POSTER SESSION BOOKLET

MISS 2014
Medical Imaging Summer School

http://www.dmi.unict.it/miss

University of Catania
University of Oxford
University of Cambridge

Medical Imaging Summer School 2014

Medical Imaging meets Computer Vision

Favignana, 28 July - 1 August 2014

Medical Imaging Summer School

Medical imaging is the science and technology to acquire images of the human body (either as a whole or in parts) for clinical interpretation or interventions. The main challenge for clinicians lies in the explosive number of images being acquired, and their hidden, often complementary or dynamic information contents. To aid the analysis of this increasing amount and complexity of medical images, medical image computing has emerged as an interdisciplinary field at the interface of computer science, engineering, physics, applied mathematics, and of course medicine. In this field, scientists aim to develop robust and accurate computational methods to extract clinically relevant information. In contrast, the field of computer vision is the science and technology of making machines that see, with a focus on the design, theory and implementation of techniques that allow for automatic processing and interpretation of images and videos. Recent research in these traditionally separate fields suggests that both scientific communities could mutually benefit from one another but a scientific gap continues to exist.

The focus of this Medical Imaging Summer School (MISS) is to train a new generation of young scientists to bridge this gap, by providing insights into the various interfaces between medical imaging and computer vision, based on the shared broad categories of: image segmentation, registration and reconstruction, classification and modelling, and computer-aided interpretation. The course will contain a combination of in-depth tutorial-style lectures on fundamental state-of-the-art concepts, followed by accessible yet advanced research lectures using examples and applications. A broad overview of the field will be given, and guided reading groups will complement lectures. The course will be delivered by world renowned experts from both academia and industry, who are working closely at the interface of medical imaging/computer vision.

The Medical Imaging Summer School MISS was established in 2014. The school is organized by University of Oxford, University of Catania and University of Cambridge. The general entry point for the MISS editions is:

http://www.dmi.unict.it/miss

MISS Poster Session

The school aims to provide a stimulating graduate training opportunity for young researchers and Ph.D. students. The participants will benefit from direct interaction with world leaders in medical image computing and computer vision (often

working in both fields). Participants will also have the opportunity to present their own research, and to interact with their scientific peers, in a friendly and constructive setting.

This booklet contains the abstract of the posters accepted to MISS 2014.

Best Presentation Prize

A best presentation prize will be given to the best presentation selected by the school committee.

Favignana, June 2014

Roberto Cipolla, University of Cambridge, United Kindom
Giovanni Maria Farinella, University of Catania, Italy
Julia Schnabel, University of Oxford, United Kingdom
Filippo Stanco, University of Catania, Italy

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NON-RIGID MONOCULAR SLAM

Agudo A., Moreno-Noguer F., Calvo B., Montiel J.M.M.

Abstract: Navier's equations modeling linear elastic solid deformations are embedded within an Extended Kalman Filter (EKF) to compute a sequential Bayesian estimate for non-rigid monocular Simultaneous Localization And Mapping (SLAM). The scene is represented as a Finite Element Method elastic thin-plate solid, where the discretization nodes are the sparse set of scene points salient in the image. It is assumed a set of Gaussian normalized forces acting on solid nodes to cause incremental scene deformation.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

SEGMENTATION OF LIVING, FLUORESCENTLY LABELED CELLS USING GRAPH CUTS

Akram S., Kaakinen M., Heikkilä J., Kannala J., Eklund L.

Abstract: Accurate cell segmentation is an essential initial step for most detailed automatic quantitative analysis. When the images are captured sequentially from the 3D culture containing living, proliferating and moving cells the incidences of cell-cell interactions and collisions increase, which makes cell segmentation very challenging. Here we present a method which utilizes the edge probability map and graph cut method to segment individual cells from within a cluster.

Contact: sakram@ee.oulu.fi

Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

A NOVEL SUPERVISED METHOD FOR CORNEAL FIBRES TORTUOSITY CLASSIFICATION USING A MULTI-SCALE-MULTI-WINDOW APPROACH

Annunziata R., Kheirkhah A., Aggarwal S., Cavalcanti B. M., Hamrah P., Trucco E.

Abstract: We present a novel method for classifying corneal nerves images in 4 levels of tortuosity. We use multi-scale features and a new multi-window algorithm for curvature estimation. A wrapper using logistic ordinal regression or an embedded method based on random forests is applied for feature and scale selection. Tested with 90 images classified by 3 clinicians, the accuracy of our system is 88.89%, 76.67%, 77.22% against each observer, outperforming the best one hold out (76.67%,76.67%,75%).

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

PATIENT-SPECIFIC SIMULATION OF LIVER TUMOR ABLATION

Audigier C., Mansi T., Delingette H., Kamen A., Comaniciu D., Ayache N.

Abstract: Radio-Frequency Ablation (RFA) is a minimally invasive ablative therapy of liver tumor ablation and a solution when resection or transplantation are not possible. However there are still some problems with this method, for exemple, a high rick of recurrence, which can lead to incomplete treatments. Models based on Finite Element Method (FEM) have been proposed to compute the heat diffusion in the liver, to predict the state of the cells with Cellular Necrosis Models, and even to predict the optimal placement of the probe. Nevertheless these methods are too slow for planning or guidance. Thus, our goal is to propose a predictive framework for patient-specific liver tumor ablation which is able to models the time-varying diffusivity, the thermal effect of the parenchyma and vasculature, but which is also real time to allow planning and guidance.

Contact: chloe.audigier@inria.fr

Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

EFFICIENT ENERGY MINIMIZATION FOR MOTION COMPENSATION IN ROBOTIC SURGERY

Aviles A.I., Sobrevilla P. and Casals A.

Abstract: The existing Robotic Surgical Systems have two drawbacks: i) lack of physiological motion compensation and ii) absence of force feedback. These issues are considered open problems due to the lack of robustness, efficiency and accuracy of the existing proposals. Thus, our research is focused on computer vision energy minimization methods, which allows approximating the heart motion via its surface deformation. Moreover, the capability of the Recurrent Neural Networks for predicting time series is used in order to deal with tool-tissue iteration.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

ROUGH SETS FOR BIAS FIELD CORRECTION IN MR IMAGES USING CONTRAHARMONIC MEAN AND QUANTITATIVE INDEX

Banerjee A. and Maji P.

Abstract: The paper presents a novel approach for bias field correction in MR images by judiciously integrating the merits of rough sets and contraharmonic mean. A theoretical analysis is presented to justify the use of both rough sets and contraharmonic mean for bias field estimation. Some new quantitative indices are also introduced to measure the performance of the proposed approach, along with other related approaches, on both simulated and real MR images for different bias fields and noise levels.

