

POSTER SESSION BOOKLET



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

University of Catania
King's College London
University of Cambridge

Medical Imaging Summer School 2018
Medical Imaging meets Machine Learning
Favignana, 29 July - 4 August 2018

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 deep learning is a subset of machine learning methods in artificial intelligence (AI) that is capable of learning data representations and extracting new features, as opposed to more task-specific algorithms employed in medical imaging that are based on human experience and hand-crafted feature extractions. 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 deep learning, based on the shared broad categories of medical image computing, computer-aided image interpretation and disease classification. 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/deep learning.

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 interac-

tion 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 2018.

Best Presentation Prize

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

Favignana, June 2018

Roberto Cipolla, University of Cambridge, United Kingdom

Giovanni Maria Farinella, University of Catania, Italy

Julia Schnabel, King's College London, United Kingdom

Filippo Stanco, University of Catania, Italy

List of Posters¹

1. STATISTICAL INFERENCE FOR IMAGE RECONSTRUCTION THROUGH MULTIMODE FIBERS
Ancora D., Marruzzo A., Antenucci F., Cazzato P., De Giorgi M., Sanvitto D., Leuzzi L.
2. SEGMENTATION OF FACIAL BONE SURFACES BY PATCH GROWING FROM CONE BEAM CT VOLUMES
Antila, K., Lilja, M., Kalke M.
3. DEEP LEARNING FOR AGE-RELATED MACULAR DEGENERATION (AMD) RECOGNITION AND PROGNOSIS
Asgari F, Waldstein S. M., Gerendas B. S., Bogunovic H., Schmidt-Erfurth U.
4. MAGNETIC RESONANCE FINGERPRINTING RECONSTRUCTION VIA A SPATIOTEMPORAL NEURAL NETWORK
Balsiger F., Shridha A., Chikop S., Scheidegger O., Geethanath S., Reyes M.
5. PATIENT DATA-ADAPTED DEEP LEARNING FOR MULTI-LABEL CHEST X-RAY CLASSIFICATION
Baltruschat I. M., Nickisch H., Grass M., Knopp T., Saalbach A.
6. DEEP LEARNING FOR MEDICAL APPLICATIONS IN DEFICIENCY OF LABELS
Baur C., Albarqouni S. Navab N.
7. DEEPER IMAGE QUALITY TRANSFER: TRAINING LOW-MEMORY NEURAL NETWORKS FOR 3D IMAGES
Stefano B. Blumberg, Ryutaro Tanno, Iasonas Kokkinos, Daniel C. Alexander
8. DEEP LEARNING FROM LABEL PROPORTIONS FOR EMPHYSEMA QUANTIFICATION
Bortsova G., Dubost F., Orting S., Katramados I., Hogeweg L., Thomsen L., Wille M., De Bruijne M.
9. CONTOUR PROPAGATION IN CT SCANS WITH CONVOLUTIONAL NEURAL NETWORKS
Léger J., Brion E., De Vleeschouwer C., Macq B.
10. AUTOMATIC SEGMENTATION OF THE HIPPOCAMPUS USING U-NET BASED DEEP CONVOLUTIONAL NETWORKS
Brusini I., Smedby Ö., Westman E., Wang C.
11. DEDICATED RADIOMICS FEATURES FOR GRADING PROSTATE CANCER
Castiillo J. , Veenland J. , Schoots I. , Niessen W.

¹Each poster is identified by a number. The page of a poster in this booklet corresponds with the ID of the poster.

-
12. AORTA AND PULMONARY ARTERY SEGMENTATION WITH CNN AND FULLY CONNECTED CRF
Chen S., Gamechi Z.S., Dubost F., Pedersen J.H., de Bruijne M.
 13. BINARY GLIOMA GRADING: RADIOMICS VERSUS PRE-TRAINED CNN FEATURES
Decuyper M., Bonte S., Van Holen R.
 14. DEFORMATION-BASED MORPHOMETRY IN A MOUSE MODEL OF INTRAUTERINE GROWTH RESTRICTION
Devine J.P., Eaton M., Percival C.J., Cross J.C., Hallgrimsson B.
 15. QUANTIFICATION OF PERIVASCULAR SPACES WITH 3D REGRESSION NETWORKS
Dubost F., Yilmaz P., Adams H., Bortsova G., Ikram A., Niessen W., Vernooij M., de Bruijne M.
 16. ART 3.5D: AN ALGEBRAIC RECONSTRUCTION TECHNIQUE TO RECOVER 4D CONTRAST DYNAMICS FROM 3D BRAIN ANGIOGRAPHIES
El Hadji S., Bonilauri A., De Momi E., Helm P., Baselli G., Cardinale F.
 17. 3D DEEP AUTOENCODER FOR TUMOR-SPECIFIC FEATURE EXTRACTION
Estienne T., Battistella E., Vakalopoulou M., Sun R., Deutsch E., Rober C., Paragios N.
 18. AUTOMATIC DETECTION OF MOTION ARTIFACTS ON MRI USING DEEP CNN
Fantini I., Rittner L., Yasuda C., Lotufo R.
 19. PHASE-SENSITIVE REGION-OF-INTEREST COMPUTED TOMOGRAPHY
Felsner L., Berger M., Kaeppler S., Bopp J., Ludwig V., Weber T., Pelzer G., Michel T., Maier A., Anton G., and Riess C.
 20. LEARNING FOR 2D-3D IMAGE REGISTRATION IN SURGERY
Fischer P., Mewes P., Piat S., Tuysuzoglu A., Liao R.
 21. FEASIBILITY OF COLONIC POLYP CLASSIFICATION WITH CNN BASED ON BLUE LASER AND LINKED COLOR IMAGING
Fonollà R., Van der Sommen F., Schreuder R.M., Schoon E.J., de With P.H.N.
 22. AUTOMATIC SEGMENTATION OF THE HUMERUS FROM CT VOLUMES USING STATISTICAL SHAPE MODELS AND MARKOV CHAIN MONTE CARLO METHODS
Fouefack J. R., Borotikar B., Burdin V., Douglas T. S. and Mutsvangwa T. E.
 23. AUTOMATIC AIRWAY SEGMENTATION AND BRONCHIECTASIS QUANTIFICATION
Garcia-Uceda A., A.W.M. H., De Bruijne M.

-
24. TISSUE CLASSIFICATION OF COLON CANCER HISTOLOGY IMAGES
Gedeon R., Nagar AK., Naguib R.
 25. AUTOMATIC PROSTATE SEGMENTATION FROM TRANSRECTAL ULTRASOUND IMAGES USING CONVOLUTIONAL NEURAL NETWORKS
Ghavami N., Hu Y., Bonmati, E., Rodell, R., Gibson, E., Moore, C., Barratt, D.
 26. COMPUTER-AIDED DETECTION OF LUNG NODULES USING MULTI-LEVEL CONTEXTUAL 3D CNNs
Gonidakis P., Omelina L., Jansen B., Vandemeulebroucke J.
 27. GRAPH CONVOLUTIONS ON SPECTRAL EMBEDDINGS: LEARNING OF CORTICAL SURFACE DATA
Gopinath K., Desrosiers C., and Lombaert H.
 28. AUTOMATIC SEGMENTATION OF MICROBLEEDS IN 3D MRI
Groothuis I., Sudre C., Pai A., Sørensen L., Nielsen M., Barkhof F., Ourselin S., Cardoso M. J., Modat M.
 29. DEEP LEARNING FOR SEGMENTING CAPILLARY BLOOD VESSELS CONTAINING REMAINING BLOOD CELLS
Grothausmann R., Knudsen L., Ochs M., Mühlfeld C.
 30. DATA-DRIVEN REWARD LEARNING FOR INDIVIDUAL PROSTHESIS SIZE PREDICTION IN VALVE-SPARING AORTIC ROOT RECONSTRUCTION
Hagenah J., Scharfschwerdt M., Ernst F.
 31. OPTIMIZATION OF DEFORMABLE IMAGE REGISTRATION WITH CONVOLUTIONAL NEURAL NETWORKS
Hering A., Heldmann S.
 32. STROKE DETECTION USING CONVOLUTIONAL NEURAL NETWORKS
Herzog L., Murina E., Dürr O., Wegener S., Sick B.
 33. UNCERTAINTY-DRIVEN SANITY CHECK: APPLICATION TO POSTOPERATIVE BRAIN TUMOR CAVITY SEGMENTATION
Jungo A., Meier R., Ermis E., Herrmann E., Reyes M.
 34. CONSTRAINED-CNN LOSSES FOR WEAKLY SUPERVISED SEGMENTATION
Kervadec H., Dolz J., Tang M., Granger É., Boykov Y., Ben Ayed I.
 35. DEEP BOOSTED REGRESSION FOR MR TO CT SYNTHESIS
Kläser K., Cardoso M. J., Ourselin S.
 36. GENERALIZING MULTISTAIN IMMUNOHISTOCHEMISTRY TISSUE SEGMENTATION USING ONE-SHOT COLOR DECONVOLUTION DEEP NEURAL NETWORKS
Lahiani A., Gildenblat J., Klamann I., Navab N., Klaiman E.

