S18 24-783 Advanced Engineering Computation
Team Project Proposal

Team name: The Good, the Bad and the Ugly
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Proposal 1:
ADAPTIVE MESHING FOR CLOTH ANIMATION

ABSTRACT

Most of the numerical simulation methods regarding cloth draping are based on mechanical models. Graphically, the representation of this model is likely to be a uniform grid. Fabrics being a very flexible material, a number of wrinkles appear on its surface when submitted to free or constrained motion (collision/applied load, supports). The problem regarding the simulation run is to represent realistically the mechanical system surface and its associated motion which are strongly related to mesh discretization. We propose a new method based on adaptive meshing allowing the mechanical system to behave without any constraint related to a uniform mesh. Numerical examples are given to show the efficiency of the method.

Visualization Video:
https://www.youtube.com/watch?v=OdX48c0B-GM
Orinigal Research Paper:
Julien Villard and Houman Borouchaki, Adaptive Meshing for Cloth Animation, Proceedings of 11th International Meshing Roundtable, 2002

Proposal 2:
CHESS ENGINE DEVELOPMENT

ABSTRACT

Implementing a chess engine from scratch which plays against a user. We are planning to use a Negamax search approach to evaluate what move to execute by the computer. The key challenge arises from the high average branching factor of 35 for the game of chess, which just allows us to look ahead 4 moves in a reasonable time. To augment this, better heuristics and pruning methods will be considered to prune large parts of the tree and consider only interesting regions. This will enable us to look more steps into the future and help in taking better informed decisions. Alpha-Beta Pruning and Principal Variation Search are some such methods which we are interested in implementing.

Reference Blog: http://www.frayn.net/beowulf/theory.html#nullmove
Technical Paper: Marsland, T. A. Single-agent and Game-tree search. Department of Computing Science, University of Alberta, 1991.

Proposal 3:
HASHLIFE IMPLEMENTATIONS

ABSTRACT
Hashlife is an algorithm which utilizes Memoization in order to increase the algorithmic efficiency of the classic
Conway's Game of Life. Due to the proclivity for many patterns in the simulation to reemerge and the ubiquity of empty regions, a memoized algorithm which uses hash tables to store the nodes of a quadtree was determined to be more efficient than the brute matrix implementations. The group would seek to recreate Hashlife and test efficiencies upon minor changes to the algorithm. A great reference is the second source listed below which details utilization of hash tables to optimize time complexities.

[1] R.Wm. GOSPER Symbolics Inc, 845 Page Mill Road, Polo Alto, California 94304, and Lawrence Livermore National Laboratory, Livermore, California 94550, USA
[2] Pesqui. Oper. vol.35 no.2 Rio de Janeiro May/Aug. 2015