HOMEWORK 3

Denise Landini - 1938388

For extra-credit I choose to do:

1. **Ray-Patch Intersection (4 points):**

   To implement this extra-credit:

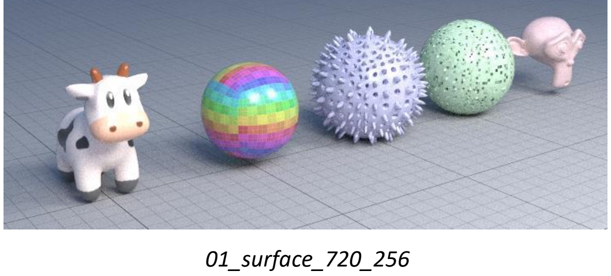
   a. In *yocto_pathtrace.h:*
   - I add **quads** in the struct pathtrace_shape;
   - I add **set_quads** in the part in which I write the shape properties.

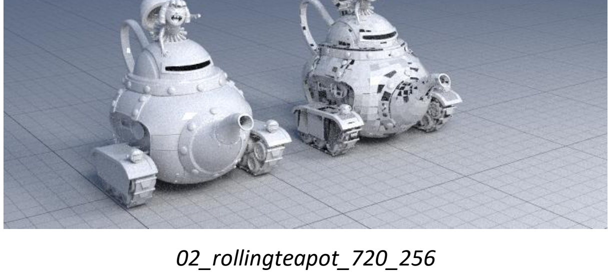
   b. I change the following functions in *yocto_pathtrace.cpp* by adding what it is necessary. The functions are:
   - Eval_position;
   - Eval_element_normal;
   - Eval_textcoord;
   - Eval_element_tangent;
   - Eval_normalmap;
   - Eval_shading_normal;
   - Init_bvh,
   - Intersect_shape_bvh;
   - Sample_lights;
   - Tesselate_shape.

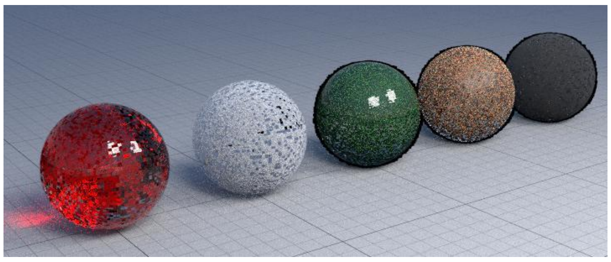
   c. In *yocto_pathtrace.cpp*, I create a new function **ray_patch_intersect**.

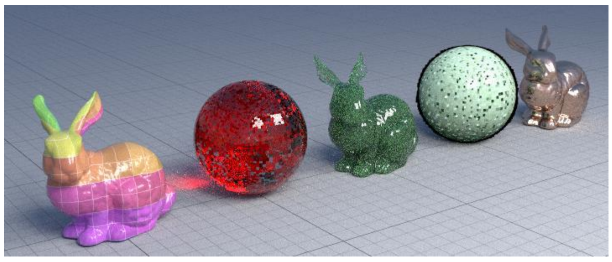
   d. In *ypathtrace.cpp* I change:
   - Init_scene.

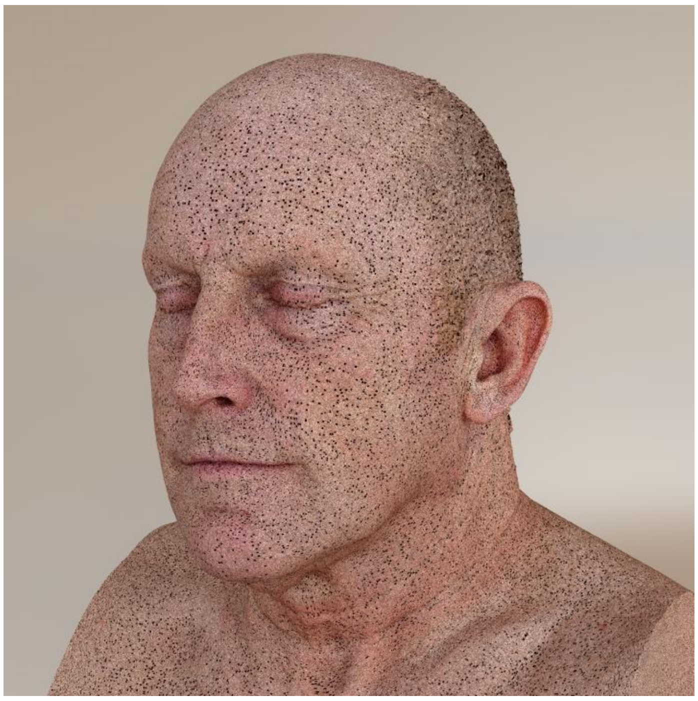
These are the pictures that I realize with my code, and I see that there is a problem, but I don't know how to resolve it.