Contact: abhirup_r@isical.ac.in

Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

DYNAMIC CT PERFUSION IMAGE DATA COMPRESSION FOR EFFICIENT PARALLEL PROCESSING

Barros R. S., Olabarriaga S. D., Borst J., van Walderveen M. A. A., Posthuma J. S., Streekstra G. J., van Herk M. B., Majoie C. B., Marquering H. A.

Abstract: CT perfusion (CTP) image data requires new approaches to deliver timely results for acute care. Cloud architectures based on graphics processing units (GPUs) can provide the processing required for delivering fast results. However, the transfer of CTP datasets to the cloud is slow and so not suitable in acute situations. To reduce transfer time, we propose a fast and lossless compression algorithm for CTP data. To the best of our knowledge, this is the first work to present a GPU-ready method for medical image compression with random access to the image elements from the compressed data.

Contact: renansalesbarros@gmail.com

Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

AUTOMATIC DETECTION AND SEGMENTATION OF LIVER METASTATIC LESIONS ON SERIAL CT EXAMINATIONS

Ben-Cohen A., Diamant I., Klang E., Amitai M., Greenspan H.

Abstract: A novel automated method for detection and segmentation of various liver metastases classes on serial CT examinations is shown. Our method uses the given 2D baseline segmentation mask for identifying the lesion location in the follow-up CT and locating surrounding tissues in order to reduce the search area for segmentation. Adaptive region-growing and mean-shift clustering are used to obtain the final lesion segmentation. Results show average Dice index of 0.84?0.07 and matching rate of 93.2%.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

AUTOMATED MONITORING OF SKIN LESIONS USING A 3D BODY MODEL

Bogo Federica, Romero Javier, Peserico Enoch, Black Michael J.

Abstract: We propose an automated pre-screening system for detecting new melanocytic lesions or changes in existing ones, as small as 2-3mm, over almost the entire body surface. Our solution relies on a multi-camera 3D stereo system. We capture textured scans of a subject at different times, and bring these scans into correspondence by aligning them with a learned, parametric 3D body model. Captured skin textures are in accurate alignment across scans, facilitating the monitoring of lesions over time.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

DEFORMABLE IMAGE REGISTRATION IN PROSTATE CANCER IMAGE-GUIDED ADAPTIVE RADIOTHERAPY

Boydev C, Taleb Ahmed A, Pasquier D, Derraz F and Thiran J-P

Abstract: In radiation therapy, the development of in-room imaging systems such as cone beam computed tomography (CBCT) allows to localize organs of interest at treatment day, and perform a more accurate dose delivery after registration of the planning CT and the daily CBCT scans. Using CT/CBCT deformable registration (DR) at this stage also allows dose plan updates during treatment course. CT/CBCT DR in the pelvic region is challenging due to the poor image quality of CBCT scans. We developed a joint registration and segmentation algorithm that integrates active contours (level sets) and a Bspline deformable transform in a variational framework.

Contact: boydevchristina@gmail.com

Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

AUTOMATED RECOGNITION OF VIEW PLANES IN FETAL HEART ULTRASOUND VIDEOS

Bridge C., Noble A.

Abstract: Ultrasound imaging of the fetal heart is vital for the antenatal diagnosis of congenital heart disease. To maximise the likelihood of detecting abnormalities, it is desirable to visualise several complementary views; however this is time-consuming and requires experienced sonographers. We present initial work towards a method for automated detection of viewing plane within ultrasound videos, arguing that such a method needs to make use of motion cues within the video.

Contact: christopher.bridge@eng.ox.ac.uk

Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

AUTOMATIC MULTI-VESSEL VOLUME FLOW CALCULATION FROM 4D FLOW MRI DATA

Bustamante M., Dyverfeldt P., Petersson S., Eriksson J., Carlhäll C., Ebbers T.

Abstract: A method was developed to automatically calculate volume flow through planes located on the major vessels of the heart on 4D flow MRI data. An atlas was created from one subject and was used to locate the planes on more subjects using registration. Vessel motion over the cardiac cycle was also taken into account. Initial results of the volume flow on the aorta in healthy volunteers show good agreement with volume flows in the pulmonary trunk, pulmonary branches and vena cava.

Contact: mariana.bustamante@liu.se

Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

3D FREEHAND ULTRASOUND: RECONSTRUCTION AND FEATURES EXTRACTION IN LOWER LIMB MUSCLE

Cenni F., Monari D., Schless S.H., Aertbeliën E., Desloovere K.,Bruyninckx H.

Abstract: Ultrasound systems can be enhanced to combine 3D data and corresponding spatial information. This approach, called 3D freehand Ultrasound (3DFUS), uses ultrasound (US) images and the corresponding pose of the transducer with the purpose of reconstructing the 3D morphology for large anatomical parts. So far, this 3D reconstruction has only limited clinical use as the procedure is not widely accessible and features extraction is very time consuming. Our current work is aimed at developing a new tool for image reconstruction and to optimizing the features extraction process in 3DFUS.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

MEDICAL SIEVE: APPLICATION TO STENOSIS DETECTION IN X-RAY ANGIOGRAPHY

Compas C., Syeda-Mahmood T., McNeillie P., Beymer D.

Abstract: The Medical Sieve is a worldwide IBM research Grand Challenge Project. It is a collaboration between groups in San Jose CA, Haifa Israel, and Melbourne Australia. The aim of this ambitious project is to produce automated radiology and cardiology assistants to help clinicians in their diagnostic decision-making. Here we present an example of the system applied in the cardiac domain, with a focus on an image processing pipeline for stenosis detection in X-ray angiography.

Contact: cbcompas@us.ibm.com

Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

MODERN CT IN KIDNEY ANALYSIS : SEMI-SUPERVISED LEARNING MEETS STEREOLOGY

Correa Shokiche C., Hlushchuk R., Schaad L., Wnuk M., Zubler C., Barr S., Tschanz S., Reyes M., Djonov V.

Abstract: Nephron number and glomerular volume are the key features in renal morphometry. The accurate estimation of these parameters has become increasingly important because their alterations may play a significant pathophysiological role in the development and/or progression of a range of nephropathies and various kidney-related pathologies. Nowadays the gold-standard method of the kidney morphometry is the exhaustive physical fractionator/dissector method (often combined with Cavalieri for kidney volume estimation). Although accepted as standard in the lab animal research, it is extremely time-consuming and laborious and therefore rather rarely performed. We use an automatic detection and segmentation scheme based on semi-supervised decision forest for a fast estimation of such parameters as nephron number, glomerular volume, glomerular size distribution and kidney volume.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

TASK-DRIVEN FEATURE LEARNING FOR TUMOR HISTOLOGY

Couture H.D., Marron J.S., Thomas N., Eberhard D., Perou C., Niethammer M.

