AZ "ÖVEGES JÓZSEF" HALLGATÓI és PhD ÖSZTÖNDÍJ

2013-2014-AS TANÉVRE ÉRVÉNYES PROJEKT TÉMÁI

szervezeti egységenként csoportosítva

Advantage Workstation képfeldolgozó és diagnosztikai munkaállomás egység

A legfontosabb termékünk az Advantage Workstation, amely nagyban segíti az orvosokat, hogy az adatok alapján döntéseket hozzanak, és megsokszorozzák az adatfeldolgozás sebességét, kezdve az adatátviteltől egészen az eredmények közléséig. Olyan hardver és szoftveralkalmazásokat készítünk, amelyek megkönnyítik az orvosoknak a modern képalkotó rendszerek (CT, MR stb.) által szolgáltatott hatalmas mennyiségű információ feldolgozását. Többek között háromdimenziós modelleket alkotunk, illetve más speciális orvosi képfeldolgozáson alapuló alkalmazásokkal segítjük a diagnózisok felállítását.
Legfontosabb szoftver területeink:

- 3D rekonstrukció
- Érszűkület, valamint szívkamra analízis
- Radioterápiás tervezés virtuális szimulációval
- Vizsgálatok követése PET-tel: daganatok összehasonlítása a kezelés előtt és után
- Az alkalmazások működéséhez és az adatok kezeléséhez, tárolásához szükséges platform

Title	**Web applications in medical imaging**
Id	G-AW-PLATF-1202
Introduction	In medical diagnostics and imaging mobility, accessibility and collaboration is an increasing need. At a radiology department images generated by acquisition systems and their post processed 2D and 3D forms – which usually contain large amount of data - need to be presented to radiologists and physicians independently their location and hardware. Our product provides 2D and 3D anatomical reconstructions and measurements to doctors in order to guide diagnosis, radiotherapy, and surgery. Main focus of the thesis is fast, effective image visualization and basic manipulation using web based application technics like HTML5, WebGL and related technologies (CSS3, javaScript, eventually some WHATWG specifications). Another area of investigation is how to provide direct access to the medical data (DICOM) using web services in concordance with the IHE specifications and guidelines.
Goal	Design platform architecture and create guideline and requirement for hosted applications and suggest how to create and us web applications in medical world
Duration	1+8 months
Required skills	Fundamentals of WebGL, HTML, Web services, SOA Communication level English
Tutors	Sótanyi Balázs +36 23 410 044; balazs-zoltan.sotanyi@med.ge.com
Further information	

Title	**DICOM test data generation**
Id	G-AW-PLATF-1302
Introduction	Medical applications require extensive testing but sometime it is not feasible to gather real medical test data sets due to time, cost, legal or other practical reasons. Artificial data generation could answer many test situations, starting from simple textual informations to clinically validated models for phantoms.

Goal	Set up a data generation framework and basic modules that is able to generate new DICOM test data using algorithms or existing test data to create new cases. Creating an easy-to-use interface for testers to generate datasets and API to add new modules for specific areas, like patient information or pixel data. Basic modules should handle patient information, patient setup geometry, image plane geometry and some artificial pixel value generation and transformation for CT and preferably other frequently used modalities.
Duration	1 year or more
Required skills	C/C++ or other language that has accessible DICOM library to manipulate data. Willingness to understand DICOM format and content. Experience in Web enabled applications is preferred.
Tutors	Cziria Balázs balazs.cziria@ge.com
Further information	

Title	**Code change impact estimation based on historical data and code analysis**
Id	G-AW-PLATF-1310
Introduction	Codebase of medical applications can evolve throughout many years, developer team may also change significantly. Discovering the impact of a specific change in the code and having a proper test harness for it is not an easy task. However codebase evolution is typically versioned and archived and historical data may support the assessment of impact and creating test cases to cover possible regressions.
Goal	Investigate the possibility of using versioning history to provide automated impact assessment of a code change, review literature. Setting up a system that is capable to do analysis on nightly builds or integrated items. Measure the effectiveness of the system to uncover problems on historical versions.
Duration	1 year
Required skills	Basic knowledge of c/c++/java languages required. Knowledge about code versioning systems are preferred.
Tutors	Cziria Balázs balazs.cziria@ge.com
Further information	

