

Spatial Trees

4/27/2009

Opening Discussion

- Do you have any questions about the exam?
- Do you have any questions about the project?

Spatial Trees

- We started last time talking about computational geometry and at the very end discussed some aspects of how we can break space into regions to help us with various tasks.
- The most flexible ways of breaking things up are typically trees. We saw that a binary tree can be viewed as a 1-D spatial tree.
- There are lots of options for spatial trees.

Quad/Octrees

- The most conceptually simple spatial trees are the quad/octrees.
- These break a space into a number of regions appropriate for the dimension of the problem at each level.
- They can be region or point based, uniform or non-uniform.
- Don't work well for high dimensional spaces.

Implementation

- As with all trees, the spatial trees are a collection of nodes with one node as the root.
- For point based, every node stores a particle, the split happens around that particle. Have proper number of references for children.
- For region based the leaves can store one or more particles. Internal nodes store split values and children.

kD-Trees

- For some applications (high dimensionality or odd geometry) the kD-tree is a better alternative.
- It splits on one dimension at a particular value for each internal node.
- Methods of picking split dimension and value differ.
- Rules for region based vs. point based are the same.

Implementation

- Most of the implementation is very similar to the quad/octree, but you store an int for what dimension to split on with the value of the split.
- Building the tree can be done incrementally or using a quicksort like method. The latter guarantees balance.

No Hard Rules

- One of the things about spatial trees is that there generally aren't hard and fast rules.
- I have had region based octrees where the data has a “size” and I place data elements higher up in the tree based on size.

Other Variations

- There are other more complex spatial trees like BSP trees that are often used in 3-D graphics applications.

Minute Essay

- Do you have any questions?
- Keep working on your project.