Flexible Performance Predictions at Run-time

Vision Talk

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http://se.informatik.uni-wuerzburg.de/
Which approach should we use?
User preferences influence solver choice

- Accuracy
- Time-to-result

Brosig et al. [1] showed:

- Significant time-to-result and accuracy differences between different simulation-based solvers
  - Time-to-result and accuracy depend on model properties

→ No static order for solvers

→ Best suited solver depends on model structure and user preferences

In a nutshell ...

Problem

- Best suited solver depends on model structure and user preferences

Idea

- Automate solver selection

Benefit

- Reduces expert knowledge required
- Improved accuracy and time-to-result

Action

- Predict accuracy
- Predict time-to-result
- Design solver selection algorithm
Accuracy Prediction Challenge

- Exact loop iteration vs probabilistic approximation
- Same mean response time
- Different response time distribution

Accuracy Prediction Idea

➢ Estimate accuracy based on:
  • Information loss during transformation
  • Expert knowledge about solvers

➢ Develop smart transformations
  • Knowledge about transformation steps with information loss
  • Number of occurrences for specific model
  • Derive accuracy score

➢ Why not machine learning?
  • Not enough training data
  • Feature selection challenging

Loop simplified: 4
Semaphore ignored: 0
Fork approximated: 7
Time-to-result Prediction Scenario

- Online Scenario
  - Running system
  - Evolving performance model
  - Performance queries concerning reconfigurations
  - Recurring performance queries

- Model repository contains all model iterations

- Performance repository contains
  - Performance query
  - Target model
  - Selected solver
  - Time-to-result
Time-to-result Prediction Idea

- System evolves, but only stepwise
- Time-to-result for previous queries contained in the performance repository
- Idea: Use machine learning to predict time-to-result based on historic data
- Challenges:
  - Limited training data, but highly relevant
  - Limited prediction time
  - Feature selection
Conclusion

➢ Selecting the best suited solver is challenging

➢ Predict accuracy based on
  • Information loss during transformation
  • Expert knowledge about solvers

➢ Predict time-to-result using
  • Historic information about previous queries
  • Machine learning

➢ Automatically select best suited solver based on these predictions

➢ Reduces expert knowledge required and improves performance predictions
Thank you for your attention!

Slides are available at https://descartes.tools/