POSTER SESSION BOOKLET

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

University of Catania

King's College London

University of Cambridge

Medical Imaging Summer School 2016

Medical Imaging meets Machine Learning

Favignana, 31 July - 6 August 2016

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 was established in 2014. The school is organized by King's College London, 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 2016.

Best Presentation Prize

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

Favignana, June 2016

Roberto Cipolla, University of Cambridge, United Kindom
Giovanni Maria Farinella, University of Catania, Italy
Julia Schnabel, King's College London, United Kingdom
Filippo Stanco, University of Catania, Italy

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FULLY AUTOMATIC AND QUANTITATIVE MEASUREMENT OF BONE MARROW EDEMA ON MRI OF THE WRIST IN PATIENTS WITH EARLY ARTHRITIS

Aizenberg E., Roex E.A.H., Nieuwenhuis W.P., Mangnus L., van der Helm-van Mil A.H.M., Reijnierse M., Bloem J. L., Lelieveldt B.P.F., Stoel B.C.

Abstract: Early treatment of rheumatoid arthritis (RA) can increase chances of drug-free sustained remission. MRI is sensitive to early inflammation and is currently being studied as means of early detection of RA. Visual scoring of MRI scans in RA studies is time-consuming, costly, and relies on perceptual estimates of the extent of inflammatory biomarkers, such as bone marrow edema (BME). In this study, we developed and validated a fully automatic and quantitative framework (BME-QM) for measuring BME in the carpal bones of the wrist.

Contact: E.Aizenberg@lumc.nl

Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

2D ADAPTIVE GRID-BASED IMAGE ANALYSIS APPROACH FOR BIOLOGICAL NETWORKS

Alhasson H. , Obara B.

Abstract: The accurate analysis of biological networks can reveal important underlying biological principles. We present a novel approach for a weighted and undirected graph-based network reconstruction and quantification from 2D images using an adaptive mesh refinement approach. The proposed approach is able to identify the organizational principles of the network, capturing the network structure, and computing relevant properties. We validate our approach by comparing it with the state-of-the-art method.

Contact: h.f.alhasson@durham.ac.uk

Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

VISUAL SLAM FOR MONOCULAR ENDOSCOPE

Ali N.M., Hostettler A, Montiel J.M.M., Doignon C., Soler L., Marescaux J.

Abstract: In minimally invasive surgery (MIS) and due to organ deformation by surgical manipulation during surgery, the 3D reconstruction in that case is challenging and still open problem. The depth ambiguities make such monocular shape recovery highly under-constrained. Moreover, when the surface is partially occluded or has minimal texture, the problem becomes even more challenging because there is little or no useful information about large parts of it.

Existing non-rigid approaches are well suited for paper-like surfaces, they are only applied to short in-vivo endoscope sequences with small deformations [1,2] without ground truth. The accuracy of current methods have not been evaluated against complex deformation which normally occurs by surgical manipulation.

The state-of-the-art rigid Visual SLAM [3] is adapted and exploited to track endoscope position and provide 3D estimation of detected feature points in MIS scene. A real-time augmented reality superimposition of pre-operative data is achieved thanks to accurate estimation of endoscope position. Rigid Visual SLAM is to be extended in the future work to tackle non-rigid MIS scenes and evaluated against a realistic ground truth.

Contact: eng.nader.mahmoud@gmail.com

Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

DEEP LEARNING FOR BIOMEDICAL TEXTURE IMAGE ANALYSIS

Andrearczyk V., Whelan P. F.

Abstract: We present promising results in the application of Convolutional Neural Networks (CNN) to biomedical imaging. Texture is often dominant in biomedical imaging and its analysis is essential to obtain meaningful information. Therefore, we introduce a method using a Texture CNN for the classification of biomedical images. We set a new state of the art in the classification of liver tissues images.

Contact: vincent.andrearczyk@gmail.com

Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

NON-LINEAR B-SPLINE IMAGE REGISTRATION FOR THREE-DIMENSIONAL RECONSTRUCTION OF BRAIN TISSUE

Anner P., Passecker J., Klausberger T., Dorffner G.

Abstract: Generating three dimensional (3D) models of paraformaldehyde-fixed sections of brain tissue is a major task in current research. Histological entities are cut in thin slices (70 μm) and 3D scanned with a confocal microscope resulting in z-stacks. Distortions caused by processing of the tissue have to be accounted when merging the z-stacks to a single 3D model. A simulation study was performed to assess the image registration techniques based on images of one physical slice. Using B-spline transformations we could remove the distortions in order to achieve a consistent 3D model.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

TOWARDS SEMANTIC ANALYSIS OF PCI: EMPTY CATHETER SEGMENTATION

Bacchuwar K., Cousty J., Vaillant R., Najman L.

Abstract: Semantic analysis of the progress of the PCI procedure can be performed by monitoring the interventional tools: an important one being the guiding catheter, which is mostly empty. To segment it, we extract curve blobs (small dark elongated structures) on min tree of the image. We then propose a novel structural scale-space, a hierarchy built on these curve blobs. A cluster of curve blobs on this hierarchy, which maximizes the likelihood to be an empty catheter is retained as final segmentation.

Contact: ketan.bacchuwar@ge.com

Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

DETECTION OF AN INVISIBLE NEEDLE IN ULTRASOUND: TOWARDS IMAGE-GUIDED EPIDURAL INSERTIONS

Beigi P., Rohling R., Salcudean S., Gunka V., Dube A., Ng G.

Abstract: Ultrasound (US) imaging is clinically used to guide needle insertions, as it is safe, real-time and low cost. The visualization of the needle in US however, remains a challenging task [1]. Most of the previous work rely on the needle appearance as a high intensity line of pixels. In reality however, the main challenge is to identify the needle when it is invisible or partially visible. We propose a spatio- temporal image processing technique to detect an invisible hand-held needle in ultrasound.

