Parallel Data analytics and stragglers

Job

Task1
Task2
Task3

Straggler

Intuition

Design Space

Wasted Resources

Speculative Execution

LATE

Dolly
Mantri
Wrangler

Wasted Time in detecting stragglers

Load-Balancing

Without Wrangler

Few highly loaded nodes

With Wrangler (p=0.7)

Faster Job Completion

Share data across nodes and workloads:
Multi Task Learning

Proposal

• Underlying modeling task remains the same
• Learning from other similar tasks
• Reduce training data capture time
• Improve accuracy by generalizing better

Regularized MTL [KDD’04]:

\[ W_t = W_0 + V_t \]

Common across all the learning tasks

Specific for a learning tasks, t

Our Formulation:

\[ W_t = W_0 + V_t + W_g(t) \]

Common across the tasks in a group, denoted by g

Evaluation

Workload: FB2009

Prediction Accuracy: 70-80%

Scalability!

Train too many models separately

Why? Heterogeneity across nodes and tasks

Prohibitively long data capture time

Wrangler: Architecture

Model Builder

Confident ?
Predictive Scheduler

Utilization Counters
Heartbeats
Scheduling Decisions

Approach: Binary Classification
Input: Perf. counters at launch time
Label: Yes/No

Share data across nodes and workloads: Multi Task Learning

Training Problem

\[
\begin{align*}
\min_{W_0, V_t, b} & \quad \lambda_0 \| W_0 \|^2 + \frac{\lambda_1}{T} \sum_{t=1}^{T} \| V_t \|^2 + \sum_{t=1}^{T} \sum_{i=1}^{m_t} \xi_{it} \\
\text{s.t.} & \quad y_{it} \left( (W_0 + V_t)^T x_{it} + b \right) \geq 1 - \xi_{it} \quad \forall i, t \\
& \quad \xi_{it} \geq 0 \quad \forall i, t
\end{align*}
\]