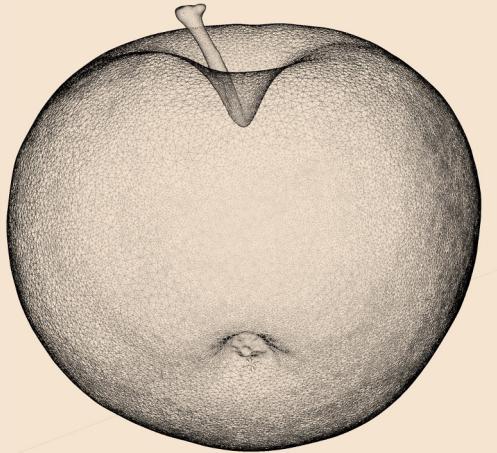


Point Based Painterly Rendering

Zachary Mayhew
CS 334





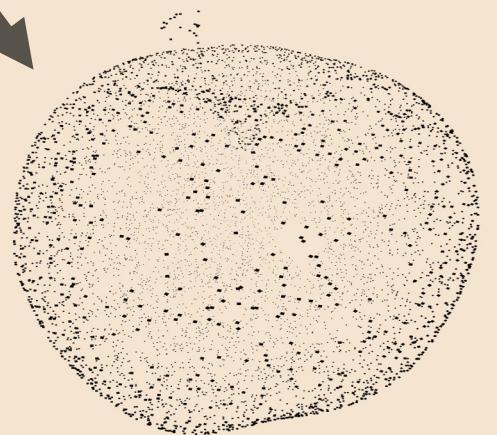
Mesh



Albedo Texture



Canvas Texture



Point Cloud



Composite Strokes



Final Image

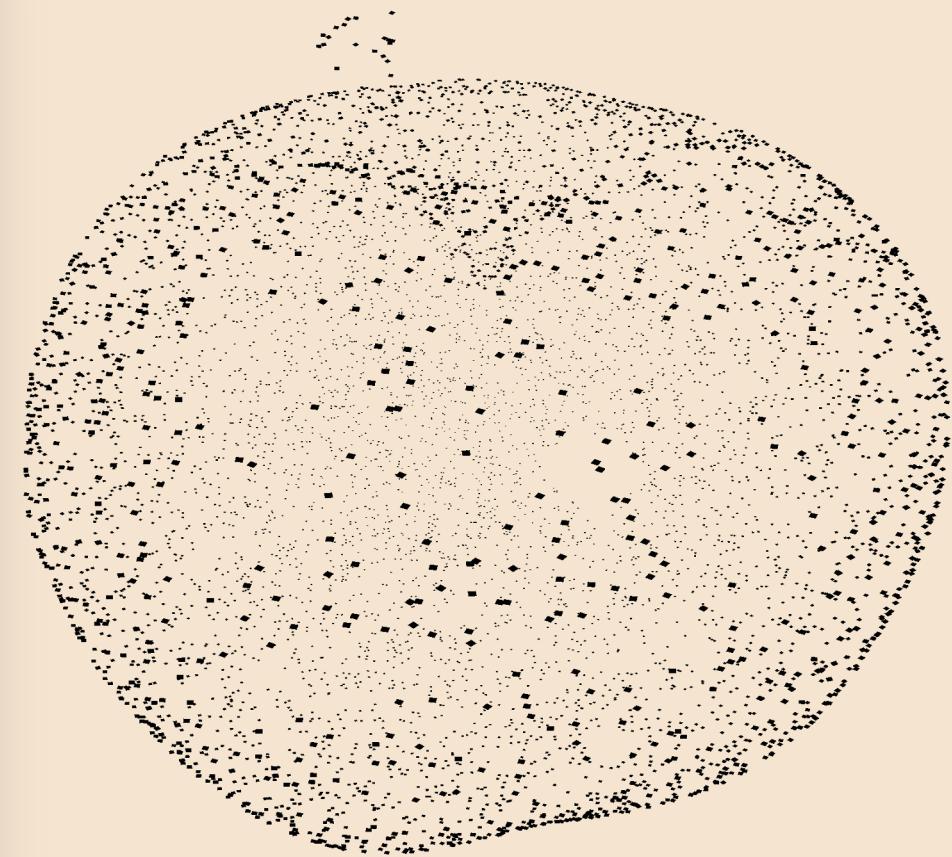


Brush Strokes

Based on:

Meier, B. J. (1996). Painterly rendering for animation.
Proceedings of the 23rd Annual Conference on Computer Graphics and Interactive Techniques, 477–484.
<https://doi.org/10.1145/237170.237288>

```
struct Point {  
    pub position: [f32; 3],  
    pub normal: [f32; 3],  
    pub tangent: [f32; 3],  
    pub bitangent: [f32; 3],  
    pub uv: [f32; 2],  
    pub brush_index: i32,  
}
```



```
let num_points_f32 = area * density;
let mut num_points = num_points_f32.floor();
let num_points_remainder = num_points_f32.fract();
if rand::random() < num_points_remainder {
    num_points += 1;
}
for _ in 0..num_points {
    let mut u1 = rand::random();
    let mut u2 = rand::random();
    if u1 + u2 >= 1.0 {
        u1 = 1.0 - u1;
        u2 = 1.0 - u2;
    }
    let position = A + AB * u1 + AC * u2;

    let (u, v, w) = gen_barycentric_coords(...);
    let normal = A_normal * u + B_normal * v + C_normal * w;
    let uv = A_uv * u + B_uv * v + C_uv * w;
    points.push(Point { ... })
}
```

```
Loaded model red-apple-2_red-apple-2_0 with 86824 triangles
red-apple-2_red-apple-2_0:
    Total area: 7.048687
    expected density: 2200
    actual density: 2217.5762
    error: 0.7989169%
Generated 15631 points for model red-apple-2_red-apple-2_0 (115.166µs)
```

```
points.par_sort_by_cached_key(|point| {
    let point: Vector4<f32> = perspective
        * view
        * model
        * point.extend(1.0);
    Reverse(Ord(point.z / point.w))
});
```

Sort time for 70,000 points: ~5.5ms
(Apple M1 Pro – 10 cores)

```
if (quantization != 0) {
    vec3 hsv = rgb2hsv(v_color.xyz);
    hsv.z = max(
        floor(hsv.z * (quantization - 1.0) + 0.5) / (quantization - 1.0),
        1.0 / quantization
    );
    v_color.xyz = hsv2rgb(hsv);
}
```

$$\frac{\lfloor color * (n - 1) + 0.5 \rfloor}{n - 1}$$

