Cut-And-Stitch
Efficient Parallel Learning of Linear Dynamical Systems on SMPs

Lei Li (leili@cs.cmu.edu), Wenjie Fu, Fan Guo, Todd C. Mowry, Christos Faloutsos

Problem Definition

• Problem: Given a Linear Dynamical System, to find the model parameters.
• Traditional Method: Maximum Likelihood Estimation via Expectation-Maximization (EM) algorithm
• Objective: Parallelize the learning algorithm
• Tool: OpenMP with shared memory parallelism

Proposed Method: Cut-And-Stitch

“Leap of faith” start computation without feedback from previous node (cut), and reconcile later (stitch)

Experiments

• Dataset: 58 motion capture sequences. Each with 93 dimensions (bone positions).
• Setup: tested on both SMP (SGI Altix) and desktop multicore (4-core)

Speed up over the sequential algorithm

Quality: Reconstructed v.s. Real

Conclusion

• General approximate parallel learning algorithm for LDS
• Near linear speed up
• Quality (RMSE): ~ identical to sequential learning
• Promising Extensions:
  - Cut-And-Stitch for HMM
  - Cut-And-Stitch for general Markov models

Dataset and software available at http://www.cs.cmu.edu/~leili/paralearn/