3D Complexity Class Notes

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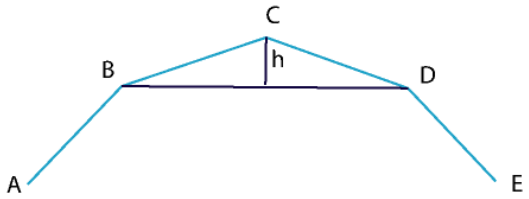
1 How to estimate the radius of curvature at a vertex?

What is the radius of curvature, r(c), at C?



Method 1: Fit a circle to (B, C, D)

$$r_1(c) = \frac{(L_1)^2}{8h}, L_1 = \|BC\| + \|CD\| \tag{1}$$

Method 2: Fit a parabola.

$$r_2(c) = \frac{(L_2)^2}{8h}, L_2 = \|BD\| \tag{2}$$

Notice that L_1 and L_2 are converging so that $L_1 = L_2$. When h is strong L_2 is better. L_1 also has no concept of the order of the vertices. Method 2 is Jarek recommended.

2 How to estimate the normal at vertex C?

Tangent at C is simply:

$$T_C = \frac{T_{BC} + T_{CD}}{2} \tag{3}$$

$T_C \| BD$ (they are parallel)

3 "Visual" fidelity

Not so much about geometry...more about the way it looks.

Maps (roads)

- topological consistency between real world and map.
- left, straight, winding.

We need to preserve the qualitative attributes of a curve.

Examples of things to preserve:

- Extrema
  - Number of extrema
  - Relative size, position.
- Orientation (with respect to each other)
- Features
  - junction
  - endings
  - max/min
  - inflection point
  - local curvature extrema

The human is good at detecting vertical and horizontal lines. It's also good at recognizing similar shapes and finding patterns.

4 Measuring the error between curves

Remember the poor man's Hausdorff distance algorithm?

Problems: trade off between accuracy and computation time. Is there a bound to our Hausdorff approximation?

$H <= h$, where H is the real Hausdorff and h is the approximation.

5 Hierarchical simplification

a.k.a. Multiresolution. This is the "please the biggest offender" idea.