Abstract: Through learning a dictionary of images features, we can capture the local structure of tumor tissue from histology images. Our work strives to improve the discriminatory power of the dictionary by incorporating class information into the sparse coding formulation. This technique is shown to improve tumor diagnosis and subtyping models and further our goal of interpretable features.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

WEARABLE STEREOSCOPIC AUGMENTED REALITY SYSTEM FOR MEDICAL PROCEDURES

Cutolo F.

Abstract: Aim of my research project is to optimize and validate a newly designed, localiser-free, stereoscopic head-mounted system featuring augmented reality (AR) as an aid to several surgical procedures. AR may provide physicians with a direct perception of where virtual anatomies are located within an actual scene and may constitute a functional and ergonomic integration between navigational surgery and virtual planning. In a preliminary study we demonstrated the potential utility of the proposed system for the freehand external guidance of endovascular magnetic carriers.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

MULTI-ATLAS SEGMENTATION OF PARTIALLY VISIBLE STRUCTURES ON CT IMAGES OF MIDDLE AND INNER EAR

Demarcy T., Delingette H., Ayache N.

Abstract: Cochlear implant surgery planning requires careful segmentation of middle and inner ear anatomical structures. This process is complex and challenging on CT images because small structures are partially visible. High resolution images are accurate enough for providing the missing information. Atlases based on manually segmented micro CT images are registered to CT, generating a probability map (work in progress). Segmentation of partially visible anatomy can be performed using shape prior.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

MULTI-SUBJECT WHITE MATTER FIBER CLUSTERING OF MOUSE BRAIN

Dodero L., Vascon S., Gozzi A., Sona D. and Murino V.

Abstract: Diffusion Tensor Imaging is a useful technique for describing white matter structure, through which it is possible to estimate the anatomical connectivity via tractography measurements. One problem related to the use of tractography is the large number of fibers estimated. We present an unsupervised approach based on the Dominant Sets framework, which is rooted in the Game Theory, to automatically segment white matter fibers into clusters for retrieving group-wise bundles of fibers.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

FREQUENCY BASED STRAIN ESTIMATION AND CLINICAL RESEARCH TOOL USING OPTIC FLOW FOR TMRI

Filatova O.G., Kause H.B., Duits R., Bruurmijn L.C.M., Fuster A., Marquering H.A., Florack L.M.J. and Van Assen H.C.

Abstract: For patients who require an aortic valve replacement, but have a high operative risk, the Transcatheter Aortic Valve Implantation technique has recently become available. Imaging, often including tagging magnetic resonance imaging (tMRI), is performed to assess the patient-specific situation and to verify the success of valve implantation. To assess functional success, we propose a method to estimate cardiac left ventricular deformation from tMRI based on local tag frequency estimation and which will be incorporated in a software tool being developed at TU/e.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

STATISTICAL MODELS FOR THE COUPLING OF ASL AND BOLD MAGNETIC RESONANCE MODALITIES TO STUDY BRAIN FUNCTION AND DISEASE

Frau-Pascual A., Vincent T., Forbes F., Ciuciu P.

Abstract: ASL fMRI data provides a quantitative measure of blood perfusion, that can be correlated to neuronal activation. In contrast to BOLD measure, it is a direct and closer to neuronal activity measure. However, ASL data has a lower SNR and resolution. We aim at using both signals advantages to improve the estimation of the response functions.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

SEGMENTATION AND TEXTURE ANALYSIS OF RETINAL OCT IMAGES

Giannini D., Lombardo M., Ziccardi L., Vichi M. , Grzywacz N. M.

Abstract: Inherited retinal dystrophies (IRD) lead to severe loss of foveal photoreceptors. Optical Coherence Tomography (OCT) is an imaging technology that allows monitoring retinal disease progression. We developed automated methods to analyze the OCT images in a patient suffering from Occult Macular Dystrophy (OMD) during 3 years follow-up. The methods included the segmentation and texture analysis of OCT images. We showed their reliability to quantify structural disruption of the photoreceptor layer.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

RETINAL LAYERS ANALYSIS IN OCT IMAGES

Gonzàlez-Lòpez A., Ortega M., Penedo M.G.

Abstract: Optical Coherence Tomography (OCT) is a very promising imaging technique used by ophthalmologist to diagnose diseases. Retinal morphology can be identified effectively on them, providing information of disease pathogenesis. In this work, retinal layers are segmented using different approaches, combining 2D and 3D models, being robust when vessel shades or anomalous structures are present. After that, indicator extraction and detection of pathological structures can be tackled.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

SOURCES OF ERRORS IN PHARMACOKINETIC ANALYSIS OF DCE-MRI

Hallack A., Chappell M. A., Anderson E. A., Gleeson F. V., Gooding M. J. and Schnabel J. A.

Abstract: Variable flip angle SPGR MRI sequences are used to compute the T10 (relaxation time) map of regions of interest which is used in Pharmacokinetic parameter (Ktrans/kep) analysis of dceMRI. We evaluate the effects of motion in these sequences on the accuracy of T10 and subsequent Ktrans and kep estimation. Using rigid registration, we also estimate the amount of motion found in colorectal SPGR sequences. With this we quantify the expected error in Ktrans and kep due to motion between these images.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

ACCURACY MEASUREMENT FOR MULTI-MODAL RIGID REGISTRATION USING FEATURE DESCRIPTORS

Hauler F., Jurisic M. Furtado H, Birkfellner W.

Abstract: In radiotherapy (RT), different image modalities like CT and MRI or CBCT help to define tumor structures before applying a high dose of ionizing radiation to tumor regions (called target volume). These images need to be registered, finding an optimal geometrical transformation which aligns one dataset (moving image) with corresponding areas into an other dataset (fixed image) taken at various point in time or by different scanners [1]. The accuracy of multi-modal image registration is crucial to spare the surrounding healthy tissues; therefore a reliable evaluation method for registration outcome is needed. The gold standard validation methods are visual inspection by experts and fiducial-based evaluation[2]. However visual inspection is time consuming and prone to errors. The fiducial-based evaluation is an invasive method when fiducial markers are fixated to the bone or organs. Therefore, a robust non-invasive automated method is needed for validating the registration accuracy in RT. The aim of this study is to introduce and evaluate an automatic landmark-based accuracy measure using feature descriptors for multi-modal rigid registration.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

MODEL SELECTION FOR DCE-MRI APPLIED TO SUBTLE BLOOD-BRAIN BARRIER DISRUPTION

Heye A., Thrippleton M., Armitage P., Hernàndez M., Wardlaw J.

