BVH 加速架構

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Outline

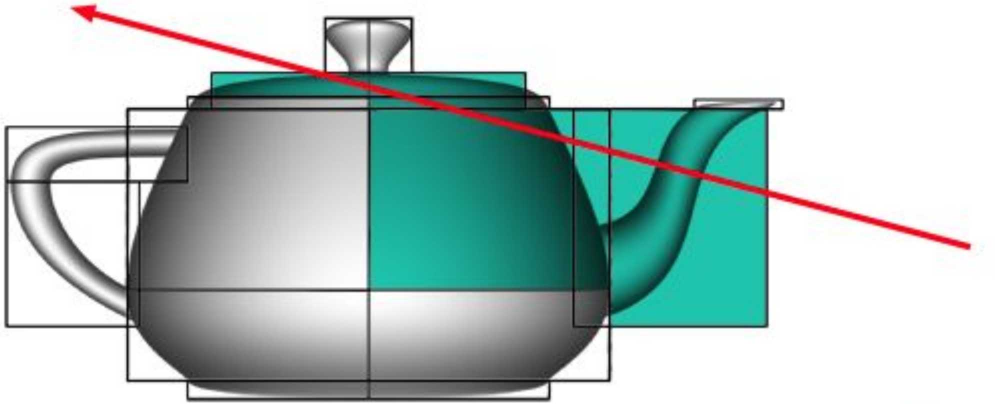
1. Bounding Volume
2. Bounding Volume Hierarchy
3. Experiment

Motivation

```
For every pixel
    Construct a ray from the eye
    For every object in the scene // Speed bottleneck
        Find intersection with the ray
        Keep if closest
        Shade
```

