Bounding Volume Hierarchy

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Bounding Volumes
Bounding Volume Hierarchy
Bounding Volume Hierarchy
BVH Construction for AABB

1. **Find minimal boxes**
2. **Split along longest axis**
3. **x is longest**
4. **Find minimal boxes**
OBB Construction
# BVH Complexity

<table>
<thead>
<tr>
<th>Model</th>
<th>Triangles (M)</th>
<th>Size of BVH (MB)</th>
<th>Mean and std of depth of leaves</th>
<th>Comp. time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hugo</td>
<td>0.02</td>
<td>2</td>
<td>16, 1.7</td>
<td>0.03</td>
</tr>
<tr>
<td>Bunny</td>
<td>0.07</td>
<td>8</td>
<td>17, 0.8</td>
<td>0.26</td>
</tr>
<tr>
<td>Dragon</td>
<td>0.8</td>
<td>108</td>
<td>21, 1.6</td>
<td>3</td>
</tr>
<tr>
<td>1M power plant</td>
<td>1.1</td>
<td>139</td>
<td>23, 2.9</td>
<td>6</td>
</tr>
<tr>
<td>Turbine</td>
<td>1.7</td>
<td>220</td>
<td>22, 0.7</td>
<td>8</td>
</tr>
<tr>
<td>Lucy</td>
<td>28</td>
<td>4,811</td>
<td>37, 3.4</td>
<td>34</td>
</tr>
</tbody>
</table>

Table 1: **Benchmark Models**: Model complexity, sizes of BVHs, mean and standard deviation (std) of depth of leaf nodes, and computation time to compute cache-oblivious layouts are shown.
View Frustum Culling
Example of Hierarchical View Frustum Culling
View Frustum Intersection
View Frustum Intersection
Frustum/Box Intersection
Distance Queries

\[ A - B = \{ a - b \mid a \in A, b \in B \} \]
Minkowski Sum/Difference

\[ A + B = \{a + b \mid a \in A, b \in B\} \]
\[ A - B = \{a - b \mid a \in A, b \in B\} \]

\[ A \cap (B + p) \neq \emptyset \]
\[ a = b + p \]
\[ p = a - b \]
\[ p \in A - B \]
Collision-Avoidance Motion Planning
GJK Algorithm for Convex Obj.