Rachel Muir

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Education

2023

PhD, Programming Languages and Systems, *Current- Year Three*

Advisors: Prof Mark Batty & Dr Michael Vollmer – University of Kent, PLAS

Current work involves mechanising G.Morrisett and D.Walker's typed assembly language (TAL) in Rocq. My core contributions are mechanising the lemmas and theorems presented in the original paper, as well as extending the work with mechanised proofs for determinism and type erasure. Future work involves extending the language with vector instructions and extending the type system and proofs accordingly.

2019 – 2023

BSc (Hons), *University of Kent, Canterbury*

Dissertation: Formal Verification of a MIR-to-MIR Optimisation

2016 – 2019

College Qualifications, *Bexhill College*

Applied Science	180 Credit Extended Diploma	Distinction* Distinction* Distinction*
Information Technologies	90 Credit Certificate	Distinction* Distinction*

Work Experience

2023

Research Assistant, *The University of Kent*, In-Person

This work aimed to provide a first step towards proving the soundness of Rust's middle intermediate representation (MIR), starting with a modest optimisation — tautology elimination. It required defining a grammar and semantics, a formal definition of a target optimisation, and using proof techniques over the semantics to prove their soundness. This project was shortlisted for the PLDI Student Research Competition.

2022

Rolls-Royce Data Scientist, *R^2 Data Labs*, London - Hybrid Internship, *Python*

My role involved developing bespoke AI-based software. I optimised training throughput by reducing the memory footprint of data, improving the performance of inference and adding checkpointing and data change detection to drastically cut downtime. The project consisted of making NLP-based software to aid in presenting large collections of data in a human-readable way. Our team worked through prototyping stages over multiple weeks and developed the software into a minimum viable product, which we then delivered to the customer. This project required the use of natural language processing, clustering of data, and data visualisation.

2021 – 2022

Developer and Maintainer, *Smart Start Minds*, London - Remote, *Javascript*

In my second year of university, I joined a team of developers in researching and developing bespoke hardware and software to improve and treat mental health conditions. Our neurofeedback hardware used non-invasive imaging (fNIRS) to measures changes in the concentration of oxygenated haemoglobin. I designed a web-based prototype system to detect lulls in mental concentration and to prompt the user to perform an activity, increasing concentration above their baseline. This prototype software enabled the company to demonstrate the viability of this automated self-treatment method to businesses and funders interested in using this technology. More importantly, it demonstrated that accessible and affordable treatment could reasonably allow treatment of patients in low socio-economic areas globally and patients without access to in-person healthcare, the internet, or medical funding. I won the UK-wide *Undergraduate of the Year* award for this work.

2019–2022 **Academic Ambassador**, *University of Kent*, Canterbury

Prizes

2023 **Student Research Competition**, *Shortlisted*, PLDI

2022 **Undergraduate of the Year 2022**, *Winner*, Target Jobs

2022 **Kent Star**, *Winner*, The University of Kent

Conferences

2023 **PLDI**, *Florida*, Invited - Student Research Competition, Poster Session

2020 **36th Chaos Communication Congress**, Technology and Cyber Security Conference, Leipzig

Summer Schools

2024 **Advanced Functional Programming**, University of Utrecht, 1.5 ECTS

2023 **OPLSS**, University of Oregon

2023 **VetSS**, University of Sussex

Volunteering

2022– **TinkerSoc**, *Committee*, *TinkerSoc.org*

The Tinker Society is a maker society for hobby electronics, 3D printing, and engineering. I was president for two years, and am now vice-president. I rebuilt the society after COVID by leading people through their first projects with accessible learning plans. This worked, increasing gender diversity and course diversity. I currently run interactive seminars and training courses, and have helped to build an amazing community along the way.

References

Prof. Mark Batty M.J.Batty@kent.ac.uk

Dr. Michael Vollmer M.Vollmer@kent.ac.uk