Abstract: The purpose of this study was to choose a suitable pharmacokinetic model to quantify subtle blood-brain barrier (BBB) permeability using dynamic-contrast enhanced MRI (DCE-MRI). 201 mild stroke patients underwent DCE-MRI; three nested models were fitted to the data and ranked according to the Akaike information criterion. The Patlak model proved to be the most suitable model under the conditions of this experiment, providing the best trade-off between goodness-of-fit and model complexity.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

GENERATING GROUND TRUTH DATA FOR SKULL-FACE OVERLAY

Ibànez O., Huete M.I., Cavalli F., Campomanes-Àlvarez B.R., Campomanes-Àlvarez C., Valsecchi A.

Abstract: Craniofacial superimposition (CFS) is a technique to identify a missing person from skeletal remains. It involves the superimposition of a skull (or a skull model) with a number of ante mortem images of an individual, creating a skull-face overlay(SFO), followed by the analysis of their morphological correspondence. The assessment of SFO methods is hindered by the lack of ground truth superimpositions, preventing the forensic community to study the reliability of the process in an objective, quantitative way. In this work, we created the first such dataset using photos and Cone Beam Computed Tomography (CBCT) scans of 19 subjects.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

AUTOMATIC PERIVENTRICULAR WHITE MATTER HYPERINTENSITY SEGMENTATION, QUANTIFICATION & GRADING

Iheme L. O., Tepe S. M., Kandemir M., Kahraman T., Unal G., Yalciner B. Z., Unay D.

Abstract: We perform periventricular white matter hyperintensity segmentation by applying adaptive thresholding and 3D connectivity analysis to Fluid Attenuated Inversion Recovery MR images. The results were evaluated by comparing the automatic method to the manually delineated segmentations obtained from the experts. We obtained a dice score of up to 0.82 and a correlation coefficient of approximately 0.8 for the segmentation and quantification respectively.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

AUTOMATIC MULTIPLE SCLEROSIS BRAIN LESION LOCALISATION AND VOLUMETRY

Jain S., Smeets D., Ribbens A., Sima D.M., Maes F., Van Hecke W.

Abstract: The presence and location of white matter lesions on MRI are important criteria for diagnosing multiple sclerosis. Quantitative values such as lesion volumetry are expected to have high impact in clinical practice. Therefore, we propose an accurate, automatic method for lesion quantification based on T1 and FLAIR. The proposed method segments the lesions as an outlier to the normal brain. Finally, the number and volume of lesions is quantified for different brain regions.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

TRACKING JOINTS WITH ULTRASOUND

Jia, R., Mellon, S., Monk, P., Noble, J A.,

Abstract: About a quarter of the population in England have musculoskeletal conditions in 2006. The pathology of many musculoskeletal problems is likely to be related to abnormal joint kinematics. However, there is currently no effective method to dynamically measure 3D joint kinematics due to the spatial limitation or time consumption, etc. My research is to develop a novel ultrasound-based system to dynamically describe 3D joint kinematics for musculoskeletal condition diagnosis and therapy monitoring.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

UNCERTAINTY-AWARE INFORMATION FUSION FOR REAL-TIME MOTION ESTIMATION IN INTERVENTION NAVIGATION AND INTERACTION

Kocev B., Linsen L., Hahn H. K.

Abstract: Soft-tissue navigation systems face obstacles in the registration of the virtual information on the deformable soft-tissue organ, and in the surgeon-computer interaction process. We enable a real-time non-linear registration by uncertainty-aware fusion of three information sources: soft-tissue local motion measurements, motion dynamics, and shape information. To alleviate the interaction problem, we use a projector-based augmented reality and provide multi-touch gestures for direct interaction.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

LINE SEGMENT BASED PATTERN DETECTION

Lazarek J., Szczepaniak P.

Abstract: A novel solution for detecting the boundaries between areas of different brightness. Its goal is to provide a way to detect the boundaries between unclearly separated areas characterised by tonal transition. Our solution solves this problem by separating areas of different brightness and gives coordinates of boundary segments. It can be used as one of the steps in modern hierarchical image analysis techniques.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

STUDY OF THE DISLOCATION AND THE CHANGES OF THE VESSELS BEFORE DIABETIC RETINOPATHY

Leontidis G., Hunter A., Al-Diri B.

Abstract: One of the main challenges remains the understanding of the diabetes effect in hemodynamic functionality (blood flow, oxygen perfusion etc.) and vascular geometric adaptation before the first lesions of diabetic retinopathy appear. Crucial and Important part is the study of the progress of diabetes through the screening program. Multiple images of the same patient are useful in order to understand the progress by comparing these images either by taking vascular measurements or/and using registration algorithms.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 16:00 - 17:45

Poster Session: 1

COMPUTER-AIDED PERFUSION QUANTIFICATION OF MYOCARDIAL CONTRAST ECHOCARDIOGRAPHY

Li Y., Senior R., Chahal N., Eckersley R.J., Tang M.X.

Abstract: Myocardial contrast echocardiography (MCE) uses microbubbles as contrast agents to image myocardial perfusion. Myocardial perfusion analysis can aid in the diagnosis of coronary heart diseases. However, current analyses mostly rely on human visual assessments which are subjective and unreliable since MCE is noisy and highly variable. The project aims to use image processing techniques and quantitative methods to reduce human error and improve the diagnostic accuracy of MCE analysis.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

FAST VESSEL CENTERLINE TREE EXTRACTION ALGORITHM

Lidayova K., Frimmel H.

Abstract: Precise segmentation of vascular structures is crucial for studying the effect of stenoses on arterial blood flow. Segmentation of tubular structures may be facilitated and accelerated by first extracting the centerline tree directly from the grayscale 3D image and then using this as a seed region. We propose an algorithm for extracting the blood vessel centerline tree from Computer Tomography Angiography images. The algorithm is adapted to the tubular shape of vessels and is fast enough to permit interactive clinical use.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

INTRACORPOREAL SOFT TISSUE NAVIGATION SYSTEM FOR MINIMALLY INVASIVE SURGERY

Lo Presti

Abstract: According to the National Center for Health Statistics, about 600.000 hysterectomies/year are performed in USA, where a third of women can be expected to have a hysterectomy by age 60. In Italy more than 125.000/year. Minimally invasive surgery (MIS) offers many benefits. On the other hand, the related unexpected ureter injuries (incidence 0.2 - 6.0 %) are often associated with significant morbidity, the formation of utero-vaginal fistulas and the potential loss of kidney function. The research is aimed at developing and testing a system to avoid undesired ureters cutting in MIS.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

MELANOMA DETECTION AS A PROBLEM OF VISUAL RECOGNITION

MADOOEI A., DREW M.S.