Contact: parmidab@ece.ubc.ca

Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

FULLY AUTOMATIC SEGMENTATION OF ARBITRARILY SHAPED FIDUCIALS IN CBCT PROJECTIONS

Bertholet J., Wan H., Toftegaard J., Schmidt M.L., Chotard F., Parikh P., Poulsen P.R.

Abstract: Radio-opaque markers are often used as surrogates for tumors in radiotherapy. However, there is still a need for robust, automatic marker segmentation. Our aim was to combine a Dynamic Programming (DP) algorithm with a template based method to automatically segment arbitrarily shaped markers and generate a reusable 3D model of the marker in a DP-assisted, template-based algorithm (DPTB). DP and DPTB were compared for a large data set with available ground truth, quantifying the accuracy as the root-mean-square error (RMSE). The mean 2D RMSE was 3.49 pixels (DP) and 2.28 pixels (DPTB).

Contact: jennbe@rm.dk

Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

EVALUATION OF BREAST CANCER DIAGNOSIS WITH FREE-HAND ULTRASOUND TRANSDUCER

Bílková Z., Bartoš M., Šroubek F., Zitová B., Vydra J., Daneš J.

Abstract: We address the drawback of ultrasound breast cancer diagnosis which is the uncertainty whether the whole breast was scanned. We propose a methodology how the completeness of the examination can be efficiently evaluated. We propose simultaneous tracking and grabbing a video from a free-hand 2D ultrasound transducer during standard breast examinations. From the recorded data we calculate duration in seconds. For every part of the examined region we perform algorithmically local 3D reconstruction.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

CELL TRACKING UNDER DENSE CELL CULTURE CONDITIONS FOR CELL BEHAVIOR ANALYSIS AND APPLICATION FOR VASCULAR MODELING

Bise R., Sato Y., Sato I.

Abstract: We propose a cell-tracking method to address difficulties under dense culture conditions where cells often touch with blurry intercellular boundaries. The method first generates reliable tracklets by jointly solving both cell detection and association between successive frames. Then, the method links the tracklets using global temporal information. We also applied the tracking method for 3D structure modeling of dense capillaries. The experiment results demonstrate the efficacy of our method.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

AUTOMATED GRADE PREDICTION OF GLIOMA PATIENTS BASED ON MAGNETIC RESONANCE IMAGING AND A RANDOM FORESTS APPROACH

Bonte S., Goethals I., Van Holen R.

Abstract: An automated brain tumour classification method is presented which is able to distinguish between low-grade and high-grade glioma on conventional MRI scans. Per patient, 208 quantitative features are extracted from a manually annotated brain tumour database of 274 patients. These features were then used to train a Random Forests classification algorithm. We achieved a high-grade prediction sensitivity of 95.5% and specificity of 79.6%, with a global accuracy of 92.3%.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

3D CORTICAL BONE MAPPING OF THE PROXIMAL FEMUR IN A LARGE PROSPECTIVE POPULATIO BASED STUDY SUPPORTS THE GANZ HYPOTHESIS OF HIP OSTEOARTHRITIS CAUSATION: AGES-REYKJAVIK STUDY

Burkov I. S, Treece G. M, Gee A. H., Turmezei T. D., Johannesdottir F., Sigurdsson S., Aspelund T., Jósson H., Gudnason V., Poole K. E. S.

Abstract: The mechanical aetiology hypothesis of hip osteoarthritis (OA) implicates focal mechanical wear of the joint surface from increased contact pressures, often associated with subtle abnormalities in 3D structure, such as those identified in femoro-acetabular impingement. Thickening of subchondral bone is emerging as an important OA disease feature and may be implicated in pathogenesis. Cortical bone mapping (CBM) is a proven technique, that has been used to measure structural properties of bone.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

DEEP LEARNING FOR TISSUE MICROARRAY IMAGE-BASED OUTCOME PREDICTION IN PATIENTS WITH COLORECTAL CANCER

Bychkov D., Turkki R., Haglund C., Linder N., Lundin J.

Abstract: In the current study we evaluate whether a convolutional neural network (CNN) can be trained to predict disease-specific outcome in patients with colorectal cancer based on digitized hematoxylin-eosin stained tissue samples. We compare the prognostic accuracy of a CNN trained on whole, unsegmented tissue microarray spot images, with that of a CNN features on segmented epithelium. The prognostic accuracy of visually assessed histological grade is used as a reference.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

MULTI-SPECTRAL CHARACTERISATION OF THALAMIC NUCLEI USING 3T MRI

Corona V., Acosta-Cabronero J., Lellmann J., Nestor P., Schoenlieb C.B.

Abstract: The thalamus is one of the most complex structures in the human brain. Changes in its structures have been related to several neurodegenerative diseases, including Parkinson's disease, Alzheimer's disease, multiple sclerosis and dementia.In this context, accurate delineation of the major nuclei is extremely important in clinical practice. We propose an automatic and reliable method to segment the thalamus using multi contrast MRI data.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

SPATIALLY ADAPTIVE SPECTRAL DENOISING FOR MR SPECTROSCOPIC IMAGING USING FREQUENCY-PHASE NON LOCAL MEANS

Das Dhritiman., Coello Eduardo., Schulte Rolf., Menze Bjoern.

Abstract: Magnetic resonance spectroscopic imaging (MRSI) is an imaging tool which suffers from long scanning times, poor SNR and inaccurate metabolite quantification due to noise-sensitive nonlinear model fitting. In this work, we propose a frequency-phase spectral denoising method based on the concept of non-local means. Using both simulated and human in-vivo data, we demonstrate that our method improves SNR of the metabolites while maintaining spatial-spectral resolution.

Contact: dhritiman.das@tum.de

Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

MRI-BASED PSEUDO-CT SYNTHESIS FOR APPLICATION IN PET-MRI AND LINAC-MRI

Degen J., Rafecas M., Barkhausen J., Heinrich M. P.