-
37. SIMULTANEOUS LOCALIZATION AND MAPPING IN DEFORMABLE SCENES
Lamarca J., Montiel J. M. M.
 38. AN EXTENDED BLOCK RESTRICTED ISOMETRY PROPERTY FOR SPARSE RECOVERY WITH NON-GAUSSIAN NOISE
Leffler K., Zhou Z., Yu J.
 39. BLAST IDENTIFICATION IN CHILDHOOD ACUTE MYELOID LEUKAEMIA USING WGAN LATENT SPACE EMBEDDINGS
Licandro R., Schlegl T., Reiter M., Diem M., Dworzak M., Schumich A., Langs G., Kampel M.
 40. MOBILE PHONE-BASED EVALUATION OF LATENT TUBERCULOSIS INFECTION USING DEEP LEARNING
Maclean S., Malila B., Mutsvangwa T., Douglas T.
 41. LOCALIZATION AND LABELING OF POSTERIOR RIBS IN CHEST RADIOGRAPHS USING A CRF-REGULARIZED FCN WITH LOCAL REFINEMENT
Mader A.O., von Berg J., Fabritz A., Lorenz C., and Meyer C.
 42. PROBABILISTIC JOINT FACE-SKULL MODELLING FOR FACIAL RECONSTRUCTION
Madsen D., Lüthi M., Schneider A., Vetter T.
 43. BREAST CANCER HISTOLOGICAL IMAGE CLASSIFICATION USING FINE-TUNED DEEP NETWORK FUSION
Mahbod A., Ellinger I., Ecker R., Smedby Ö., Wang C.
 44. AUTOMATIC 2D-3D DETECTION AND SEGMENTATION OF SPHERIC AND ASPHERIC FEMORAL HEADS IN MR IMAGES USING HOUGH TRANSFORMS
Memis A., Albayrak S., Bilgili F.
 45. SYMMETRY ANALYSIS OF 3D BACK SURFACE FOR SCOLIOSIS DIAGNOSIS AND FOLLOW-UP
Morand M., Comas O., Fiorio C., Subsol G.
 46. EXTRACTION OF SIGNATURES FROM MRI DATA IN EARLY PARKINSONS DISEASE
Munoz Ramirez V., Arbel J., Moro E., Forbes F., Dojat M.
 47. BIWGAN: LEARNING STABLE ADVERSARIAL REPRESENTATIONS FOR PROSTATE HISTOPATHOLOGY IMAGES
Otálora S., Andrearczyk V., Atzori M., Müller H.
 48. SKIN LESION CLASSIFICATION USING LIGHT-FIELD IMAGING
Pereira P., Paiva R., Fonseca-Pinto R., Tavora L., Assuncao P., Faria S.

-
49. CONVOLUTIONAL NEURAL NETWORKS FOR BONE LESION DETECTION IN MEDICAL IMAGING DATA
Perkonigg M., Hofmanninger J., Menze B., Weber M.-A., Langs G.
 50. IMPROVING HIGH-RESOLUTION QUANTITATIVE MRI MAPS FOR IN-VIVO HISTOLOGY MRI OF THE HUMAN BRAIN
Podranski K., Scherf N., Weiskopf N.
 51. IMPROVING SKIN LESION SEGMENTATION WITH GENERATIVE ADVERSARIAL NETWORKS
Pollastri F.
 52. DUAL ASYMMETRIC AND HIGH RESOLUTION DETECTION HEADS OF A NOVEL COMPACT MOLECULAR BREAST IMAGING SYSTEM FOR EARLY BREAST CANCER DIAGNOSIS
Poma G. E., Cisbani E., Garibaldi F., Giuliani F., Inero T., Lucentini M., Marcucci A., Musico P., Santavenere F.
 53. PATTERN RECOGNITION ANALYSIS FOR PROGNOSIS OF INFLAMMATORY BOWEL DISEASE
Pradhan P., Tolstik T., Stallmach A., Popp J., Bocklitz T.
 54. SEMI-AUTOMATIC LIVER AND LESION SEGMENTATION IN CT IMAGES
Prasad P. J. Ray, Oram L., Elle O. J., Kumar R. P.
 55. LEARNING REPRESENTATIONS BY PREDICTING THE FUTURE
Rivail A., Bogunovic H., Waldstein S., Gerendas B., Vogl W., Schmidt-Erfurth U.
 56. MACHINE LEARNING APPLICATION ON FMRI DATA: BOLD AND HEAD MOTION SIGNALS
Sacca V., Sarica A., Novellino F., Barone S., Tallarico T., Filippelli E., Granata A., Valentino P., Quattrone A.
 57. A MULTI-SCALE APPROACH FOR MICROANEURYSMS SEGMENTATION USING EMBEDDING TRIPLET LOSS IN COLORED FUNDUS IMAGES
Sarhan M.H., Albarqouni S., Navab N., Eslami A.
 58. UNSUPERVISED LEARNING OF ULTRASOUND SIMULATORS
Senouf O., Vedula S., Bronstein A., Michailovich O., Zibulevsky M.
 59. DECOUPLED NEURAL NETWORKS FOR CLASSIFICATION OF BREAST MICROCOSCOPY IMAGES
Stone R., Wright A., Clarke E., Hanby A., Treanor D., Hogg D., Bulpitt A.
 60. TOWARDS A ROBUST DEEP CT-ULTRASOUND REGISTRATION METHOD FOR IMAGE GUIDANCE IN LIVER TUMOR ABLATION
Sun Y., Moelker A., Niessen W.J., van Walsum T.

-
61. TOWARDS LONGITUDINAL RADIOMICS FOR SURVIVAL PREDICTION OF GLIOBLASTOMA PATIENTS
Suter Y., Knecht U., Valenzuela W., Wiest R., Reyes M.
 62. A 3D CONVOLUTIONAL NEURAL NETWORK WITH TRANSFER LEARNING ON MRI FOR INCOMPLETE HIPPOCAMPAL INVERSION CLASSIFICATION
Tafari B., Cherubini A., Caligiuri M.E., Labate A., Gambardella A., Arabia G., Quattrone A.
 63. TISSUE SEGMENTATION IN VOLUMETRIC LASER ENDOMICROSCOPY DATA USING FUSIONNET AND A DOMAIN-SPECIFIC LOSS FUNCTION
van der Putten J., van der Sommen F., Struyvenberg M., de Groof J., Curvers W.L., Schoon E.J., Bergman J.J.G.H.M., de With P.H.N.
 64. TOWARDS CT-QUALITY ULTRASOUND IMAGING USING DEEP LEARNING
Vedula S., Senouf O., Bronstein A., Michailovich O., Zibulevsky M.
 65. CNN FOR SEGMENTATION OF FETAL CORTEX IN 3D ULTRASOUND
Venturini L., Papageorgiou A. T., Noble J. A., Namburete A. I. L.
 66. A DIRECT ULTRASOUND PHANTOM FABRICATION FOR CATHETER INTERVENTION SIMULATION
Wang S., Noh Y., Casajuana M., Housden R., Wang S., Pontiki A., Rhode K.
 67. THE DEVIL IS IN THE DECODER
Wojna Z., Ferrari V., Guadarrama S., Fathi A., Silberman N., Chieh Chen N., Uijlings J.
 68. AUTOMATIC CATHETER DETECTION IN PEDIATRIC X-RAY IMAGES USING A SCALE-RECURRENT NETWORK AND SYNTHETIC DATA
Yi X., Adams S., Babyn P., Elnajmi A.
 69. REAL-TIME PREDICTION OF SEGMENTATION QUALITY: SWAPPING EXPERT ANNOTATIONS FOR GENERATED LABELS
Rob R., Oktay O., Bai W., Valindria V.V., Sanghvi M.M., Aung N., Paiva J.M., Zemrak F., Fung K., Lukaschuk E., Lee A.M., Carapella V., Kim Y.J., Kainz B., Piechnik S.K., Neubauer S., Petersen S.E., Page C., Rueckert D., Glocker B.
 70. LOSS FUNCTIONS IN IMBALANCED CLASSIFICATION
Janocha K., Pouplin A., Higgins C., Linton N., Bharath A.
 71. AUTOMATIC GRADING OF ACNE VULGARIS USING DEEP LEARNING
Melina A., Ngo Dinh N., Tafari B., De Vitis S., Schipani G., Nisticò S., Cosentino C., Amato F., and Cherubini A.
 72. DESCRIPTION OF BREAST MORPHOLOGY THROUGH BAG OF NORMALS REPRESENTATION
Allegra D., Milotta F. L. M., Sinitò D., Stanco F., Gallo G., Catanuto G.

STATISTICAL INFERENCE FOR IMAGE RECONSTRUCTION THROUGH MULTIMODE FIBERS

Ancora D., Marruzzo A., Antenucci F., Cazzato P., De Giorgi M., Sanvitto D., Leuzzi L.

Abstract: A major interest in biomedical imaging is the comprehension of the photon scattering through disordered media: Many studies have pursued the solution of this riddle achieving light-focusing control or for reconstructing images in complex media. In the present work, we investigate how statistical inference could help the calculation of the transmission matrix in a multimode fiber, thus enabling its usage as a normal optical element. Our desire is to uncover insights from the scattering problem, encouraging the development of imaging techniques for better medical investigations.

Contact: daniele.ancora@nanotec.cnr.it

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

SEGMENTATION OF FACIAL BONE SURFACES BY PATCH GROWING FROM CONE BEAM CT VOLUMES

Antila, K., Lilja, M., Kalke M.

Abstract: This work was for developing a segmentation algo for dental and facial bones from CBCT. It works by parameterizing the shape of the target, searching points on the bone-soft tissue edge, reconstructing a mesh by growing patches on the points and regularizing the result with a polynomial. The result was benchmarked against a hand-drawn reference with a 0.50 ± 1.0 -mm average and 1.1-mm RMS error. The results were consistent and the pipeline was found fast (< 1-min average computation time).

Contact: kari.antila@student.tut.fi

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

DEEP LEARNING FOR AGE-RELATED MACULAR DEGENERATION (AMD) RECOGNITION AND PROGNOSIS

Asgari F, Waldstein S. M., Gerendas B. S., Bogunovic H., Schmidt-Erfurth U.

Abstract: Age-related macular degeneration (AMD) is a leading cause of blindness. The presence of drusen, small accumulations of extracellular material, is the hallmark of AMD. We develop a deep learning model called U-net for drusen segmentation in retinal optical coherence tomography (OCT). Segmentation is defined as a multiple classification problem, where the importance of drusen is weighted at 70 percent, surrounding retinal pigment epithelium (RPE) at 20 percent and Bruch's membrane (BM) at 10 percent, for the purposes of calculating the loss function. The proposed method segments drusen in 425 scans with a mean dice score of 0.74. This preliminary study shows that automated drusen segmentation using deep learning without any post-processing is fast and accurate.

Contact: fatemeh.asgari@meduniwien.ac.at

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

MAGNETIC RESONANCE FINGERPRINTING RECONSTRUCTION VIA A SPATIOTEMPORAL NEURAL NETWORK

Balsiger F., Shridha A., Chikop S., Scheidegger O., Geethanath S., Reyes M.