Bounding Volume

Bounding Volume



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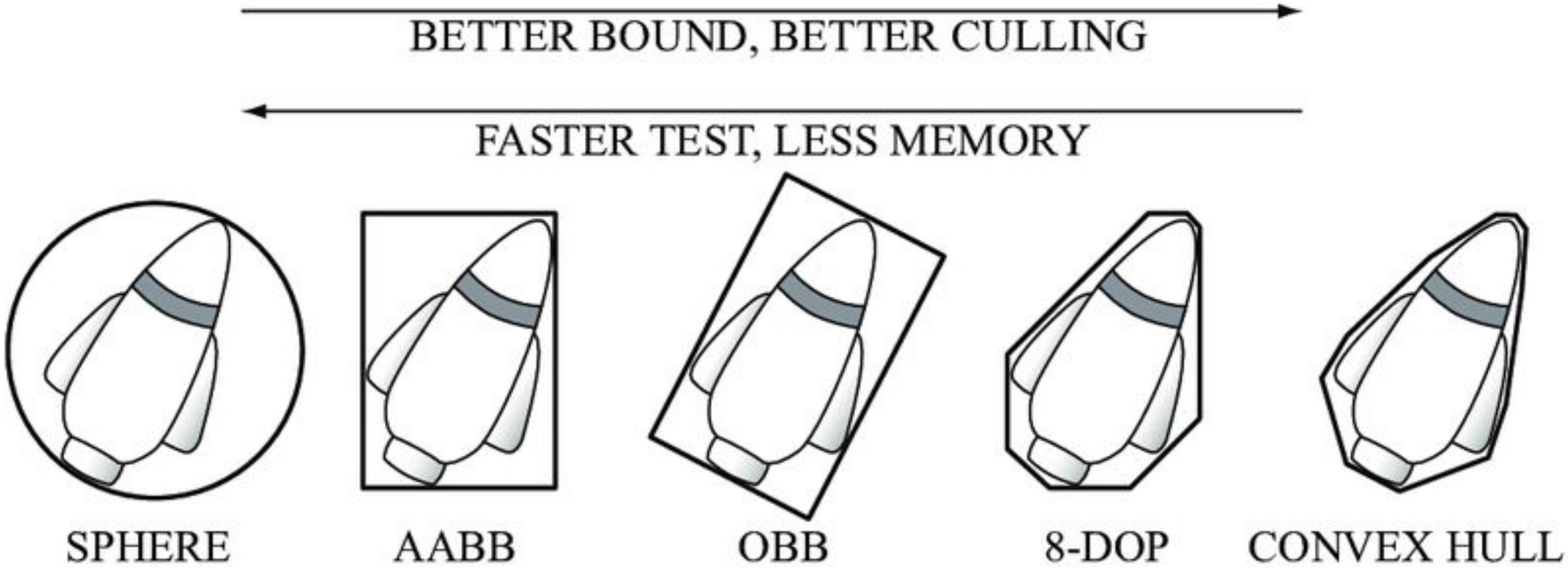
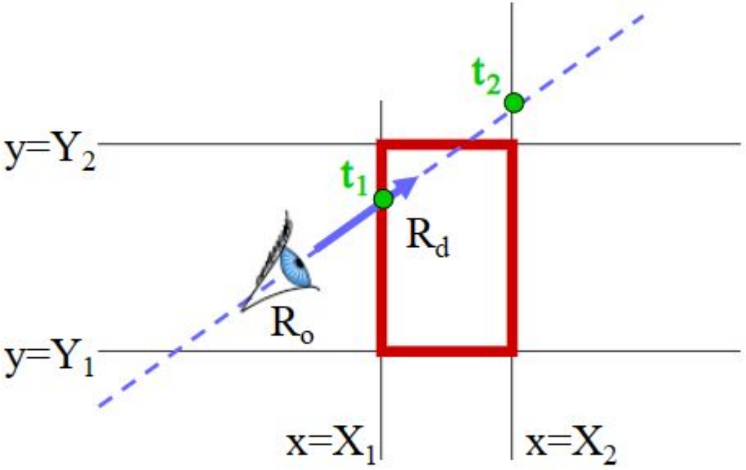
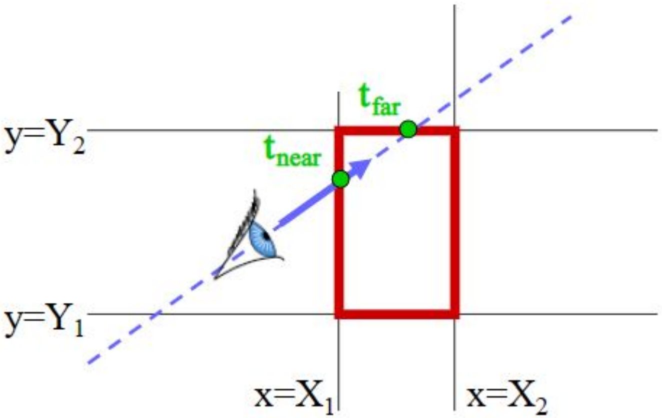
Bounding Volume