Abstract: The question of how a CT scan can be synthesized of a patient's MRT scan states a problem of the current research on hybrid PET-MRI devices and MRI-based radiotherapy. The aim of this work is to generate a so-called pseudo-CT scan with the help of multiple atlas scans. In contrast to previous work, the synthesis will be extended to whole body data sets.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

IMAGE SEGMENTATION METHODS FOR THE QUANTIFICATION OF CANDIDA CELLS IN FLUORESCENCE IMAGES

Dietrich S., Brandes S., Hünniger K., Engert N., Jacobsen I., Kurzai O., Figge T.

Abstract: Candida species are ubiquitous and can lead to severe infections. Our body possesses several defence mechanisms against infections, like cells of the innate immune system. To study the interplay of body cells and pathogens, different biological assays can be used, wherein fungal cells are labeled and imaged. We use automated image segmentation methods and machine learning to quantify Candida cells, thereby characterizing the cell interactions.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

SEGMENTING ANATOMY WITH BEST POSSIBLE SHAPE MODEL

Eguizabal A., Schreier P.J.

Abstract: Object segmentation becomes challenging when the object to be segmented belongs to the human body since anatomy has a tremendous variability among individuals. Many applications require accurate segmentation of anatomy structures, such as Computer Assisted Surgery (CAS) applications. CAS sometimes uses a C-arm that utilizes a low dose X-ray source. Low dose X-ray images are more noisy and have low-contrast. The better the shape model is, the more robust it will be to overcome this challenge. Our research is focused on defining a shape model that is in some sense optimal: the best shape model should capture the anatomy variation among individuals, but with minimal representation error and maximum segmentation performance.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

A ROUBUST TECHNIQUE FOR DETECTING AND QUANTIFYING THE ABDOMIAL AORTIC CALCIFICATION USING DUAL ENERGY X-RAY ABSORBIOMETRY

Elmasri, Hicks, Yang, Sun, Pettit, Evans.

Abstract: Arterial calcification, in particular, abdominal aortic calcification (AAC) is a manifestation of atherosclerosis and a predictor of Cardiovascular diseases (CVD). Dual energy x-ray absorptiometry (DXA) is a standard diagnostic technique that is widely used to diagnose and monitor osteoporosis through the measurement of bone mineral density (BMD). The aim of this work is to develop an automatic method to detect and quantify the severity of (AAC) based on the analysis of the lateral instant vertebral assessment (IVA) images performed by using DXA scanner. An automatic segmentation stage on the lumbar spine L1-L4 and aorta on IVA images is implemented firstly by employing the active appearance model. In the second stage, features representing calcified regions in the aorta will be extracted to quantify the severity of AAC. The presence and severity of AAC is determined using an established visual scoring system (AC24). In this scoring system, the abdominal aorta is divided into eight parts immediately anterior to each vertebra, and the severity of calcification in the anterior and posterior aorta walls is graded separately for each part on a 0-3 scale. The results are summed to give a composite severity score ranging from 0 to 24. This severity score is classified as follows: mild AAC (score 0-4), moderate AAC (score 5-12) and severe AAC (score 12-24). An automatic method to automatically extract features describing region calcification is proposed. Two classification algorithms (k-nearest neighbour and support vector machine) are applied to assign the extracted features into three calcification classes as defined by the AC24 system. There is good agreement between the accuracy of the automated technique relative to visual classification indicating that it is capable of identifying and quantifying AAC over a range of severity.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

A C-ARM-BASED PEDICLE SCREW VERIFICATION SYSTEM

Esfandiari H., Newell R., Anglin C., Hodgson A

Abstract: Pedicle screw insertion is a common practice in spinal surgeries. Freehand procedures are the most common method with considerable rates of screw malplacement. This study provides a robust intraop pedicle screw verification system. Intraop X-ray shots are first acquired and calibrated. 2D/3D registration methods are utilized to analytically represent the vertebral/screw models within a common coordinate frame. Vertebral and screw models are then superimposed on one another. The proposed method is capable of localizing the implanted screws with an mean error of 1.3o and 2.0 mm.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

DEEP CONVOLUTIONAL NEURAL NETWORKS FOR BINARY CLASSIFICATION OF SKIN LESIONS

Friedman S.

Abstract: Deep Convolutional Neural Networks (CNNs) classify potential melanoma skin lesions as either malignant or benign. Usually melanoma starts in pigment cells (melanocytes) and presents as dark raised lesions though the appearance is variable. Four different CNN architectures are trained and evaluated on the skin legion dataset released as part of the International Symposium on Biomedical Imaging (ISBI) 2016 challenge. Because of the relative paucity of the ISBI 2016 dataset (it contains only 900 training images) all of the networks were pre-trained on the imagenet dataset. The pre- trained weights were fine-tuned to optimize performance on the ISBI dataset. All of the networks performed well with average precision scores that would have ranked in the top 4 submissions to the challenge. The residual network architecture achieved an average precision of 0.648 which is better than any submission to the ISBI 2016 challenge.

Contact: umpteee@yahoo.com

Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

STEREO ENDOSCOPE CALIBRATION AND 3D US VESSEL DETECTION FOR AUGMENTED REALITY HEPATIC SURGERY

Garcia-Guevara J., Cotin S., Berger M-O.

Abstract: Augmented reality hepatic surgery can be done with pre (MRI/CT) and intraoperative (stereo endoscopic images and 3D US) data registration. To register these multimodality data anatomical features are used. Two parts of the intraoperative data features extraction are described. First robust endoscopic stereo calibration, that is needed because the 3D reconstruction is uncertain when the reconstruction rays angle is small. The second part is the 3D US vessel detection that includes preprocess filtering, shadow detection, and vessel tree centerline detection.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

MULTI-MODAL MARKERLESS RESPIRATORY MOTION ESTIMATION IN RADIATION THERAPY

Geimer T., Unberath M., Taubmann O., Bert C., Maier A.