Abstract: Introduction: Magnetic resonance fingerprinting (MRF) quantifies multiple tissue parameters in one fast and motion-robust acquisition. Standard MRF reconstructs the parametric tissue maps by matching the fingerprints of each voxel to a dictionary of pre-computed signals. This dictionary matching lacks scalability due to computational efficiency and introduces artefacts due to the under-sampled k-space during the acquisition. We propose a dictionary-free, spatiotemporal deep learning-based MRF reconstruction, motivated by the issues associated with dictionary-based reconstruction. Materials & Methods: We use a convolutional neural network (CNN) that exploits the spatiotemporal relationship between neighbouring MRF signal evolutions. The CNN consists of one three-dimensional convolutional layer and three fully-connected layers. We acquired four brain scans of healthy volunteers with four parametric maps: static magnetic field inhomogeneity (B0), proton density (PD), T1 relaxation time (T1), and T2 relaxation time (T2). We evaluate our approach using a leave-one-out cross-validation and compare to one dictionary-based and two dictionary-free reconstruction approaches, which represent the state-of-the-art reconstruction approaches. Results: We achieve state-of-the-art reconstruction accuracy and robustness compared to the dictionary-free approach while the dictionary-based approach remains challenging to compete. The root mean square errors for B0, PD, T1, and T2 reconstruction are 233.9 Hz, 0.058, 593.4 ms, and 144.8 ms. Compared to 79.2 Hz, 0.052, 485.0 ms, and 128.5 ms for the dictionary-based method. The reconstruction of the four parametric maps requires several seconds with our method while the dictionary-based method requires several minutes. Discussion & Conclusion: We developed a dictionary-free and deep learning-based approach to reconstruct parametric maps from MRF. We exploit the spatiotemporal relationship between neighbouring fingerprints, which yields a more accurate and robust reconstruction compared to other dictionary-free reconstructions. Our approach reconstructs the parametric maps in significantly reduced time compared to the dictionary-based approach. These preliminary results suggest that dictionary-free MRF reconstruction is possible and might be a solution to a clinical application of MRF.

Contact: fabian.balsiger@istb.unibe.ch

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

PATIENT DATA-ADAPTED DEEP LEARNING FOR MULTI-LABEL CHEST X-RAY CLASSIFI- CATION

Baltruschat I. M., Nickisch H., Grass M., Knopp T., Saalbach A.

Abstract: The increased availability of X-ray image archives (e.g. the ChestX-ray14 dataset from the NIH Clinical Center) has triggered a growing interest in deep learning techniques. To provide better insight into the different approaches, and their applications to chest X-ray classification, we investigate a powerful network architecture in detail: the ResNet-50. Building on prior work in this domain, we consider transfer learning with fine-tuning as well as the training of a dedicated X-ray network from scratch. To leverage the high spatial resolutions of X-ray data, we also include an extended ResNet-50 architecture, and a network integrating non-image data (patient age, gender and acquisition type) in the classification process.

In a systematic evaluation, using 5-fold re-sampling and a multi-label loss function, we evaluate the performance of the different approaches for pathology classification by ROC statistics. We observe a considerable spread in the achieved performance and conclude that the X-ray-specific ResNet-50, integrating non-image data yields the best overall results.

Contact: i.baltruschat@uke.de

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

DEEP LEARNING FOR MEDICAL APPLICATIONS IN DEFICIENCY OF LABELS

Baur C., Albarqouni S. Navab N.

Abstract: Generative Adversarial Networks (GANs) have been successfully used to synthesize realistically looking images of faces, scenery and even medical images. Unfortunately, they usually require large training datasets, which are often scarce in the medical field, and to the best of our knowledge GANs have been only applied for medical image synthesis at fairly low resolution. However, many state-of-the-art machine learning models operate on high resolution data as such data carries indispensable, valuable information. In this work, we try to generate realistically looking high resolution images of skin lesions with GANs, using only a small training dataset of 2000 samples, and try to use them to tackle the well-known problem of class imbalance.

Contact: c.baur@tum.de

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

DEEPER IMAGE QUALITY TRANSFER: TRAINING LOW-MEMORY NEURAL NETWORKS FOR 3D IMAGES

Stefano B. Blumberg, Ryutaro Tanno, Iasonas Kokkinos, Daniel C. Alexander

Abstract: We address the memory demands of 3D, high-resolution, multi-channelled medical images in deep learning. We use memory-efficient backpropagation techniques, elongating deep architectures with negligible memory increase. With a slight memory increase we obtain state-of-the-art results in Image Quality Transfer: HCP super-resolution. This methodology can be applied to most other tasks involving deep learning. Our code is publicly available.

Contact: stefano.blumberg.17@ucl.ac.uk

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

DEEP LEARNING FROM LABEL PROPORTIONS FOR EMPHYSEMA QUANTIFICATION

Bortsova G., Dubost F., Orting S., Katramados I., Hogeweg L., Thomsen L., Wille M., De Bruijne M.

Abstract: We propose a novel weakly supervised deep learning method that learns to segment and estimate the extent of emphysema from visually estimated image-level proportions of emphysematous tissue. Our method is a combination of an architecture specialized for learning from proportions and a custom loss. We outperform a commonly used regression network, traditional and recently published machine-learning based methods for emphysema quantification by a large margin. This work is accepted to MICCAI 2018.

Contact: gerdabortsova@gmail.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

CONTOUR PROPAGATION IN CT SCANS WITH CONVOLUTIONAL NEURAL NETWORKS

Léger J., Brion E., De Vleeschouwer C., Macq B.

Abstract: In many segmentation tasks, CNNs fail to exploit common sense prior to drive the segmentation. We propose a CNN architecture that maps a joint input, composed of the target image and a source segmentation, to a target segmentation. Our solution succeeds in taking advantage of the source segmentation when it is sufficiently close to the target segmentation, without being penalized when the source is far from the target.

Contact: eliott.brion@uclouvain.be

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

AUTOMATIC SEGMENTATION OF THE HIPPOCAMPUS USING U-NET BASED DEEP CONVOLUTIONAL NETWORKS

Brusini I., Smedby Ö., Westman E., Wang C.

Abstract: Accurately segmenting the hippocampus from brain MRI data is a crucial task, since its structural integrity is related to Alzheimer's disease progression. Our work implements a segmentation pipeline by using U-Net based deep learning and then combining it with shape modeling. The use of a U-Net-based approach was successful in terms of both time efficiency and accuracy in three different diagnostic groups. However, the segmentation result did not benefit from the inclusion of shape information.

Contact: irene.brusini@sth.kth.se

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

DEDICATED RADIOMICS FEATURES FOR GRADING PROSTATE CANCER

Castillo J. , Veenland J. , Schoots I. , Niessen W.

Abstract: Prostate cancer (PCa) is the most common cancer in elderly males in Europe. On PCa Initial biopsy detection rates are approximately 40–45%. Multiparametric MRI (mMRI) visualizes and quantifies cell density and tissue perfusion/permeability in a non-invasive manner. The main goal of this project is to develop a high risk PCa classifier based on mMRI Radiomics features. Our proposed method use a deep network to extract such features on the images and classify them according to Gleason score.

Contact: j.castillotovar@erasmusmc.nl

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

AORTA AND PULMONARY ARTERY SEGMENTATION WITH CNN AND FULLY CONNECTED CRF

Chen S., Gamechi Z.S., Dubost F., Pedersen J.H., de Bruijne M.

Abstract: Accurate segmentation of aorta and pulmonary artery in low-contrast CT scans is difficult due to the low-contrast between vessels and surrounding tissues, which limits the ability of measuring important risk factors for cardiovascular diseases and COPD. We propose a fully automatic 3D multi-class segmentation algorithm based on convolutional neural networks (CNN) and fully connected conditional random fields (CRF) models. The proposed pipeline is evaluated on 15 testing CT images quantitatively where we improve the DSC performance from 0.94 ± 0.01 and 0.92 ± 0.01 to 0.96 ± 0.01 and 0.94 ± 0.01 for aorta and pulmonary artery respectively. The experiments demonstrate that the algorithm is highly efficient and able to get state-of-the-art results on testing data.

Contact: chenscool@gmail.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

BINARY GLIOMA GRADING: RADIOMICS VERSUS PRE-TRAINED CNN FEATURES

Decuyper M., Bonte S., Van Holen R.

Abstract: We compare the predictive performance of hand-engineered radiomics features with features extracted through a pre-trained CNN for discriminating glioblastoma from lower-grade glioma. The BRATS 2017 database was used containing MRI data of 285 patients. State-of-the-art performance was achieved (AUC of 96.4%) with radiomics features extracted from manually segmented tumour volumes. With pre-trained CNN features extracted from the tumour bounding box, an AUC of 93.5% was obtained.

Contact: milan.decuyper@ugent.be

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

DEFORMATION-BASED MORPHOMETRY IN A MOUSE MODEL OF INTRAUTERINE GROWTH RESTRICTION

Devine J.P., Eaton M., Percival C.J., Cross J.C., Hallgrímsson B.

Abstract: Intrauterine growth restriction (IUGR) refers to differential restriction of fetoplacental growth potential. Poor placental function and maternal malnutrition are among the commonest causes of IUGR. Occurring in up to 5-10% of all pregnancies, IUGR is associated with significantly increased perinatal morbidity and mortality. Growth-restricted fetuses are often said to exhibit “brain sparing”, where the head and brain are preserved in size whilst the trunk is sacrificed due to preferential resource allocation. Less understood is the morphological variation in the IUGR brain as it develops throughout gestation.

Here, we experimentally induced IUGR in a cross-sectional sample of embryonic day (E)18 mouse embryos through chronic maternal protein undernutrition and heterozygous knockout of all 22 placenta-specific Prolactin-related (PRL) genes, since PRLs are associated with maternal adaptations to pregnancy. The project has three specific aims: 1) generate a series (E13, E16, E18) of brain and whole skeleton atlases using a study-specific volumetric registration pipeline; 2) apply deformation-based morphometry and automated landmarking to fetal heads and whole skeletons to quantify variation in shape and form; 3) automatically segment and compute whole and regional brain volumes, as well as key growth parameters (biparietal diameter, head circumference, femoral length, abdominal circumference).

