

Re: Arrange points so polygon is not self intersecting

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- *From:* Michael Press <rubrum@xxxxxxxxxxxx>
 - *Date:* Wed, 11 Jul 2007 04:27:57 GMT
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In article

<hvj693pj2ijl1qf2i5jpbq8cbns6ulcvka3@xxxxxxxx>, quasi <quasi@xxxxxxxx> wrote:

On Tue, 10 Jul 2007 01:17:50 -0700, Michael Press <rubrum@xxxxxxxxxxxx> wrote:

In article

<3f4693hbnrev4prjvpl3irnjo3ke90r13e@xxxxxxxx>, quasi <quasi@xxxxxxxx> wrote:

On Mon, 09 Jul 2007 20:10:54 -0700, Michael Press <rubrum@xxxxxxxxxxxx> wrote:

In article

<1184022077.952496.276860@xx>, mekmon@xxxxxxxxxxx wrote:

Hi all,

I was wondering if someone knows some sort of algorithm to find an order for a set of points so that the polygon of those points is not self-intersecting. Assume this is a 2-D plane with Euclidean geometry.

Re: Arrange points so polygon is not self intersecting

Find the convex hull of the points and draw a convex polygon.

Find the convex hull of the remainder of the points and draw a convex polygon.

Remove an edge from each polygon and connect the two polygonal arcs into a polygon without self intersections.

This seems similar to Chip Eastham's construction, but I think your version, by ending up as a closed polygon at each stage, appears more careful about making sure that you can get back.

Find the convex hull of the remainder of the points and draw a convex polygon.

Continue until all points are incorporated.

There are still a few issues.

One issue is that the innermost hull might not be a polygon. It might be a line segment or a point. I don't think that presents a problem but it needs to be at least thought through.

Another issue is the loss of convexity.

A four by four square grid of points cannot be connected into a convex polygon.

You misunderstood what I was worrying about. I wasn't trying to imply that you can make a convex polygon out of any finite point set. My concern has to do with how you connect from the polygon after a given ring is finished to the next inner ring. The polygon is only convex right after the outer ring is done. As long as the lack of convexity of a polygon after a given stage doesn't affect your argument, then there's no problem. I'm not doubting that you can do it -- I just feel you need to specify more fully how to connect to the next inner ring.

Re: Arrange points so polygon is not self intersecting

I expect ray tracing from the interior of the newly formed convex polygon can be made to discover candidate edges for joining.

Another scheme goes like this.

Let P be the set of all points.

Form the convex hull of all points.

If this contains all points we are done.

Sort the points by y -coordinate.

Let A be a point with maximum y -coordinate.

Let Z be a point with minimum y -coordinate.

A and Z are part of the convex hull.

Let $\text{arc}(AZ)$ be a set of points in the convex hull joining A and Z .

Let $S = P \setminus \text{arc}(AZ)$

Run a horizontal sweep line over S .

This sweep line visits each point of S in order of its y -coordinate.

In case of multiple points with equal y -coordinates,

sort on the x -coordinate.

The points can be joined in the order of visitation,

into a serpentine polygonal arc with no self intersection.

Finally, join the serpentine and $\text{arc}(AZ)$.

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Michael Press

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