Abstract: An established approach to respiratory motion estimation is to infer the internal target motion from a highly correlated external surrogate signal. We present a model to estimate 3-D internal motion fields from X-ray fluoroscopy without the need for implanted markers using dimensionality reduction and regression techniques. To improve estimation accuracy and stability, combinations of multiple surrogates based on range imaging and fluoroscopy are investigated.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

LIVER CT ENHANCEMENT USING FRACTIONAL DIFFERENTIATION AND INTEGRATION

Ghatwary N. , Ahmed A. , Jalab H.

Abstract: A digital image filter is proposed to enhance the Liver CT image for improving the classification of tumors area in an infected Liver. The enhancement process is based on improving the main features within the image by utilizing the Fractional Differential and Integral in the wavelet sub-bands of an image. After enhancement, different features were extracted such as GLCM, GRLM, and LBP, among others. Then, the areas/cells are classified into tumor or non-tumor, using different models of classifiers to compare our proposed model with the original image and various established filters. Each image is divided into 15x15 non-overlapping blocks, to extract the desired features. The SVM, Random Forest, J48 and Simple Cart were trained on a supplied dataset, different from the test dataset. Finally, the block cells are identified whether they are classified as tumor or not. Our approach is validated on a group of patients' CT liver tumor datasets. The experiment results demonstrated the efficiency of enhancement in the proposed technique.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

COMPUTATIONAL SONOGRAPHY

Göbl R., Hennersperger C., Baust M., Mateus D., Navab N.

Abstract: 3D ultrasound (US), while high in potential for diverse applications, is currently limited by the directionality of US. State-of-the-art methods reconstruct a scalar volume from a 3D freehand sweep, requiring restricted acquisition protocols. This work presents computational sonography, which creates a volume of directional-dependent models of the acquired US information. We show the potential of this method on phantom and clinically acquired US data and showcase improved visualization as potential application.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

PARAMETER MAPPING, MODALITY SYNTHESIS, AND ANATOMICAL LABELING OF THE BRAIN WITH MR FINGERPRINTING

Gómez P.A., Molina-Romero M., Ulas C., Buonincontri G., Sperl J.I., Jones D.K., Menzel M.I., Menze B.H.

Abstract: We propose a method to create the dictionary for magnetic resonance fingerprinting (MRF) from training subjects. We show that, with an adequate matching technique, it is possible to reconstruct parametric maps, synthesize modalities, and label tissue types at the same time directly from an MRF acquisition. Our method achieves relaxation mapping with higher efficiency and provides extra metrics and labels at no cost, demonstrating the potential of using MRF for multiparametric brain mapping.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

TOMOGRAPHIC SLICE RECONSTRUCTION BY CONVOLUTIONAL NEURAL NETWORK

Han C., Navarro F., Achiles F.

Abstract: We regressed Tomographic Slice (Brain MRI) from two adjacent slices using Convolutional Neural Network (CNN)

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

X-RAY DARK-FIELD IMAGING IN A HELICAL TRAJECTORY

Hu S., Maier A., Pelzer G., Rieger J., Anton G., Riess C.

Abstract: X-ray dark-field imaging (XDI) visualizes the microstructure of specimen [1, 2]. It is a promising technique for recovering bone structures or for early detection of breast cancer [3]. So far, full 3-D XDI reconstruction is still an open problem. No clinically feasible XDI system is available. Here, we propose a helical XDI system and present simulated projections.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

LOCALLY ORDERLESS REGISTRATION OF DIFFUSION WEIGHTED IMAGES

Jensen H. G., Nielsen M., Lauze F., Darkner S.

Abstract: Registration of Diffusion Weighted Images (DWI) is challenging as the data is a composition of both directional and intensity information. In this work, the density estimation framework for image similarity, Locally Orderless Registration, is extended to include directional information. We construct a spatio-directional scale-space formulation of marginal and joint density distributions between two DWI. We examine the scale-space and illustrate the approach by affine registration.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

SOFTWARE VALIDATION FOR AN ACTIVE SHAPE MODEL BASED THIGH MUSCLE AND ADIPOSE TISSUE CSA SEGMENTATION APPROACH

Kemnitz J., Eckstein F., Ruhdorfer A., Dannhauer T., Culvenor A., Ring-Dimitriou S., Sänger A.M., Wirth W.

Abstract: Introduction: Thigh muscle and adipose tissue morphologies are important disease markers and potentially modifiable for instance in osteoarthritis, tendon pathologies and chronic muscle pain. Therefore our goal is to evolve and validate a software solution for semi-automated thigh muscle and adipose tissue cross sectional area (CSA) segmentation.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

TEXTURE-BASED CARTILAGE SUB-ARCHITECTURE SEGMENTATION FROM CE-NANOCT IMAGES

M. Kvasnytsia, C.Geeroms, L-A. Guns, F. Luyten ,R.Lories, L. Geris, G.Kerckhofs

Abstract: Osteoarthritis is a group of joint disorders that affects millions of people worldwide. The shift of the demarcation line between uncalcified and calcified cartilage and the changes in the total cartilage thickness are markers of disease progression. Contrast enhanced nanoCT (CE-nanoCT) is a powerful tool for the visualization of both types of cartilage. However, it remains challenging to automatically discriminate between different tissues or tissue sub-architecture layers represented on CE-nanoCT with the similar grey values using only intensity based methods. Though calcified cartilage and subchondral bone are represented by the same grey values, calcified cartilage possesses specific texture due to chondrocyte lacunae. Manual delineation of calcified cartilage from CE-nanoCT images is time consuming and prone to errors. We therefore present an algorithm which utilizes texture differences for automatic segmentation of calcified cartilage and the subchondral bone and shows good correspondence to ground truth manual segmentation.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 15:00 - 16:15

Poster Session: 1

TEMPORAL REGISTRATION IN IN-UTERO VOLUMETRIC MRI TIME SERIES

Liao R., Zhang M., Turk E., Luo J., Grant E., Adalsteinsson E., Golland P.