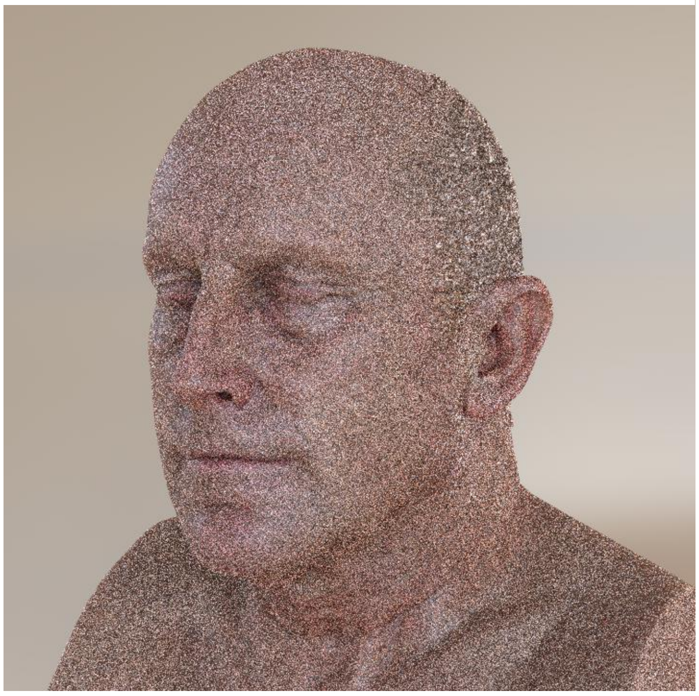

01_surface_720_256

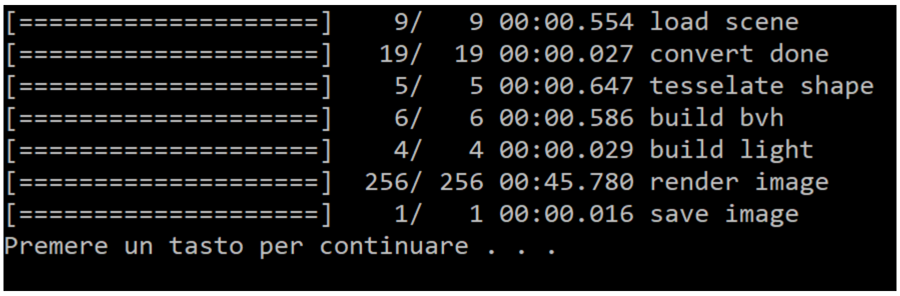

02_rollingteapot_720_256


03_volume_720_256


06_extra_720_256

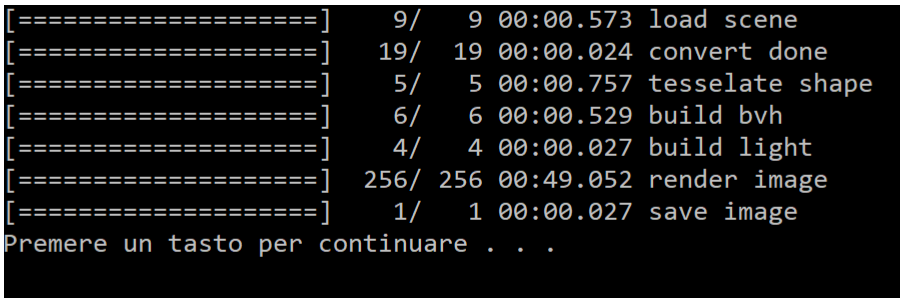

04_head1_720_256


05_head1ss_720_256



```
[====================]    9/   9 00:00.554 load scene
[====================]   19/  19 00:00.027 convert done
[====================]    5/   5 00:00.647 tesselate shape
[====================]    6/   6 00:00.586 build bvh
[====================]    4/   4 00:00.029 build light
[====================]  256/ 256 00:45.780 render image
[====================]    1/   1 00:00.016 save image
Premere un tasto per continuare . . .
```

Time without Ray_Patch_intersection



```
[====================]    9/   9 00:00.573 load scene
[====================]   19/  19 00:00.024 convert done
[====================]    5/   5 00:00.757 tesselate shape
[====================]    6/   6 00:00.529 build bvh
[====================]    4/   4 00:00.027 build light
[====================]  256/ 256 00:49.052 render image
[====================]    1/   1 00:00.027 save image
Premere un tasto per continuare . . .
```

Time with Ray_Patch_intersection

