Upcoming oberseminars

The seminar takes place continuously (also during the semester break). In order to arrange a talk, please register through our Oberseminar registration form. This can only be done by the project supervisors.

**Location:** MI 03.13.010 (Seminar Room)

**Zoom Link:** The link is shared with CAMP members via email roughly two days before each presentation. (To students: please ask your project supervisors for the Zoom link)

**Mobile view:** If you are having trouble seeing the schedule on your phone screen, please switch to the desktop version using the button on the top left corner.

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<td>Thesis Final</td>
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<tr>
<td>IDP Kick-off</td>
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<tr>
<td>Guided Research Final</td>
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**Schedule:**

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<th>Presenter</th>
<th>Title</th>
<th>Type</th>
<th>Supervisor /Contact</th>
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<tr>
<td>16. Dez (Fr)</td>
<td>10:30</td>
<td>Carlotta Hölzle</td>
<td>MONAI QUICKNAT refactoring</td>
<td>klinisches Anwendungsfach</td>
<td>Vanessa GONZALEZ</td>
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<tr>
<td>16. Dez (Fr)</td>
<td>11:00</td>
<td>Alexandra Marquardt</td>
<td>Monai implementation of DAF3D network</td>
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<td>Sören Pohl</td>
<td>Relationship between Age and Anthropometric Features of MRI Images Studied with Deep Learning</td>
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<td>Mahaut Gerard</td>
<td>Style transfer data augmentation for few-shot learning</td>
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<td>Azade Farshad</td>
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13. Jan (Fr) 11:00 Caghan Koksal Representation Learning for Semantic Image Manipulation using Diffusion Models IDP Kick-Off Azade Farshad

13. Jan (Fr) 11:30 Magdalena Wysocki Ultra-Nerf MA Kick-Off Mohammad Farid Azampour

13. Jan (Fr) 12:30 Xuesong Li Robotic Ultrasound Servoing for Smart Probe Positioning MA Kick-Off Zhongliang Jiang

20. Jan (Fr) 10:30 Yashuai Yan Tip Position Control of Robotic Catheters Based on Deep Learning MA Final Ardit Ramadani; Heiko Maier

20. Jan (Fr) 11:00 Siyuan Shen Simulator For Robotic Eye Surgery IDP Kick-Off Alireza Alikhani

27. Jan (Fr) 10:30 Sebastian Oßner Catadioptric Stereo in a Single-Camera System for Microsurgical Robotics BA Final Alireza Alikhani

27. Jan (Fr) 11:00 Daniel Cristopher Derkacz-Bogner Temporally Consistent 4D-OR Segmentation MA Kick-Off Lennart Bastian

27. Jan (Fr) 11:30 Casimir Wallwitz Segmentation of vascular trees from CT scans klinisches Anwendungsfach Heiko Maier

27. Jan (Fr) 12:00 Mane Margaryan Improved techniques of generative audio data augmentation MA Final Matthias Seibold

03. Feb (Fr) 10:30 Anna Bodonhelyi Does hematology need chemical staining? MA Final Agnieszka Tomczak

Detailed schedule:

