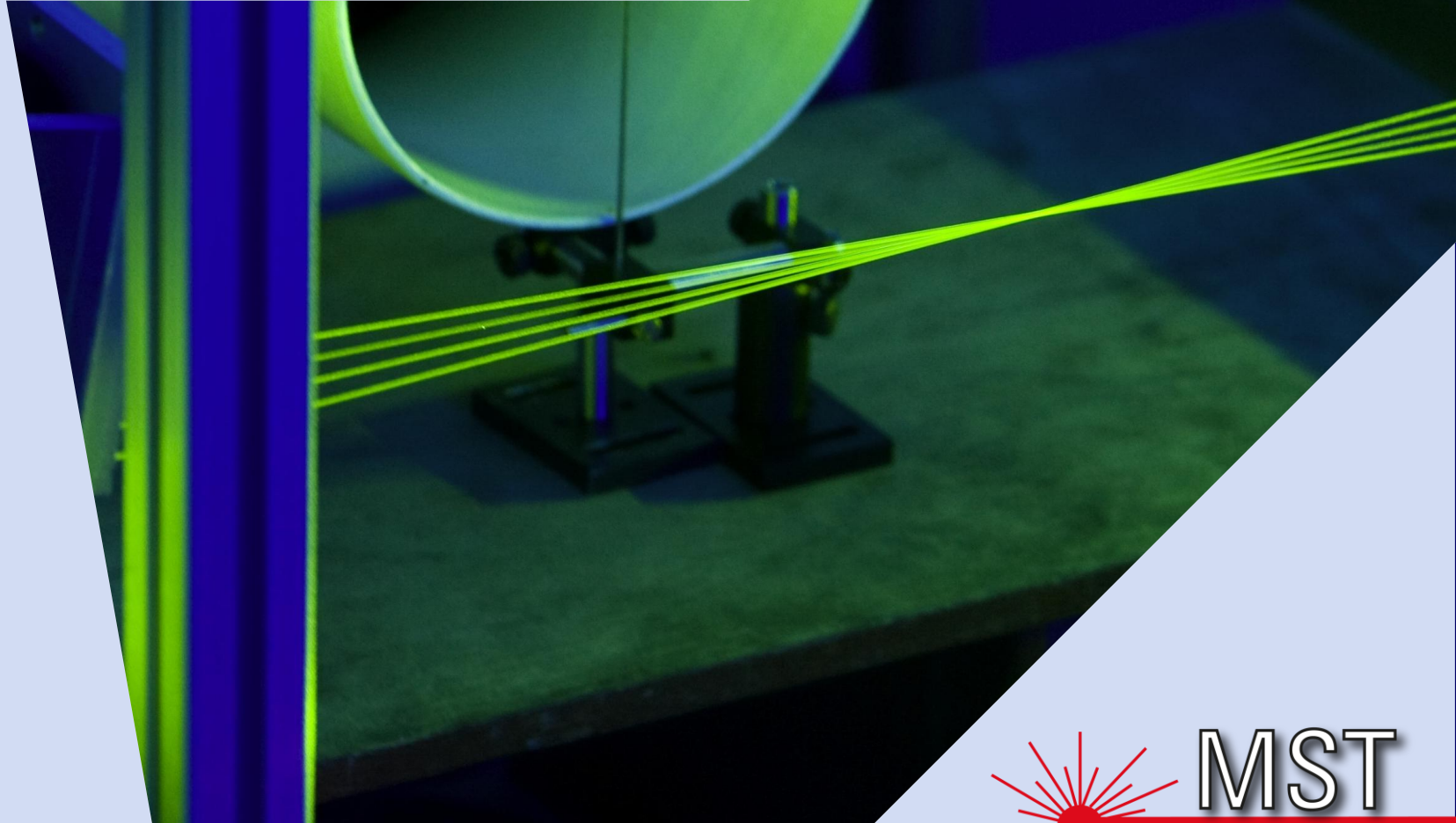


Oberseminar & Projekte der MST



Wissenschaftliches Arbeiten in der Elektrotechnik Vertiefung ET

Wissenschaftliche Arbeitsmethodik IST

Applied Lasermetrology Seminar Physik

Teil A: Wöchentliches Seminar → regelmäßig auf Aktualisierungen prüfen

Teil B: Seminararbeit - Betreute Gruppenarbeit à 2-4 Studierenden

Umfang

- 90h für Fak. Elektrotechnik & Physik
- 130h für Informatik
- Referat: 20 min Vortrag + 10 min Diskussion; pro Person