This is the comparison between the time without using Ray_Patch_intersection and by using it. I can see that the execution with Ray_Patch_intersection is slower that the other, even if of a few seconds.

2. Adaptive Rendering (4 points):

To implement this extra-credit:

a. In *yocto_pathtrace.h* I modified:
- pathtrace_params;
- pathtrace_state;

by adding some parameters and state that are useful.

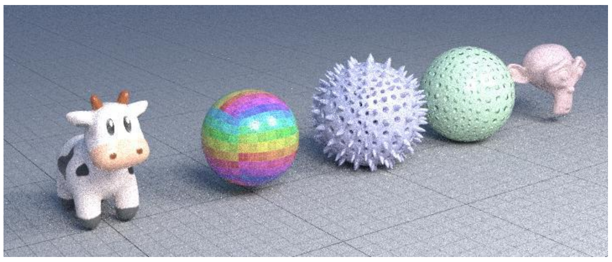
b. I add the following four structs:
- trace_info;
- pixel;
- sample_spread;
- statistic.

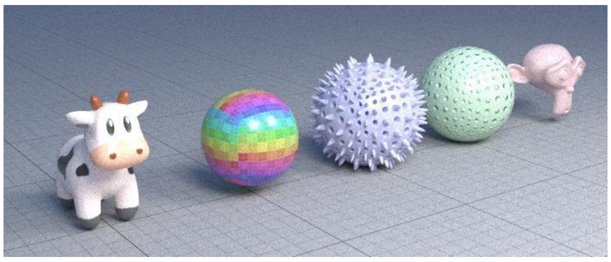
c. I add the following functions:
- progress_callback_adaptive;
- checkEnd;
- trace_sample;
- trace_until_quality;
- trace_by_budget;
- create_sample_spread;
- all_image_ij;
- parallel_pixels_in_list;
- trace_image;
- get_max_progress;
- get_actual_progress;
- collect_statistics.

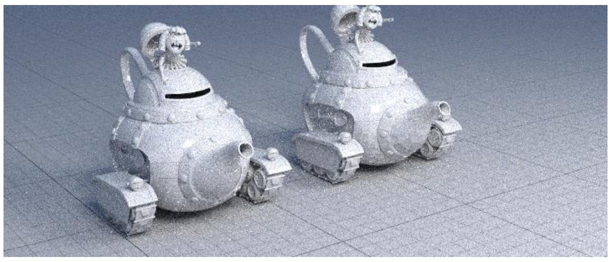
d. I create a new app called *ypathtrace_adpative.cpp*

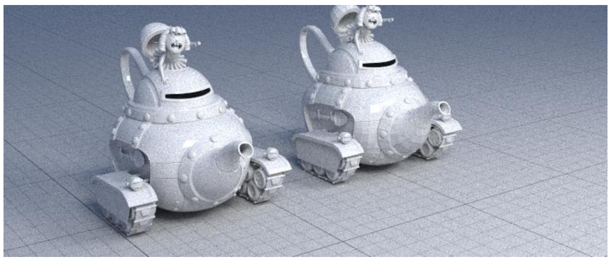
These are the pictures that I realize with my code.
At left there is the pictures that I realize with quality 1 and at right there are the pictures that I realize with quality 3.

