



Chair for Computer Aided Medical Procedures (CAMP)
Master Seminar on
Deep Learning for Medical Applications

Dr. Seong Tae Kim, Dr. Shahrooz Faghi Roohi, Azade Farshad, Ashkan Khakzar
Prof. Dr. Nassir Navab

Chair for Computer Aided Medical Procedures & Augmented Reality



Team



Dr. Seong Tae Kim

Senior Research Scientist
seongtae.kim@tum.de



Dr. Shahrooz Faghieh Roohi

Senior Research Scientist
ge37toz@mytum.de



Azade Farshad

PhD Candidate
azade.farshad@tum.de



Ashkan Khakzar

PhD Candidate
ashkan.khakzar@tum.de





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Master Seminar on
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Course Regulations

Basic Info about the course

- **Type:** Master Seminar (IN2107)
- **Language:** English
- **SWS:** 2
- **ECTS:** 5 Credits
- **Webpage:**
 - <http://campar.in.tum.de/Chair/TeachingWs20DLMA> (files are password-protected)
- **Time:**
 - Thursdays, 12:00-14:00
- **Location:**
 - Virtual Meeting Room (Zoom)
 - ~~CAMP Seminar Room (03.13.010)~~
- **Requirements:**
 - Background in Machine/Deep Learning.



Objective

- Learn through **read, understand, present, and discuss** many challenges present in Medical Applications of Deep learning:
 - **Understanding and Interpreting Predictive Models, Safety of Predictive Models—> Interpretable DL, Explanation, Uncertainty, Robustness**
 - **Handling few amount of labeled data —> Transfer Learning, Semi-/Weakly- Supervised Learning, Meta-Learning, Augmentation, Active Learning, Learning under Noisy Labels**
 - Handling class Imbalance —> Special loss functions
 - Handling Multi-Modal Data —> Graph Convolutional Networks
 - Handling Intra/Inter-Scanners Variability —> Domain Adaptation
 - Incorporating Prior Knowledge —> Shape Models/Geometric Constraints
 - Security of Predictive Models —> Adversarial examples
 - ...



Discussed Papers Examples

Topic	No	Title	Conference/ Journal	Tutor	Student (Last name)	Link
Supervised (also semi/weakly) and Unsupervised (Self-supervised) Learning	1	MixMatch: A Holistic Approach to Semi-Supervised Learning	NeurIPS 2019	Tariq	Ismail	PDF
	2	ReMixMatch: Semi-Supervised Learning with Distribution Alignment and Augmentation Anchoring	ICLR 2020	SeongTae	-	PDF
	3	Unsupervised X-ray image segmentation with task driven generative adversarial networks	MedIA 2020	Shahrooz	Bornholdt	PDF
	4	f-AnoGAN: Fast unsupervised anomaly detection with generative adversarial networks	MedIA 2019	Shahrooz	Lauenburg	PDF
	5	Temporal cycle-consistency learning	CVPR 2019	Tobias	Kondamadugula	PDF
	6	Neural Bayes: A Generic Parameterization Method for Unsupervised Representation Learning	arXiv 2020	Azade	-	PDF
	7	Automatic 3D BI-Ventricular Segmentation of Cardiac Images by a Shape-Refined Multi- Task Deep Learning Approach	TMI 2019	Shahrooz	Valeriano Quiroz	PDF
	8	A robust deep neural network for denoising task-based fMRI data: An application to working memory and episodic memory	MedIA 2020	Shahrooz	Calik	PDF
Efficient DL (Lightweight/Faster CNNs / Pruning)	9	Search for Better Students to Learn Distilled Knowledge	arXiv 2020	Azade	Wang	PDF
	10	MetaPruning: Meta-Learning for Automatic Neural Network Channel Pruning	ICCV 2019	Azade	-	PDF
Interpretable DL	11	Explaining Neural Networks Semantically and Quantitatively	ICCV 2019	Matthias Keicher	Bordukova	PDF
	12	Uncertainty and interpretability in convolutional neural networks for semantic segmentation of colorectal polyps	MedIA 2020	Tobias	Dannecker	PDF
	13	Restricting the flow: Information bottlenecks for attribution	ICLR 2020	Ashkan	Effein	PDF
	14	Understanding deep networks via extremal perturbations and smooth masks	ICCV 2019	Ashkan	Vagne	PDF
Data Efficient DL (Augmentation, learning under noisy label)	30	FastAutoAugment	NeurIPS 2019	SeongTae	Studenyak	PDF