Abstract: We present a robust method to correct for motion and deformations in in-utero volumetric MRI time series. Spatio temporal analysis of dynamic MRI requires robust alignment across time in the presence of substantial and unpredictable motion. We make a Markov assumption on the nature of deformations in the volumetric MRI time series to take advantage of the temporal structure in the image data. Forward message passing in the corresponding hidden Markov model (HMM) yields an estimation algorithm that only has to account for relatively small motion between consecutive frames. We demonstrate the utility of the temporal model by showing that its use improves the accuracy of the segmentation propagation through temporal registration. Our results suggest that the proposed model captures accurately the temporal dynamics of deformations in in-utero MRI time series.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

FALSE POSITIVE REDUCTION METHODS APPLIED TO DENSE VESSEL DETECTION IN BRAIN CT IMAGES.

Lisowska A., Beveridge E. ,Poole I.

Abstract: In medical data, there are usually fewer samples of the pathology than of the healthy tissue. To avoid neglecting the pathological samples, a common strategy is to use an equal-split training set, but this may lead to a large number of false positives as the classifier overestimates the probability of the pathology. In this study we compare a cascade of classifiers and iterative classifier retraining to reduce false positive rates for a dense vessel detection problem in CT brain images. These methods are based on selection of the healthy tissue samples which were misclassified at the previous training stage.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

MARKERLESS MOBILE AUGMENTED REALITY FOR RADIATION AWARENESS IN THE HYBRID ROOM

Loy Rodas N., De Mathelin M., Padoy N.

Abstract: We present an approach to increase the awareness to radiation during X-ray guided procedures, by displaying radiation safety information through a hand-held screen in a mobile AR manner. Instead of using markers, the system relies on multiple RGB-D cameras. Two cameras are fixed to the ceiling of the operating room and are used to detect the room's layout and X-ray device configuration. A third one, attached to the screen, is tracked with a method combining equipment detection and KinectFusion.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

PROCESSING OF ADAPTIVE OPTICS PHOTORECEPTOR IMAGES

Mariotti L., Devaney N., Lombardo G., Lombardo M.

Abstract: The use of adaptive optics cameras is greatly increasing the amount of information available about the retina, thus providing an insight into the photoreceptor physiology as well as into the early stages of retinal conditions. We present here the results of a processing method that reduces manual intervention to a minimum and that makes it possible to perform a complete cone mosaic analysis. This method was used to provide an insight into cone reflectance variability over long timescales.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

LARYNGEAL DISORDER DETECTION AND CLASSIFICATION IN NARROW BAND (NB) ENDOSCOPIC VIDEOS

Moccia S., De Momi E., Mattos L.

Abstract: Early-stage laryngeal disorders are diagnosed by detecting possible superficial vessel pattern alterations [1]; NB endoscopy is becoming the elective imaging technique in the field [1]; A feature-based key-frame (KF) [2] selection approach is used to discard noisy and redundant NB frames; A Hessian-based vesselness (V) coupled with Level-Set (LS) [3] segmentation is employed to segment blob-like pathological vessels; Dense Optical Flow (OF) [4] is used to estimate the scale in the V computation.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

A MULTISCALE 3D / 0D CARDIAC MODEL FOR FAST PERSONALISATION AND EXPLOITATION

Mollero R., Pennec X., Delingette H., Ayache N., Sermesant M.

Abstract: 3D computer models of the heart are of increasing interest for cardiac image analysis and medical applications. However, the 3D simulations can be computationally expensive and long to perform, which can be a challenge for some applications. Here we present a coupled 0D/3D multiscale model which approximates the 3D model behavior with the very fast 0D model of an idealized spherical pump. We demonstrate its efficiency in the personalisation of the model, and in prediction of clinical indices.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

AUTOMATIC SEGMENTATION AND CLASSIFICATION OF CELL NUCLEI IN IMMUNOHISTOCHEMICAL BREAST CANCER IMAGES WITH ESTROGEN RECEPTOR MARKER

Oscanoa J., Doimi F., Dyer R., Araujo J., Pinto J., Castañeda B.

Abstract: In recent years, there has been an increasing use of Immunohistochemistry (the detection of biological markers expression in histological images) to obtain useful information for cancer diagnosis. This work presents an efficient algorithm that automatically identifies breast cancer (the most common malignant tumor worldwide) cell nuclei and detects if they are expressing the ER marker or not. The algorithm achieved 93.1% of detection efficiency, while sensitivity and specificity were 95.7% and 93.2% respectively.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

QUANTITATIVE CELL ANALYSIS PIPELINE FOR CELLULAR ASTRONOMY

Pardo E., Gonzalez G., Tucker-Schwartz J., Dave S., Malpica N.

Abstract: Accurate and precise cell fluorescence estimation is an important task in the characterization of biological samples. Although fluorescence microscopy is an established powerful tool for cytometry, its capabilities at low magnifications have remained largely unexplored mainly due to the challenge of low resolution signal extraction. We propose a novel pipeline for quantitative analysis of cell fluorescence at low magnification. The first step is to detect bright spots using Fisher discriminant analysis. The detected regions are used to initialize an expectation maximization algorithm over a heterogeneous mixture model that is capable of discriminating cell signal from noise. Finally a recursive splitting procedure is applied which provides a fluorescence estimate for every single cell within the detected region.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

REGRESSING HEATMAPS FOR MULTIPLE LANDMARK LOCALIZATION USING CNNS

Payer C., Stern D., Bischof H., Urschler M.

