Rachel Muir

rm717@kent.ac.uk

Education

2023

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

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

Current work involves extending G.Morrisett and D. Walker's typed assembly language (TAL). We add vector instructions to the language extending the type system and proofs accordingly. My core contributions are designing a grammar, type system and operational semantics to capture the behaviour of vector instructions. I have implemented these semantics in OCaml with the goal of formally proving the correctness of our semantics in Rocq.

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

Summer 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 formal 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.

2019 – 2022

Academic Ambassador, *University of Kent*, Canterbury

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, in the form of non-invasive imaging (fNIRS), 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, internet, or medical funding. I won the UK-wide *Undergraduate of the Year* award for this work.

2022

Rolls-Royce Data Scientist, *R^2 Data Labs*, London - Hybrid Internship, *Python*
I was a part of a team developing developing bespoke AI-based software. This role required knowledge of Python, Github, and data science methods. Our projects consisted of making NLP-based software to aid in presenting large collections of data in a human-readable way. We worked through prototyping stages over multiple weeks and developed the software into a minimum-viable-product, which we then delivered to the customer. I optimised training throughput by reducing the memory footprint of data, improving the performance of inference and adding checkpointing and data change detection to cut downtime drastically.

Prizes

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

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

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

Conferences

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

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

Summer Schools

2023 **OPLSS**, University of Oregon

2023 **VetSS**, University of Sussex

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

Volunteering

2022 **TinkerSoc**, *Committee*, *TinkerSoc.org*
TinkerSoc 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, drawing a more diverse, and less exclusively male, membership. I ran interactive seminars and training courses and built an amazing community. It is my proudest achievement.

References

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

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