codeplay®

CDT–EI

EPSRC Centre for Doctoral Training
in Embedded Intelligence

Fully Funded PhD Studentship co-sponsored by Codeplay Software:

**High level programming of data and pipelined parallel image processing
on heterogeneous platforms**

The EPSRC Centre for Doctoral Training in Embedded Intelligence at Heriot-Watt University is offering a fully-funded PhD studentship to UK/EU applicants.

The studentship is open to all eligible UK/EU applicants. It will run for 4 years from September 2017, and includes:

- A fee waiver equivalent to the home/EU rate
- An enhanced EPSRC tax-free stipend of £17,553 p.a. for four years.
- A personal training budget of £10,000 to support specific training needs.

All non-UK applicants must meet the minimum English language requirements. Details are available on the website.

Overview

Computing platforms are constructed from diverse computing components with diverse performance and power requirements. A typical platform combines multiple cores offering SIMD, with a GPU and, increasingly, field programmable gate arrays (FPGAs) for specialised close-to-sensor processing.

A major challenge is the seamless realisation of some given computation across different configurations of these components, to minimise power consumption without compromising performance. This is made harder by major differences in programming models for such components and the lack of common abstractions and toolsets.

In particular, FPGAs are very low powered accelerated processors, and are ideal for remote computation where power access is limited and when wireless network connections cannot support raw data transmission. Exploitable application areas include remote smart CCTV surveillance, autonomous vehicles and medical diagnosis.

The major drawback of FPGAs is programmability. They are notoriously difficult and time consuming to engineer and debug. Moreover, they are very often programmed with hardware description languages, holding back their wider adoption with the software industry, domain experts, and manufacturers of heterogeneous processing hardware.

This 4 year PhD project, supported by Codeplay and the Embedded Intelligence CDT, will address this challenge by combining Heriot-Watt University's programming languages and program transformations research, with the parallel architectures and compiler expertise at Codeplay.

In particular, in the Heriot-Watt University's EPSRC funded Rathlin project (EP/K009931/1) we have developed a domain specific language (DSL) for image processing, and have identified novel ways of profiling and optimising the dataflow graph intermediate representation before deploying to FPGAs. This approach will be taken across to Codeplay's OpenCL toolsets.

Codeplay are a leading partner in the standardisation of SYCL, a programming abstraction for heterogeneous hardware. Codeplay have SYCL implementations for CPUs and GPUs. The CDT PhD student will work with Codeplay on an FPGA implementation of the SYCL open standard. Codeplay's image processing DSL, VisionCPP, will serve as an excellent case study for demonstrating high level programming of data and pipelined parallel image processing on heterogeneous platforms, in particular on low powered FPGAs via the proposed SYCL FPGA backend.

Applicants should

- Have a first class honours or good upper second class degree, or MSc with Distinction, in *Computer Science*.
- Have an understanding and experience of programming languages for parallel heterogeneous computing and language processors .
- Demonstrate a keen interest in multicore CPUs and GPUs, programmable FPGAs, programming language design and compilation, and dataflow based optimisations.
- Satisfy the UK residency requirement – see EPSRC eligibility criteria

How to Apply

Applications can be made online at:

https://www.hw.ac.uk/study/apply/uk/postgraduate.htm

Embedded Intelligence is the integration of intelligence into products, processes and services so they work better and can increase productivity, efficiency and connectivity. It is **underpinned by diverse areas of expertise** (engineering, chemistry, biology, materials, design and computer science). We offer a unique **4 year full-time programme** which enables students to **develop their research skills** whilst working with **industrial partners**. Research training is also complemented by non-technical subjects e.g. **leadership, enterprise and social responsibility**. Our researchers will be at the forefront of the latest developments in Embedded Intelligence and be supported by over 45 academic members of staff and industry specialists in this field.

Informal enquires about the research project should be made to Greg Michaelson (G.Michaelson@hw.ac.uk). Enquiries about the application process and CDT programme can be made to cdt-ei@lboro.ac.uk or visit the website www.cdt-ei.org. For answers to frequently asked questions about the CDT, visit the website. Applications will be reviewed on an ongoing basis until positions are filled. Early application is therefore strongly encouraged.