Meta-programming for statistical machine learning

Ohad Kammar
University of Oxford

NII Shonan Meeting 21 May 2018

Past work

Computational effects

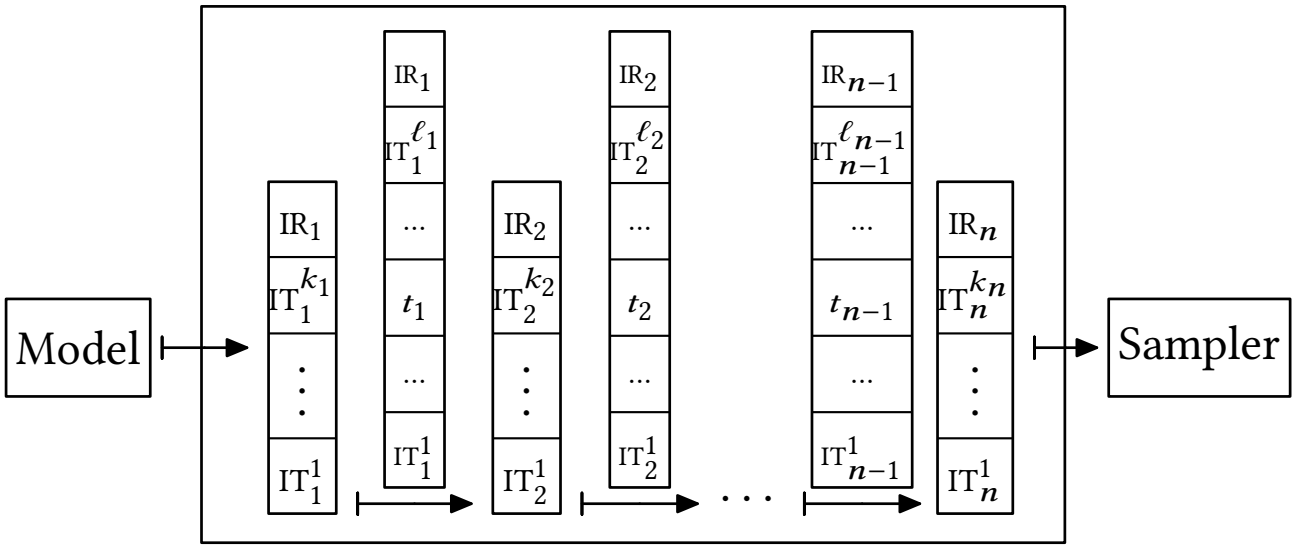
- Denotational semantics
- Operational semantics
- Effect handlers and monads

Recent work on probabilistic programming

Probabilistic programming (with Adam Ścibior)

Replace:

With:



Recent work on probabilistic programming

Probabilistic programming (with Adam Ścibior)

- Modular validation of inference algorithms:
  Sequential Monte Carlo, Trace Markov Chain Monte Carlo
  By combining:
- Synthetic measure theory [Kock'12]: measure theory without measurable spaces
- Quasi-Borel spaces: a convenient category for higher-order measure theory
- Modular implementation of inference algorithms

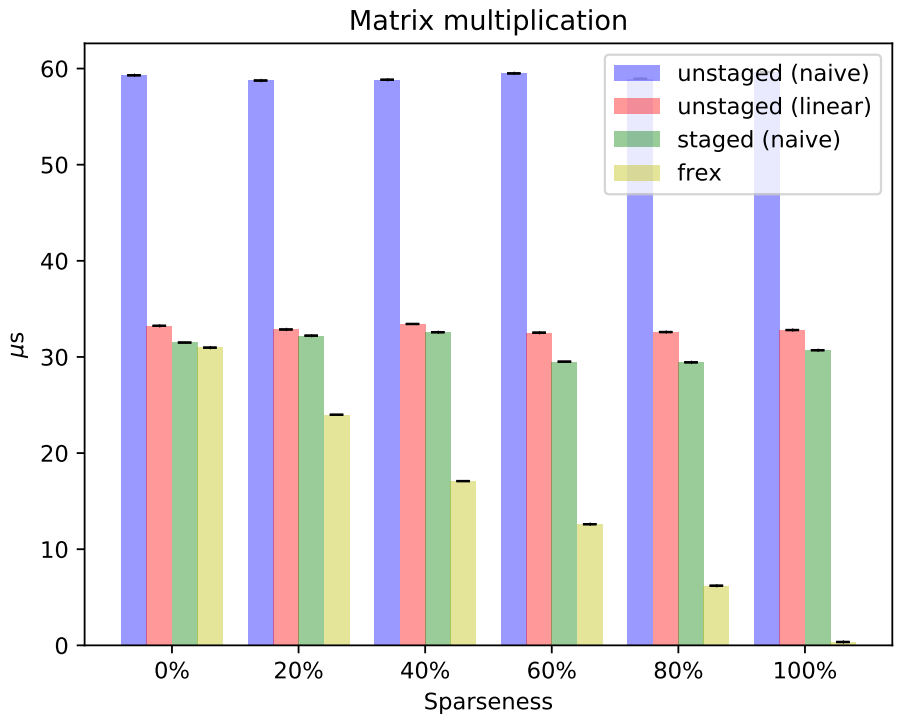
Recent work on meta-programming

Free extensions as partially static data

(with Jeremy Yallop and Tamara von Glehn)

- Partial evaluation based on algebraic equivalence:

$$(2 + x) + 5 \rightsquigarrow 7 + x$$



Ongoing work

- A domain theory for quasi-Borel spaces and statistical probabilistic programming