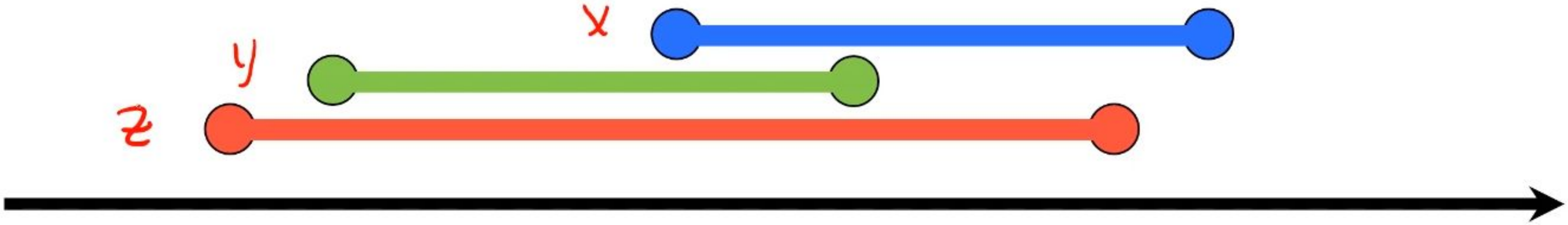


Axis Aligned Bounding Box



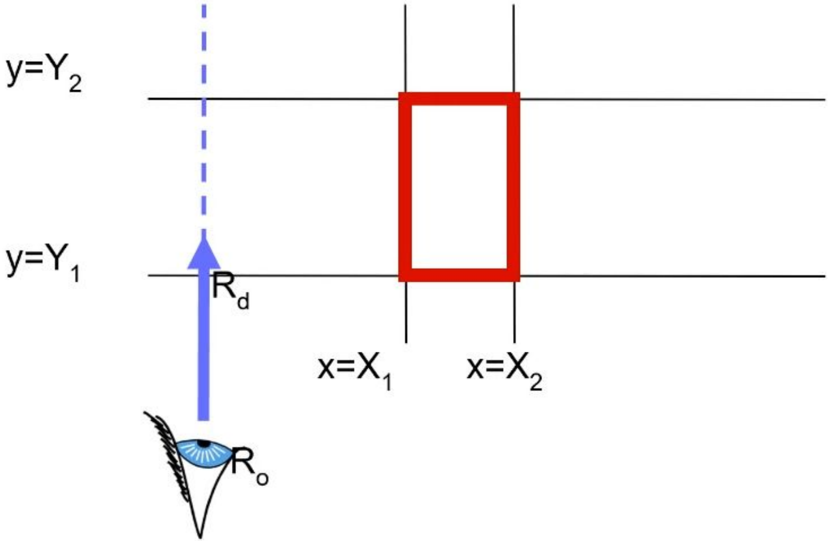


Axis Aligned Bounding Box



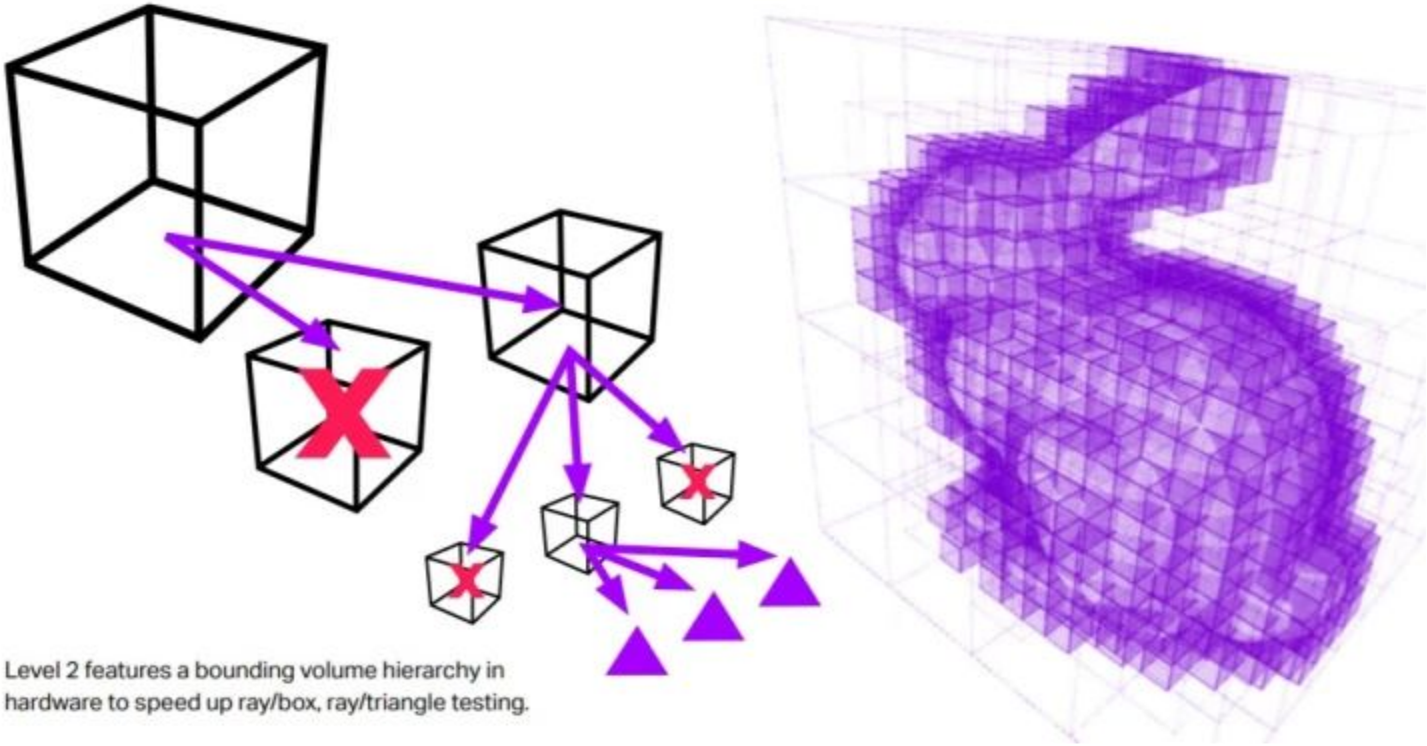
Axis Aligned Bounding Box

