ITEA 2

INFORMATION TECHNOLOGY FOR EUROPEAN ADVANCEMENT

Project Profile

Reducing complex image-processing latency

To improve immediate use of image information

Minimal invasive medical intervention needing real-time complex image processing

HiPiP is setting out to obtain high throughput image processing of often very large and heterogeneous data sets. The project is addressing the demand for shorter image-processing times in three main areas: detailed brain imaging, minimal invasive surgery and faster operation of high resolution instruments. The main users of the technology will be companies that need fast and affordable complex image processing. Success will have a major impact on their offering to clients who will be able to get more informative data readily from their images.

Currently, the processing of complex detailed brain images takes days and is only applied in academic environments; the aim of HiPiP is to reduce the processing time of complex brain images from days to minutes. Minimal invasive interventions – i.e. introducing instruments into patient through a small opening – are increasingly replacing open surgery procedures; this requires a large amount of imaging as fast and precise as possible, preferably on a real-time basis. Electron microscopes (EM) and focused ion beam (FIB) instruments are used as nanotechnology tools to obtain high-resolution structural information on nanometre-scale samples; they increasingly demand high performance image processing using complex algorithms to produce meaningful results from the vast amounts of data generated.

INEXPENSIVE SOLUTIONS FOR COMPLEX TASKS

The project enables image processing to be supported by very fast developments in the multi-core personal computer (PC) industry. This allows the consortium partners to focus on their own expertise and added value. The project strengthens the competitive advantage of European industry in the following areas:

- The ability to use standard hardware solutions for parallel processing, leading to time-to-market reduction for new innovations and to flexible integration of new image-processing algorithms;
- The ability to address market trends flexibly to more and more application-specific algorithm support in real time; and
- Offering cost reduction to the market as well as creation of new business.

The project builds on the experience of Bull in providing parallel solutions for computation-intensive solutions. Currently, these are based on special hardware configurations of several to a few thousand processors. New in this project are the kind of algorithms – complex image-processing tasks – and the demand for inexpensive hardware solutions.

IMPROVING PROCESSING LATENCY

The main objective of the project is to develop novel methods for parallel image processing, improving the throughput time of algorithms to process large

HiPiP
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Bull
CEA
DOSIsoft
FEI
IMSTAR
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Countries involved
France
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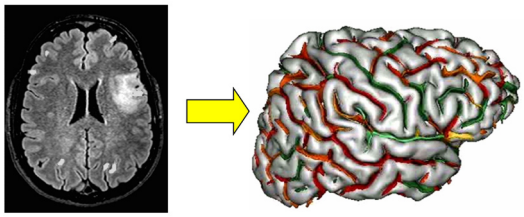
and heterogeneous data sets to make them usable for real-time or low-latency procedures.

To make these solutions affordable and easy to implement for customers, they need to be compatible with standard multi-core hardware architectures. Therefore HiPiP is not only developing image-processing algorithms, but it will also make them available to run on available multi-core architecture, interconnects and operating systems. The algorithms will be adapted for this architecture to satisfy all the non-functional requirements, such as performance, low latency and reliability.

PPARALLEL ALGORITHMS FOR HETEROGENEOUS TASKS

Easy parallel solutions exist for many basic image-processing algorithms. Often, many data points are processed by the same algorithm independently of each other, leading to long throughput times. However, there is no simple parallel solution for complex image-processing algorithms because of data and operation dependency, different scales of granularity that need to be connected or since it is unclear at which level of granularity an efficient parallel solution exist. These are the algorithms that HiPiP addresses.

The basic principle of parallel processing is to divide a task into smaller tasks that can run relatively independently in parallel, and therefore enable the whole task to be carried out faster. Parallel solutions will be found by applying a clever mixture of data partitioning, data copying and distribution, and task partitioning. Tasks may need to start without the availability of all data involved, meaning that they will work with clever predictions and approximations.



Reduce hours of processing time for complex functional brain imaging

SOLUTIONS FOR APPLICATIONS, SYSTEMS AND NETWORKS

To fulfil the objectives the following activities are envisaged:

- **Image-processing parallelisation:** Developing novel methods for transforming image-processing algorithms to run on standard multi-core hardware, with focus on algorithm structure, algorithm process representation and resource management within algorithms and interfaces, with special care to low latency;
- **Application parallelisation**: The goal is to define a generic system architecture, taking into account the requirements for medical imaging-acquisition systems and electron microscopes. This should enable execution of parallel tasks: real-time imaging, background image archiving and background image processing and reconstruction;
- **Server-based computing**: The goal is to demonstrate the feasibility and assess the technical limits of a server-based computing resource for computation, demanding algorithms within the constraints of network resources. Server-based solutions performing image processing for many systems are being investigated: creation of realistic use cases using a server, resource management at the server and quality of service management; and
- **Building demonstrators**: Validation of parallel image-processing methods, architecture and integration in hardware of medical imaging systems and electron microscopes.

DEMONSTRATING COMPLEX SYSTEMS

The project is building demonstrators that show the feasibility of complex image processing using standard multi-core hardware. In building the demonstrators, results will be documented that consolidate the lessons learned during the project.

The main findings on the parallelisation, scheduling and use of standard hardware imaging algorithms for the different applications will be made available in public reports. The project plans to demonstrate and publish the results for internal and external parties, and at open events. Key actions in disseminating the results will be publications and demonstrations of the results at public and private events.

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- ITEA 2 – Information Technology for European Advancement – is Europe's premier co-operative R&D programme driving pre-competitive research on embedded and distributed software-intensive systems and services. As a EUREKA strategic Cluster, we support co-ordinated national funding submissions and provide the link between those who provide finance, technology and software engineering. Our aim is to mobilise a total of 20,000 person-years over the full eight-year period of our programme from 2006 to 2013.

- ITEA 2-labelled projects are industry-driven initiatives building vital middleware and preparing standards to lay the foundations for the next generation of products, systems, appliances and services. Our programme results in real product innovation that boosts European competitiveness in a wide range of industries. Specifically, we play a key role in crucial application domains where software dominates, such as aerospace, automotive, consumer electronics, healthcare/medical systems and telecommunications.

- ITEA 2 projects involve complementary R&D from at least two companies in two countries. We issue annual Calls for Projects, evaluate projects and help bring research partners together. Our projects are open to partners from large industrial companies and small and medium-sized enterprises (SMEs) as well as public research institutes and universities.

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