INTERNSHIPS TO BE APPLIED

1) HARJOITTELLAJA (1-3 kpl)/Mikko-Jussi Laakso


Harjoittelijalta vaadittavat perusvalmiudet:

- Työtehtävien suorittamiseksi vaaditaan kohtuullista Java-ohjelmointitaitoa ja kykyä itsenäiseen työskentelyyn. Lisäksi edustuisi lasketaan Vaadin-käyttöliittymäkirjaston tuntemus, graafinen osaaminen (erityisesti käyttöliittymä- ja ulkoasusuunnittelun osalta), tietokanta osaaminen sekä hyvä englanninkielinen kirjallinen taito.

Hyvin sujunut harjoittelu voi avata mahdollisuuden jatkaa töitä projektissä, joten halukkuus jatko-opintojen suorittamiseen lasketaan myös eduksi.

Ajankohta: Kesä 2014

Lisätietoja: Liisätietoa VilLestä: [http://ville.cs.utu.fi](http://ville.cs.utu.fi), Mikko-Jussi Laakso, milaak@utu.fi

2) TRAINEE (1-2 students)/Tapio Pahikkala

Duties: Analysis of data related to important problems in open data. Example tasks currently under intensive research are a cloud computing platform for performing data analysis and automatic pattern recognition.

Basic abilities: Good programming skills, especially Python, and the basics of data analysis. Knowledge about data mining and machine learning techniques are useful advantages, and so are design and analysis of algorithms. You should have good skills in both written and spoken English.

Understanding Finnish is also an advantage.

Time: during May-August 2014

More information: Tapio Pahikkala, tapio.pahikkala@utu.fi

3) TRAINEE (1 student)/Filip Ginter

Duties: You will participate in the Turku Natural Language Processing group (bionlp.utu.fi). The group has a number of projects dealing with various aspects of natural language processing, both for English and Finnish. Among many other projects, we are working on large-scale text mining from English scientific literature in the biomedical domain ([http://www.evexdb.org](http://www.evexdb.org)) and we are building a billion word corpus of syntactically analyzed Finnish ([http://tinyurl.com/mz4nnm4](http://tinyurl.com/mz4nnm4)).

Depending on your background and interests, you may be participating on either the English or Finnish projects. Again depending on your interests, your tasks may be any combination of the following:

- Web application development
- Database management and development
- Processing and indexing massive amounts of semi-structured data
- Machine learning and data analysis
- Programming and testing state-of-the-art methods for statistical natural language processing

As there are a number of distinct projects you could be potentially involved with, the specific tasks will be agreed on an individual basis. If you are interested in language technology, dealing with large datasets, or machine learning, you are probably a good applicant. Leave your application in and come to discuss your interests.
Basic abilities: We hope you have prior experience with programming in Python, knowledge of Linux and shell scripting, curious nature, interest to learn new things fast, "can do" attitude, good command of English and independent thinking. Additional pluses: interest to pursue MSc degree within the group (i.e. no set MSc thesis topic), SQL, graph databases, Java, C/C++, Cython and good study record.

Time: May+June+August 2014

More information: Filip Ginter, ginter@cs.utu.fi

4) TRAINEE (1 student)/Juha Plosila Taming Adaptivity vs. Predictability Paradox on Ubiquitous Embedded Systems

Duties: Distributed embedded computing systems with heterogeneous components and subsystems become the underlying infrastructure for smart personal space, vehicle-area networks, intelligent buildings and digital cities. Inheriting the constraints from their previous generations, modern and emerging embedded systems for rapidly growing ubiquitous applications are resource-limited. Adaptivity is heavily exploited to approach optimized energy-efficiency, resource utilization, reduced manual configuration and dependability. Adaptivity has to be judiciously applied, so that the run-time reconfiguration does not cause certain applications to fail or output unpredictable performance (e.g. a prolonged surveillance alarm). Design for adaptivity conventionally involves average-performance-driven system strategies and architectural techniques, while design for predictability focuses on the pruning of unnecessary variations in the control and data path.

The project aims to propose a systematic design framework and its architectural implementation for the development of adaptive and predictable embedded systems. The objectives are:

O1: An APES (Adaptive and Predictable Embedded Systems) design framework (Fig. 1), which integrates application-specific predictability upon the classic Monitoring-Planning-Analyzing-Execution adaptation process.

O2: A DHA (Distributed Hierarchical Agent) middleware layer, which performs run-time resource allocation and adaptive management, based on the APES framework, to ensure timing predictability for applications with hard-, soft- or non-real-time requirements.