Using contrast-enhanced 3D X-ray microscopy and medical image processing techniques, we present an E18 mouse head atlas. We automatically quantify variation in whole brain size and shape, then relate these differences to body and placental size. Ongoing work seeks to a) expand these methods to E16 and E13 fetuses and b) integrate light-sheet microscopy images of cellular dynamics (e.g., cell size, proliferation, and polarity) to elucidate specific mechanisms underlying anatomical variance.

Contact: jay.devine1@ucalgary.ca

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

QUANTIFICATION OF PERIVASCULAR SPACES WITH 3D REGRESSION NETWORKS

Dubost F., Yilmaz P., Adams H., Bortsova G., Ikram A., Niessen W., Vernooij M., de Bruijne M.

Abstract: Enlarged Perivascular Spaces (PVS) are brain lesions related to small vessel diseases. We present a thorough evaluation of a simple CNN to quantify PVS.

Contact: floriandubost1@gmail.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

ART 3.5D: AN ALGEBRAIC RECONSTRUCTION TECHNIQUE TO RECOVER 4D CONTRAST DY- NAMICS FROM 3D BRAIN ANGIOGRAPHIES

El Hadji S., Bonilauri A., De Momi E., Helm P., Baselli G., Cardinale F.

Abstract: Several neurosurgical procedures require accurate reconstruction of the cerebral vascular tree, as well as the classification of arteries and veins, to increase the safety of the intervention. We propose ART-3.5D, a novel approach to recover the dynamic information from standard Cone Beam Computed Tomography Angiography scans based on the post-processing of both the segmented angiogram and the raw data-set. The method was applied to five datasets for which a measure of the sensitivity, specificity and accuracy with respect to two ROIs manually segmented are given.

Contact: sara.elhadji@polimi.it

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

3D DEEP AUTOENCODER FOR TUMOR-SPECIFIC FEATURE EXTRACTION

Estienne T., Battistella E., Vakalopoulou M., Sun R., Deutsch E., Rober C., Paragios N.

Abstract: Computational medical imaging (radiomics) is an emerging discipline, which consists of extracting high dimensional quantitative features from medical images that are related to the underlying tumor's pathology. We propose a novel way to extract radiomics features from 3D deep autoencoders, taking into account the tumor's characteristics. The proposed architecture reports lower reconstruction errors than classical architectures for different tumor locations.

Contact: theo.estienne@centralesupelec.fr

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

AUTOMATIC DETECTION OF MOTION ARTIFACTS ON MRI USING DEEP CNN

Fantini I., Rittner L., Yasuda C., Lotufo R.

Abstract: Motivation: Motion artifacts on brain Magnetic Resonance Images (MRI) constitute an important factor that degrades the image quality, impacting the quantitative analysis based on structural segmentation for clinical research. Thus, assessing the image quality is essential to determine if the image fulfills the minimal quality level necessary to the research analysis. Nowadays an MR expert, responsible for quality control, performs a visual check on every acquired image. Usually, MRI database is huge, and its quality screening is time-consuming and fatiguing.

Objective: The proposal is to automatically detect the images containing motion artifacts using Deep Convolutional Neural Networks (CNN).

Material and Methods: The dataset is composed of T1-weighted volumetric sequence from 68 healthy volunteers acquired in sagittal plane, divided into 2 classes: motion artifacts presence and motion-free images (Fig 4 and 5). The dataset was divided into 70% - 30%, at acquisition level, for training and test. 128x128 patches were randomly extracted from slices. Published networks from Keras [1] were selected: ResNet50 [2], InceptionV3 [3], Inception-ResNet [4] and Xception [5]. The method combines these four CNNs exploring the different characteristics extracted from each one. As convolutional filters from lower layers map smaller regions in the original input and our goal is to detect fine-grained image corruption, the CNNs were adapted to use the output from lower intermediate level as features to the binary classifier.

Results: To make the prediction more precise, we include the patch location information along to the four Deep CNNs probabilities. Processing these combined features, by an Artificial Neural Network (ANN), resulted in the acquisition motion presence probability (Fig. 2). The method used a 3-fold approach to learn the training set due to the small amount of sample data. The method results were predictions $p \in [0,1]$ for the presence of motion artifacts on the input image (Fig.3). The overall performance on the test set was 95.05% per patch and 100% per acquisition (Fig. 3).

Discussion: The technique focused on detecting motion presence on MRI regardless the motion artifact severity. The variation on probabilities results suggests a correlation to the motion artifact severity level. The correctness of these probabilities results needs to be verified by testing annotated data reporting different levels of image quality.

Contact: irene.heleonora@gmail.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

PHASE-SENSITIVE REGION-OF-INTEREST COMPUTED TOMOGRAPHY

Felsner L., Berger M., Kaeppler S., Bopp J., Ludwig V., Weber T., Pelzer G., Michel T., Maier A., Anton G., and Riess C.

Abstract: X-Ray Phase-Contrast Imaging can provide high soft-tissue contrast. Unfortunately, all grating-based systems are limited by the grating sizes of a few centimeters. This leads to truncation in the projection images and therefore artifacts in the reconstruction. We propose a system and a reconstruction algorithm to correct for phase truncation artifacts, and to obtain quantitative phase values. Our method is robust, and shows high-quality results on simulated data and on a biological mouse sample.

Contact: lina.felsner@fau.de

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

LEARNING FOR 2D-3D IMAGE REGISTRATION IN SURGERY

Fischer P., Mewes P., Piat S., Tuysuzoglu A., Liao R.

Abstract: Registration of pre-operative planning data to intra-operative imaging is an integral step of the image-guided surgery. Limited image quality, obstructing surgical devices and high accuracy requirements challenge the state of the art in 2d-3d registration. The recent success of deep learning raises the hopes that it can help to tackle these challenges. This poster presents strategies for data collection in this scenario and a learning-based method for 2d-3d registration. The method achieves a low failure rate with 4.1% of the cases with a TRE over 1cm.

Contact: peterfischer@siemens-healthineers.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

FEASIBILITY OF COLONIC POLYP CLASSIFICATION WITH CNN BASED ON BLUE LASER AND LINKED COLOR IMAGING

Fonollà R., Van der Sommen F., Schreuder R.M., Schoon E.J., de With P.H.N.

Abstract: Visual differentiation of benign and pre-malignant colonic polyps is an on-going challenge in clinical endoscopy routine. White Light Endoscopy (WLE) is the most common technique to visually assess lesions in the intestinal tract but is arguably unreliable due to hampering in polyp classification. LED-based enhanced techniques like Blue Laser Imaging (BLI) and Linked Color Imaging (LCI) are potentially promising alternatives to avoid the use of chemical stains and to obtain enhanced visual classification results.

In this work, a Convolutional Neural Network (CNN) is trained to automatically classify colorectal polyps between benign and pre-malignant tissue using three image acquisition modalities: White Light Imaging (WL), Blue Laser Imaging (BLI) and Linked Color Imaging (LCI).

Contact: r.fonolla.navarro@tue.nl

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

AUTOMATIC SEGMENTATION OF THE HUMERUS FROM CT VOLUMES USING STATISTICAL SHAPE MODELS AND MARKOV CHAIN MONTE CARLO METHODS

Fouefack J. R., Borotikar B., Burdin V., Douglas T. S. and Mutsvangwa T. E.

Abstract: Three-dimensional volumes are important tools in the clinical community. However, efficient extraction of useful information from these images remains a challenge in the medical imaging field. This project aims to develop automatic tools to improve the reproducibility and speed of the surgery planning, and provide accurate patient-specific ancillaries for prostheses pose guiding. This study specifically focuses on the development of an automatic method to segment the humerus from CT volumes.

Contact: fjrassaire@gmail.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

AUTOMATIC AIRWAY SEGMENTATION AND BRONCHIECTASIS QUANTIFICATION

Garcia-Uceda A., A.W.M. H., De Bruijne M.

Abstract: Bronchiectasis is a disease that affects the lungs and causes an abnormal and permanent widening of the airways. It causes health problems such as chronic cough, shortness of breath, and can lead to lung infections. Segmentation of the airway tree in CT images is critical to obtain biomarkers to assess bronchiectasis. In this work, we develop novel image processing techniques to segment automatically the airways. These methods are based on state-of-the-art deep convolutional neural networks.

Contact: a.garciauced@erasmusmc.nl

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

TISSUE CLASSIFICATION OF COLON CANCER HISTOLOGY IMAGES

Gedeon R., Nagar AK., Naguib R.

Abstract: Colon cancer has a high death rate, but early diagnosis can prevent its progression. In this study, two approaches were used to classify hematoxylin and eosin stained images into normal, adenomatous polyp, and cancerous tissues. First, a shallow Convolutional Neural Network (CNN) is trained from scratch, whose architecture is designed to retrieve information at different scales. Google's Inception V3 architecture is then fine-tuned to do the classification. Fine-tuning outperformed learning from scratch.

Contact: rawan.gedeon@gmail.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

AUTOMATIC PROSTATE SEGMENTATION FROM TRANSRECTAL ULTRASOUND IMAGES USING CONVOLUTIONAL NEURAL NETWORKS

Ghavami N., Hu Y., Bonmati, E., Rodell, R., Gibson, E., Moore, C., Barratt, D.

Abstract: Identification of clinically important targets, is challenging on TRUS images, yet, much better defined on MRI. An important step for many MRI-TRUS registration involves automatic segmentation of the prostate on both modalities. In this work, a CNN is proposed for segmenting the prostate in 2D TRUS slices. achieving mean 2D DSC and absolute boundary distance error of 0.89 ± 0.12 and 1.80 ± 2.05 mm respectively, suggesting a promising approach to aiding TRUS-guided prostate cancer procedures.

Contact: nooshin.ghavami.15@ucl.ac.uk

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

COMPUTER-AIDED DETECTION OF LUNG NODULES USING MULTI-LEVEL CONTEXTUAL 3D CNNs

Gonidakis P., Omelina L., Jansen B., Vandemeulebroucke J.

Abstract: Lung cancer is one of the main causes of cancer-related deaths worldwide. The detection of pulmonary nodules during lung cancer screening through CT scanning is of high importance since they may indicate early stage of lung cancer. In the last years, Computer-Aided-Detection (CAD) systems have been developed to automatically detect pulmonary nodules. A CAD system consists of three parts; preprocessing, nodule candidate detection and false positive reduction. Existing systems tend to have high false positive rates and often lead to unnecessary and high interventional treatments.