- Parallel Exception



Bounding Volume Hierarchy

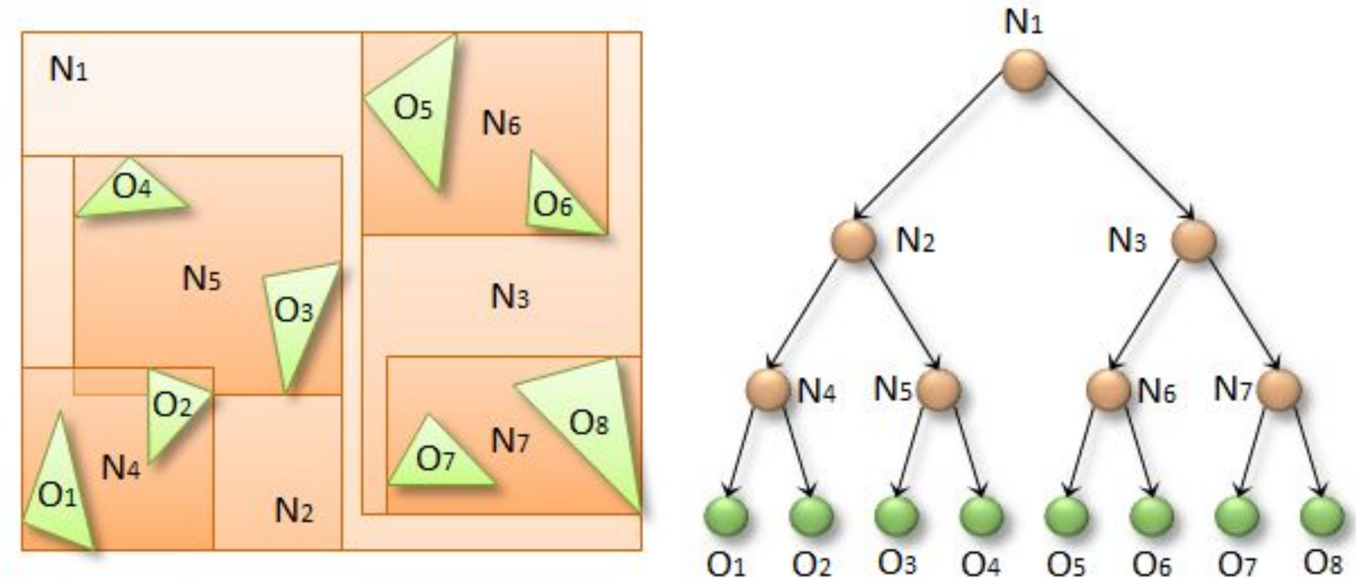
Bounding Volume Hierarchy



Level 2 features a bounding volume hierarchy in hardware to speed up ray/box, ray/triangle testing.