Title	**Test Automation for clinical platforms**
Id	G-AW-PLATF-1303
Introduction	Nowadays there is an increasing need for autotests in GE Healthcare. Medical applications platforms are getting more complicated, number of possible configuration is exponentially growing, the role and the number of the tests are growing. With autotests we can reduce the test execution time and increase the configuration coverage.
Goal	The goal of the project is to • create test scenarios and framework base • analyse test infrastructure configurations, and based on statistical and test coverage literature define the number of configuration conbinations for best possible coverage • establish and maintain the nightly test sets and executions • create design/ validation documentation and validate the scenarios • prove the initial concept for test coverage performing statistical analysis after test execution
Duration	8-12 months
Required skills	QFTest experience is an advantage English: Communication level
Tutors	Jakab Jozsef +36 23 410 040 jozsef.jakab@med.ge.com
Further information	

Title	**Image transfer through network**
Id	G-AW-PLATF-1304
Introduction	In today's word image transfer is more relevant than ever. Either domestic video transfer, collaboration with screen sharing or medical image shall be moved over network with good performance. It shall be analyzed what available technologies can be applied to the AW Server client – server communication needs and what would be the impact on the current product. Such a technology shall be selected and integrated into the current AWS. The AW Server product is an image post-processing solution allowing selection, review, processing and filming of multiple modalities DICOM images from a variety of PC client machines, using LAN or WAN networks.
Goal	Research, select, reuse or develop an image transfer technique meeting CTQs defined by the AW Server
Duration	1 year
Required skills	Search engines, image processing Communication level English
Tutors	Attila Vojtek +36 23 410 213; attila.vojtek@ge.com
Further information	

AW Klinikai alkalmazások egység, szegedi K+F iroda

Az AW szegedi K+F irodájában jövőbeli klinikai alkalmazásokat megalapozó algoritmus-fejlesztés folyik. A legfontosabb kutatási terület a különböző modalitású orvosi képek automatikus szegmentációja.

Title	**Anatomy based multi-modality registration**
Id	PhD-AW-APPS-1305
Introduction	The registration of multi-modality images is a well developing, but still very complicated and challenging area of the science. Multi-modality registration methods are often used in medical imaging as images of a subject are frequently obtained from different scanners. Examples include registration of brain CT/MRI images or whole body PET/CT images for tumor localization, registration of contrast-enhanced CT images against non-contrast-enhanced CT images for segmentation of specific parts of the anatomy, or registration of ultrasound and CT images for prostate localization in radiotherapy.
Goal	In this research project we would like to focus on the registration of medical images acquired from the same patient in different times or with different modalities. The goals are to study the most up-to-date registration techniques and develop a fast and robust hierarchical registration algorithm, which uses the anatomy information during the optimization (such as the typical deformation or shift of different organs, respiration correction, sub-anatomy registration, etc.).
Duration	3 years
Required skills	MsC in computer science, programming, image processing experience is advantage Communication level English
Tutors	Tamás Blaskovics: +36-23-410-362; tamasblaskovics@ge.com
Further information	

Title	**Automated segmentation of MR images for MR-only RT planning**
Id	PhD-AW-APPS-1306
Introduction	Radiation therapy is one of the most efficient ways of cancer treatment. Today the radiation therapy planning is primarily based on CT images, which allow computing dose distribution in the region of interest. Since MR images allow better separation of pathology, the role of MR modality is increasing in RT planning. However, MR images cannot be used for dose calculation due to different physical background of imaging. There is a big need for automated segmentation of the main anatomical structures because it could facilitate the actual (contouring organs at risk) as well as future (MR only) RT planning workflow.
Goal	The goal is to develop method that can automatically segment all structures (including inside and outside air, fat, organs, and bones) within an anatomical region (such as head and neck, pelvis, or abdomen). The method shall work for T2 (as well as T1) weighted MR images.
Duration	3 years
Required skills	MsC in computer science, programming, image processing experience is advantage Communication level English
Tutors	Gábor Novák: +36-23-410-115; Gabor_Novak@ge.com
Further information	