The main purpose of our research is to optimize the false positive reduction task by determining the true nodules from a given long list of potentially cancerous lesions. Towards this purpose, we employ 3D convolutional neural networks (CNNs). It has been proved that 3D CNNs can better encode spatial information than equivalent 2D architectures and are able to extract better representative features. Moreover, we implement a framework with three different network architectures which take into account three different levels of contextual information. To manage the highly class imbalance, we use data augmentation techniques to produce more positive samples. We employ rotation, translating and flipping techniques in the 3 axes of the extracted 3D patches. We present the results of classifying the candidate nodules using the two out of three architectures. Each of the three networks can output a probability of being a nodule for every candidate patch and by fusing them a more accurate probability can be calculated.

Although this implementation is used for pulmonary nodule detection, it is general enough and can be easily adapted to any other 3D object detection tasks using volumetric medical images where the desired objects can vary a lot and they can be very similar with other components.

Contact: pgonidak@etrovub.be

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

GRAPH CONVOLUTIONS ON SPECTRAL EMBEDDINGS: LEARNING OF CORTICAL SURFACE DATA

Gopinath K., Desrosiers C., and Lombaert H.

Abstract: We propose a novel method for learning directly on multiple surfaces via spectral graph convolutions. The Standard method relies on spherical inflation and slow mesh deformations. Graph convolution networks are fast but, restricted to a single fixed-graph structure, relying on Euclidean representations. Our contributions are multifold. Graph convolutions for multiple graph structures. Geometry aware spectral filters. A fast surface based algorithm for cortical parcellation.

Contact: karthik.g.haritz@gmail.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

AUTOMATIC SEGMENTATION OF MICROBLEEDS IN 3D MRI

Groothuis I., Sudre C., Pai A., Sørensen L, Nielsen M., Barkhof F., Ourselin S., Cardoso M. J., Modat M.

Abstract: Microbleed segmentation is a challenging task due to skewed foreground-background ratio in the dataset. Training a convolutional neural network with an selective sampling scheme overcomes this difficulty, but we still observe a high number of fall positive per image. Various methods are explored to reduce the number of FPs per image, but this does seem to have a negative impact on the amount of true positives as well.

Contact: i.groothuis@ucl.ac.uk

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

DEEP LEARNING FOR SEGMENTING CAPIL- LARY BLOOD VESSELS CONTAINING REMAIN- ING BLOOD CELLS

Grothausmann R., Knudsen L., Ochs M., Mühlfeld C.

Abstract: The gas exchange in the lung between airspace and blood vessels takes place in the alveolar capillary network (ACN). Characterizing its structure and its change during growth and disease is important to understand the sources of dysfunction in order to develop specific treatments. The various scales in lung tissue make this a challenge and demand a dataset with a large extent as well as a small voxel size.

A series of light microscopy (LM) images were aligned to form a 3D dataset. The segmentation into air, blood and tissue can be achieved with conventional techniques. Remaining erythrocytes represent a major problem concerning the complete segmentation of the blood vessels up to the details of the ACN because they have the same contrast as tissue and can only be recognized by context (at the given resolution).

Their constant volume even during deformation makes this problem an ideal candidate for applying 3D deep learning (DL) to improve the segmentation. The results from preliminary tests with specifically trained 3D U-Nets are promising but also point to general problems when the structures become larger than the receptive field (RF). We therefore investigate adjustments to the network architecture to take segmentation of nearby regions into account in order to preserve consistency between neighbouring regions.

Contact: grothausmann.roman@mh-hannover.de

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

DATA-DRIVEN REWARD LEARNING FOR INDIVIDUAL PROSTHESIS SIZE PREDICTION IN VALVE-SPARING AORTIC ROOT RECONSTRUCTION

Hagenah J., Scharfschwerdt M., Ernst F.

Abstract: Choosing the individually optimal prosthesis size is a critical task during valve-sparing aortic root reconstruction. A pre-operative planning requires an estimation of the aortic valve's healthy state based on its dilated one. Previous approaches suffered from unrealistic demands on the training data. We present a cognition-inspired approach combining data-driven reward learning with model-based optimization. Our method reaches accuracies comparable to previous approaches while decreasing the demand on training data, thus it is suitable for clinical application.

Contact: hagenah@rob.uni-luebeck.de

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

OPTIMIZATION OF DEFORMABLE IMAGE REGISTRATION WITH CONVOLUTIONAL NEURAL NETWORKS

Hering A., Heldmann S.

Abstract: We propose a CNN-based registration method in the context of follow-up analysis for thoracic CT scans. In contrast to conventional registration approaches, we do not employ iterative optimization schemes at runtime on each image pair. Instead, we invest computational time to suitably pretrain a CNN. Therefore, at inference, given a new pair of images, only one forward pass through the network yields the desired displacement field much faster.

Contact: alessa.hering@mevis.fraunhofer.de

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

STROKE DETECTION USING CONVOLUTIONAL NEURAL NETWORKS

Herzog L., Murina E., Dürr O., Wegener S., Sick B.

Abstract: We apply deep learning approaches to magnetic resonance images of stroke and TIA patients. We show how to take the special three-dimensional structure of the data into account in order to improve the model performance. We further utilize MC dropout methods during test time for probabilistic predictions and corresponding confidence measures. For reliable patient-level predictions, we evaluate how to combine the image-based prediction values by considering the uncertainty measurements.

Contact: lisa.herzog@uzh.ch

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

UNCERTAINTY-DRIVEN SANITY CHECK: APPLICATION TO POSTOPERATIVE BRAIN TUMOR CAVITY SEGMENTATION

Jungo A., Meier R., Ermis E., Herrmann E., Reyes M.

Abstract: Introduction: Uncertainty estimates can increase the understanding and foster acceptance of deep learning technologies by providing additional information about their predictions. This additional information enables building systems with a self-assessment capability for cases necessitating human monitoring. We propose an approach based on a fully-convolutional neural network for postoperative brain tumor cavity multi-sequence image segmentation that employs model’s uncertainty to automatically identify challenging cases for expert review.

Method: We use a fully-convolutional DenseNet architecture to perform the segmentation of the tumor resection cavity. The architecture processes the three-dimensional brain volumes as three separated two-dimensional plane-wise predictions. We compute the model’s uncertainty by applying Monte Carlo dropout sampling. As a result, for each segmentation we obtain a corresponding uncertainty map indicating the regions of high and low confidence. We aggregate the overall uncertainty with the help of a spatial prior, penalizing uncertainties being distant from the segmentation result, and define the resulting scalar value as doubt score. High doubt score values indicate a high likelihood that a user correction is needed. We evaluated the segmentation as well as the error detection performance of our approach on 30 standard multi-sequence (T1, T1c, T2, FLAIR) postoperative brain tumor cavity magnetic resonance images with six-fold cross-validation. Results: Regarding segmentation performance, we achieved an average Dice coefficient of 0.792 ± 0.154 with a median of 0.839. The average Hausdorff distance is 16.24 ± 9.07 mm with a median of 14.74mm. By applying uncertainty-driven sanity check, we were able to detect the worst segmentation result (Dice coefficient: 0.184) and three out of the four cases with Dice coefficients below 0.6. The doubt score also pointed us to cases with Dice coefficients greater than 0.7 containing abnormalities in the images. Conclusion: The proposed method produces accurate segmentations of postoperative brain tumor cavities and identifies cases necessitating user monitoring by using the model’s uncertainty. Additionally, the results point out the importance of the spatial prior introduced in the doubt score to improve the reliability of the score as indicator of challenging cases. Overall, the results suggest that a transfer of the uncertainty-driven sanity check to other segmentation tasks is possible.

Contact: alain.jungo@istb.unibe.ch

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

CONSTRAINED-CNN LOSSES FOR WEAKLY SUPERVISED SEGMENTATION

Kervadec H., Dolz J., Tang M., Granger É., Boykov Y., Ben Ayed I.

Abstract: In weakly supervised segmentation, enforcing global inequality constraints on CNN outputs can leverage unlabeled data, guiding training with domain-specific knowledge, e.g., the target-region size. We introduce a differentiable term, which enforces constraints directly in the loss. Surprisingly, our simple approach yields substantially better results than Lagrangian-dual optimization. We reach 90% of full supervision performances for left ventricle segmentation with only 0.1% of annotations.

Contact: hoel.kervadec.1@etsmtl.net

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

DEEP BOOSTED REGRESSION FOR MR TO CT SYNTHESIS

Kläser K., Cardoso M. J., Ourselin S.

Abstract: Attenuation correction is essential for PET image reconstruction, but challenging for PET-MRI as neither PET nor MRI can directly image attenuation properties. CT synthesis has been proposed as an alternative to segmentation-based methods. We propose a deep fully convolutional neural network that generates pseudo CTs recursively by gradually reducing the residuals of the previous network, increasing the overall accuracy and generalisability, while keeping the number of trainable parameters low.

Contact: kerstin.klaser.16@ucl.ac.uk

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 15:00 - 16:15

Poster Session: 1

GENERALIZING MULTISTAIN IMMUNOHISTOCHEMISTRY TISSUE SEGMENTATION USING ONE-SHOT COLOR DECONVOLUTION DEEP NEURAL NETWORKS

Lahiani A., Gildenblat J., Klaman I., Navab N., Klaiman E.

Abstract: A key challenge in cancer immunotherapy biomarker research is quantification of pattern changes in microscopic whole slide images of tumor biopsies. Different cell types tend to migrate into various tissue compartments and form variable distribution patterns. Drug development requires correlative analysis of various biomarkers in and between the tissue compartments. To enable that, tissue slides are manually annotated by expert pathologists. Manual annotation of tissue slides is a labor intensive, tedious and error-prone task. Additionally, with the tools existing today it is also limited in precision and inconsistent between different experts and can even be inconsistent in different annotations by the same expert. Automation of this annotation process can improve accuracy and consistency while reducing workload and cost in a way that will positively influence drug development efforts. In this poster we present a novel one-shot color deconvolution deep learning method to automatically segment and annotate digitized slide images with multiple stainings into compartments of tumor, healthy tissue, and necrosis. We address the task in the context of drug development where multiple stains, tissue and tumor types exist and look into solutions for generalizations over these image populations.