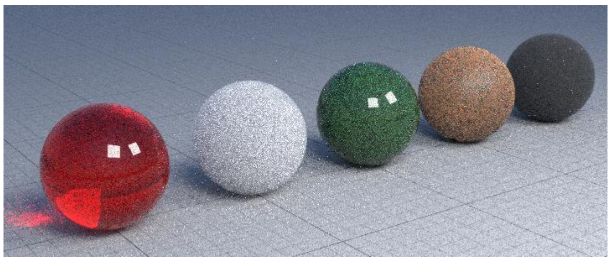
I can see that there is the difference that I was expecting: the better is quality 3.

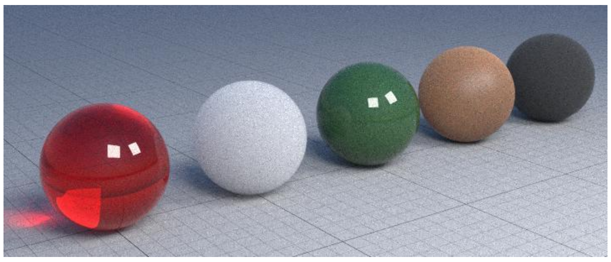

01_surface_720_256 q1

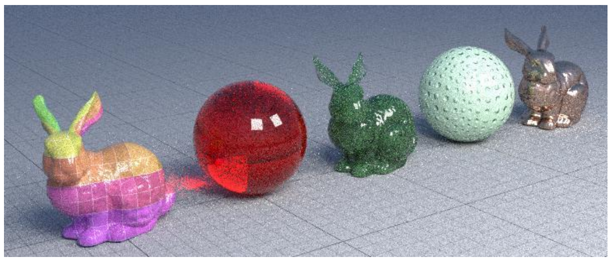

01_surface_720_256 q3

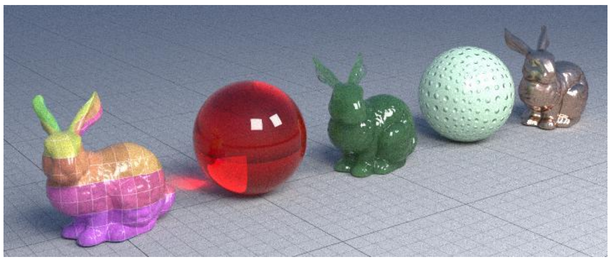

02_rollingteapot_720_256 q1

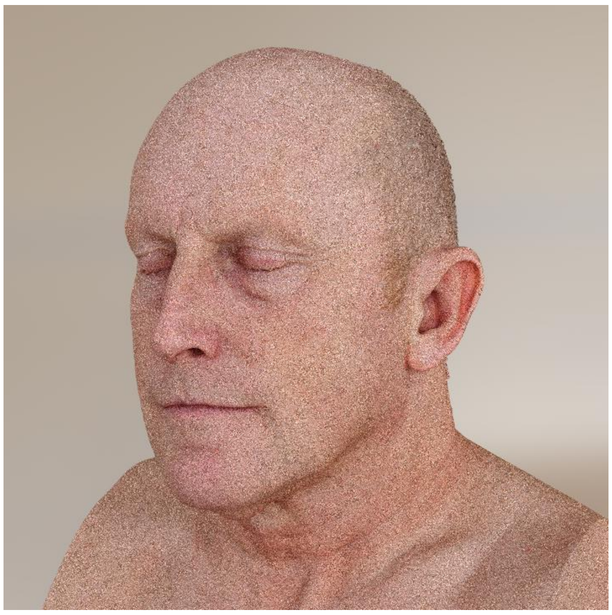

