Follow the Blind Seer –
Create Better Performance Models Using Less Information
Why?

Common performance analysis chart in a paper

Can't we obtain these kinds of graphs automatically?
When?

2012

log\(p\)

\(p\)

\(p^2\)

\(p^3\)

main() {
  foo()
  bar()
  compute()
}
How?

2013

main() {
    foo()
    bar()
    compute()
}

Performance measurements

Instrumentation

M_i

M_j

Extra-P

Input

Output

Human-readable performance models of all functions (e.g., \( t = c_1 \log(p) + c_2 \))
How?

\[ f(p) = \sum_{k=1}^{n} c_k \cdot p^{i_k} \cdot \log_2(j_k(p)) \]

\[ n \in \mathbb{N} \]
\[ i_k \in I \]
\[ j_k \in J \]
\[ I, J \subset \mathbb{Q} \]

What can it do?


What can it do?

- Search space generation
- Model generation
- Benchmark

2015

Expectation: $\log p$

Scaling model: $p$

Divergence model: $p/\log p$

- Initial validation
- Comparing alternatives
- Regression testing

Performance measurements
Can EXTRA-P do more?

\[ f(x_1, \ldots, x_m) = \sum_{k=1}^{n} c_k \prod_{l=1}^{m} x_{l}^{i_{kl}} \cdot \log_{2}^{j_{kl}}(x_l) \]

Can EXTRA-P do more?

• **Hierarchical search** – Assumes the best multi-parameter model is created out of the combination of the best single parameter hypothesis for each parameter

• **Modified golden section search** – Speeds up the single parameter search by ordering the hypothesis space and then using a variant of binary search to find the model in logarithmic time rather than linear time
Can Extra-P find more than bugs?

2017

OpenFoam

Re-learn

Lulesh

Milc

Kripke

Communication

Computation

Memory footprint

Memory access

OpenFoam

Lulesh
What about now?

Get it here: http://www.scalasca.org/software/extra-p/download.html

Tutorial available on demand – just ask!

Past tutorials: EuroMPI 2015, SC‘15, SC‘16, 25th. VI-HPS Workshop
What about tomorrow?

Performance modeling for graph algorithms

How to identify metaparameters?
What about tomorrow?

- Real-time modeling
- Scheduling?
What about tomorrow?

Performance models of DNNs – deployment, characteristics
What about tomorrow?

Performance models using DNNs – better, worse, or different?