Abstract: We explore the applicability of deep convolutional neural networks (CNNs) for multiple landmark localization, by regressing heatmaps that represent individual landmark locations. Therefore, we propose a novel SpatialConfiguration-Net that combines accurate local appearance with spatial landmark configurations. Evaluation on a dataset of hand radiographs shows that our CNN achieves state-of-the-art localization performance, while being robust even in case of limited amounts of training data.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

NON-STATIONARY NOISE ESTIMATION IN ACCELERATED PARALLEL MRI DATA

Pięciak T., Vegas-Sanchez-Ferrero G., Aja-Fernandez S.

Abstract: The aim of this study is to retrieve spatially variant noise patterns from accelerated parallel MRI data using only a single image. Variance-stabilizing transformations (VSTs) for noncentral Chi (nc-χ) data are derived: (1) an analytic model and (2) a numerical model to improve the performance for low signal-to-noise ratios (SNRs). The VSTs generate Gaussian-like distributed variates from nc-χ data. The noise patterns are estimated then using Gaussian homomorphic filter.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

OPTIMIZED SEGMENTATION METHOD FOR COMPUTED TOMOGRAPHIC IMAGES GENERATION FROM MAGNETIC RESONANCE IMAGES FOR PROTON THERAPY

Pileggi G., Speier C., Sharp G., Seco J., Spadea M.F.

Abstract: Proton therapy planning for brain tumor ideally requires the use of both MR and CT images. The former because of the good contrast in showing soft tissues, the latter because of the correlation between Hounsfield Units (HU) and Relative Linear Stopping Power (RLSP, i.e. a measurement of the loss of energy of a proton beam while travelling inside a tissue), and possibility of easily detect bone structures. The rationale behind this project is to obtain a HU map (pseudo CT) from the T1 and T2 MRIs, thus bypassing the acquisition of a CT scan, starting from a segmentation of the MRIs in 6 tissue classes. An immediate advantage would be the reduction of X-ray dose for the patient. Although, similar MRI-to-CT conversion algorithms are already available in literature, they require the application of very specific MRI sequence, needing a skilled and dedicated operator, and limiting their applicability. In this project, only diagnostic T1 and T2 MRI sequences are used. In order to validate the applicability of these pseudo CT in clinical, proton therapy planning simulations are being conducted at the moment. This research is being performed at the Massachusetts General Hospital in collaboration with the Radiation Oncology research group.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

RELIABLE, FAST, AND AUTOMATED ANALYSIS OF CYST FORMATION USING DIGITAL HOLOGRAPHY WITH APPLICATION TO CANCER RESEARCH

Pitkäaho T., Zhang K., Manninen A., Naughton T.

Abstract: When normal epithelial cells are embedded in a three-dimensional (3D) collagen gel, the cells proliferate to form spherical cysts with a hollow lumen surrounded by aligned cells. Abnormal cells that fail to assemble a proper basement membrane grow as an amorphous cell mass. We show how digital holographic microscopy together with image processing and analysis algorithms can be used to analyse efficiently 3D cysts.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

MULTIMODAL PET AND MR IMAGE SEGMENTATION IN STEREOTACTIC NEURORADIOSURGERY

Rundo L., Militello C., Stefano A., Russo G., Pisciotta P., Sabini M.G., D'Arrigo C., Marletta F., Ippolito M., Vitabile S., Mauri G., Gilardi M.C.

Abstract: The aim of this study is to combine Biological Target Volume (BTV) segmentation, using MET-PET images, and Gross Target Volume (GTV) segmentation, delineated on the respective co-registered MR images, in stereotactic neuroradiosurgery. GTV often does not match entirely with BTV, which provides metabolic insights about brain tumors. This complementary information is clinically significant for treatment planning and Clinical Target Volume (CTV) definition will be thus enhanced using multimodal PET-MRI segmentation results, achieved using a novel joint segmentation method.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

NEUROIMAGING BIOMARKERS AUTOMATICALLY PREDICT CONVERSION FROM MILD COGNITIVE IMPAIMENT TO ALZHEIMER'S DISEASE

Salvatore C., Battista P., Castiglioni I.

Abstract: The potential of neuroimaging to improve diagnostic accuracy of Alzheimer's Disease (AD) and to monitor its progression has been recognized. Machine Learning (ML) algorithm implemented here performs automatic classification of AD and extracts Magnetic Resonance Imaging-related predictors of conversion, using structural data of 509 patients. Classification performance for AD vs CN, MCIc vs CN, MCIc vs MCInc is 76, 72, 66%. Voxels influencing classification include critical regions involved in AD.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

IN VIVO QUANTITATIVE FRACTAL ASSESSMENT OF CINEANGIOGRAPHIES

Scaramuzzino S., Zaffino P., Spadea MF.

Abstract: Low complexity imaging modalities, such as Fluoroscopy is widespread, being cheaper, less invasive, and featuring real time capabilities, particularly useful into the intra-operative context. The drawback is that these imaging modalities are very difficult to process in order to extract quantitative information. This work aims at developing novel techniques for angiography imaging of the cardiovascular district. More in detail, we present a tool for Fractal Analysis of cineangiography for collateral growth assessment in patients with Peripheal Vascular Disease.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

AUTOMATIC PLANNING FOR INTRACRANIAL ELECTRODES PLACEMENT IN SEEG

Scorza D., De Momi E., Cardinale F., Kabongo L.

Abstract: Stereo ElectroEncephaloGraphy (SEEG) is a surgical procedure which implies the insertion of intracranial electrodes and record the brain activity in patients affected by focal epilepsy. Neurosurgeons need to plan up to 20 electrodes by selecting manually entry and target points and analysing 3D anatomical images. This poster presents an automatic planner tool which optimizes electrode trajectories given only a rough entry and target point, and maximize hard and soft constraints as distance from vessels and trajectory insertion angle. In addition, we added Maximum Intensity Projection (MIP) images obtained from angiographic-CT to help the neurosurgeon evaluating the trajectories feasibility.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

MHT AND TEMPLATE-MATCHING BASED EXTRACTION OF AIRWAY TREES FROM CT

Selvan R., Petersen J., de Bruijne M.