Contact: amal.lahiani@roche.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

SIMULTANEOUS LOCALIZATION AND MAPPING IN DEFORMABLE SCENES

Lamarca J., Montiel J. M. M.

Abstract: Visual simultaneous localization and mapping is a well-known problem for rigid environments. Our proposal is a novel pipeline that allows to fully extend these algorithms to medical environments. We have conceived a pipeline able to work in deformable environments. Key ideas:

- Shape-from-Template (SfT) techniques to track the camera pose w.r.t. the deformable map in real-time.
- Non-Rigid-Structure-from-Motion (NRSfM) techniques to estimate the deformable maps.
- Upgrading the state-of-the-art rigid VSLAM (ORB-SLAM [1]) pipeline to deformable.

Contact: jlamarca@unizar.es

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

AN EXTENDED BLOCK RESTRICTED ISOMETRY PROPERTY FOR SPARSE RECOVERY WITH NON-GAUSSIAN NOISE

Leffler K., Zhou Z., Yu J.

Abstract: Recovering an unknown signal from significantly fewer measurements is a fundamental aspect in computational sciences today. The key ingredient is the sparsity of the unknown signal – a realisation that that has led to the theory of compressed sensing, through which successful recovery of high dimensional (approximately) sparse signals is now possible at a rate significantly lower than the Nyquist sampling rate. Today, an interesting challenge lies in customizing the recovery process to take into account prior knowledge about e.g. signal structure and properties of present noise.

We study recovery conditions for block sparse signal reconstruction from compressed measurements when partial support information is available via weighted mixed l_2/l_p minimization. We show theoretically that the extended block restricted isometry property can ensure robust recovery when the data fidelity constraint is expressed in terms of an l_q norm of the residual error. Thereby, we also establish a setting wherein we are not restricted to a Gaussian measurement noise. The results are illustrated with a series of numerical experiments.

Contact: klara.leffler@umu.se

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

BLAST IDENTIFICATION IN CHILDHOOD ACUTE MYELOID LEUKAEMIA USING WGAN LATENT SPACE EMBEDDINGS

Licandro R., Schlegl T., Reiter M., Diem M., Dworzak M., Schumich A., Langs G., Kampel M.

Abstract: Acute Myeloid Leukaemia is a rare type of childhood blood cancer and is monitored using flow cytometry. During treatment, the quantification of remaining cancer cells (Minimal Residual Disease (MRD)) is particularly important to determine therapy response and to guide treatment. We propose a Wasserstein Generative Adversarial Network (WGAN) latent space embedding strategy, trained in a semi-supervised fashion for the classification of cancer cells. Results suggest that our approach outperforms semi-supervised learned PCA embeddings and fully connected neural networks.

Contact: roxane.licandro@meduniwien.ac.at

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

MOBILE PHONE-BASED EVALUATION OF LATENT TUBERCULOSIS INFECTION USING DEEP LEARNING

Maclean S., Malila B., Mutsvangwa T., Douglas T.

Abstract: The most common method used to screen for latent tuberculosis infection (LTBI) is the tuberculin skin test (TST). The test requires a follow-up clinical visit 48h - 72h after administration of the tuberculin for measurement of the resultant cutaneous induration. A mobile phone-based imaging application is in development for use as an alternative measurement procedure. Deep learning is being considered to improve the usability and accuracy of the current image processing application.

Contact: sarahgmaclean@gmail.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

LOCALIZATION AND LABELING OF POSTERIOR RIBS IN CHEST RADIOGRAPHS USING A CRF-REGULARIZED FCN WITH LOCAL REFINEMENT

Mader A.O., von Berg J., Fabritz A., Lorenz C., and Meyer C.

Abstract: We propose a general approach for localizing spatially correlated landmarks using a combination of a fully convolutional network (FCN) as hypotheses generator and a conditional random field (CRF) as spatial regularizer. To overcome potentially incorrect hypotheses, we introduce a third refinement step based on a novel "refine" label introduced in the CRF. We use our method to solve the detection of posterior ribs, achieving a success rate of 94.6% on the public Indiana chest X-ray collection.

Contact: alexander.o.mader@fh-kiel.de

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

PROBABILISTIC JOINT FACE-SKULL MODELLING FOR FACIAL RECONSTRUCTION

Madsen D., Lüthi M., Schneider A., Vetter T.

Abstract: We solve the task of combining two independent Statistical Shape Models (SSM). We obtain the complete joint probability distribution of the human head by combining a face shape model [2] and a skull shape model [3]. The models are joint with independent tissue-depth information [4] using Markov Chain Monte Carlo (MCMC). With the joint face-skull probability distribution we show how:

- facial reconstruction can be described as a conditional distribution of plausible face shapes given a skull shape.
- face photographs can be ranked according to their likelihood of corresponding to a given skull.
- to estimate the skull pixels in an MR-image.

Contact: dennis.madsen@unibas.ch

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

BREAST CANCER HISTOLOGICAL IMAGE CLASSIFICATION USING FINE-TUNED DEEP NETWORK FUSION

Mahbod A., Ellinger I., Ecker R., Smedby Ö., Wang C.

Abstract: Breast cancer is the leading cause of death by cancer in women worldwide. Early diagnosis and treatment is essential to reduce its morbidity rates. Breast cancer diagnosis, which is performed on hematoxylin and eosin (H&E) stained sections of tissue biopsies, is non-trivial and even among experienced pathologists the average diagnostic consensus is in the range of 75%. To assist pathologists in their diagnostic decision, automated image analysis systems have been introduced. Among them, machine learning-based algorithms and in particular deep convolutional neural networks (CNN) have been shown to be superior over conventional, feature-based methods for lesion classification. In this work, we propose a fully automatic method to classify images derived from breast tissue biopsies in four classes, normal tissue, benign lesion, in situ carcinoma and invasive carcinoma, respectively. The method is based on fusion of fine-tuned deep networks applied on normalized H&E stained images. We utilized the modified architecture of ResNet-50 and ResNet-101, fine-tuned on a limited amount of training images and fused their prediction vectors to opt for the breast tissue type by the model. Moreover, we tried extensive normalization techniques to investigate its effect on classification performance. We show that our approach outperforms a previous published method (patch wise CNN training from scratch) by a large margin when applied on the BioImaging 2015 challenge dataset yielding an accuracy of 97.22%. Moreover, the same approach provided an excellent classification performance with an accuracy of 88.50% when applied on the international ICIAR 2018 grand challenge dataset using a 5-fold cross validation method. The obtained results demonstrate that our approach is a robust and reliable method for breast cancer histological image classification even with limited training images.

Contact: amahbod@kth.se

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

AUTOMATIC 2D-3D DETECTION AND SEGMENTATION OF SPHERIC AND ASPHERIC FEMORAL HEADS IN MR IMAGES USING HOUGH TRANSFORMS

Memis A., Albayrak S., Bilgili F.

Abstract: In most of the computerized analysis and assessment cases of the hip joint, segmentation of the femoral head with the automatic or semi-automatic segmentation methods is an important issue. In this study, we aimed to perform 2D-3D detection and segmentation of the spheric and aspheric femoral heads automatically in MR hip images of patients with Legg-Calve-Perthes disease (LCPD) by using the Circular and Spherical Hough Transforms. Successful results were achieved with the proposed methods.

Contact: abbasmemis@gmail.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

SYMMETRY ANALYSIS OF 3D BACK SURFACE FOR SCOLIOSIS DIAGNOSIS AND FOLLOW-UP

Morand M., Comas O., Fiorio C., Subsol G.

Abstract: Symmetry analysis of anatomical structure surfaces offers good promise for diagnosis, follow-up and therapy planning of pathologies causing abnormal deformities. Especially, analysis of back surface asymmetry shows good results for monitoring patients affected by scoliosis, which is characterized by a lateral deviation of the spine with local rotation of vertebrae. Our work addresses the problem of detecting and modelling symmetry of bilateral structures, and more particularly of the back surface of scoliotic patients. We propose a new method to compute a piecewise curved symmetry surface for 3D back surface. The algorithm is based on the computation of a 3D symmetry line, which defines strips by orthogonal slicing and which corresponds to the spinous process line. A set of local symmetry planes forms a piecewise symmetry surface and allows to quantify the back surface rotation, which could be correlated to the local rotation of vertebrae.

Contact: mmorand@dms-imaging.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

EXTRACTION OF SIGNATURES FROM MRI DATA IN EARLY PARKINSONS DISEASE

Munoz Ramirez V., Arbel J., Moro E., Forbes F., Dojat M.

Abstract: The putative delay between the onset of neurodegeneration and the manifestation of clinical symptoms of Parkinson's disease drives the quest to find biomarkers present in the pre-motor stages of PD that can lead to earlier diagnosis and more tailored treatments to slow down the disease process.

In this context, our project employs Magnetic Resonance neuroimaging and unsupervised classification methods to study the interaction of several functional and structural brain characteristics and ultimately, to draw out specific signatures in newly diagnosed Parkinson patients.

Contact: veronica.munoz-ramirez@univ-grenoble-alpes.fr

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

BIWGAN: LEARNING STABLE ADVERSARIAL REPRESENTATIONS FOR PROSTATE HISTOPATHOLOGY IMAGES

Otálora S., Andriarczyk V., Atzori M., Müller H.

Abstract: Morphological changes used for Gleason grading are based on the visual patterns transitions: from healthy glands to malignant tissue. We build an unsupervised representation of the benign and malignant patches using the rich semantic space spanned in a WGAN generator by encoding back the patches to semantic space using a novel bidirectional Wasserstein adversarial network formulation. We compare our results with another state of the art representations, showing competitive performance in classification.

Contact: juan.otaloramontenegro@hevs.ch

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

SKIN LESION CLASSIFICATION USING LIGHT-FIELD IMAGING

Pereira P., Paiva R., Fonseca-Pinto R., Tavora L., Assuncao P., Faria S.