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<td>Prof. Navab</td>
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<td>Additional supervisors</td>
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<td>Prof. Jan Kirschke</td>
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<td>Director</td>
<td>Prof. Nassir Navab</td>
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<tr>
<td>Abstract</td>
<td>Image synthesis have become a growing research topic in the context of deep learning. By developing artificial data by ourself it helps us to get a deeper understanding and furthermore gives us the opportunity to investigate the hidden space of Neural Networks (NN). The more we understand about the hidden space, the better we can manipulate the synthetic data and increase the quality of the output. It then becomes easier to shape the synthesized output in its respective domain according to our previous set requirements. Therefor we would like to use a StyleGAN [1] to investigate the latent space of spine MRIs. By interpolating between two vectors with age-features in the latent space we want to explore if the StyleGAN is able to detect or assuming any biases or anomalies in the ageing process of spines. To visualize the ageing process we are going to create a time lapse of the different images that are created during the interpolation. To have an insight in how the anthropometric features are varying during the interpolation we are developing a classifier to approximate the weight, size and sex of the shown MRI. Because we do not have any follow up data we are not able to compare the created aged image with the real one, therefor the classifier is also going to be able to evaluate the age of the spine. The dataset we are going to use for the training consists of around 12 000 full body MRIs.</td>
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<tr>
<td>Title</td>
<td>Real-Time Visualization of a Virtual Simulation Environment for Retinal Surgery</td>
</tr>
<tr>
<td>Student</td>
<td>Timon Sommer</td>
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<td>Type</td>
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<tr>
<td>Supervisor</td>
<td>Michael Sommersperger</td>
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<tr>
<td>Director</td>
<td>Prof. Nassir Navab</td>
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<tr>
<td>Abstract</td>
<td>Vitreoretinal surgeries are delicate procedures that require extreme dexterity. Surgical procedures need to be trained extensively before being performed on patients. Virtual surgical simulators offer a good possibility to train and evaluate surgical skills. The goal of this thesis is to design concepts that can improve the realism of virtual simulations with a focus on improving visual rendering. These concepts should be implemented and showcased in a selected training scenario.</td>
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<td>Additional supervisors</td>
<td>Francesca De Benetti</td>
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<td>Director</td>
<td>Prof. Dr. Nassir Navab</td>
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<tr>
<td>Abstract</td>
<td>During the COVID-19 pandemic, the world has felt the strong impact that viruses and bacteria can have. To combat the spread of bacteria and viruses, disinfection solutions were proposed. Our work focuses on an optimal and automatic disinfection system with UVC light, a self-disinfecting room. To optimally disinfect a given room, we propose a reinforcement learning powered solution to find the minimal number of lamps with the best positions to maximise the cleaned area.</td>
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<th>Date &amp; Time</th>
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<td>Style transfer data augmentation for few-shot learning</td>
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<tr>
<td>Student</td>
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<td>Supervisor</td>
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<tr>
<td>Additional supervisors</td>
<td>Yousef Yeganeh, Etienne Bennequin</td>
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<td>Director</td>
<td>Prof. Dr. Nassir Navab</td>
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<tr>
<td>Abstract</td>
<td>The goal of few-shot image classification tasks is to classify images even though the available labeled dataset has only a few samples for each class. In fact, this is often the case in real-world scenarios. As for any classifier, the performance of the method is dependent on the quality and representativeness of the samples in the training dataset. In the context of few-shot learning, the choice of the dataset, and especially of the support set, is even more critical as there are few samples to represent each class. We propose to augment the support set with photorealistic style transfer to leverage the style biases in the support images. This approach gives more emphasis to the content of the support images.</td>
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<td>Representation Learning for Semantic Image Manipulation using Diffusion Models</td>
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<tr>
<td>Student</td>
<td>Caghan Koksal</td>
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<td>Type</td>
<td>IDP Kick-Off</td>