Benotung

- Modulnote = Referat
- Modulnote = (Kolloquium + Praktikum + Referat) / 3 (Physik)

CLM Seminar Informatik

Literature Studies in Computational Metrology CMS

Teil A: Wöchentliches Seminar → regelmäßig auf Aktualisierungen prüfen

Teil B: Seminararbeit - Betreute Gruppenarbeit à 2-4 Studierenden

Umfang

- 50h für CMS
- 130h für Informatik
- Referat: 10 min Vortrag + 10 min Diskussion; pro Person
- Beleg: 6 Seiten

Benotung

- Modulnote = Referat & Beleg

Projekt: Photonische Messsysteme ET, MT, IST, RES

Projektarbeit - Betreute Gruppenarbeit à 2-4 Studierenden

Umfang

- 40h + Selbststudium
- Referat: 5 min Vortrag pro Person + 10 min Diskussion
- Beleg: 6 Seiten

Benotung

- $\text{Projekt} = (\text{Referat} + \text{Beleg}) / 2$
- $\text{Modul Photonische Messsystemtechnik} = (\text{LMFT-Kolloquium} + \text{Projekt}) / 2$

Project: Computational Laser Systems PoL

Project work - supervised group work à 2-4 students

Scope

- 60h + self-study
- Presentation: 5 min lecture per person + 10 min discussion
- Receipt: 6 pages (template on website)

Grading

- $CLS = (\text{presentation} + \text{document}) / 2$

Zeitplan



13.10 Themenvorstellung

Bis 19.10 Einschreibung für Themen per E-Mail:

jakob.dremel@tu-dresden.de

Jedes Thema kann nur durch eine Gruppe bearbeitet werden

First Come, First Serve

Ab 20.10 Bearbeitung der Projekte und wöchentliche Seminare

Ab Januar Präsentationen der Projektergebnisse und ggf. Abgabe der Belege
(in Rücksprache mit den Betreuenden)

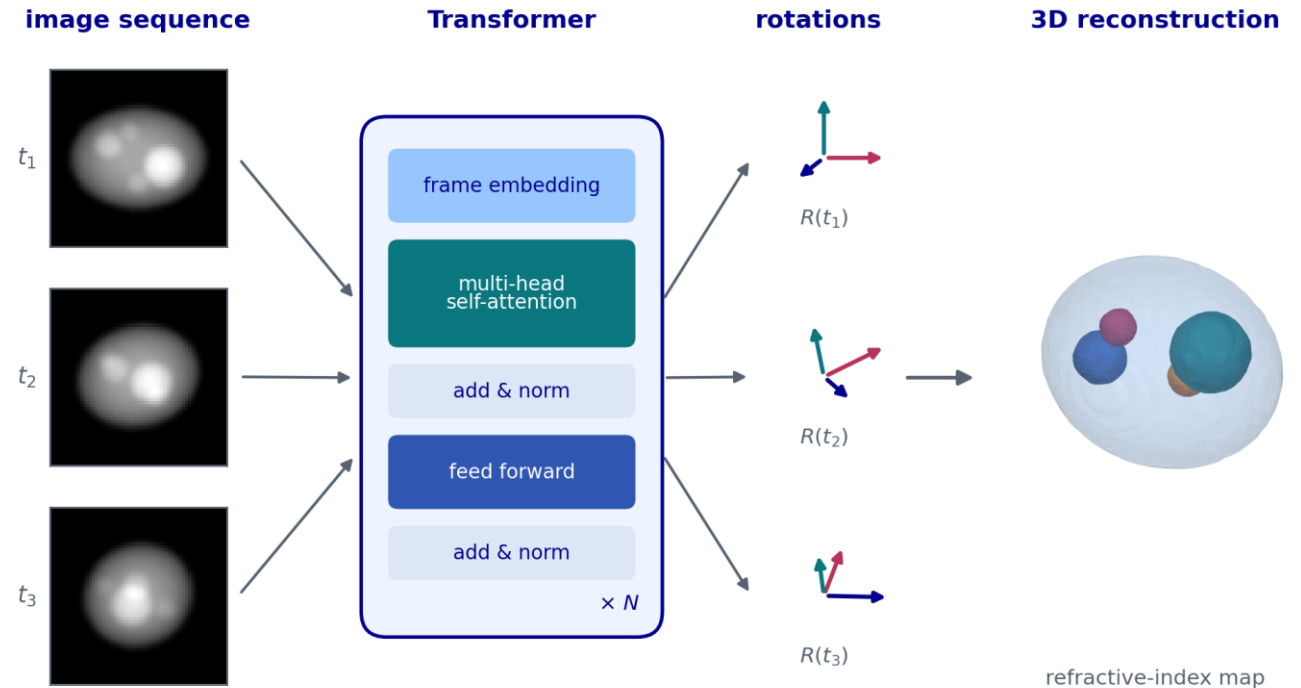
Seminar on Computational Laser Systems (Measurement Systems Seminar/BIOLAS), WS 2026/2027