Abstract: Accurate early detection of suspicious skin cancer is highly critical. Computer vision techniques can be used as part of the diagnosis process increasing the sensitivity, but lead in many cases at the cost of specificity. The balance between both is fundamental, which can be improved through extraction of new features, such as 3D lesion information obtained from a newly contactless light-field dermoscopy technique, and using Artificial Intelligence to achieve a high classification accuracy.

Contact: pedrommpereira@gmail.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

CONVOLUTIONAL NEURAL NETWORKS FOR BONE LESION DETECTION IN MEDICAL IMAG- ING DATA

Perkonigg M., Hofmanninger J., Menze B., Weber M.-A., Langs G.

Abstract: Bone lesions are one of the symptoms of Multiple Myeloma. Automatic detection of lesions can lead to earlier treatment. Here, we present an approach to detect bone lesions in computed tomography and magnetic resonance imaging volumes, based on convolutional neural networks and transfer learning. A three channel patch extraction method is introduced. Finally, a sliding window approach is used to detect lesions in whole body scans.

Contact: e1129269@student.tuwien.ac.at

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

IMPROVING HIGH-RESOLUTION QUANTITATIVE MRI MAPS FOR IN-VIVO HISTOLOGY MRI OF THE HUMAN BRAIN

Podranski K., Scherf N., Weiskopf N.

Abstract: To do in-vivo histology MRI of the human brain there is a need to further improve the quality of acquired images using computational methods.

Contact: kpodranski@cbs.mpg.de

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

IMPROVING SKIN LESION SEGMENTATION WITH GENERATIVE ADVERSARIAL NETWORKS

Pollastri F.

Abstract: Malignant melanoma is the most dangerous skin cancer, with a substantial death rate. Automated skin lesion segmentation is a fundamental step to help experts in early diagnosis, but requires a huge amount of data to be performed. We present a Convolutional-Deconvolutional Neural Network (CDNN) to automatically generate the lesion segmentation mask from dermoscopic images, and propose a novel strategy to augment data, generating both skin lesion images and their segmentation masks.

Contact: federico.pollastri.94@gmail.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

DUAL ASYMMETRIC AND HIGH RESOLUTION DETECTION HEADS OF A NOVEL COMPACT MOLECULAR BREAST IMAGING SYSTEM FOR EARLY BREAST CANCER DIAGNOSIS

Poma G. E., Cisbani E., Garibaldi F., Giuliani F., Insero T., Lucentini M., Marcucci A., Musico P., Santavenere F.

Abstract: Early cancer diagnosis increases therapy success probability. Molecular Breast Imaging (MBI) by dedicated gamma camera represents one of the most promising technique of early cancer detection. A new MBI device, recently designed, with two peculiar asymmetric detectors facing each other, for spot compression, and Limited-Angle Tomography. The complementary sensors offer substantial opportunities to improve the tumor detectability and its characterization but requires dedicated algorithms and data analysis tools; some of them are illustrated here.

Contact: elio.poma@ct.infn.it

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

PATTERN RECOGNITION ANALYSIS FOR PROGNOSIS OF INFLAMMATORY BOWEL DISEASE

Pradhan P., Tolstik T., Stallmach A., Popp J., Bocklitz T.

Abstract: Non-linear multimodal imaging, the combination of coherent anti-Stokes Raman scattering (CARS), two-photon excited auto-fluorescence (TPEF) and second-harmonic generation (SHG), can provide a real-time diagnosis of Inflammatory Bowel Disease (IBD) activity. Morphological changes like the crypt architecture can be used as a marker for characterizing the IBD activity. Manually annotating cryptal regions is a time-consuming task. Therefore, we present an automatic segmentation of the multimodal image into cryptal and mucosal regions.

Contact: pranita.pradhan@uni-jena.de

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

SEMI-AUTOMATIC LIVER AND LESION SEGMENTATION IN CT IMAGES

Prasad P. J. Ray, Oram L., Elle O. J., Kumar R. P.

Abstract: Primary liver cancer, which consists predominantly of hepatocellular carcinoma (HCC), is the fifth most common cancer worldwide and the third most common cause of cancer mortality. In clinical routine, in-order to make decisions on liver resections, doctors require prior understanding on the tumor volume and the functional liver volume. A successful surgical resection of HCC requires complete removal of the tumour including a safety margin while sparing as much healthy tissue as possible. However, due to technical and clinical difficulties currently only a relatively low percentage of patients are eligible for resection, and the recurrence rate is considerable. Segmentation of the liver and tumor is valuable from medical perspective as well as from the point of view of Computer Vision. This is a complex problem as there exist many difficulties for segmentation. The liver has a highly variable shape and displays low difference of appearance compared to neighborhood organs. Intensities of the adjacent organs and tissues are very similar to liver tissue itself. This research work aims in developing a segmentation method that can provide efficient and robust solutions for creating models for interventional guidance.

Contact: pravda.mec@gmail.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

LEARNING REPRESENTATIONS BY PREDICTING THE FUTURE

Rivail A., Bogunovic H., Waldstein S., Gerendas B., Vogl W., Schmidt-Erfurth U.

Abstract: Longitudinal imaging displays the static anatomical structures and the dynamic changes of the morphology due to aging or disease progression. We aim at capturing these structures and their evolution in a compact representation to improve the understanding of pathologies and to forecast them. We adapted an unsupervised deep learning framework (CVAE) to learn these structures. Initial evaluation shows that learned representations allow to improve the prediction of morphologic abnormalities.

Contact: antoine.rivail@meduniwien.ac.at

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

MACHINE LEARNING APPLICATION ON FMRI DATA: BOLD AND HEAD MOTION SIGNALS

Sacca V., Sarica A., Novellino F., Barone S., Tallarico T., Filippelli E., Granata A., Valentino P., Quattrone A.

Abstract: Resting state fMRI represents an innovative technique to understand cerebral mechanism behind brain networks interactions, but its elaboration results to be prone to noise. Head motion has become a particularly challenging problem. An interesting approach could be represented by characterizing the movements of a specific pathology. We evaluated the most important head motion in early Multiple Sclerosis patients applying Support Vector Machine. Moreover, second aim was to evaluate how well Random Forest and Support Vector Machine algorithms could support the early diagnosis of Multiple Sclerosis from these data.

Contact: valeria.sacca87@gmail.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

A MULTI-SCALE APPROACH FOR MICROANEURYSMS SEGMENTATION USING EMBEDDING TRIPLET LOSS IN COLORED FUNDUS IMAGES

Sarhan M.H., Albarqouni S., Navab N., Eslami A.

Abstract: Microaneurysms (MAs) are an important indicator of diabetic retinopathy progression. We introduce a two-stage deep learning approach for MAs segmentation using multiple scales of the input with selective sampling and embedding triplet loss. The approach facilitates a region proposal fully convolutional network (FCN) trained on segmented patches and a patch-wise refinement network for improving the results suggested by the hypothesis. The approach introduces a 56% improvement over the simple FCN.

Contact: hasan.sarhan@tum.de

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

UNSUPERVISED LEARNING OF ULTRASOUND SIMULATORS

Senouf O., Vedula S., Bronstein A., Michailovich O., Zibulevsky M.

Abstract: Simulators play an important role in medical ultrasound (US) imaging practice and research.

Common simulators for realistic imaging (e.g., Field-II and kWave) are not practical in conducting real-time simulations or for generating massive datasets.

Aiming at boosting simulation speed while maintaining realism, we propose an unsupervised learning method for simulating ultrasound images given corresponding X-ray CT image/scatterer map.

Contact: senouf@campus.technion.ac.il

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

DECOUPLED NEURAL NETWORKS FOR CLASSIFICATION OF BREAST MICROSCOPY IMAGES

Stone R., Wright A., Clarke E., Hanby A., Treanor D., Hogg D., Bulpitt A.

Abstract: Pathologists classify tissue samples by identifying cell diversity, spatial relationships and abnormal features. Our approach to breast microscopy image classification aims to model the pathologist diagnostic process by purifying patch labels using a simple model for normal morphologies, then training a convolutional neural network for patch feature extraction. Feature representations of the original images are then learned by a second network, yielding a final 4-class accuracy of 90.6%.

Contact: sc16rsmy@leeds.ac.uk

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

TOWARDS A ROBUST DEEP CT-ULTRASOUND REGISTRATION METHOD FOR IMAGE GUID- ANCE IN LIVER TUMOR ABLATION

Sun Y., Moelker A., Niessen W.J., van Walsum T.

Abstract: Multi-modal registration, especially CT/MR to ultrasound (US), is still a challenge, as conventional similarity metrics such as mutual information do not match the imaging characteristics of ultrasound. The main motivation for this work is to investigate whether a deep learning network (DVNet) can be used to directly estimate the displacement between a pair of multi-modal image patches, without explicitly performing similarity metric and optimizer, the two main components in a registration framework. The proposed DVNet is a fully convolutional neural network and is trained using a large set of artificially generated displacement vectors (DVs). The DVNet was evaluated on mono- and simulated multi-modal data, as well as real CT and US liver slices (selected from 3D volumes). The results show that the DVNet is quite robust on the single- and multi-modal (simulated) data, but does not work yet on the real CT and US images.

Contact: y.sun@erasmusmc.nl

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

TOWARDS LONGITUDINAL RADIOMICS FOR SURVIVAL PREDICTION OF GLIOBLASTOMA PATIENTS

Suter Y., Knecht U., Valenzuela W., Wiest R., Reyes M.

Abstract: Glioblastoma (GBM) are the most common primary brain tumors in humans. Due to their rapid growth and infiltrative nature, the prognosis for patients with high-grade glioma is poor, with an average survival time of only 14 months. There is no curative treatment available. Glioblastoma are treated with a combination of surgical resection, radiation- and chemotherapy [1]. The response of a patient to a treatment is currently assessed by the Response Assessment in Neuro-Oncology (RANO) criteria. RANO categorizes response as complete response, partial response, stable disease, or progression. Apart from qualitative criteria, RANO relies on 2D-based metrics with known limitations (e.g. [2]). An increase of $\geq 25\%$ of the sum of product of perpendicular diameters is used to define disease progression, while a decrease by $\geq 50\%$ defines a response. These thresholds are widely used but remarked to be rather arbitrary. Reported shortcomings of the current RANO recommendations along with promising results in radiogenomics, radiomics and automated tumor segmentation, call for improving the RANO criteria by a combined medical image computing approach. Performing radiomics regarding survival of GBM patients may lead to MR imaging biomarkers for disease progression assessment. The current state of the art (e.g. [3]) uses almost exclusively pre-operative MR imaging data, we propose a longitudinal radiomics approach.