O3: A UBB (Ubiquitous Building Blocks)-based reconfigurable computing platform with heterogeneous soft and hardware components, which is monitored by the DHA middleware to run hybrid applications.

O4: A design flow from transactional-level modeling (TLM) to register-level modeling (RTL) to explore, simulate and analyze the proposed architecture, with worst-case or statistical timing models of basic processing or communication components.

O5: A case study prototyped on off-the-shelf programmable ICs to demonstrate the design framework and UBB system architecture.

The task of the intern is to work on some of these objectives during the 3-month internship. The details will be agreed on later.

Basic abilities: Background in computer architecture, HDL programming preferably SystemC, and preferably parallel programming languages.


More information: Juha Plosila, juplos@utu.fi

5) TRAINEE (1 student)/Pasi Liljeberg ELL-I: AN INEXPENSIVE PLATFORM FOR FIXED THINGS

Duties: The Internet of Things (IoT) vision is enticing; each and every “thing” in the world is expected to be eventually connected to the Internet, thereby becoming a part of the “context” within which the applications live. In most of the IoT research, the focus has been in enabling movable things to communicate, including phones, tablets, RFID tags, watches, and jewellery, to name but a few. In such an approach, the things are expected to have their own batteries or receive temporary power over short distance electro-magnetic field. This approach has also dominated the more fixed side of the IoT research, including a large fraction on the work on stationary sensors and actuators, focusing also there on battery-based operations and wireless communication.

In this project, we introduce an alternative view to the world of stationary Internet-connected things. We argue that a large majority of the fixed or stationary things would benefit from being permanently powered using wireline connections, and while doing so, it becomes natural to use the same wires also for their communication and
contextual needs. Such an approach allows the appliances to become part of the wider application context. With this in mind, we introduce the Ell-i platform, a new open source initiative for provide a low-cost flexible prototyping and production platform for extensible, Power-over-Ethernet based smart appliances.

As its first technical platform, the Ell-i initiative provides open source hardware and software for building inexpensive embedded intelligence into devices, allowing them to communicate and be powered with Power-over-Ethernet (PoE), an established but rapidly evolving standard for providing up to 100 Watts of electric power through standard Ethernet cables. The currently available ELL-i prototyping board is compatible with the popular Arduino prototyping platform.

**Basic abilities:** Background in computer networks and operating systems preferably tiny (embedded) operating systems, programming skills preferably for microcontrollers, preferably some experience in wireless sensor/actuator networks (WSAN)

**Time:** 1.6.2014-31.8.2014

**More information:** Pasi Liljeberg, pakrli@utu.fi

6) **TRAINEE (1-2 students)/Pasi Liljeberg** Proactive Health Monitoring Framework Based on Internet-of-Things

**Duties:** In the near future, it is predictable that any gadget will be identified by a unique address. This will lead to an addressable sequence of computers, sensors, actuators, PDAs and mobile phones. As defined by European Commission Information Society, the Internet of Things (IoT) is a manageable set of convergent developments in sensing, identification, communication, networking, and informatics devices and systems. The IoT is in the revolutionary road and it will remodel the healthcare sector on the way in terms of social benefits and penetration as well as economics. Enabled by ubiquitous computing, all the healthcare system entities (individuals, appliances, medicine) can be monitored and managed continuously. The IoT’s connectivity provide a way to monitor, store and utilize health and wellbeing related data (diagnosis, treatment, recovery, medication, finance, and even daily activity) on a 24/7 basis.

In this project, we will develop a proactive health monitoring framework to provide a way to give early warning to the user of any potentially threatening medical conditions. The idea is to create a system that could detect an emerging medical condition that the user has not recognized yet. The early medical treatment by an appropriate physician is important to prevent or alleviate further health deterioration. That is, early detection is utmost important to increase chances for full recovery or to decrease the amount of medication. In our IoT-based proactive health monitoring system, we collect patient health related information by body-worn or implanted sensors, with which the patient is equipped for personal monitoring of multiple parameters. We also supplement these IoT generated data with context information. Context-awareness enables to identify unusual patterns and making more precise inferences about the situation.