Abstract: As the incidence of skin cancer rises worldwide, the demand for computer-aided diagnosis of skin disease increases. Advances in imaging technology and image processing, have expanded the repertoire of diagnosis via image analysis; a task similar to visual recognition from static images in computer vision. The latter has significantly improved lately. We take inspiration from this progress and aim to transfer domain experience for further improving computerized image analysis of skin lesions.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

RSURF - THE EFFICIENT TEXTURE-BASED DESCRIPTOR FOR FLUORESCENCE MICROSCOPY IMAGES

Majtner T., Stoklasa R., Svoboda D.

Abstract: Our work relates to the problem of classification of Human Epithelial (HEp-2) cells. We introduce a new efficient texture-based image descriptor for HEp-2 images and compare it with LBP, Haralick features (GLCM statistics) and Tamura features using the public MIVIA HEp-2 Images Dataset. Proposed descriptor outperforms all previously mentioned approaches and the kNN classifier based solely on this descriptor achieve the accuracy as high as 91.1%.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

PATIENT-SPECIFIC SEMI-SUPERVISED LEARNING FOR POSTOPERATIVE BRAIN TUMOR SEGMENTATION

Meier R., Bauer S., Slootboom J., Wiest R., Reyes M.

Abstract: We present a fully-automatic method for segmenting the residual enhancing tumor in postoperative multimodal MR images. The idea behind our approach is to effectively fuse information from both pre- and postoperative image data of the same patient to improve segmentation of the postoperative image. The method is evaluated on a cohort of 10 high-grade glioma patients, with segmentation performance comparable or superior to a state-of-the-art brain tumor segmentation method.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

STATISTICS ON LIE GROUPS

Miolane N., Pennec X.

Abstract: Medical Imaging often requires to estimate continuous transformations of the space, in other words: elements of a Lie group. A consistent statistical framework for Lie groups is needed. We investigate here the definition of the mean.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

STATISTICAL DEFORMATION MODELS FOR HIP FRACTURE DISCRIMINATION: VALIDATION BY MODEL COMPARISON

Museyko O., Bousson V., Adams J., Laredo J.-D., Engelke K.

Abstract: Using statistical shape models to classify shapes where shape differences are not readily observed may be complicated, one example is classification of proximal femur shape with respect to the fracture risk. Apart from the issues with model quality, the classifications made may depend on the shape model due to the real difference between model populations. We propose few simple similarity measures on the space of models and use them to check if the model (dis)similarity can explain difference, resp. conformity, in hip fracture discrimination from these models.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

SURFACE MOTION ESTIMATION VIA CONFORMAL MAPS

Nicolas Gallego-Ortiz, Jonathan Orban de Xivry, Samuel Goossens, Xavier Geets, Guillaume Janssens, Benoit Macq

Abstract: Breathing motion challenges precision of radiation therapy on thorax and abdominal regions. Direct measurement is often infeasible and only available through surrogates. This study aims the accurate estimation of surface motion. The proposed method maps 3D surfaces into common 2D parametric plane. Point correspondences are resolved as a registration problem between feature images. The approach will be validated on patient data with skin marks as ground-truth.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

UTILIZING PHASE RETARDATION FEATURES FOR SEGMENTING CELLS IN PHASE CONTRAST MICROSCOPY IMAGES

Nketia T. A., Rittscher J., Noble J.A.

Abstract: Label free imaging, especially, phase contrast microscopy, plays an important role in high-content microscopy, in particular live cell screening. We aim to develop a fast and robust segmentation algorithm that enables the extraction of accurate morphometric measurements at a single cell level. Here we make use of a recently introduced image restoration method, which captures intrinsic features of phase contrast images. The resulting features are aggregated into superpixels and then grouped into objects using standard clustering methods. The resulting method is computationally effective and only requires a minimal amount of user annotation. Proposed method is tested on a set of 10 phase contrast images of cervical cancer cell colonies of the HeLa cells. In order to compare our results with the literature, we report a Tanimoto coefficient of 0:94 for the set of images that were used in this study. The reported results indicate that our method does compare with the current state of the art.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

ACCURATE REGISTRATION OF MYOCARDIUM REGION IN CARDIAC PHASE-RESOLVED BOLD MRI

Oksuz I., Tsaftaris S. A.

Abstract: Unfortunately, most imaging methods used today for ischemia detection are invasive. Cardiac Phase resolved Blood Oxygen Level Dependent (CP-BOLD) MRI is a recently developed approach for examining BOLD changes and wall motion in a single cine acquisition. It does not use ionizing radiation or contrast media and provides physiological information on myocardial oxygenation. With this technique,myocardial BOLD signal intensity can be obtained as a function of cardiac phase. BOLD MRI may be used for detecting myocardial oxygenation changes secondary to coronary artery stenosis (1,2). To identify the disease, CP?BOLD relies on the observation that myocardial signal intensity varies as a function of cardiac phase (3). The method has the potential to rapidly determine the presence of oxygenation anomalies in the myocardium due to coronary artery disease, and provide an unbiased and quantitative imaging biomarker that can enable the assessment of the critical states of stenosis. In order to achieve highly sensitive results, accurate pixelwise registration of the myocardium region in between the cardiac cycle is essential. The pixels need to be specified and tracked throughout a cardiac cycle for determining the location of ischemia.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

COMPLEX LUNG MOTION ESTIMATION VIA ADAPTIVE BILATERAL FILTERING OF THE DEFORMATION FIELDS

Papiez, Bartlomiej W., Heinrich Mattias P., Risser Laurent, Schnabel Julia A.

Abstract: Estimation of physiologically plausible deformations is critical for several medical applications. For example, lung cancer diagnosis and treatment requires accurate image registration which preserves sliding motion in the pleural cavity, and the rigidity of chest bones. This work addresses these challenges by introducing a novel approach for regularisation of non-linear transformations derived from a bilateral filter. For this purpose, the classic Gaussian kernel is replaced by a new kernel that smoothes the estimated deformation field with respect to the spatial position, intensity and deformation dissimilarity. The proposed regularisation is a spatially adaptive filter that is able to preserve discontinuity between the lungs and the pleura and reduces any rigid structures deformations in volumes. Moreover, the presented framework is fully automatic and no prior knowledge of the underlying anatomy is required. The performance of our novel regularisation technique is demonstrated on 3D inhale and exhale pairs of clinical CT lung volumes. The results of the quantitative evaluation exhibit a significant improvement when compared to the corresponding state-of-the-art method using classic Gaussian smoothing.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

STUDY AND DEVELOPMENT OF INNOVATIVE TECHNOLOGIES FOR ENDOVASCULAR NAVIGATION

Parrini S.