Conferences & Journals

- CVPR: Conference on Computer Vision and Pattern Recognition
- ICLR: International Conference on Learning Representations
- ICML: International Conference on Machine Learning
- NeurIPS: Neural Information Processing Systems
- ECCV/ICCV: European/International Conference on Computer Vision
- TMI: IEEE Transaction on Medical Imaging
- MedIA: Medical Image Analysis (Elsevier)
- TPAMI: IEEE Transactions on Pattern Analysis and Machine Intelligence
- Nature: world's leading multidisciplinary science journal
- MICCAI: Medical Image Computing and Computer Assisted Intervention
- BMVC: British Machine Vision Conference
- MIDL: Medical Imaging with Deep Learning



Schedule

Tentative

Date	Session: Topic	Slides	Students
16.07.2020	Preliminary Meeting		
Online	Paper Assignment		
22.10.2020	No Class!		
29.10.2020	Introduction to DLMA		
05.11.2020	No Class!		
12.11.2020	No Class!		
19.11.2020	Presentation Session 1: Supervised Learning/Weakly-supervised learning/Multitask Learning		
26.11.2020	Presentation Session 2: Efficient deep learning 1 (Self-supervised learning/semi-supervised learning)		
03.12.2020	Presentation Session 3: Efficient deep learning 2 (augmentation, learning under noisy labels, active learning)		
10.12.2020	Presentation Session 4: Efficient deep learning 3 (few-shot learning, meta-learning, lightweight/realtime deep learning)		
17.12.2020	No Class!		
24.12.2020	No Class!		
31.12.2020	No Class!		
07.01.2021	No Class!		
14.01.2021	Presentation Session 5: Interpretable deep learning 1 (interpretation, feature attribution, explanation)		
21.01.2021	Presentation Session 6: Interpretable deep learning 2 (robustness, uncertainty)		
28.01.2021	Tentative		



Evaluation

Presentation 45%

- 20 minutes + 10 minutes Q&A
- Slides (Powerpoint, Latex, see website for templates)
- They should cover all relevant aspects of the paper
 - Motivation
 - Methodology
 - Experimental results
 - Take Home Message
 - Discussion
- Self-contained (review of state of the art is necessary!)
- Presentation guidelines will be released later.
- **All students are expected to attend all presentations and interact during Q&A**
- **Examples from previous semester:** <https://wiki.tum.de/display/dlma/Presentations%3A+Summer+2020>



Evaluation

Blog Post (45%)

- Blog post explaining the main ideas of the paper.
 - Motivation + Contributions
 - Methodology
 - Results & Discussion
- You can refer to <https://bair.berkeley.edu/blog/> to get ideas
- 1000-1200 words paper summary + 200-300 words your own review
- Students will be requested to comment on each other's blog posts.
- The website where the posts will be uploaded is [1].
- You can later privately share your blog posts in other websites as well (eg Medium).
- Upload the blog post two weeks before presentation. There will be discussion until presentation
- **Examples from previous semester:** <https://wiki.tum.de/display/dlma/Blog%3A+Summer+2020>

Attendance (10%)



[1] <https://wiki.tum.de/display/dlma/>

How can you apply?

- Submit the registration form in: <https://wiki.tum.de/pages/viewpage.action?pageId=558433411>

DLMA Registration

Student Name *

Email *

Master's Program *

Current Semester *

Related Courses *

If passed, mention the grades

Resume (max 150 words) *

max 150 words (if exceeded, your application will be discarded) You may talk about your related projects - publications/competitions/github repositories - work experience, ...

Deadline for submitting the registration form: 21.07.2020, 11:59 pm



Important Dates

Deadline for submitting the registration form:

21.07.2020, 11:59 pm

You can find these slides and other info on the course website:

<http://campar.in.tum.de/Chair/TeachingWs20DLMA>

Don't forget to register at TUM matching system

Register via matching.in.tum.de

16.07 to 21.07.2020

