TOSHIBA FELLOWSHIP PROGRAMME

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INNOVATION IS A JOURNEY, NOT A DESTINATION... JOIN OUR JOURNEY!

What is the Fellowship Programme?

The Toshiba Fellowship Programme offers outstanding scientists an annual opportunity to apply to join Toshiba's research and development laboratories in Japan for up to two years, on a Research Fellowship Contract.

The Toshiba Fellowship Programme is a unique opportunity for recently qualified PhD level scientists, mainly from science, computing and mathematics disciplines. It offers a chance to journey alongside Toshiba into innovation, discovering a new world of research and development, as well as exploring and living a new cultural experience in Japan.

Toshiba Fellows nurture cross-cultural understanding between the UK, Europe and Japan whilst benefiting from working in our highly innovative and research-centred organisation, in a country renowned for its world class technology. Every Toshiba Fellow has a real possibility to contribute to our future technologies. Participating in our scheme leads to both career development and personal growth.

The Programme has successfully operated for over 25 years, enjoying a strong and long-running collaboration with the EPSRC (Engineering and Physical Sciences Research Council) as well as fostering and developing the relationship between Japanese industry and UK academia. The successful Fellow receives a generous package, including a fixed salary and relocation assistance to and from Japan, together with support and advice prior to and during their stay.

Would I be eligible to apply?

Candidates must:

- Be a PhD-level researcher
- Be of EU nationality
- Be based in a UK academic or Government institution at the time of application (studying or working)
- Have no more than 10 year's post-Doctoral experience
- Have completed their PhD by the time they begin working for Toshiba in Japan.

What would the job be like?

Toshiba Fellows usually remain in their team for up to two years. The type of work carried out depends mainly on which team the Fellow joins and the research project area.

A normal working day is standard eight hours, Monday to Friday.

So that they can settle in and feel at home in their work and a new country, Toshiba assigns a mentor to assist the Fellow in and outside of the workplace.

Would I cope with the language barrier?

Many Fellows enjoy the experience of learning a new language skill, at the same time as the challenges of their research project work. A basic grasp of Japanese helps Fellows fully appreciate the time spent in Japan. Toshiba offers Japanese language courses to all Toshiba Fellows during the Programme. And of course, Toshiba staff also like to practice their English skills with you!

What would I research?

Research topics and project areas generally fall into the following categories:

- Wireless and Network
- Human Interface and Digital Media
- Software
- Hardware and Mechatronics
- LSI and Storage
- Nano Materials and Devices
- Systems and Environment

Applicants may also submit their own research project proposals, provided they are relevant to Toshiba's areas of interest and future technology.

Where would I live?

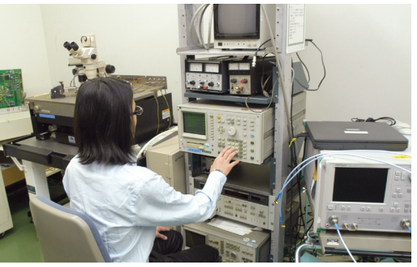
Toshiba Fellows are always offered a choice between Toshiba company accommodation or private accommodation. Toshiba supports the Fellow with advice and support to find whichever home they will feel most happy in during their stay in Japan.

What would my stay be like?

Toshiba Fellows work in one of the Toshiba's research labs in Tokyo. The Toshiba Corporate R&D Center (RDC) is based in Kawasaki, Japan's prosperous 'Silicon Valley', located just 20 minutes from Tokyo city centre by train. Kawasaki is the prime location for advanced R&D operations for many multi-national computer and electronics companies.

As a Toshiba Fellow, you could regularly enjoy a diverse mix of cultural and leisure pursuits. There is a whole new world of temples, shrines, food, museums, theatre and shopping to discover.Peaceful lakes and shrines in Nikko are simply beautiful during the Autumn season.

Japan's land area of 1432 square miles covers a diverse geography of mountains, lakes, hot springs, forests and islands. It is the perfect environment to relax or enjoy something more active - whatever takes your fancy!



"The Toshiba Fellowship Programme is ideal for researchers with a little curiosity for Japan. The research facilities are excellent and Toshiba has excellent relations with universities, so you will probably also be in touch with researchers from Japanese universities working in your field. For me, joining the Fellowship has allowed me to move into a new area of research. Of course, the learning curve was steep, but people have been very helpful and supportive. Japan is a very different country and culture, but it is an experience of a lifetime."

Dr Sven Meier, Water Treatment Technology, Toshiba Fellow 2007

"I love exploring the different areas around Tokyo, and the big cities further afield. Last summer I hiked up Mount Fuji, which was an amazing experience. As a snowboarder, I have taken full advantage of the fantastic snow conditions over the winter and the easy access to ski reports. One of my most fun experiences in Japan is flying down a field of fresh powder on a crisp winter's morning in the Japan Alps..."

Dr Jamie Shotton, Computer Vision, Toshiba Fellow 2006

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RESEARCH TOPICS 2017

The Toshiba Fellowship Programme is this year inviting proposals in the areas of Artificial Intelligence and Deep Learning.

We are now encountering an explosive increase in data quantity due to advances in information and communication technology including the advent of IoT, the Internet of Things, and new approaches in data processing such as Artificial Intelligence and Deep Learning are starting to appear in a vast range of applications. However, current Deep Learning is based on highly integrated CMOS GPU's/CPU's which consume a huge amount of electric power, highlighting the need for improving the power efficiency of devices and architectures significantly while we are approaching the ultimate limits to the scaling of CMOS (Complementary Metal Oxide Semiconductor) technology.