Abstract: The aim of my research project is to overcome the static nature of current endovascular navigators, based on preoperative static images of the vasculature, in order to account for the various sources of vessels movements during the surgical intervention. The goal is the development of a system able to integrate various sources of intraoperative information to update preoperative virtual models of the vasculature in real-time during the surgical procedure.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

MITOSIS DETECTION FOR INVASIVE BREAST CANCER GRADING

Paul A., Mukherjee D. P.

Abstract: Mitosis count in histologic slide plays the key role in breast cancer grading. We propose a fast and accurate solution for automatic mitosis detection. Cells are detected in a novel manner using area morphological scale space. The scale space is restricted by maximization of cross-entropy between cells and background for precise cell detection. The Random Forest Classifier classifies the detected cells in mitotic and non-mitotic class. Experiments show promising results on a variety of data.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

ENHANCED VISION SYSTEM TO IMPROVE SAFETY IN ROBOTIC SINGLE INCISION LAPAROSCOPIC SURGERY

Penza V., De Momi E., Bertini A., Bussi A., Righetto F., Zaltieri R., Mattos L., Forgione A.

Abstract: - Robotic systems can overcome the maneuverability drawbacks of single incision laparoscopic surgery (SILS). - Enhanced vision system is proposed to merge pre-operative planning, intra-operative 3D reconstruction and organ tracking in order to define active constraints to improve safety in robotic SILS. - This work focus at the evaluation of the calibration accuracy of our stereo imaging system.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

PERSONALISING POPULATION-BASED RESPIRATORY MOTION MODELS OF THE HEART USING ANATOMICAL FEATURES

Peressutti D., Penney G., Kolbitsch C., King A.

Abstract: Respiratory motion models have been proposed to compensate for respiratory motion of the heart in image acquisition and image-guided interventions. We present a novel population-based respiratory motion model which overcomes the limitations of current techniques by learning the relationship between the anatomy of the heart and its respiratory motion using a neighbourhood approximation technique. For the first time, correlation between the anatomy and respiratory motion of the heart is analysed.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

STRATEGIES FOR HEAD MOVEMENT IN CT IMAGING

Ping Lu, Tom Williamson, Nicolas Gerber, Brett Bell, Stefan Weber, Mauricio Reyes

Abstract: Cochlear implantation can help people who suffer from hearing loss to restore hearing. A micro-IGS (Image Guided Surgery) approach has been proposed to reduce the invasiveness and provide a more repeatable outcome. A surgical drill should pass through a safe path without penetrating any critical structure, such as the facial nerve, the chorda tympani, the external auditory canal wall, and ossicles. One challenge is to improve the quality of segmenting critical structure from CT scan, ensuring high repeatability. The CT scanning image may be influenced by head movement. The blurred CT image may lead to suboptimal surgical planning, and hence, to the cochlear trauma and damage any critical structure. In this work we aim at estimating patient head movement; determine data reliability; and find the amount of motion considered as acceptable for cochlear imaging.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

MYOCARDIAL MICROSTRUCTURE INVESTIGATION USING STATE-OF-THE-ART MAGNETIC RESONANCE TECHNIQUES

Popescu I., Grau V.

Abstract: Abnormal myocardial wall motion is related with the most majority of the cardiac pathologies. Wall motion imaging plays a key role in the diagnosis, clinical management of the disease and prognosis of the evolution of the disease. In terms of prognosis, one important investigated feature is the viability of the cardiac tissue. Preservation of normal contractile function represents a characteristic of viable tissue. The ability to assess the viability of the myocardial tissue in an area affected by infarction can prove to be crucial in improving the clinical outcome and therefore significantly decrease the risk of sudden death caused by a second asymptomatic infarction. Imaging has advanced in the last decades from minimal invasive techniques, like using implantable radiopaque fiducial markers or ultrasonic crystals, to state of the art noninvasive MRI techniques like velocity encoding phase contrast imaging and more recently, displacement encoding imaging using stimulated echoes (DENSE). DENSE measures the tissue displacement pixel wise, encoding time using the phase of the acquired signal. DENSE is capable of better tracking the cardiac wall motion and if combined with diffusion MRI techniques can provide a valuable tool in non invasive tissue viability assessment. Computer vision techniques will be used in developing prediction tools in assessing the post-infarction myocytes recovery.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

JOINT MOTION CORRECTION AND ESTIMATION FOR T1 MAPPING: PROOF OF CONCEPT

Ramos-Llordèn G., den Dekker A.J., Sijbers J.

Abstract: In conventional T1 mapping, the acquired images are registered prior to T1 estimation. The interpolation involved in the registration step, however, introduces bias in the T1 estimates. We propose a joint motion correction and estimation method that estimates the motion model parameters and the T1 values simultaneously, using a Maximum Likelihood approach. Results from synthetic experiments show a bias reduction compared to prior registration as well as more accurate motion parameter estimation.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

SIMULTANEOUS RECONSTRUCTION OF THE ACTIVITY IMAGE AND REGISTRATION OF THE CT IMAGE IN TOF-PET

Rezaei A., Nuyts J.

Abstract: Previously, maximum-likelihood methods have been proposed to jointly estimate the activity image and the attenuation image [1]-[2] (or the attenuation sinogram [3]-[5]) from TOF-PET data. In this contribution, we propose a method that addresses the same problem for TOF-PET/CT by combining reconstruction and registration. The method, called MLRR, iteratively reconstructs the activity image while registering the available CT-based attenuation image, so that the pair of activity and attenuation images maximize the likelihood of the TOF emission data. With a non-rigid motion model, MLRR sequentially updates: 1. Activity using TOF-MLEM, 2. Attenuation using MLTR + Demons' Registration [6]-[7]. The algorithm is accelerated by using Nesterov's momentum and a multi-resolution scheme, which also helps to avoid getting stuck at a local optima.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

CASCADED RANDOM FOREST CLASSIFIERS FOR SOMITE LOCALIZATION AND IDENTIFICATION IN ZEBRAFISH

Richmond D.L., Kainmüller D., Rother C., Myers E.W.

Abstract: During embryonic development, vertebrates undergo a sequential patterning process that leads to their segmented body plan. Understanding this process is an important challenge for developmental biology, and will improve our understanding of diseases such as congenital scoliosis. This poster describes automated tools for analyzing timelapse movies of segmentation in zebrafish. We explore the use of cascaded Random Forest classifiers, following a scheme similar to auto-context.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

SIMULTANEOUS SEGMENTATION AND ANATOMICAL LABELING OF THE CEREBRAL VASCULATURE

Robben, D., Türetken, E., Sunaert, S., Thijs, V., Wilms, G., Fua, P., Maes, F., Suetens, P.