**Basic abilities:** Background in computer networks, C++ programming skills preferably for microcontrollers, preferably some experience in wireless sensor/actuator networks (WSAN)

**Time:** 1.6.2014-31.8.2014

**More information:** Pasi Liljeberg, pakrli@utu.fi

7) **TRAINEE (1 student)/Pasi Liljeberg** Energy-Efficient Computing for the Dark Silicon Age

**Duties:** It has been a decade since the end of frequency scaling, and multicore has become ubiquitous, there being no other means to increase a chip's performance. The shift to multicore designs has aimed to increase the number of cores along with transistor count increases, and continue the proportional scaling of performance. As a result, architecture researchers have started focusing on 100-core and 1000-core chips and related research topics and called for changes to the undergraduate curriculum to solve the parallel programming challenge for multicore designs at these scales. On the other hand, one of the most important challenging issues in today multicore systems is power and energy consumption problem. With the failure of supply voltage scaling, core count scaling is in jeopardy. The main reason is that CMOS scaling in terms of energy efficiency has broken down.

In this project, we aim to address challenges that limit higher data-densities and efficient energy utilization in application areas where low power consumption combined with dependable operation is required. Our research
addresses the Dark Silicon (i.e., under-utilization of transistors on chip) problem directly through a set of energy-saving specialized cores which are monitored and managed by an efficient hierarchical approach. As direct consequence of dark silicon, large swaths of a chip’s silicon area must remain mostly passive to stay within the chip’s power budget. Our approach is to fill a chip’s dark silicon area with specialized cores and to find architectural techniques that trade this cheap resource, dark silicon, for the more valuable resource, energy efficiency.

**Basic abilities:** Background in computer networks, C++ programming skills preferably for microcontrollers, preferably some experience in wireless sensor/actuator networks (WSAN)

**Time:** 1.6.2014-31.8.2014

**More information:** Pasi Liljeberg, pakrli@utu.fi

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8) **TRAINEE (1-2 students)/ Seppo Virtanen**

**Duties:** to help building laboratory and to develop it, doing the master’s thesis

**Basic abilities:**
- B.Sc. degree
- the knowledge in communication systems, information security
- trainee position is targeted mainly for students majoring in communication systems or information security
- trainee has to start doing master’s thesis
- ability to communicate fluently in English (both written and oral)

**Time:** during April-June 2014

**More information:** Seppo Virtanen, seppo.virtanen@utu.fi

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9) **TRAINEE (1-2 students)/ Ilona Tuominen** Ikitik health technology projects

**Duties:** The Ikitik consortium ([www.ikitik.fi](http://www.ikitik.fi)) is looking for computer science, information technology, nursing science, or linguistics students (e.g. students entering the thesis stage) for its projects for the summer. The aim of these projects is to develop information and language technology to support communication and decision making concerning health information, e.g. ontologies, mobile applications, and biobank analysis methods and tools. The work includes, inter alia, method and application development, content analysis, and testing in an authentic environment. Tasks are adapted according to personal skills.

**Basic abilities:** Applicants should have an interest in the fields of health, information technology, and language. Good programming skills are advantageous, and any linguistic competence is considered a plus. We work in an inspiring, multi-scientific team, and our working languages are Finnish, Swedish and English. Due to the nature of our real-world data, such as electronic health records, good command of Finnish is a plus.

**Time:** 1.5.-31.8.2014

**More information:** Coordinator Ilona Tuominen, TUCS, ilmitu@utu.fi

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10) **TRAINEE (2 students)/ Martti Tolvanen** Study of carbonic anhydrase related domains in protein tyrosine phosphate receptors

**Duties:** The α-carbonic anhydrases (α-CA) are enzymes that catalyze the reversible hydration of carbon dioxide (CO₂ + H₂O ↔ HCO₃⁻ + H⁺) [1-3]. There are 17 isoforms in α-CA family in vertebrates, of which 14 isoenzymes are catalytically active [4]. Three of the isoforms, namely, carbonic anhydrase-related proteins (CARPs) VIII, X, and XI, represent catalytically inactive isoforms due to the lack of one or more of the three histidine residues required for binding to the zinc atom essential for the classical CA catalytic activity [5]. In addition, two protein tyrosine phosphatase receptors, PTPRZ1 and PTPRG, contain an N-terminal CA domain, which is another catalytically inactive member of the family, termed CARP XVI domain [4,6].

At the moment, there is no specific knowledge of the evolutionary origin of the CARP XVI domain. The summer project would involve a phylogenetic analysis of these sequences in vertebrate animals.

**Project 1:**
Would include sequence retrieval and quality checking (assisted by Ensembl REST scripts developed in the Parkkila group), construction of phylogenetic trees in the context of the vertebrate alpha CA family, study of the taxonomic pattern of occurrence of CARP XVI domains, and analysis of sequence conservation within the CARP XVI domains.
(again, assisted by scripts developed in the Parkkila group). The sequence conservation work would involve protein visualization and analysis of the placement of highly conserved residues, and comparison to sets of conserved residues observed in all alpha CAs (prepared in the Parkkila group).