Date: Tuesday, 4. DS., 13:00 – 14:30, BAR I88

Date	CW	Lecturer	Topic
13. Oct.	42	Jakob Dremel Dr. Lars Büttner	Introduction to Seminar & Presentation of Topics for Students
20. Oct.	43	Nick Schubert	Intelligent Mode Recovery in Multimode Fibers with Crosstalk Mitigation (<i>Studienarbeit defense, SJ</i>)
27. Oct.	44	Niklas Weise	Analysis of Cardiac Contraction Dynamics Using 3D Localization Microscopy (<i>DA intermediate report, RW</i>)
03. Nov.	45	Kevin Pham	Modeling and Optogenetic Closed-Loop Control of Excitation Propagation in Cardiomyocyte Networks (<i>Studienarbeit defense, RW</i>)
10. Nov.	46	t.b.d.	t.b.a.

Transformer-based orientation estimation of rotating cells

Motivation In optical diffraction tomography (ODT), the 3D refractive-index map of a cell can be reconstructed from images recorded while the cell itself rotates. The reconstruction requires the precise cell orientation in every frame, which needs to be estimated from the image sequence itself. Transformers, which are the backbone of modern LLMs, are promising for this task, because self-attention directly relates each frame to all others instead of passing information from frame to frame.

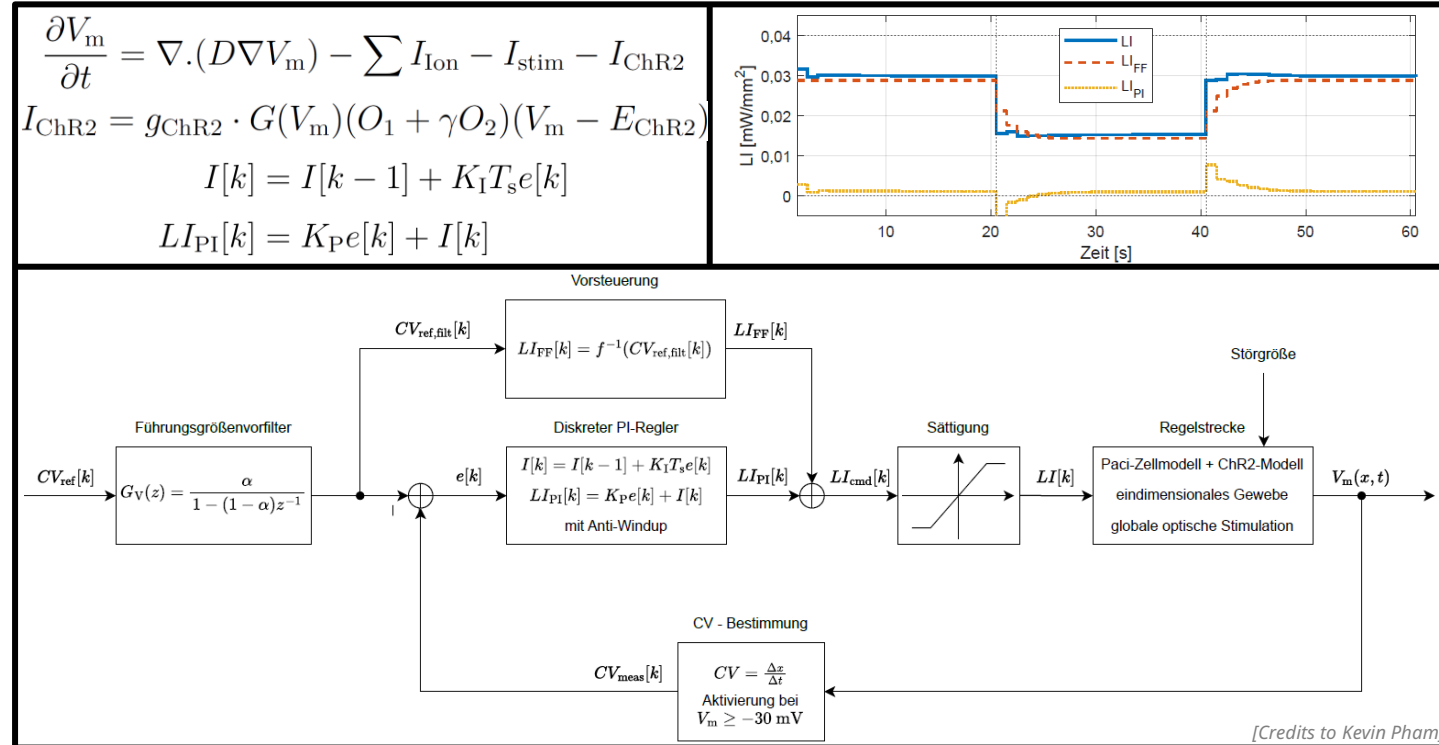


Tasks

- Implementation of a transformer model for orientation estimation (Python, PyTorch)
- Training on simulated rotating cells and evaluation of the orientation error
- Analysis of the attention maps: which frames and image features does the model rely on?

Two-Dimensional Closed-Loop Control of Cardiac Conduction Velocity with Subthreshold Optogenetics