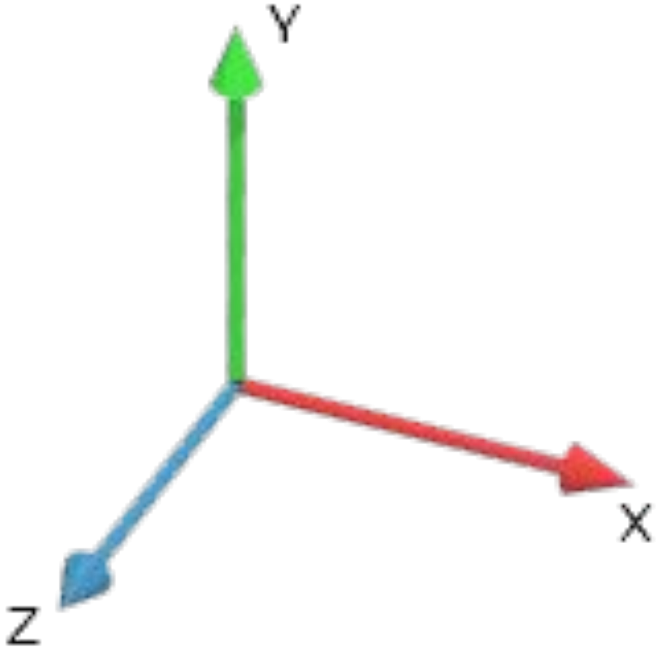
Main Idea

- Merge Cost: Unused volume



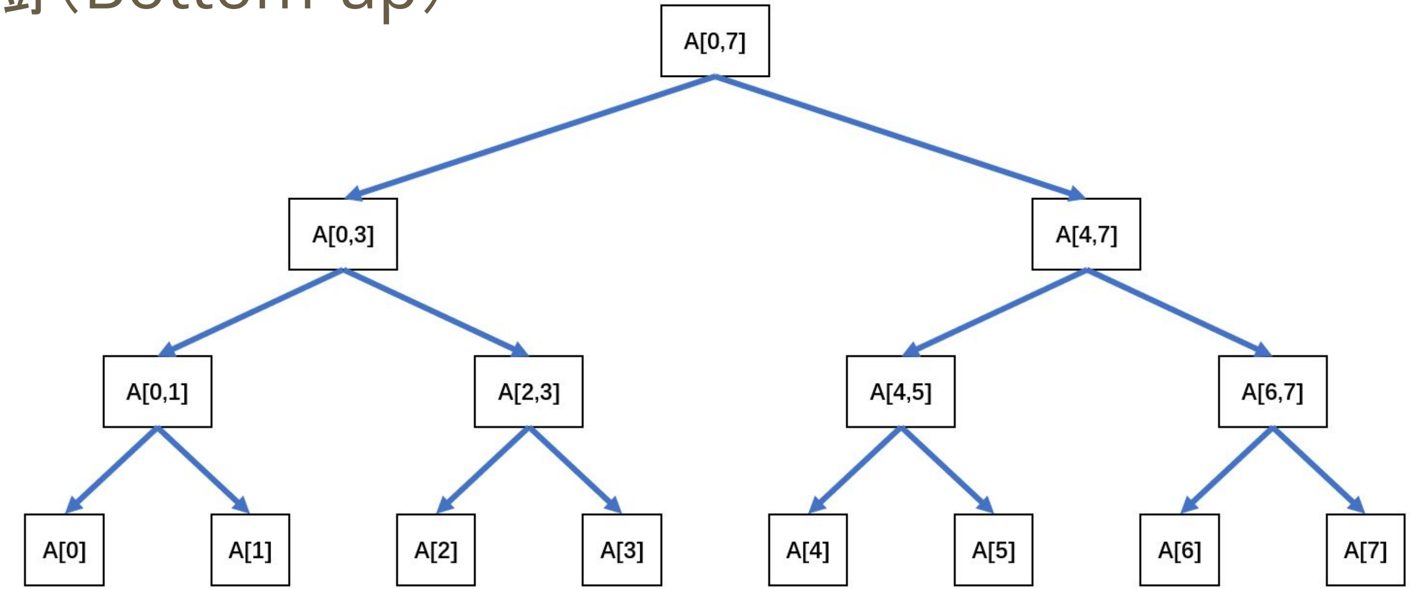
Box Sort

- 以最大跨幅軸進行排序
- 根據Max排序



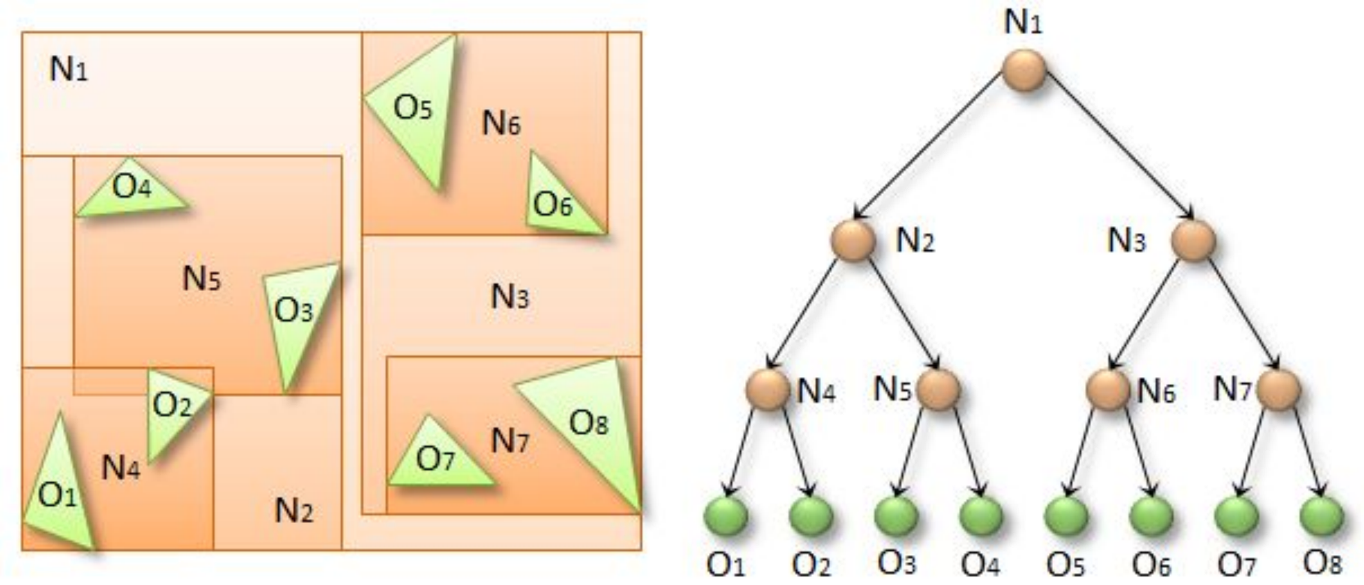
Binary Tree

- 線段樹（Bottom-up）



Pruning strategy

- Merge Cost < Limit



Experiment

