



# Ray Tracing

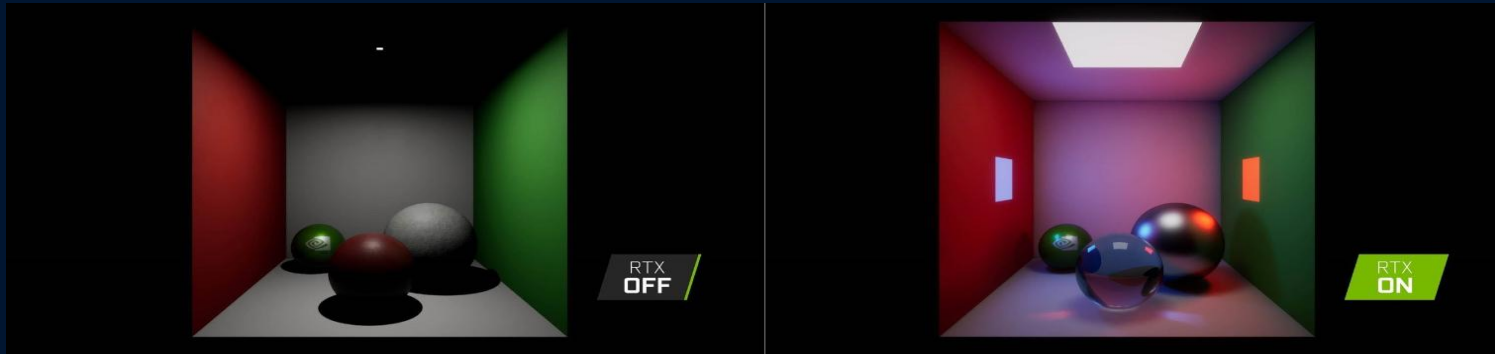
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A Video Game  
Algorithm

BY: Ahmed Krubally

# What Is Ray Tracing

Ray tracing is a rendering technique used in computer graphics to generate realistic images. It simulates the behavior of light by tracing the path of light rays as they interact with objects in a scene.



The algorithm works by shooting a ray from the camera through each pixel of the image, and calculating how the ray interacts with the objects in the scene. The color of each pixel is then calculated based on the light that reaches it through that ray.

# The Basic Steps Involved In Ray Tracing

01

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## CREATE

For each pixel on the screen, create a ray that starts at the camera and passes through that pixel.

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## TEST

Test if the ray intersects any object in the scene. If it does, calculate the point of intersection.

03

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## CHECK

Determine the amount of light that reaches that point from all the light sources in the scene.

04

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## CALCULATE

Calculate the color of the pixel based on the properties of the material at that point, the angle between the incoming light and the surface normal, and other factors.



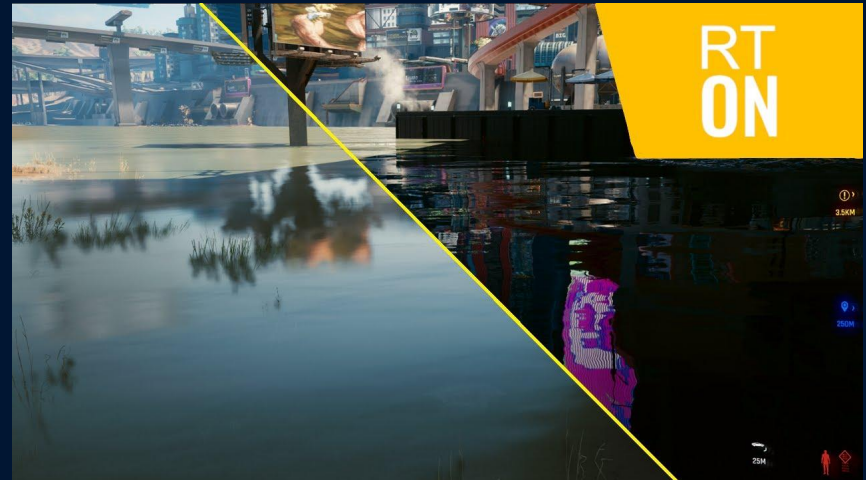
# Complexity

Ray tracing time complexity is generally  $O(N^2)$ , where  $N$  is the number of objects in the scene, but it can be reduced using modern techniques such as spatial partitioning and parallel processing to  $O(\log N)$  or  $O(1)$  in some cases.



# Complexity

Ray tracing space complexity depends on scene complexity and pixel count. It requires storing object information and ray tracing details, resulting in high space complexity. However, memory optimizations can reduce memory usage.





# OVERALL,

Ray tracing is a powerful algorithm that allows for realistic and visually stunning graphics in video games and other applications. However, it can be computationally expensive and requires careful optimization to achieve real-time performance.