Based on these circumstances, we are offering the following two research topics.

One is the brain-inspired "memory-based computing", where a core technology for massively parallel sequencing and ultimate power efficiency based on cutting edge non-volatile memory technologies will be explored. The other is the research on sensing and learning technologies for autonomous cooperative systems. In both topics a strong interaction involving devices, algorithms, and systems will be necessary.

As one of the largest memory firms globally, Toshiba has been conducting research and development on these original devices with the hope that these research topics will lead to new computing paradigms and will contribute to our future device business. However, other proposals regarding these device technologies for future computing will also be welcome.

Hardware Research for Deep Learning Systems of Brain-Inspired “Memory-Based Computing”

Explanation

In order to realise highly intelligent operations for Deep Learning (DL) systems, optimization of a vast number of parameters is required for the training sequences with Big-Data stored in memory which results in long computational times and large power consumption with classical processor architectures. Original hardware systems are required to satisfy the growing needs of DL implementations both in terms of fast computation and low power consumption.

The main challenge of this research programme consists of exploring new hardware-oriented DL algorithms that possess the capacity to overcome the limitations of traditional computing and implementing them into VLSI using Toshiba’s leading new memory technology. In order to achieve this goal, brain-inspired “memory-based computing” will be created as a core technology for massively parallel sequencing and ultimate power efficiency based on cutting edge non-volatile memory technologies. Furthermore detailed analysis on this new VLSI chip will be carried out to determine the performance of each approach to promising applications, which may lead to widening the potential uses of the DL hardware.

Knowledge and Skills Required

Candidates are required to have thorough knowledge of at least one of the following fields: algorithms to model neural communication to enable efficient use of memory or brain-inspired memory-based computing for Deep Learning. They should also possess expertise in memory modeling, design and evaluation of VLSI for massively parallel computation.

Related Papers

T. Marukame et al., "Error tolerance analysis of deep learning hardware using restricted Boltzmann machine towards low-power memory implementation," IEEE Transactions on Circuits and Systems II: Express Briefs, 2016, in press.

K. Ueyoshi, T. Marukame et al., “FPGA implementation of a scalable and highly parallel architecture for restricted Boltzmann machines,” Circuits and Systems, vol. 7, 2016, in press.

K. Ueyoshi, T. Marukame et al., “Robustness of hardware-oriented restricted Boltzmann machines in deep belief networks for reliable processing,” Nonlinear Theory and Its Applications, vol. E7-N, no. 3, 2016, in press.

Research on Sensing and Learning Technologies for Autonomous Cooperative Systems

Explanation

We are developing technologies for realizing autonomous behaviour in systems such as robots, drones, and automobiles. Research on sensing and machine-learning is important for enabling systems to recognize their environments and to act on their own judgments. In particular, to create a society where many kinds of autonomous systems coexist with people, systems will need to understand human behaviour and how to cooperate with people.

Computational photography is one area of interest for our research and we have proposed a method based on a colour-filtered aperture which enables the simultaneous capture of a colour image and a depth image using a single camera. Further work is required on ways to make use of the “RGB+D (Depth)” information acquired by such cameras while decreasing measurement errors using such methods as SLAM (Simultaneous Localization and Mapping), modelling, matching and integration methods.

Toshiba has continued to develop machine-learning methods such as hand-written postal code recognition (since 1967), face detection, and face identification. Recently, we have been focusing on super-resolution, image categorization and image classification using Deep Learning. We are also trying to realize automatic answering in speech dialogue exploiting POMDB (Partially Observable Markov Decision Process), which is a sort of Reinforcement Learning framework. While Reinforcement Learning is a useful methodology, how we should design the reward is an open issue. Research on fundamental reward design or reducing trial and error which is currently necessary in most Reinforcement Learning frameworks is needed.

You will carry out fundamental research on new sensing methods or advanced machine-learning approaches which may become key technologies for realizing autonomous systems. The new sensing methods could be a kind of computational photography, sensor fusion integrating multiple camera images, or RGB+D processing such as SLAM or modelling. The advanced machine-learning approaches could be Deep Learning and Reinforcement Learning (for example, speed-up methods while keeping accuracy), or autonomous learning of entire systems exploiting the above sensing information.

The goal is to build a strong technology for Toshiba’s business in the field of logistics, infrastructure, and self-driving cars.

Knowledge and Skills Required

Candidates are required to have a deep knowledge of at least one of the following fields: computational photography, sensor fusion, RGB+D processing, machine learning, Deep Learning or Reinforcement Learning and should have software programming skills such as C, C++, C#, MATLAB(R) or python(TM).

Related Papers

Preparing for submission (Depth from defocus using color-filtered aperture) Zhuoran Wang, Yannis Stylianou, Tsung-Hsien Wen, Pei-Hao Su, Steve Young, “Learning Domain-Independent Dialogue Policies via Ontology Parameterisation”, Proc. SIGDIAL 2015, September 2015.

Other Research Topics

Proposals from applicants for new advanced research topics which are relevant to this year’s Toshiba Fellowship Programme research topics are also welcome. Toshiba appreciates such proposals and will determine their acceptability based on the current circumstances of Toshiba’s R&D activities.

› Visit the Toshiba Fellowship Programme website **www.toshiba.eu/fellowship** for more information