Project 2:
Background study of the taxonomic patterns and duplication history in the PTPR family in general. This project involves a larger amount of proteins from several families of PTPRs. We would be interested in duplications in fish species in particular, and the timing of the duplication which produced PTPRZ1 and PTPRG.

**Basic abilities:** All three CA projects are suitable for a successful student who ended their first year in our Bioinformatics MDP, or preferably a second-year student who has completed the phylogenetics course. Preference is given to best students, in terms of both grades and courses completed. Depending on the student’s skills in phylogenetics and protein visualization, some parts of these tasks can be assigned to the supervisor or members of the Parkkila group. The goal of projects 1 and 2 is to generate majority of the results to be used in one scientific publication, and project 3 would most probably lead into results to be used in another publication.

**Time:** Summer 2014

**More information:** Martti Tolvanen, martti.tolvanen@utu.fi

11) **TRAINEE (1 student)/ Martti Tolvanen**
**Cytoplasmic carbonic anhydrases in birds**

**Duties (project 3):** We have preliminary evidence that the gene cluster of four cytoplasmic CA genes (CA1, CA2, CA3, CA13) is modified in birds so that CA3 is duplicated, and CA1 is present either as a pseudogene, or has been poorly predicted because of the target structure of four CA genes in most vertebrate species. The project would involve a closer study of these regions in available bird genomes, optimizing gene models for CA1, sequence collection of cytoplasmic CAs (assisted by scripts from the Parkkila group) and a phylogenetic study of these genes.

**Basic abilities:** All three CA projects are suitable for a successful student who ended their first year in our Bioinformatics MDP, or preferably a second-year student who has completed the phylogenetics course. Preference is given to best students, in terms of both grades and courses completed. Depending on the student’s skills in phylogenetics and protein visualization, some parts of these tasks can be assigned to the supervisor or members of the Parkkila group. The goal of projects 1 and 2 is to generate majority of the results to be used in one scientific publication, and project 3 would most probably lead into results to be used in another publication.

**Time:** Summer 2014

**More information:** Martti Tolvanen, martti.tolvanen@utu.fi

12) **TRAINEE (1 student)/ Risto Punkkinen**

**Duties:** 1) Characterization of new semiconductor structures by electrical measurements (current-voltage and capacitance-voltage measurements controlled by LabView) or 2) Practical works in finishing the particle radiation measuring instrument Radmon in the Finnish student satellite Aalto-1.

**Basic abilities:** 1) Understanding of semiconductors and measuring technology. Work is done clean room. 2) Understanding of electronic circuits and measuring technology. Eager, handy and cooperative person is appreciated.

**Time:** During 1.5.-31.8.2014

**More information:** Risto Punkkinen, risto.punkkinen@utu.fi

13) **TRAINEE (1 student)/ Sampsa Rauti**

**Duties:** The Department of Information Technology is looking for an intern interested in software security. In our project, we are researching and developing a tool that obfuscates software layers in an operating system in order to render malware useless. The main task of the intern is research and development work related to this obfuscation tool. Our goal is also to study what kind of obfuscation techniques are best suited for low-level obfuscation.

**Basic abilities:** The intern should have good programming skills and a basic understanding of Linux operating system. Also, knowledge of compilers and machine language is recommended. Previous knowledge of code obfuscation is an advantage.

**Time:** During May-August 2014

**More information:** Sampsa Rauti, sjprau@utu.fi
14) HARJOITTELIJA (1 kpl)/Jouni Smed

Tärkeimmät työtehtävät: Harjoittelijan päätehtävänä jatkokehittää kokeellista interaktiivisesta tarinankerrontajärjestelmaa, jonka avulla tutkitaan uusia lähestymistapoja kuvalliseen kerrontaan.


Ajankohta: Huhti-kesäkuu 2014

Lisätiedot: Jouni Smed, jouni.smed@utu.fi

HOW TO APPLY:

The length of internship is three months. The salary will be 1154 €/month.

Applications have to be sent to Päivi Rastas by e-mail pairit@utu.fi. If you are applying several internships, put them in the order of preference. Please indicate in the title of your e-mail the number of the position you are applying.

There has to be at least the following information in the application:

- your personal information and contact information
- your work experience and know-how
- student record transcript
- other information you think is needed

Application deadline is 28.2.2014. Decisions will be made in March-April.

Päivi Rastas
Department of Information Technology