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<td>Supervisor</td>
<td>Azade Farshad</td>
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<td>Director</td>
<td>Prof. Nassir Navab</td>
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<tr>
<td>Abstract</td>
<td>In this project, we explore semantic image manipulation using diffusion models. To facilitate the conditioning of the diffusion model on the scene graph, graph representation learning is performed.</td>
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<tr>
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<td>Ultra-Nerf</td>
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<td>Additional supervisors</td>
<td>Mehrdad Salehi, Dr. Benjamin Busam</td>
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<td>Director</td>
<td>Prof. Dr. Nassir Navab</td>
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<tr>
<td>Abstract</td>
<td>Neural Radiance Fields (NeRF) is a data-driven method developed for photorealistic view synthesis of a three-dimensional scene from unseen viewpoints. NeRF generates novel views by storing a scene as neural network weights from which it renders images by tracing rays into the scene. Since its introduction, researchers have used NeRF on various tasks beyond its original objective, such as image editing, pose estimation, and robot navigation. Recent publications on NeRF’s applications to ultrasound imaging demonstrated that the method learns a representation of a three-dimensional scene from a set of two-dimensional ultrasound frames. However, the rendering scheme presented in the existing work does not consider view-dependent changes in appearance and geometry observed in ultrasound imaging. In this paper, we propose a physics-inspired method that learns the tissue properties from ultrasound sweeps. Furthermore, it leverages a ray-tracing-based neural rendering for ultrasound novel view synthesis. To the best of our knowledge, our work is the first to address view-dependent ultrasound image synthesis using the NeRF-like approach.</td>
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<td>Director</td>
<td>Prof. Dr. Nassir Navab</td>
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<tr>
<td>Abstract</td>
<td>Ultrasound (US) imaging has been widely employed for image-guided intervention processes due to real-time performance and no ionizing radiation. However, due to the potential patient motion, and/or positioning accuracy of the inserted instruments, e.g., needle, the target tissue point or the instrument tip could become invisible in the initial planned US plane. To allow close monitoring of the insert procedure and provide effective image guidance, this work investigates the robotic ultrasound servoing technique to actively adjust a 2D probe position and orientation to maintain the target tissue point and surgical instrument simultaneously.</td>
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<tr>
<td>Title</td>
<td>Tip Position Control of Robotic Catheters Based on Deep Learning</td>
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<tr>
<td>Student</td>
<td>Yashuai Yan</td>
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<tr>
<td>Supervisor</td>
<td>Ardit Ramadani; Heiko Maier</td>
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<td>Additional supervisors</td>
<td>Di Wu</td>
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<td>Prof. Nassir Navab</td>
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<td>Abstract</td>
<td>In order to treat Coronary Artery Disease (CAD), catheters are often employed in Percutaneous Coronary Intervention (PCI) procedures. The employment of robotic catheters can achieve good performance in recanalization compared to conventional passive catheters. The robotic catheter is a snake-like flexible instrument that integrates the-state-of-art robotic, sensing and actuation technologies. It can be inserted via a small incision and steered to hard-to-reach regions inside the human body. Due to the fragility of the blood vessel, it is essential to manage the contacts between catheters and the environment (e.g. vessel wall) as excessive contact would lead to tissue damage. However, due to the loss of vision, as well as the hysteresis that originates from the catheter hardware, it is challenging to control the robotic catheter inside the body. Using classic method such as PID control with sensory feedback at the catheter tip has been explore in the past. In this thesis, a deep-learning-based approach is proposed to autonomously control the catheters.</td>
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<tbody>
<tr>
<td>Title</td>
<td>Simulator For Robotic Eye Surgery</td>
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<tr>
<td>Student</td>
<td>Siyuan Shen</td>
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<td>Alireza Alikhani</td>
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<td>Director</td>
<td>Dr. M. Ali Nasseri</td>
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<tr>
<td>Abstract</td>
<td>This project belongs to a larger project aiming to provide a robotic eye surgery system. Our IDP focus on the simulation software development on Unity3D. It offers an immersive environment for training of surgical steps.</td>
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</table>
### Catadioptric Stereo in a Single-Camera System for Microsurgical Robotics

