SLS Runtime Visualization

THE PROBLEM DOMAIN: STOCHASTIC LOCAL SEARCH

- Class of meta-heuristics for solving hard combinatorial optimization problems
  - They explore a solution (search) space by moving from one complete (potentially infeasible) solution to another via some definition of a neighbourhood.

- Common (academic) problems: satisfiability (SAT), traveling salesman problem (TSP), job shop problem (JSP), vehicle routing problem (VRP)
  - (all NP-complete)

- Substantial portion of SLS development time is spent analyzing and tuning their performance

THE PROBLEM DOMAIN: STOCHASTIC LOCAL SEARCH

- Can be instrumented to provide information about the runtime behaviour of the search

- solution quality over time/iteration
  - Not always as simple to describe as academic problems. An industrial scheduling problem may be measured using 30+ (competing) objectives.

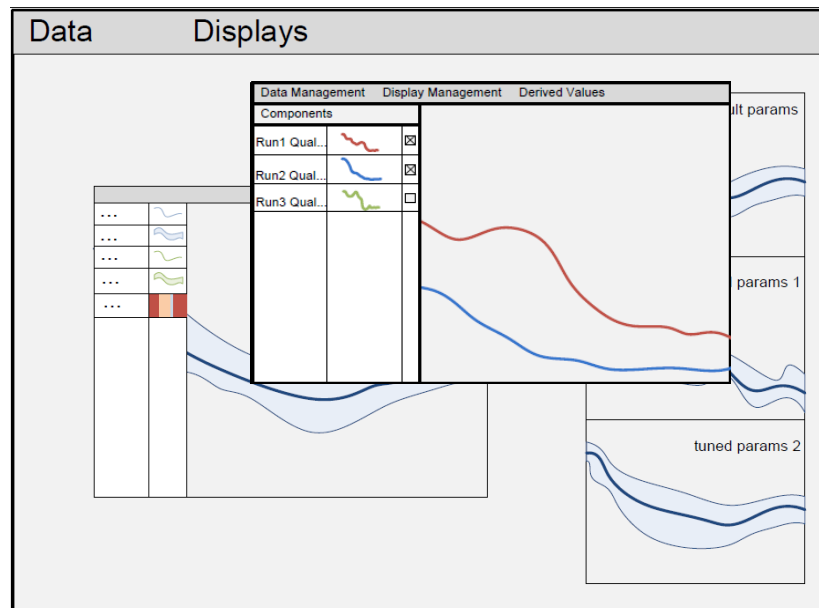- solution over time/iteration
  - solutions can be very large

The Problem Domain: Stochastic Local Search

- state of the search over time/iteration
  - contents tabu lists, nogood caches, size/contents of neighbourhoods
  - current strategy (ie, intensification vs diversification)

The Visualization Approach

- Issue #1: No standard visualization task

- Solution: Interactive creation of multiple layered time series plots

The Visualization Approach

○ Issue #2: Data collect may not be what you want to be visualizing, may be interested in

- aggregate runtime behaviour
- similarity of solutions over time to some elite solution
- etc.

○ Solution: Generating derived values.

The Visualization Approach

- Issue #3: Lots of collected data, but only a small subset is important at a time

- Solution: Pivoting view of available data sets
  - Relevant data sets are likely to be (near) neighbours under some pivot

Evaluation Data Set

- Focusing on subtle variations of Keld Helsgaun's LKH implementation (state of the art SLS for TSP)
  - Testing done on TSPLIB instances
    - optimal solution known for each one

- Substantially different behaviour despite very similar search strategies
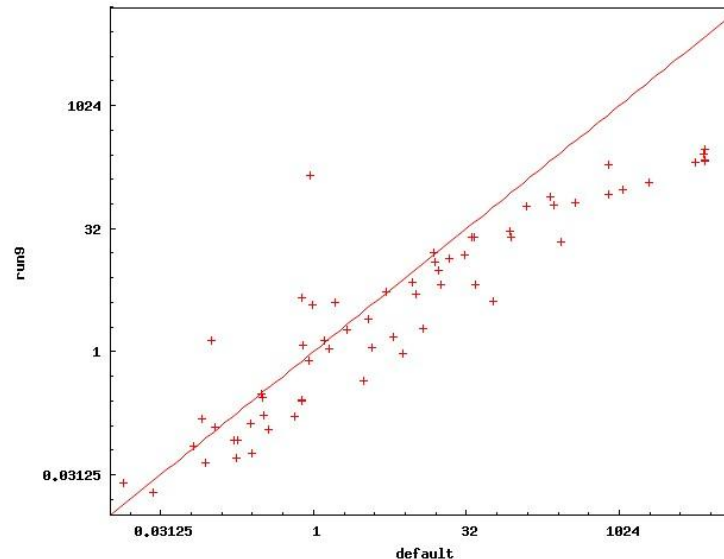
Project Status – What's Done

- Data Set:
  - Data Format for logging runtime information
  - First pass at instrumenting Keld's LKH implementation

- Data Set Viewer

- Utilities
  - (reasonably) efficient time series representation for both display and computation of derived values

Project Status – Current Work / Partially Done

- Additional solver instrumentation & runs
  - longer sets of runs take ~2 weeks to complete

- Basic Time Series Plot

- Interface for generating derived values

PROJECT STATUS – HAVEN'T STARTED

o Problem domain (TSP) specific displays / derived values

o Potential rewrite of data set viewer to try to improve performance when dealing with several thousand items