02_rollingteapot_720_256 q3

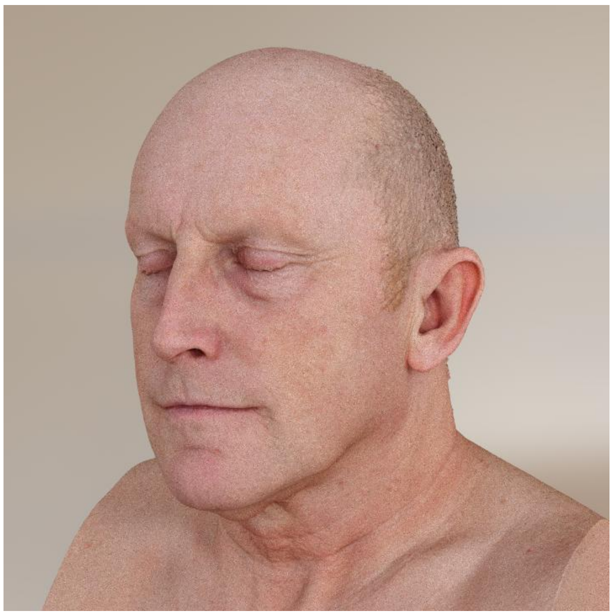

03_volume_720_256 q1

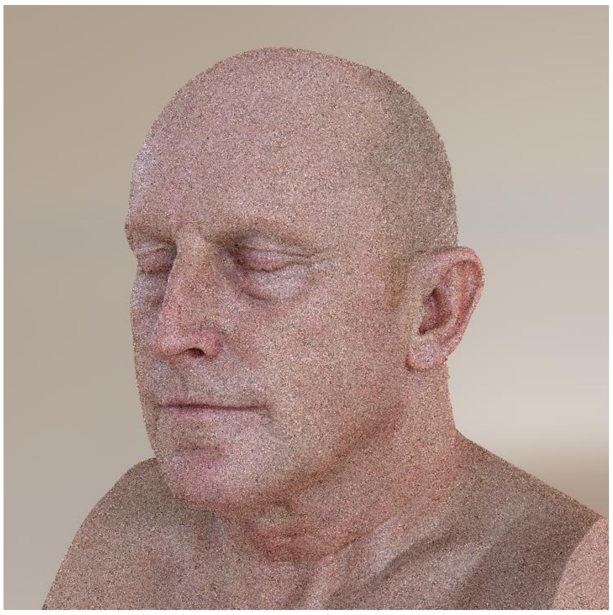

03_volume_720_256 q3

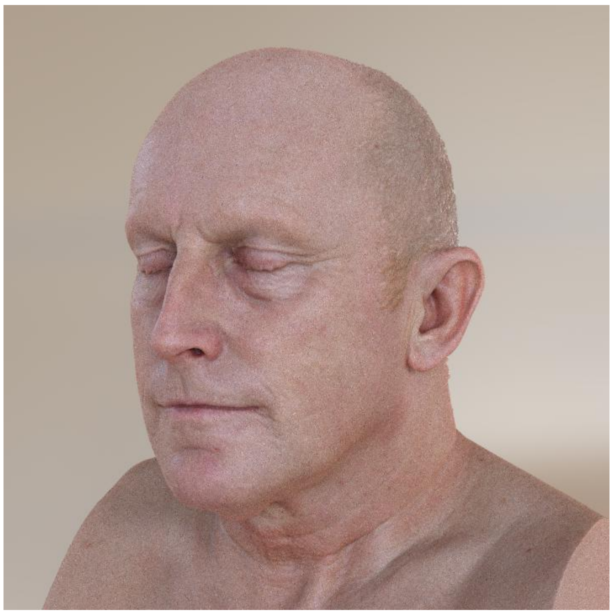

06_extra_720_256 q1


06_extra_720_256 q3


04_head1_720_256 q1


04_head1_720_256 q3


05_head1ss_720_256 q1


05_head1ss_720_256 q3