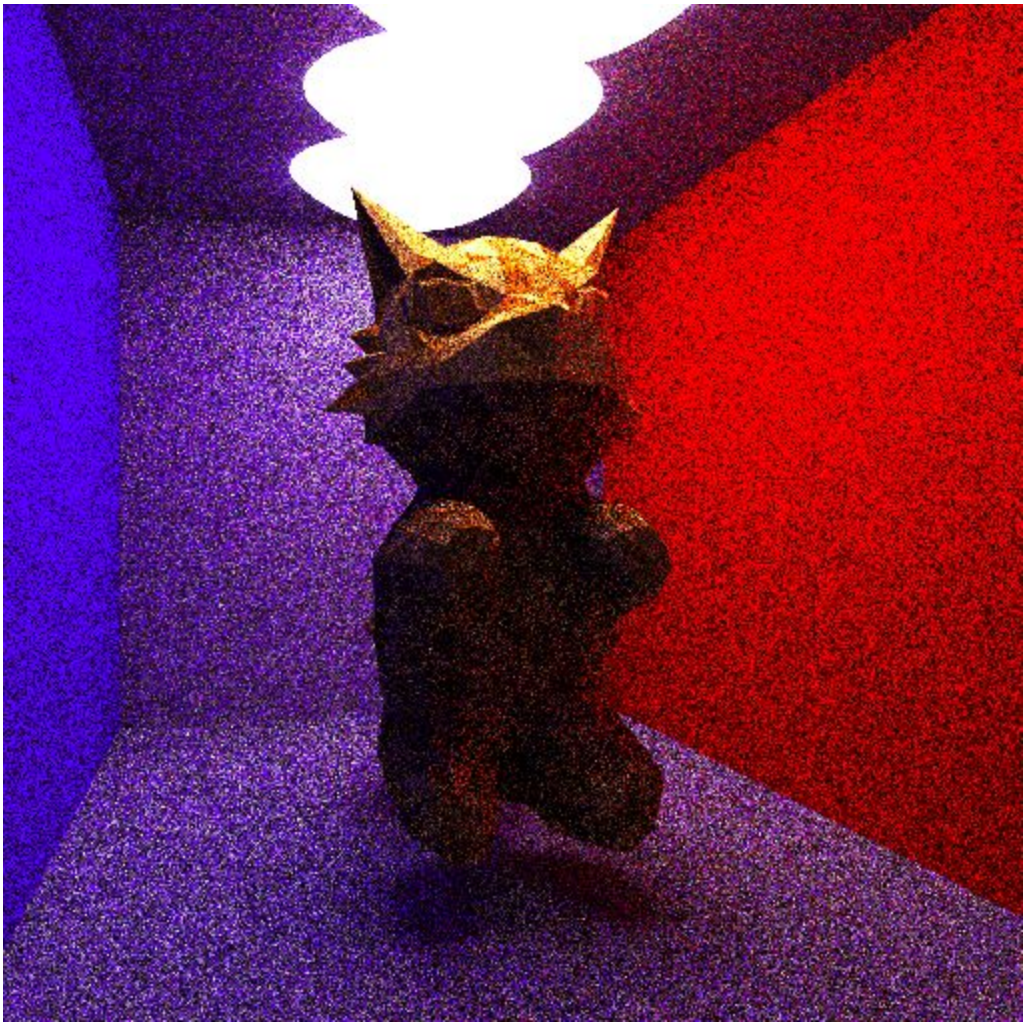
***With only multithreading***

```
ryuugami@ryuugami-station:~/Codes/ray-tracer-university-project-master$ ./swpathtracer
  BVH building progress ............: 100.00%
Time spent to build BVH: 0 horas 0 minutos 0 segundos
  progress .........................: 100.00%
Buffer saving started... finished!
Time spent to render image: 0 horas 1 minutos 12 segundos
```

***With only acceleration structure***

```
ryuugami@ryuugami-station:~/Codes/ray-tracer-university-project-master$ ./swpathtracer
  BVH building progress ............: 100.00%
Time spent to build BVH: 0 horas 0 minutos 0 segundos
  progress .........................: 100.00%
Buffer saving started... finished!
Time spent to render image: 0 horas 0 minutos 20 segundos
```

***With both, multithreading and acceleration structure***



***Generated image***