Title	**Multi-modality tumor contouring**
Id	G-AW-APPS-1307
Introduction	The objective quantification of a tumor (i.e. measuring its size and volume) plays very important role in image guided monitoring of cancer treatment. There were various medical imaging techniques developed to visualize pathology inside the human body. The different modalities (CT, MR, PET) provide complementary information about a region of interest, so a tumor may have different morphology in each image. That is why there is a big need for tools, which enable the physician to take all available images into account, when the tumor contour is defined.
Goal	The goal is to explore the state of the art in multi-modality image segmentation and develop a semi automated tool that can visualize multiple images of a tumor in an informative way (fusion) and determine the tumor boundary (segmentation) incorporating the information of all input images and the interactions of the physician.
Duration	1 year
Required skills	BsC in computer science, programming, image processing experience is advantage Communication level English
Tutors	Árpád Tari: +36-23-410-467; arpad.tari@ge.com
Further information	

Title	**Contour adaptation for medical images**
Id	G-AW-APPS-1308
Introduction	Radiation therapy is one of the most efficient ways of cancer treatment. This technique allows irradiating the tumor without significant damaging healthy organs around the tumor. The radiation therapy planning is based on 3-dimensional medical images (CT, PET, MR). The workflow involves the contouring of the tumor and other anatomical structures. This process is very time consuming, especially when more images are available for planning or re-planning is necessary due to significant change of the tumor or patient anatomy during a long treatment.
Goal	The goal is to develop an algorithm that can adapt a set of contours defined for a reference image into another image that was acquired with another modality or in another time. Such an algorithm would allow the transfer of organ contours defined on the MR image (better soft tissue contrast) into the CT image (used for dose calculation) and automating the re-planning process.
Duration	1 year
Required skills	BsC in computer science, programming, image processing experience is advantage Communication level English
Tutors	András Osztroluczki: +36-23-410-442, AndrasOsztroluczki@ge.com
Further information	

Title	**Automated methods in medical image processing**
Id	G-AW-APPS-1309
Introduction	Due to the widespread of 3D imaging modalities (CT, MR, PET) the number of cases processed by the radiologists has been significantly increased in the last decade. In order to facilitate medical image processing, various software applications have been recently developed. These applications can be further optimized, if some of their functions are automated. When the number of manual steps is decreased in a clinical workflow, the physician can focus on complex problems, which cannot be solved by the computer. Even a small modification of the workflow can result in big improvement of efficiency, when the workflow is repeated many times by the clinician.
Goal	The goal is to develop new algorithms to facilitate automated processing of 3D medical images. The topic may involve visualization (2D image fusion, 3D rendering), detection (locating characteristic structures, recognizing patterns or abnormality), segmentation (intensity modeling, contouring algorithms, quantification of 3D structures), registration (image to image, model to image), as well as optimization (parallelizing algorithms). The problem to solve is defined based on the actual research needs and the student's interest.
Duration	1 year
Required skills	BsC in computer science, programming, image processing experience is advantage
Tutors	László Ruskó: +36-23-410-173; laszlo.rusko@ge.com
Further information	

Vscan egység

Csapatunk a legújabb generációs hordozható ultrahang, a Vscan fejlesztésén dolgozik. A Vscan méretének köszönhetően egyedülálló orvosi berendezés a vállalat termékei között és világszerte is.

Title	**Automated testing for mobile ultrasound device**
Id	G-Vscan-1311

Introduction	Nowadays there is an increasing need for auto-tests in GE Healthcare. Mobile medical devices usage is increasing, hospital and even outdoor use scenarios are getting significant. Due to their intended use / environment, broad robustness testing of these devices is needed. To make sure most of these cases are covered, automated test tools need to be used.
Goal	The goal of the project is to establish a test infrastructure needed for testing embedded devices, concretely Vscan, a mobile ultrasound device. This activity includes: • basic understanding of the underlying hardware components • understand the current automated test tools / scripts • evaluate the efficiency the test methods • enhance / redesign current test framework
Duration	12 months
Required skills	C++, Java, scripting English: Communication level
Tutors	Csaba Devenyi csaba.devenyi@ge.com
Further information	