Motivation Subthreshold optogenetic illumination offers a way to modulate cardiac excitation without directly triggering action potentials. By altering action-potential dynamics and slowing conduction, it provides a tool for controlling wave propagation in cardiac tissue. Building on an existing closed-loop framework for conduction-velocity control, this study extends the approach to a 2D model of cardiomyocyte tissue. Subthreshold illumination should be used to establish controlled differences in conduction velocity, allowing the resulting effects on excitation-wave propagation to be investigated *in silico*.



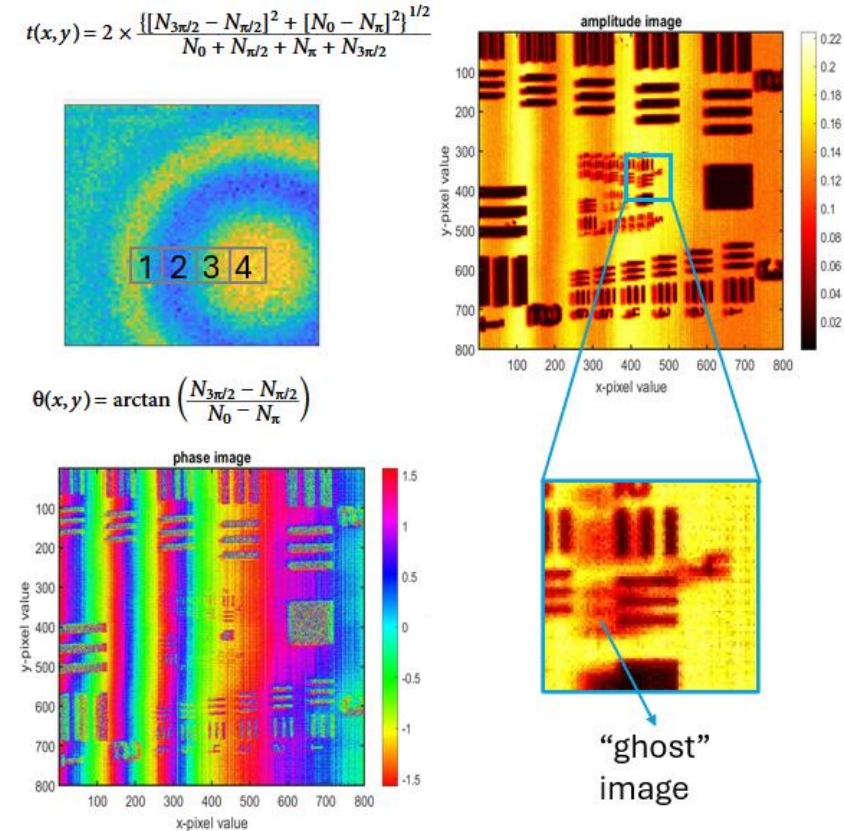
Tasks

- Review literature and familiarize with an existing simulation environment
- Extend the existing framework from one to two spatial dimensions
- Investigate effects of spatially varying subthreshold illumination on wave propagation in silico

Improving Confocal Quantum Imaging Analysis

Motivation Quantum imaging with undetected light (QIUL) holds great potential for detecting biological fingerprint absorption of biomarkers with ultrahigh efficiency. This is achieved by transferring the infrared absorption via a quantum mechanical process into the visible spectra range. However, this approach is limited by the dimensions of non-linear crystals which can not be grown above a few millimeters. To circumvent the resulting small fields of view and optical resolution a confocal realization of QIUL is implemented. This promising solution, however, requires good data analysis software which is currently missing.

