

Hrutvik Kanabar

hk324@kent.ac.uk

hrutvik.co.uk

Education

- 2018- UNIVERSITY OF KENT** *Computer Science, PhD*
- 2018- PhD studentship, supervised by Scott Owens (now at Facebook) and Olaf Chitil, in the Programming Languages and Systems group. Part of the *Building Verified Applications in CakeML* project, funded by the UK Research Institute in Verified Trustworthy Software Systems (VeTSS).
- 2015-18 UNIVERSITY OF CAMBRIDGE, KING'S COLLEGE** *Computer Science, BA (Hons)*
- 2017-18 Computer Science, second/third year: Class I/Class I, Palantir Prize for Highly Commended Dissertation. Extended individual project/dissertation: *Implementing and verifying a compiler optimisation for CakeML*.
- Implemented a dead code elimination pass to two intermediate languages of the CakeML compiler.
 - Proved correctness using the HOL4 interactive theorem-prover.
 - Supervisors: Magnus Myreen (technical), Stephen Kell (planning/dissertation), Anthony Fox (HOL4)
- 2016 Natural Sciences, first year: Class I, studying Mathematics, Physics, Chemistry, Computer Science.

Research

Semantic type soundness for CakeML *May 2019 -*

Using logical relations to develop a semantic notion of CakeML types.

- CakeML compiler correctness theorems assume input has a non-failing semantics, enforced by syntactic type system, type safety, and a sound/complete type inferencer. Syntactic typing is too strong a restriction however.
- Semantic type soundness allows stronger reasoning about when terms safely behave as if they have a certain type.
- Compatibility with each syntactic typing rule allows for composition of typeable and untypeable code (c.f. RustBelt).
- Potential use cases include:
 - Faster array accesses by removing bounds-checks, if proved safe via the semantic type system.
 - Extraction for (e.g.) Coq into CakeML, with reasoning about unsafe type casts.
 - Reasoning about module boundaries and enforcement of type abstraction.

Translation from higher-order logic into stateful CakeML *Jan 2019 - Apr 2019*

Augmenting the existing translator from the HOL4 logic into CakeML abstract syntax.

- Support for parametric polymorphism, translation of non-obviously terminating functions, proof automation.
- Part of a collaborative paper accepted by the Journal of Automated Reasoning (JAR).

Industry

- 2020 Software Engineer Intern - FACEBOOK**
- Jul-Oct Improving type-inference for Hack by generating constraints on method invocations.
- 2020 Intern Research Engineer - ARM LTD**
- Apr-Jul Investigating the Sail language ecosystem and its applications in formal reasoning about the semantics of the Arm instruction set. In particular, using HOL4 to reason in the context of CakeML.
- 2018 Software Development Intern - ENSOFT LTD**
- Jul-Sep Creating an open-source Python Linux profiling and visualisation tool in a small group of interns. Employing agile practices of testing, code review, and version control.
- 2016 Data Analyst - CASSANDRA GOAD OF SLOANE STREET**
- Jul-Aug Extracting and analysing data from a bespoke database system, segmenting client base for targeted advertisement, and creating summary statistics and visualisations of business trends and patterns.

Teaching and communication

Assistant Lecturer – UNIVERSITY OF KENT

Leading undergraduate seminars

- 2020-21 - *Functional Programming* – second year course – Haskell and Erlang, language semantics.
- 2019-20 - *Theory of Computing* – second year course – logic and proof, regular languages, CFGs, computability.
- *Algorithms, Correctness, and Efficiency* – second year course – data structures, sorting, graphs, big-O.
- *Programming Languages: applications and design* – third year course – language design and its trade-offs.
- 2018-19 - *Foundations of Computing* – first year course – foundations in: algebra, statistics, proofs, and set theory.
- *Functional and Concurrent Programming* – second year course – Erlang and the actor model, Haskell.

Research placement – RAINBOW RESEARCH GROUP, UNIVERSITY OF CAMBRIDGE

- 2017 Creating Java-based coursework for a first-year graphics course, with automated assessment in a VLE.

Rowing coach – KING'S COLLEGE CAMBRIDGE BC and UNIVERSITY OF KENT RC

- 2018- Volunteer coach at University of Kent Rowing Club. Coached crews to many wins.
- 2015-18 Coached beginner and experienced crews. Including beginner crews placing 3rd and 5th out of ~70 intercollegiate crews, the most successful performances in club memory.

Public speaking – CAROLS FROM KING'S

- 2017 Reader at *Carols from King's* on BBC Two, Christmas Eve.

Conferences and presentations

ACM Student Research Competition at the Symposium on Principles of Programming Languages (POPL) – NEW ORLEANS, USA

Jan 2020

Placed 2nd in the competition after three rounds: an extended abstract submission, a poster show, and a presentation.

Programming Languages Mentoring Workshop (PLMW) at the International Conference on Functional Programming (ICFP) – BERLIN, GERMANY

Aug 2019

Awarded a scholarship to attend both PLMW and ICFP.

- Received mentoring and advice from PLMW on technical topics, research skills, and future careers.

CakeML Developers Meeting – GOTHENBURG, SWEDEN

May 2019

Presented work on and future directions for stateful translation from HOL4 to CakeML at an annual meeting for developers.

Google Compiler and Programming Language Summit – MUNICH, GERMANY

Dec 2018, Dec 2019

Funded to attend the summits by Google. Presented a poster on both occasions.

Referees

Scott Owens

Software Engineer, Facebook
sao@kent.ac.uk
cs.kent.ac.uk/~sao

Magnus Myreen

Associate Professor,
Chalmers University of Technology
myreen@chalmers.se
cse.chalmers.se/~myreen

Timothy Griffin

Reader, University of Cambridge
tgg22@cam.ac.uk
cl.cam.ac.uk/~tgg22