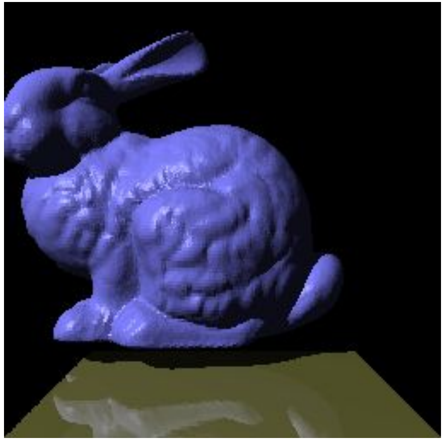
Experiment Information

Suzanne

970 polygons

Bunny

69668 polygons

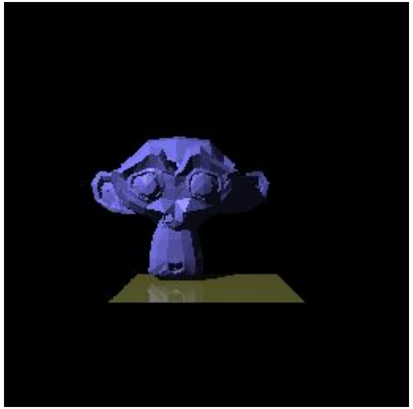


Experiment Results: With/Without BVH

	Without BVH	With BVH	Speed Up
Suzanne	11.17 sec	4.28 sec	61.68%
Bunny	858.81 sec	322.99 sec	62.39%

