Leveraging Resource Bottleneck Awareness and Optimizations for Data Analytics Performance

Tiago Barreto Goes Perez, Xiaobo Zhou (Advisor)
University of Colorado, Colorado Spring

Introduction

Spark Tuning:
• Current tuning work is resource-oblivious
• Spark has dozens of performance affecting parameters, previous tuning work modifies one at a time

Spark Memory Management:
• Spark LRU caching policy is DAG-oblivious
• Current DAG-aware solutions do not take into account the reference-distance and gaps between data usage

Motivation

PETS:
• Use of Fuzzy Logic with resource awareness feedback
• Tuning is expedited by the use of Parameter Ensemble Tables, which allow multiple parameters to be tuned simultaneously

MRD:
• Reference-distance (job and stage) is defined the distance between current workflow processing and data block usage
• MRD has centralized (pre-fetch and purge) and distributed (eviction) components

Design

Evaluation

PETS:
• Speedups of up to x4.78;
• Convergence as low as 2 iterations;
• Performance stable with varying workload data sizes, homogenous and heterogeneous clusters, and varying initial parameters.

MRD:
• Average performance improvement over LRU by 53% and up to 4x faster;
• Improvement over other DAG-aware caching policies up to 68% and on average 32%;
• Best results with workloads that are I/O intensive, have high stage-reference distance and high reference per stage values.