Abstract: Segmentation of airway trees from CT scans of lungs has important clinical applications, in relation to the diagnosis of chronic obstructive pulmonary disease (COPD). Here we present a method based on multiple hypothesis tracking and template matching, originally devised for vessel segmentation, to extract airway trees. Idealized tubular templates are constructed and assigned a score based on the image data. Several such regularly spaced hypotheses are used in constructing a hypothesis tree, which is then traversed to obtain improved segmentation results.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

EFFICIENT RECONSTRUCTION OF MULTI-PATCH MAGNETIC PARTICLE IMAGING DATA

Szwargulski P., Hofmann M., Gdaniec N., Knopp T.

Abstract: Magnetic Particle Imaging (MPI) is a new tomographic imaging modality with a high temporal and spatial resolution. It is based on the response of magnetic material to dynamic magnetic fields. The field of view (FoV) is currently restricted due to technical and physiological limitations. In order to overcome this a multi-patch approach can be used. In this work an efficient implicit reconstruction of multi-patch MPI data is presented.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

AID DIAGNOSIS SYSTEM FOR BRAIN MEDICAL IMAGE

Talbi F., Alim-Ferhat F., Hachemi B., Mohamed L.AIT, Abdelaziz M., Seddiki S.

Abstract: This project allows better visualization of areas of interest, facilitating medical diagnosis, to monitor the evolution of brain tumors, and provides crucial indicators for interpreting the conditions of individual adaptation of the therapeutic strategy, which necessarily requires: Evaluation of the shape and volume of the tumor (2D and 3D). The location of the tumor and its position. The nature and severity of the tumor (the grade and type of pathology).Interactions with nearby brain structures.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

BAYESIAN IMAGE QUALITY TRANSFER

Tanno R., Ghosh A., Criminisi A., Alexander C. D.

Abstract: Image quality transfer (IQT) aims to enhance clinical images of relatively low quality by propagating high quality image structures from expensive or rare data sets. However, the original framework gives no indication of confidence in its output, which is a significant barrier to adoption in clinical practice. We present a general Bayesian extension of IQT which enables accurate quantification of uncertainty, providing users with an essential prediction of the accuracy of enhanced images.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

4-D CARDIAC C-ARM COMPUTED TOMOGRAPHY

Taubmann O., Lauritsch G., Maier A., Hornegger J.

Abstract: C-arm CT-based interventional assessment of cardiac function could prove highly useful. However, for clinically feasible scan protocols, time-resolved reconstruction is extremely challenging due to massive angular undersampling of the trajectory. We show two ways to effectively utilize all available data and thereby improve image quality: Non-rigid motion compensation and temporally regularized reconstruction.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

TOWARDS A CLINICAL TOOL FOR AUTOMATED DATSCAN CLASSIFICATION

Taylor J., Fenner J., Barber D.

Abstract: This study aimed to develop a computer aided diagnosis (CAD) tool for Ioflupane I-123 (DaTSCAN) imaging based on the requirements of end users and regulatory authorities. A well-understood technique, eigenimage analysis, was adapted to create a simple, robust CAD algorithm. Performance was demonstrated using a large, reliable image database. Area under the Receiver Operator Curve (AUROC), a clinically relevant metric, was 0.980 highlighting impressive diagnostic performance

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

3D reconstruction of protein nano-crystals using cryo-electron tomography

Toots M., Skoglund U.

Abstract: Knowing the structure of biological molecules plays a key role in understanding their function. In this work we present a proof of concept for imaging protein nano-crystals at mid-range resolution (~ 15) using cryo-electron tomography and exploiting crystallographic space group symmetry. We show on a model protein lysozyme (14kDa) how this method can be used to not only analyze one averaged structure but also provide a unique peek into the disorder and mosaicity inherent within the crystal.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

HYPERSPECTRAL IMAGING FOR DISCRIMINATION OF BACTERIA COLONIES ON SOLID BLOOD AGAR MEDIA

Turra G., Arrigoni S., Signoroni A.

Abstract: Clinical Microbiology is living a digital revolution promoted by the rapid diffusion of Total Laboratory Automation. We investigate and develope a hyperspectral analysis solution (from data acquisition to classification) of bacteria colonies. We present our last improvements related to sample illumination, segmentation and classification aimed to the discrimination of main urinary tract pathogens on generic culturing media and to demonstrate the workability of a Virtual Chromogenic Agar.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

CONSISTENCY-BASED MOTION ASSESSMENT IN ROTATIONAL CORONARY ANGIOGRAPHY

Unberath M., Aichert A., Achenbach S., Maier A.

Abstract: Background estimation in angiography allows for subtraction that approximates detector-domain material decomposition yielding non-truncated images. This enables epipolar geometry-based motion estimation. We outline a pipeline for virtual digital subtraction coronary angiography and evaluate it on phantom data. Shifts maximizing epipolar consistency are estimated that serve as surrogate for respiratory and cardiac motion. We devise an image-based surrogate for cardiac motion.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

RANDOM FOREST FOR MULTIPLE SCLEROSIS LESION SEGMENTATION

Vera Olmos F.J., Malpica N.

