Visualizing Binary Trees Embedded in Hypercubes

CPSC 533C Project Update
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Motivation

• Binary decision trees are prevalent
• Most multiprocessor systems modelled after n-dimensional hypercubes
• Does there exist a static assignment of a binary tree with $2^k$ nodes in a k-dimensional hypercube?
  – Communication in a hypercube of processors
Problem Statement
(not the visualization problems)

• The embedding problem:
  – Assign nodes of a binary tree to nodes of a hypercube of equal size with no dilation
  – Problem is NP-Complete [Wagner]
  – Parallel methods used last term
  – Stochastic methods used this term
  – Build and embed random binary trees
Problem Statement
(the visualization problems)

• Can my embedding visualization be used to create more intelligent embedding heuristics

• Show 2 embeddings of the same tree
  – Show embedding of either tree
  – Show the differences in the hypercube
  – Show similarities in the hypercube

• Visualization will (hopefully) lead to insight
Status

• Using Geomview and Java, can display trees with coloured embeddings
• Two embeddings can be compared
• An entire hypercube of 6 dimensions can be shown with no occluded edges
• A partial hypercube of an embedding can be shown with same structure
Current solutions

- Drawing a 6 dimensional cube in 3 dimensions is possible with 3 dimensions slightly skewed
- Tree layout doesn’t overlap, could be better
- Everything is drawn incrementally
  - bad in X, better in GL
- Extensible GUI to allow for different hypercube views
Upcoming Features

• The ability to solve problems
• Edge picking
• Better tree layout
• A better user interface
An Interactive Demo

• How do things look now
• What’s next
• Let’s play “find the edge”…
Questions

Comments?

Suggestions?

What would you do better?
Something went wrong with the demo…

• Here are some pictures