PREDICTING ATOM POSITIONS USING MACHINE LEARNING ALGORITHMS

Project Team:

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April 23, 2014

Executive Summary

The Steck Lab is investigating the motion of a single atom in a Magneto Optical Trap (MOT). The atom is imaged using a pair of aspheric lenses and a CCD camera. Given an 2D image from the CCD, the lab wants to predict the probability distribution of the atom's location within the MOT.

1 Project Description

To tackle this problem we will run simulations of the CCD output for a given atom location by solving the linear wave equation using a Partial Differential Equation (PDE) Solver. The output images will be labeled by atom location and used as training set for machine learning algorithms. The algorithms can then be used to generate a probabilistic distribution for the atom's location for a new CCD image.

2 Highlevel Architecture
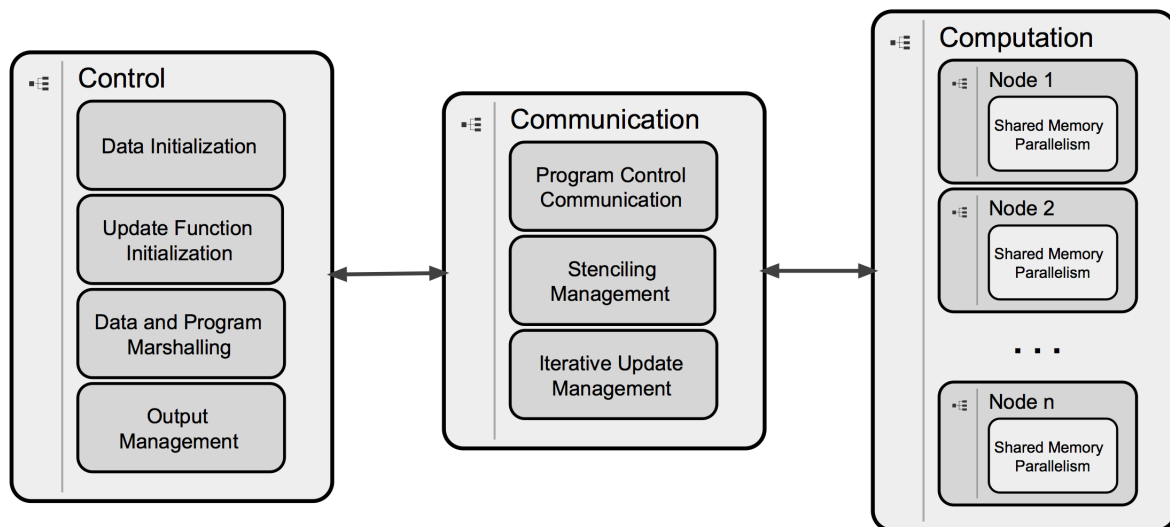
Figure 1: High Level Data Flow Architecture Diagram

Figure 1 shows a block level diagram of the project data flow. There are three main components to the solution.

Simulation

Machine Learning

Visualization

2.1 Simulation

2.2 Machine Learning

2.3 Visualization

2.4 Data Format

The data will be formatted in the standard Visualization Tool Kit (VTK) format. We will use a regular regtagonal structured grid.

3 Parallel Plan

The each stage of the project data flow includes several places to introduce and explore parallelism.

Simulation PETSc...

Machine Learning Which algorithms and how...

Visualization Visit, paraview...

4 Project Schedule

Week	Deliverable
5	Petsc PDE solver installed and running data runs, identify parallel classifiers and get them running
6	Get classifiers working on acciss and extend/create code based on prediction goals.
7	Process initial Petsc ouput to identify best classifiers.
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