Abstract: Multiple Sclerosis (MS) is a chronic, inflammatory and demyelinating disease that primarily affects the white matter of the central nervous system. Automatic segmentation of MS lesions in brain MRI has been widely investigated in recent years with the goal of helping MS diagnosis and patient follow-up. It offers an attractive alternative to manual segmentation which remains a time-consuming task and suffers from intra- and inter-expert variability. We propose a new approach that uses a Random Forest (RF) classifier. Its input has been filtered with a GM threshold and use several features to take in count voxel and context information, then a Markov Random Field (MRF) post process algorithm has been applied to make lesions grow through probable neighbourhoods. Our approach will be used in the MS challenge 2016, that will take place in October during MICCAI 2016, therefore to train and test the method we use the database provided from the challenge, it consists in 15 subject from 4 different centers, imaged on 1.5T or 3T scanners and each patient has being manually annotated by seven experts. The provided MR sequences include: 3D FLAIR, 3D T1-w, 3D T1-w GADO, 2D DP and 2D T2. We found that segmentation results are maximized by using all available sequences, of which the FLAIR volume provides the most information.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

GLOBAL AND LOCAL ANOMALY DETECTORS FOR TUMOR SEGMENTATION IN DYNAMIC PET ACQUISITIONS

Verdoja F., Bonafè B., Cavagnino D., Grangetto M., Bracco C., Varetto T., Racca M., Stasi M.

Abstract: We explore the application of anomaly detectors to tumor segmentation. The developed algorithms work on 3-points dynamic FDG-PET acquisitions and leverage on the peculiar anaerobic metabolism that cancer cells experience over time. A few anomaly detectors are discussed, together with different algorithms aiming at estimating normal tissues statistics. All algorithms have been tested on a 9-patients dataset proving that anomaly detectors are able to outperform state-of-the-art techniques.

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

PREDICTION OF DEFORMABLE IMAGE REGISTRATION ERROR IN LUNG 4DCT

Vickress J., Morgan J., Barnett R., Battista J., Yartsev S.

Abstract: Introduction: In this study we investigate methods to predict deformable image registration (DIR) error throughout a 3D volume. Methods: Using 10 thoracic 4DCT containing 300 landmarks between the 0% and 50% phase of respiration to calculate DIR error. Evaluated four methods including the Distance discordance metric (DDM) for point-wise DIR error prediction using a Pearson correlation. Results: The best method DDM, had a Pearson correlation of 0.88 for predicting DIR error. Conclusion: Overall we have shown that prediction DIR error is possible using multiple methods.

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Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

ROBUST LIVE TRACKING OF MITRAL VALVE ANNULUS FOR MINIMALLY-INVASIVE INTERVENTION GUIDANCE

Voigt I., Scutaru M., Mansi T., Georgescu B., El-Zehiry N., Houle H., Comaniciu D.

Abstract: 1) Clinical Background: Mitral valve (MV) treatment entails risk and high costs (140K / procedure - 4.9% in-hospital death rate). Increasing demand for percutaneous approaches (MitraClip(TM), Carillon, NeoChord). Recent breakthroughs in 3D TEE imaging enable for real-time, full volume 3D imaging of valve anatomy and flow ==> Need for real-time anatomical modeling and quantification for efficient image-driven procedures.

2) Technical Background: * State-of-the-art 3D+t valve modeling is limited to offline image analysis - too slow for real-time applications * Existing approaches for real-time object tracking are limited to 2D imaging (e.g. 2D ultrasound & fluoroscopy applications) ==> Need for 3D volumetric real-time tracking techniques

3) Goal: To automatically detect and track the mitral valve annulus in real-time from 4D TEE imaging for live quantification and guidance

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Presentation Type: Poster

Date: Tuesday 2 August 2016

Time: 16:45 - 18:00

Poster Session: 2

UNSUPERVISED LEARNING WITH IMBALANCED DATA VIA STRUCTURE CONSOLIDATION LATENT VARIABLE MODEL

Yousefi F., Dai Z., Ek C., Lawrence N.

Abstract: Unsupervised learning on imbalanced data is challenging because, when given imbalanced data, current model is often dominated by the major category and ignores the categories with small amount of data. We develop a latent variable model that can cope with imbalanced data by dividing the latent space into a shared space and a private space. Based on Gaussian Process Latent Variable Models, we propose a new kernel formulation that enables the separation of latent space and derive an efficient variational inference method. The performance of our model is demonstrated with an imbalanced medical image dataset.

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Poster Session: 2

FULLY AUTOMATED IMAGE ANALYSIS FOR ASSESSMENT OF CARDIOVASCULAR DISEASE, OSTEOPOROSIS AND COPD STATUS IN PATIENTS UNDERGOING LOW-DOSE CT LUNG CANCER SCREENING

Elnekave E., Arav G., Bregman-Amitai O., Shadmi R.

Abstract: Low dose chest CT (LDCT) screening was instituted in the US after the American National Lung Cancer Screening Trial (NLCST) found that screening of long-term smokers resulted in a 20% reduction in lung cancer mortality. We evaluated significant co-morbidities in the same population (cardiovascular disease, chronic obstructive lung disease (COPD), osteoporosis) and assessed feasibility of automatic opportunistic screening for each using LDCT.

COPD: It has recently been shown that CT-identifiable patterns of lung architecture have been correlated to different risks of clinical deterioration and can even be used to predict which of various therapy options would be most effective. In addition, CT evidence of pulmonary hypertension is the most powerful predictor of hospitalization and mortality in COPD patients.

Cardiovascular disease: LDCT screening in Italy, Israel and the Netherlands have all been used to measure coronary artery calcium as a marker of cardiovascular disease. Routine coronary calcium quantification in lung CT screening may discover undiagnosed cardiovascular disease and trigger preventative therapy in 84 out of every 1000 (8.4%) participants. The diagnosis of fatty liver (which can be made with nearly 100% accuracy on CT) is independently associated with a 2x - 4.6x risk of cardiovascular events within seven years.

Osteoporosis: Smokers carry a 2.3x risk of osteoporotic spine fractures and a 1.7x increase risk of hip fractures and recent studies have demonstrated that routine thoracic and abdominal CT data allows accurate assessment bone mineral density and effective fracture risk stratification.

Methods: Zebra Medical Vision has developed a series of algorithms which automatically analyzes CT Chest/Abdomen studies and combines various image-processing, computer-vision and machine-learning algorithms to provide the essential medical insights in a continuous or ordinal manner.

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Poster Session: 2