**Student:** Sebastian Oßner  
**Type:** BA Final  
**Supervisor:** Alireza Alikhani  
**Additional supervisors:** Shervin Dehghani  
**Director:** Prof. Dr. Nassir Navab  
**Abstract:**  
3D reconstruction remains one of the most important topics in computer vision. Using all available information to one or multiple cameras, some equipped with highly intricate sensors to aid in-depth perception, in order to regain geometric information about a scene that was lost when it was transformed into images. This thesis will propose a novel approach to 3D point reconstruction in which the known geometric information and the relationships between a single camera and one or multiple mirrors are leveraged in order to estimate the 3D position of a point in space. Given a calibrated camera, our approach will use two or more pixel coordinates and use them in conjunction with the calibration data to construct a robust, efficient, but most of all simple estimation of the point of interest.

### Temporally Consistent 4D-OR Segmentation

**Student:** Daniel Cristopher Derkacz-Bogner  
**Type:** MA Kick-Off  
**Supervisor:** Lennart Bastian  
**Director:** Prof. Dr. Nassir Navab  
**Abstract:** TBA

### Segmentation of vascular trees from CT scans

**Student:** Casimir Wallwitz  
**Type:** klinisches Anwendungsfach  
**Supervisor:** Heiko Maier  
**Additional supervisors:** Ardit Ramadani; Farid Azampour  
**Director:** Prof. Nassir Navab  
**Abstract:**  
Segmentation of blood vessels from preoperative data, e.g. a CT scan of the patients, is the starting point for many computer aided medical applications. Examples are the automated creation of preoperative vascular tree models that can be registered with tracking modalities during the intervention, or computer aided diagnosis. For this, robust models are needed that can segment diverse vascular trees. This clinical application project explores the current state of the art in vascular segmentation from CT scans. After comparing the various existing works, one of the approaches will be chosen and adopted to a publicly available dataset. Following this, adaptations that increase the performance for a specific target anatomy might be explored.
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<td>Director</td>
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<tr>
<td>Abstract</td>
<td>Data augmentation is a valuable tool for the design of deep learning systems to overcome data limitations and stabilize the training process. Especially in the medical domain, where the collection of large-scale data sets is challenging and expensive due to limited access to patient data, relevant environments, as well as strict regulations, community-curated large-scale public datasets, pretrained models, and advanced data augmentation methods are the main factors for developing reliable systems to improve patient care. However, for the development of medical acoustic sensing systems, an emerging field of research, the community lacks large-scale publicly available data sets and pretrained models. To address the problem of limited data, we propose a conditional generative adversarial neural network-based augmentation method which is able to synthesize mel spectrograms from a learned data distribution of a source data set. In contrast to previously proposed fully convolutional models, the proposed model implements residual Squeeze and Excitation modules in the generator architecture. We show that our method outperforms all classical audio augmentation techniques and previously published generative methods in terms of generated sample quality and a performance improvement of 2.84% of Macro F1-Score for a classifier trained on the augmented data set, an enhancement of 1.14% in relation to previous work. By analyzing the correlation of intermediate feature spaces, we show that the residual Squeeze and Excitation modules help the model to reduce redundancy in the latent features. Therefore, the proposed model advances the state-of-the-art in the augmentation of clinical audio data and improves the data bottleneck for the design of clinical acoustic sensing systems.</td>
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<td>Title</td>
<td>Does hematology need chemical staining?</td>
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<tr>
<td>Student</td>
<td>Anna Bodonhelyi</td>
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<td>Type</td>
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<tr>
<td>Supervisor</td>
<td>Agnieszka Tomczak</td>
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<td>Director</td>
<td>Slobodan Ilic</td>
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<tr>
<td>Abstract</td>
<td>Hematologists routinely perform chemical staining to analyze a blood smear. The procedure is costly and time-consuming but allows them to enhance features essential for blood cell classification and arrive at the correct diagnosis. This work explores the possibility of replacing chemical staining with automated staining combined with the classification of unstained images captured with a differential inference contrast microscope. Classifying the unstained erythrocytes’ size, shape, hemoglobin distribution, and inclusion allows for faster discovery of pathologies. Similarly, the automatic classification of leukocytes into categories defined by hematologists would speed up the diagnosis and facilitate the recognition of diseases such as leukemia. To address the challenges of this problem, we combine multi-output learning with style transfer based on Generative Adversarial Networks (GANs). We aim to answer two questions: (1) are the features allowing correct classification present in unstained images, and (2) how does the class information affect staining generation, and how does the staining generation affect the classification. We propose and analyze different ways of combining the classifier and the generator of GAN. Our results on two datasets show that in healthy samples, all features needed for classification are present in unstained images. Additionally, we show that in specific scenarios, the generator features improve the classification performance in terms of accuracy and F1, and the class information improves the generated image quality in terms of accuracy MSE, SSIM, and LPIPS.</td>
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