Abstract: We present an algorithm for the simultaneous segmentation and anatomical labeling of the cerebral vasculature. Unlike existing approaches that first attempt to obtain a good segmentation and then perform labeling, we jointly optimize for both by simultaneously taking into account the image evidence and the prior knowledge about the geometry and connectivity of the vasculature. We show that our method compares favorably against state-of-the-art methods on a public dataset of 50 MRA.

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Presentation Type: Poster

Date: Tuesday 29 July 2014

Time: 18:15 - 20:00

Poster Session: 2

BLOOD POOL IDENTIFICATION IN CONTRAST-ENHANCED IMAGING USING SPECTRAL CLUSTERING

Saporito S, IHF Herold IHF, Houthuizen P, Korsten HMM, van Assen HC, Mischi M

Abstract: Indicator dilution theory allow quantification of thoracic fluid volumes. However, the definition of regions of interest (ROIs) in the dynamic contrast-enhanced images is a time demanding task, often performed manually. A method for automatic ROI identification is proposed. Indicator dilution curves (IDCs) are clustered in a subspace defined by principal component analysis. The extracted IDCs correlate well with the manually extracted ones. Derived parameters show good agreement as well.

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Poster Session: 2

PARCELLATION-INDEPENDENT FRAMEWORK FOR ANALYSING DEVELOPING BRAIN NETWORKS USING REPARAMETRISATION

Schirmer MD., Ball G., Counsell SJ., Edwards AD., Rueckert D., Hajnal JV., Aljabar P.

Abstract: Brain connectivity may be studied with diffusion MR (dMR), tractography and network theory. However, the lack of a standard for parcellating the neonatal brain leads to the use of atlas- and random-based methods, and thus to the unresolved challenge of comparing graphs with varying numbers and an unknown correspondence of nodes. We propose a parcellation-independent multi-scale analysis of network measures and show its potential in describing developmental changes in neonatal serial dMRI data.

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Poster Session: 2

OBJECT-BASED IMAGE ANALYSIS AND ITS APPLICATION TO BIOMEDICAL IMAGING

Schwier M., Chitiboi T., Homeyer A., Hahn H.

Abstract: Object-based image analysis (OBIA) is a powerful concept, lifting image analysis from the limitations of the pixel-based representation which is merely dictated by capturing and storing devices. The idea is to partition the image into regions which become the base units for image analysis and create a graph-based representation of the image. Regions exhibit a wealth of features and information about their spatial context. In this poster we present the OBIA concept and its successful application to biomedical image analysis.

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Poster Session: 2

A NEW RULE-BASED VENTRAL CAVITY MULTI-ORGAN AUTOMATIC SEGMENTATION IN CT SCANS

Spanier A.B., Joskowicz L.

Abstract: About 68 million CT scans are performed in the USA each year. This huge number of scans does not allow adequate diagnosis and interpretation of each scan, as the time invested for scan reading is only a few minutes. There is an urgent need for novel methods to automatically analyze and quantify different structures in CT scans in order to improve current patient care We describe a new method for the automatic delineation (segmentation) of multiple organs of the ventral cavity in CT scans. Our method is unique in that it uses the same generic segmentation approach for all organs.

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Poster Session: 2

AUTOMATIC BONE AGE ESTIMATION FROM LEFT HAND MR IMAGES

Stern D., Ebner T., Urschler M., Bischof H.

Abstract: There has recently been an increased demand in bone age estimation (BAE) of living individuals and human remains in legal medicine applications. A severe drawback of established BAE techniques based on X-ray images is radiation exposure, since many countries prohibit scanning involving ionizing radiation without diagnostic reasons. We propose a completely automated method for BAE based on volumetric hand MRI images. On our database of 56 male caucasian subjects between 13 and 19 years, we are able to estimate the subjects age with a mean difference of 0.85 ± 0.58 years compared to the chronological age, which is in line with radiologist results using established radiographic methods. We see this work as a promising first step towards a novel MRI based bone age estimation system, with the key benefits of lacking exposure to ionizing radiation and higher accuracy due to exploitation of volumetric data.

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Presentation Type: Poster

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Poster Session: 2

PATIENT-SPECIFIC TISSUE MODELS FOR HIGH FIELD MRI ACQUISITION DESIGN

Torrado-Carvajal A., Hernandez-Tamames J.A., Herraiz J.L., Eryaman Y., Turk E.A., San Jose Estepar R., Rozenholc Y., Adalsteinsson E., Wald L.L., Malpica N.

Abstract: When using High-Field MRI scanners, the specific absorption rate (SAR) or the power deposited in patients may cause unsafe tissue heating, thus restricting the application of these systems. Several studies have used head and shoulder tissue models based on MRI and CT to simulate SAR, which could be used to improve the safety of high-field MRI by adapting the pulse sequences to each specific patient. However, CT images require the use of ionising radiation and additional costs and time. We propose a pipeline for creating patient-specific tissue models based only on MRI and ?a priori? whole brain CT data that could enable patient-specific pulse design in high-field MRI. In this work, we have focused on head-only tissue segmentation models, as the torso does not require a very precise segmentation when simulating SAR in brain MRI studies. To the best of our knowledge, no complete automatic segmentation methods for head and neck have been previously implemented.

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Poster Session: 2

SUPPORTIVE AUTOMATIC ANNOTATION OF EARLY ESOPHAGEAL CANCER USING LOCAL GABOR AND COLOR FEATURES

van der Sommen F., Zinger S., Schoon E., de With P.

Abstract: We present a novel algorithm for automatic detection of early cancer in HD endoscopic images. The algorithm detects the region of interest and computes local color- and texture features based on the original and the Gabor-filtered image. Using spectral analysis of early cancerous tissue we select optimal filter parameters. The features are classified by a trained SVM, after which the region containing early cancer is annotated. For 7 patients, we compare 32 annotations made by the algorithm with the delineations made by an expert gastroenterologist, yielding an accuracy of 85.7%.

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Poster Session: 2

ASSOCIATION BETWEEN PARENCHYMAL ENHANCEMENT AND OUTCOME OF PATIENTS WITH BREAST CANCER

Van der Velden, B.H.M., Dmitriev, I., Loo, C.E., Gilhuijs, K.G.A.

Abstract: Parenchymal enhancement on DCE-MRI may affect outcome of patients with breast cancer. The aim of this study was to determine if contrast enhancement in healthy contralateral parenchyma is associated with outcome of patients with ipsilateral breast cancer. The contralateral parenchyma of 524 patients was automatically segmented, in which the late enhancement was calculated. Breast cancer subtype, parenchymal enhancement, and age at diagnosis were significantly associated with overall survival.