- Tasks**
- Improvement of the current slow analysis software (Python, Matlab)
 - Implementation of phase extraction from experimental data sets
 - Comparison of the achieved results with widefield QIUL

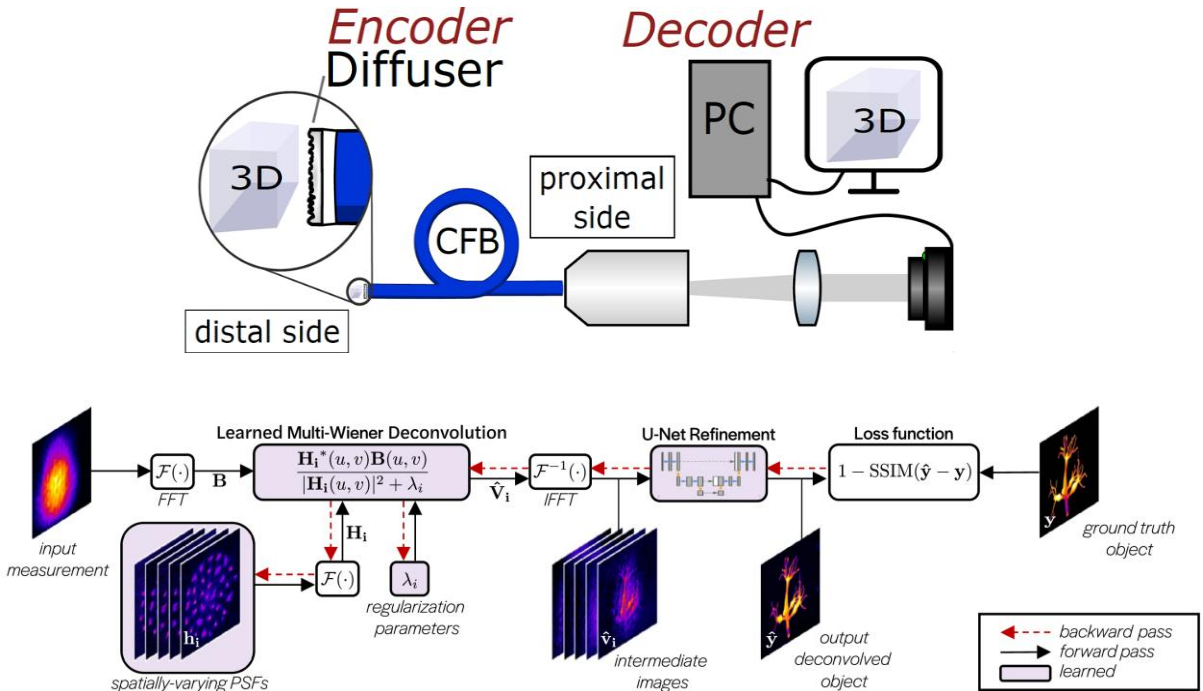


Noise resilient neural network image reconstruction in diffuser endoscopy

Motivation Diffuser based imaging is a recent topic in computational optics. The diffuser generates a unique pseudorandom speckle pattern for every point within a volumetric field-of-view on an image plane. By solving the inverse problem, the 3D scene can be reconstructed fast computationally by using neural networks. In conjunction with imaging waveguides, this enables the realization of single shot 3D microendoscopes.

However, resolving these highly complex, overlapping speckle patterns is highly sensitive to signal degradation, meaning that the achievable spatial resolution is strictly dictated by the system's Signal-to-Noise Ratio (SNR). In practical *in vivo* applications, low photon budgets and camera limitations introduce severe Poisson (shot) and Gaussian (readout) noise. This project systematically investigates the physical limits of computational image reconstruction by analyzing how different noise levels degrade the effective resolution and reliability of neural network-based decoders in a purely simulative environment.

- Tasks**
- Forward modeling and data generation
 - Physics-informed neural network training
 - Quantitative evaluation



Kyrollos Yanny et. al., "Deep learning for fast spatially varying deconvolution," *Optica* **9**, 96-99 (2022)

Themen für das Oberseminar & die Projekte

Themenübersicht

	Kürzel	Betreuende
Transformer-based orientation estimation of rotating cells	TraRoCell	David Krause
Two-Dimensional Closed-Loop Control of Cardiac Conduction Velocity with Subthreshold Optogenetics	CardiacVelo	Robert Wendland
Quantum Enhanced Deep Tissue Imaging	QuDIT	Stefan Krause
Noise resilient neural network image reconstruction in diffuser endoscopy	DiffScope	Tom Glosemeyer