Contact: yannick.suter@istb.unibe.ch

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

A 3D CONVOLUTIONAL NEURAL NETWORK WITH TRANSFER LEARNING ON MRI FOR INCOMPLETE HIPPOCAMPAL INVERSION CLAS- SIFICATION

Tafuri B., Cherubini A., Caligiuri M.E., Labate A., Gambardella A., Arabia G., Quattrone A.

Abstract: The project defines the potential of transfer learning applied to brain MRI images for diseases classification. Starting from a 3d CNN pre-trained on a large dataset of subjects with hippocampal atrophy, this method uses transfer learning on a subdomain of Incomplete Hippocampal Inversion (IHI). This is atypical anatomical pattern of the hippocampus, mostly described in epileptic patients. The principal aim is to obtain, via transfer learning, an improved task accuracy with a small dataset.

Contact: benedetta.tafuri@gmail.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

TISSUE SEGMENTATION IN VOLUMETRIC LASER ENDOMICROSCOPY DATA USING FUSIONNET AND A DOMAIN-SPECIFIC LOSS FUNCTION

van der Putten J., van der Sommen F., Struyvenberg M., de Groof J., Curvers W.L., Schoon E.J., Bergman J.J.G.H.M., de With P.H.N.

Abstract: Volumetric Laser Endomicroscopy (VLE) is a promising balloon based imaging technique for detecting early neoplasia in Barrett's Esophagus. Especially Computer Aided Detection (CAD) techniques show great promise compared to medical doctors, who cannot reliably find disease patterns in the VLE signal. However, an essential pre-processing step for the CAD system is tissue segmentation. At present, tissue segmentation is selected manually and is therefore not scalable for full VLE scans of $1,200 \times 4,096 \times 2,048$ pixels. Furthermore, the current CAD methods cannot use the VLE scans to their full potential as only a small section is selected while an automated system can delineate the entire image. This paper explores the possibility of automatically segmenting relevant tissue for VLE scans using a convolutional neural network.

Contact: j.a.v.d.putten@tue.nl

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

TOWARDS CT-QUALITY ULTRASOUND IMAGING USING DEEP LEARNING

Vedula S., Senouf O., Bronstein A., Michailovich O., Zibulevsky M.

Abstract: Ultrasound (US) is a wide-spread, fast, costeffective and harmless medical imaging modality. Beamforming based image formation produces granular speckle noise, blurring, shading and other undesired artifacts. In this work, we aim to optimize and speed-up the post-processing stage with convolutional neural networks (CNN).

Contact: sanketh@cs.technion.ac.il

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

CNN FOR SEGMENTATION OF FETAL CORTEX IN 3D ULTRASOUND

Venturini L. , Papageorghiou A. T., Noble J. A., Namburete A. I. L.

Abstract: Accurate and automatic segmentation of the cortex and thalamus in fetal ultrasound images can track cortical development and help predict fetal health outcomes. We propose a multi-task CNN to produce automatic segmentations from expert manual segmentations of fetal cortices and thalami. The network as trained on 32 volumes produced accurate 3D segmentations on 6 test volumes, with Dice coefficient of 0.9 on cortical and 0.7 on thalamic segmentation.

Contact: lorenzo.venturini@new.ox.ac.uk

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

A DIRECT ULTRASOUND PHANTOM FABRICATION FOR CATHETER INTERVENTION SIMULATION

Wang S., Noh Y., Casajuana M., Housden R., Wang S., Pontiki A., Rhode K.

Abstract: Developing tissue mimicking phantoms for clinical use has been of interest for a long time; the appearance of 3D printing technology makes it possible to fabricate hollow cardiac models with complicated structures.

Two new materials-Layfomm 40 & Tango Plus-are used to fabricate phantoms for a general catheter intervention simulation. With these special materials, the phantoms can be printed directly instead of constructing and perfusing a mould.

The echocardiography results demonstrate that both materials are ultrasound compatible, and the softness comparison shows that they can be appropriate substitutes for soft tissue.

Contact: shu.1.wang@kcl.ac.uk

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

THE DEVIL IS IN THE DECODER

Wojna Z., Ferrari V., Guadarrama S., Fathi A., Silberman N., Chieh Chen N., Uijlings J.

Abstract: Many machine vision applications require predictions for every pixel of the input image (for example semantic segmentation, boundary detection). Models for such problems usually consist of encoders which decreases spatial resolution while learning a high-dimensional representation, followed by decoders who recover the original input resolution and result in low-dimensional predictions. While encoders have been studied rigorously, relatively few studies address the decoder side. Therefore this paper presents an extensive comparison of a variety of decoders for a variety of pixel-wise prediction tasks. Our contributions are: (1) Decoders matter: we observe significant variance in results between different types of decoders on various problems. (2) We introduce a novel decoder: bilinear additive upsampling. (3) We introduce new residual-like connections for decoders. (4) We identify two decoder types which give a consistently high performance.

Contact: zbigniewwojna@gmail.com

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

AUTOMATIC CATHETER DETECTION IN PEDIATRIC X-RAY IMAGES USING A SCALE-RECURRENT NETWORK AND SYNTHETIC DATA

Yi X., Adams S., Babyn P., Elnajmi A.

Abstract: Catheters are commonly inserted life supporting devices. X-ray images are used to assess the position of a catheter immediately after placement as serious complications can arise from malpositioned catheters. Previous computer vision approaches to detect catheters on X-ray images either relied on low-level cues that are not sufficiently robust or only capable of processing a limited number or type of catheters. With the resurgence of deep learning, supervised training approaches are beginning to showing promising results. However, dense annotation maps are required, and the work of a human annotator is hard to scale. In this work, we proposed a simple way of synthesizing catheters on X-ray images and a scale recurrent network for catheter detection. By training on adult chest X-rays, the proposed network exhibits promising detection results on pediatric chest/abdomen X-rays in terms of both precision and recall.

Contact: xiy525@mail.usask.ca

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

REAL-TIME PREDICTION OF SEGMENTATION QUALITY: SWAPPING EXPERT ANNOTATIONS FOR GENERATED LABELS

Rob R., Oktay O., Bai W., Valindria V.V., Sanghvi M.M., Aung N., Paiva J.M., Zemrak F., Fung K., Lukaschuk E., Lee A.M., Carapella V., Kim Y.J., Kainz B., Piechnik S.K., Neubauer S., Petersen S.E., Page C., Rueckert D., Glocker B.

Abstract: Being able to predict segmentation quality in the absence of ground truth is of paramount importance in clinical practice, where even the best segmentation methods can fail. As deep learning requires a large, manually labelled dataset for training, real-time segmentation quality control (QC) is challenging. We show a method to predict segmentation quality using generated labels in place of expert annotations. We report mean average error of 0.14 on Dice Score and 91% classification accuracy. This may allow us to perform segmentation QC, even whilst a patient is still in the scanner

Contact: r.robinson16@imperial.ac.uk

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

LOSS FUNCTIONS IN IMBALANCED CLASSIFICATION

Janocha K., Pouplin A., Higgins C., Linton N., Bharath A.

Abstract: One of the key characteristics of medical data is imbalance between classes, which can inappropriately bias deep learning models' predictions toward the majority class. Such a bias can reduce the effectiveness of a model in detecting rare pathologies. In this study, we aim to compare and analyse the effect of various loss objectives on models' behaviour with respect to the level of class imbalance. Such a bias can reduce the effectiveness of a model in detecting rare pathologies.

Contact: k.janocha17@imperial.ac.uk

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

AUTOMATIC GRADING OF ACNE VULGARIS USING DEEP LEARNING

Melina A., Ngo Dinh N., Tafuri B., De Vitis S., Schipani G., Nisticò S., Cosentino C., Amato F., and Cherubini A.

Abstract: Introduction. The evaluation of Acne grading using ordinal scales reflect the clinical perception of severity but have shown low reproducibility both intra- and inter-rater. In this study, we investigated if Artificial Intelligence trained on images of Acne patients could perform acne grading with high accuracy and reliabilities superior to those of expert physicians. Methods. 479 patients with acne grading ranging from clear to severe and sampled from three ethnic groups participated in this study. Multi-polarization images of facial skin of each patient were acquired from five different angles using the visible spectrum. An Artificial Intelligence was trained using the acquired images to output automatically a measure of Acne severity in the 0-4 numerical range. Results. The Artificial Intelligence recognized the Investigator Global Assessment of a patient with an accuracy of 0.854 and a correlation between manual and automatized evaluation of $r=0.958$ ($p<.001$). Discussion. This is the first work where an Artificial Intelligence was able to directly classify acne patients according to an Investigator Global Assessment ordinal scale with high accuracy, no human intervention and no need to count lesions.

Contact: antomelina@hotmail.it

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2

DESCRIPTION OF BREAST MORPHOLOGY THROUGH BAG OF NORMALS REPRESENTATION

Allegra D., Milotta F. L. M., Sinitò; D., Stanco F., Gallo G., Catanuto G.

Abstract: In this work we focus on digital shape analysis of breast models to assist breast surgeon for medical and surgical purposes. A clinical procedure for female breast digital scan is proposed. After a manual ROI definition through cropping, the meshes are automatically processed. The breasts are represented exploiting “bag of normal” representation, resulting in a 64-d descriptor. PCA is computed and the obtained first 2 principal components are used to plot the breasts shape into a 2D space. We show how the breasts subject to a surgery change their representation in this space and provide a cue about the error in this estimation. We believe that the proposed procedure represents a valid solution to evaluate the results of surgeries, since one of the most important goal of the specialists is to symmetrically reconstruct breasts and an objective tool to measure the result is currently missing.

Contact: dsinito@dmi.unict.it

Presentation Type: Poster

Date: Tuesday 31 July 2018

Time: 16:45 - 18:00

Poster Session: 2