Progressive Splatting
Topics

• Splatting techniques
• Progressive Splats
  - Initial Splat Creation
  - Error Metrics
  - Progressive Splat Format
  - Results
• Comparison with other techniques
  - Performance
  - Overdraw
  - Visual Quality
• Conclusion
• Questions
Splatting techniques

- Level of Detail (LOD)
- Interactive Point Simplification (IPS)
- Optimal Splat Sub sampling
- Progressive Splats
LOD

Benefits
• Fast
• Easy to implement

Disadvantages
• Bad quality
Example

415 Splats Bunny Model
IPS

Benefits
• Fast (Slower than LOD)
• Better Quality than LOD

Disadvantages
• Still bad Quality compared to OSS and PSP
• More overdraw than the other methods
Example
415 Splats Bunny Model
OSS

Benefits
• Precise
• Good image quality
• Little overdraw (least of all methods)

Disadvantages
• Slow
• Scales badly
Example

419 Splats Bunny Model
Progressive Splats

- Initial Splat Creation
- Error Metrics and Splat Merge
- Progressive Splat Format
- Comparison to other techniques
Initial Splat Creation

\[ r = \max \| (p_j - c_i) - n_i^T (p_j - c_i) n_i \| \]

for all \( p_j \in N_k(p_i) \)
Error Metrics

Used for merging splats that overlap into bigger splats of a different shape.

$L^2$  

$L^{2,1}$
\[ \varepsilon_\Phi = \|e\| \cdot \sum_{f \in \{f_m\}} \left| \text{dist}(p_f, T_m) \right|^2, \quad \{f_m\} = \{f_l\} + \{f_r\} \]
L^{2,1}\text{Metric}

\[ \varepsilon_{\Phi} = \|e\| \cdot |T_l| \cdot |T_r| \cdot \|n_l - n_r\|^2 \]

Center

\[ c_m = \frac{|T_l| \cdot c_l + |T_r| \cdot c_r}{|T_l| + |T_r|} \]

Normal

\[ n_m = \frac{|T_l| \cdot n_l + |T_r| \cdot n_r}{|T_l| + |T_r|} \]
Progressive Splat Format

- You keep the information used during Error Metric.
- Upstream/Downstream without extra storage
Results

415 Splats Bunny Model
Comparison with other techniques

- Performance
- Overdraw
- Visual Quality
Performance

Time (sec.)

Num of splats $\times 10^5$

- LOD
- IPS
- PSP ($L^2,1$)
- PSP ($L^2$)
- OSS

Charlemagne
Dragon

- Bunny
- Dinosaur
- Iggy
- Isis
- Max
<table>
<thead>
<tr>
<th>$n_{splat}$</th>
<th>PSP</th>
<th>LOD</th>
<th>IPS</th>
<th>OSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>415</td>
<td>2.18</td>
<td>2.34</td>
<td>4.14</td>
<td>1.63</td>
</tr>
<tr>
<td>2591</td>
<td>2.52</td>
<td>2.71</td>
<td>4.12</td>
<td>2.15</td>
</tr>
<tr>
<td>11588</td>
<td>3.23</td>
<td>3.22</td>
<td>4.23</td>
<td>3.13</td>
</tr>
</tbody>
</table>
Splat amounts for LOD/IPS/PSP from left to right: 415, 2591, 11588, for OSS: 419, 2577, 11564
Conclusion

- Much faster than OSS
- Better Quality than IPS and LOD
- Less overdraw than IPS
- Visual quality pretty close to OSS
Questions