Experiment Information: Further Camera Distance (250%)

Suzanne

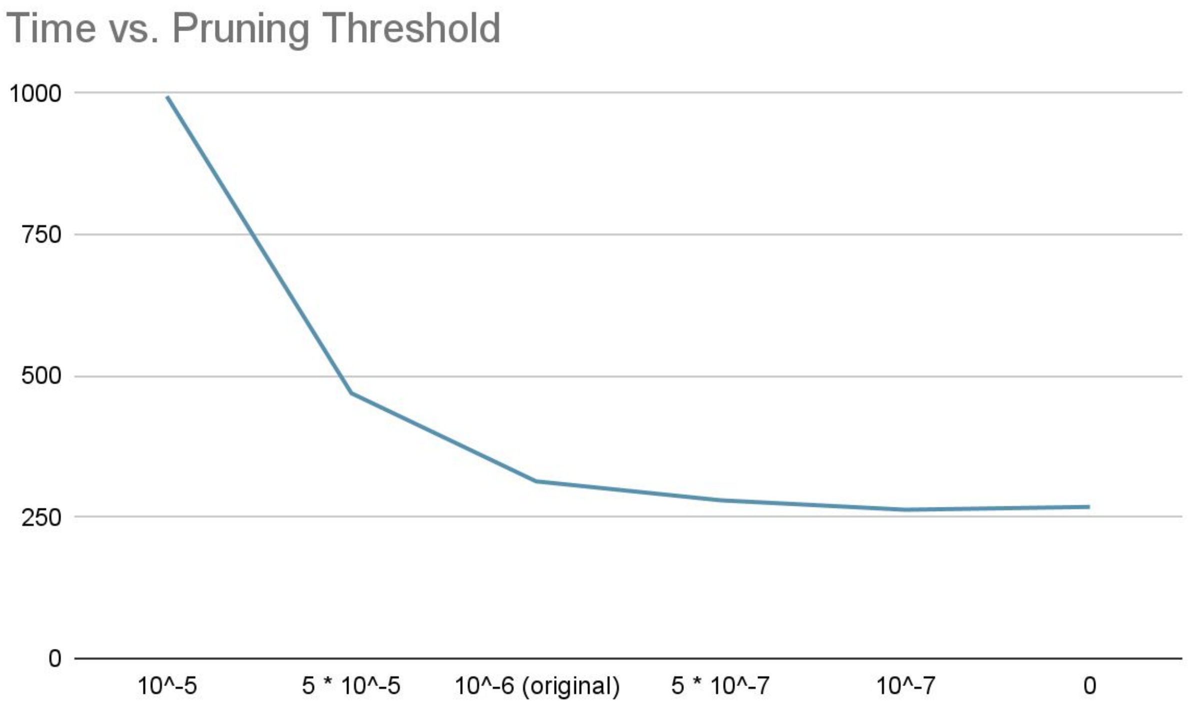


Bunny

Experiment Results: Further Camera Distance

	Without BVH	With BVH	Speed Up
Suzanne	8.91 sec	1.33 sec	85.07%
Bunny	556.63 sec	78.53 sec	85.89%

Experiment Results: Different Pruning Threshold



(Unfinished)Greedy Strategy

- 根據 merge cost 從小到大進行兩兩合併
- 需要動態計算新Node和其他Node的merge cost
    - 時間複雜度超標
- 只考慮相鄰合併，需要動態修改陣列
    - STL不可用
    - 需要手刻

Thank You For Listening!