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Poster Session: 2

BRAIN (DYS)CONNECTIVITY IN MULTIPLE SCLEROSIS: NETWORK TOPOLOGY

Welton T.

Abstract: Using the Signed Differential Mapping voxelwise meta-analysis technique, we identify statistical consensus between studies for minimally-overlapping distributions of injury relating to physical disability and cognitive impairment in multiple sclerosis (MS). These findings form a basis for the study of brain network properties as potential markers of cognitive impairment in MS. We present our future plans to that end.

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Poster Session: 2

BIOMECHTOOLS: CONSTRUCTING PATIENT SPECIFIC MUSCULOSKELETAL ANALYSIS OF THE LOWER EXTREMITY.

Wielingen G.V.F., Sprengers A.M., Janssen D.W., Verdonschot N.J.J.

Abstract: Current tools for assessing a patient?s biomechanical condition are often crude and subjective, leading to suboptimal care. Enhancing biomechanical models with MRI data can yield more accurate and objective patient specific tools. For practical purposes, these tools require fast, robust and highly accurate segmentation of structures and consequent conversion to geometric objects, with minimal user input. To this end segmentation schemes for the lower extremities will be developed and validated.

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Poster Session: 2

AN AUTOMATIC MACHINE LEARNING SYSTEM FOR CORONARY CALCIUM SCORING IN CLINICAL NON-CONTRAST ENHANCED, ECG-TRIGGERED CARDIAC CT

Wolterink J.M., Leiner T., Takx R.A.P., Viergever M., I?gum I.

Abstract: Presence of coronary artery calcium (CAC) is a strong and independent predictor of cardiovascular events. We present a machine learning system using estimated positions of the coronary arteries to automatically identify and quantify CAC in routinely acquired cardiac non-contrast enhanced CT. Candidate lesions the system could not label with high certainty were automatically identified and presented to an expert. This allowed a substantial increase in performance with little expert effort.

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Poster Session: 2

MODEL-BASED SEGMENTATION OF BODY FAT

Yeo S. Y., Loper M., Romero J., Black M. J.

Abstract: It is known that body fat distribution is an important indicator of the cardiovascular and metabolic health. The modeling and analysis of the body fat distribution can lead to insights of diseases caused by obesity, and can allow us to design treatments for such diseases. There exists several techniques for the measurement of fat, such as the BMI, skinfold calipers and bioelectrical impedance etc., however these techniques do not measure the body fat distribution. Magnetic resonance imaging (MRI) can be used to quantify the body fat distribution. The fat tissue is however often segmented manually by clinicians, which can be laborious and time consuming due to the voluminous MRI data. A robust segmentation algorithm can be advantageous for the quantification of the body fat. Here, we propose the use of an articulated body model for the segmentation of the subcutaneous fat layer. This will allow us to model the body fat distribution and conveniently investigate the role of fat distribution in the human well-being.

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Poster Session: 2

AUTOMATIC SEGMENTATION BASED ON DEFORMABLE IMAGE REGISTRATION

Zaffino P.

Abstract: The aim of my project is to investigate the impact of automatic segmentation in several clinical scenarios. The proposed strategy is based on deformable image registration technique, in order to integrate different information available in different images. The strategies have been developed for radiotherapy and for neuroscience applications. Most of the new features have been included in Plastimatch (www.plastimatch.org), an open source software for defomable image registration that offers also several tools for segmentation. In this poster, some applications with the relative results are shown.

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Poster Session: 2

INTEGRATIVE AND MULTISCALE IMAGE REGISTRATION: APPLICATION TO FETAL AND NEONATAL BRAIN DEVELOPMENT ANALYSIS

Zimmer V.A., Gonzàlez Ballester M.A., Piella G.

Abstract: The quantification of abnormal brain development is important for the study of diseases such as Intrauterine Growth Restriction (IUGR) or Ventriculomegaly, where already in utero changes in brain structure and function can be noticed and where the neurodevelopmental outcome is unknown. To be able to characterize early the severness of the disease, quantification of the abnormal fetal brain development and comparison to normality are necessary. To achieve this, image registration is an important preprocessing step for spatial normalization of subjects and/or populations. To obtain good registration results, which is crucial for the quantification, we adress two different issues of image registration, the integration of additional sources of information and the multiscale nature of medical image data. For the former, we propose a spatially weighted multichannel similarity measure to distiguish between useful and redundant additional information. For the latter, we present an adaptive multiscale similarity measure which combines image statistics at multiple scales for a multiscale representation of regional image similarities. In addition, we present the idea of simultaneously optimization of transformation parameters to capture better the different scales in the datasets. Both approaches show improvements over common registration methods. Preliminary results are presented on synthetic and clinical data.

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Poster Session: 2

LONGITUDINAL ALIGNMENT OF DISEASE PROGRESSION IN FIBROSING INTERSTITIAL LUNG DISEASE

Vogl WD., Prosch H., Mller-Mang C., Schmidt-Erfurth U. and Langs G.

Abstract: Generating disease progression models from longitudinal medical imaging data is a challenging task, due to the varying and often unknown state and speed of disease progression at the time of data acquisition. We propose an appearance driven method for aligning follow-up series of multiple patients in time, resulting in a cross-sectional spatio-temporal disease distribution model. We demonstrate the benefit of the method by classifying instances of different fibrosing interstitial lung diseases.

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Poster Session: 2

LONGITUDINAL DIFFEOMORPHIC FETAL BRAIN ATLAS LEARNING FOR TISSUE LABELING USING GEODESIC REGRESSION AND GRAPH CUTS

Licandro R., Schwartz E., Langs G., Sablatnig R.

Abstract: The human brain undergoes fundamental structural changes between the second and the third trimester of pregnancy. The most accurate non-invasive method for observing these events to date is the (ultra) fast magnetic resonance (MR) imaging technique. It allows to image a fetus at a satisfying resolution, despite its small size or varying position. A problem of MR imaging is the lack of comparability and constancy of gray-values, which are mapped according to the proton (hydrogen) concentration. It differs among patients and results in varying gray-values for varying proton density. This motivates to build a fetal brain atlas to use it as a standard space. Brain structures can be mapped according to marked anatomical locations, to make fetal brains comparable for studying brain development, fetal pathology locations, fetal abnormalities or anatomy. The aim of the work is to provide an atlas of the developing fetal brain, consisting of a continuous, quantifiable model of brain development derived by geodesic shooting regression and an automated labeling procedure using a graph cut based segmentation approach.

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