Projects (+ Theses)

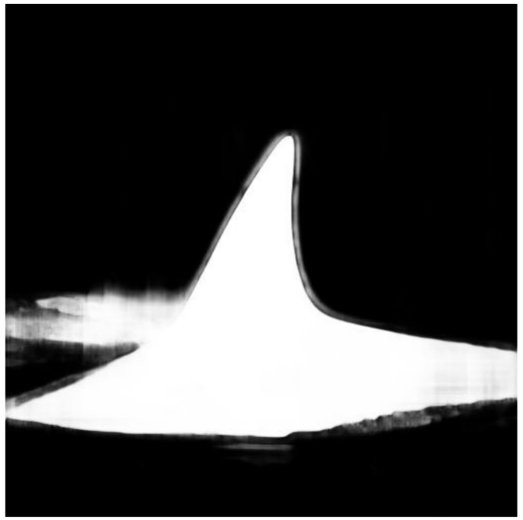
Notes

- Please contact the respective contact persons and ask if the project is available
- The shown projects are not exhaustive
  - There might be more topics, have a look at the groups/lab members
- The shown projects are not exclusive
  - Your topic might not be available anymore
  - Your topic might be given out multiple times
- **Want to do something else? Please contact us!**

Orca / Whale Fin Extraction from Environmental Images

Master's Project (10 ECTS)

Input



Generated Binary Mask

Resulting Isolated Fin

- Dorsal fin and saddle patch are necessary for identification of orca individual
- Goal: Extend and refine of existing deep learning-based binary mask generation
- Prerequisite Knowledge: Pattern Recognition, Deep Learning
- Interested? Contact alexander.barnhill@fau.de

Source: Killer whale images taken from FIN-PRINT (Bergler et al.), Copyright Jared Towers & Gary J. Sutton, Other Images, Pexels License – taken from https://pexels.com/ – and recreated

Deep Metric Learning for Image Quality Verification

Master's Project (10 ECTS)

Valid

Invalid

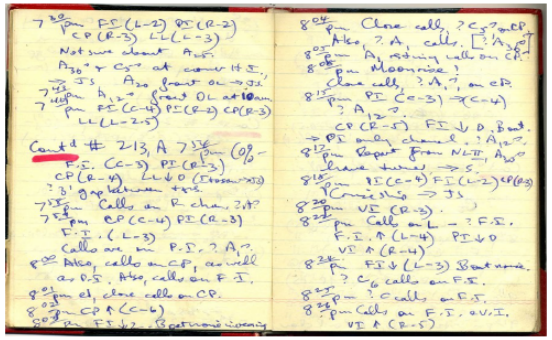
- Deep Learning-supported biovision software requires valid images as input
- The sets of valid as well as invalid images are vast and the overlap can be uncertain
- Goal: Implement deep metric learning to determine within a certain confidence if an image is valid or not
- Prerequisite Knowledge: Deep Learning, Computer Vision
- Interested? Contact alexander.barnhill@fau.de

Source: Killer whale images taken from FIN-PRINT (Bergler et al.), Copyright Jared Towers & Gary J. Sutton, Other Images, Pexels License – taken from https://pexels.com/ – and recreated

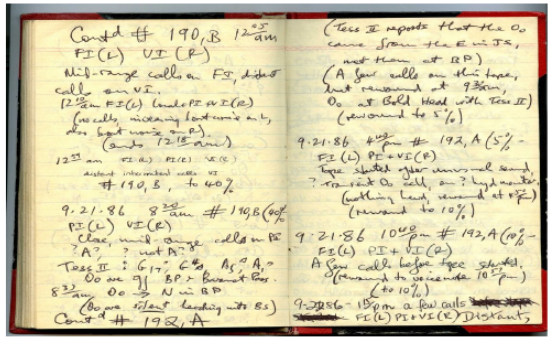
High Volume Handwriting Recognition

Master's Project (10 ECTS)

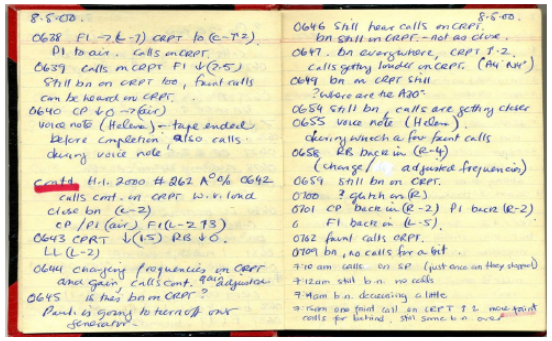
- 30k Pages of handwritten annotations about orca activity
- Annotations can provide insight into individuals and social structures and enable the linking of audio data to temporal and behavioural contexts
- Goal: Apply, extend, and improve existing handwriting recognition approaches
- Prerequisite Knowledge: Deep Learning, Computer Vision
- Interested? Contact alexander.barnhill@fau.de



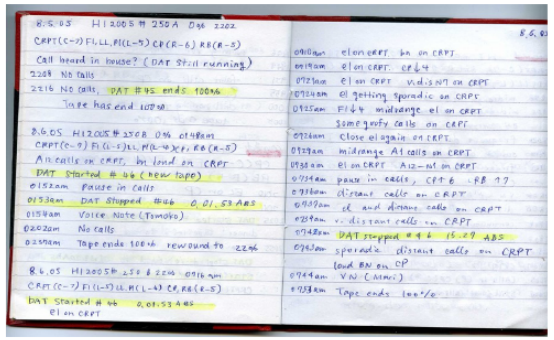
OrcaLab Book Pages 1985



OrcaLab Book Pages 1992



OrcaLab Book Pages 2000

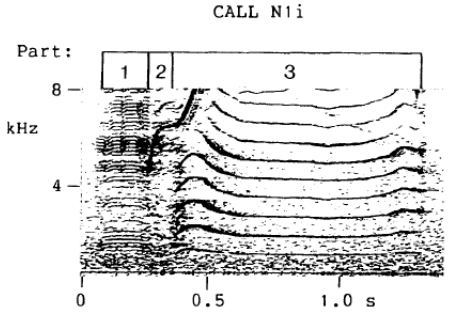


OrcaLab Book Pages 2004

Orca Vocalization Sub-Unit Identification

Master's Thesis (30 ECTS)

- Orca vocalizations consist of distinct parts
- Recognition of these parts enables the identification of call type classes and sub-classes
- Recognition of the differences in these sub-parts can give insight into differences between individuals and social groups
- Goal: Application / Development of deep-learning based techniques for the recognition and identification of sub-units
- Prerequisite Knowledge: Deep Learning
- Interested? Contact alexander.barnhill@fau.de



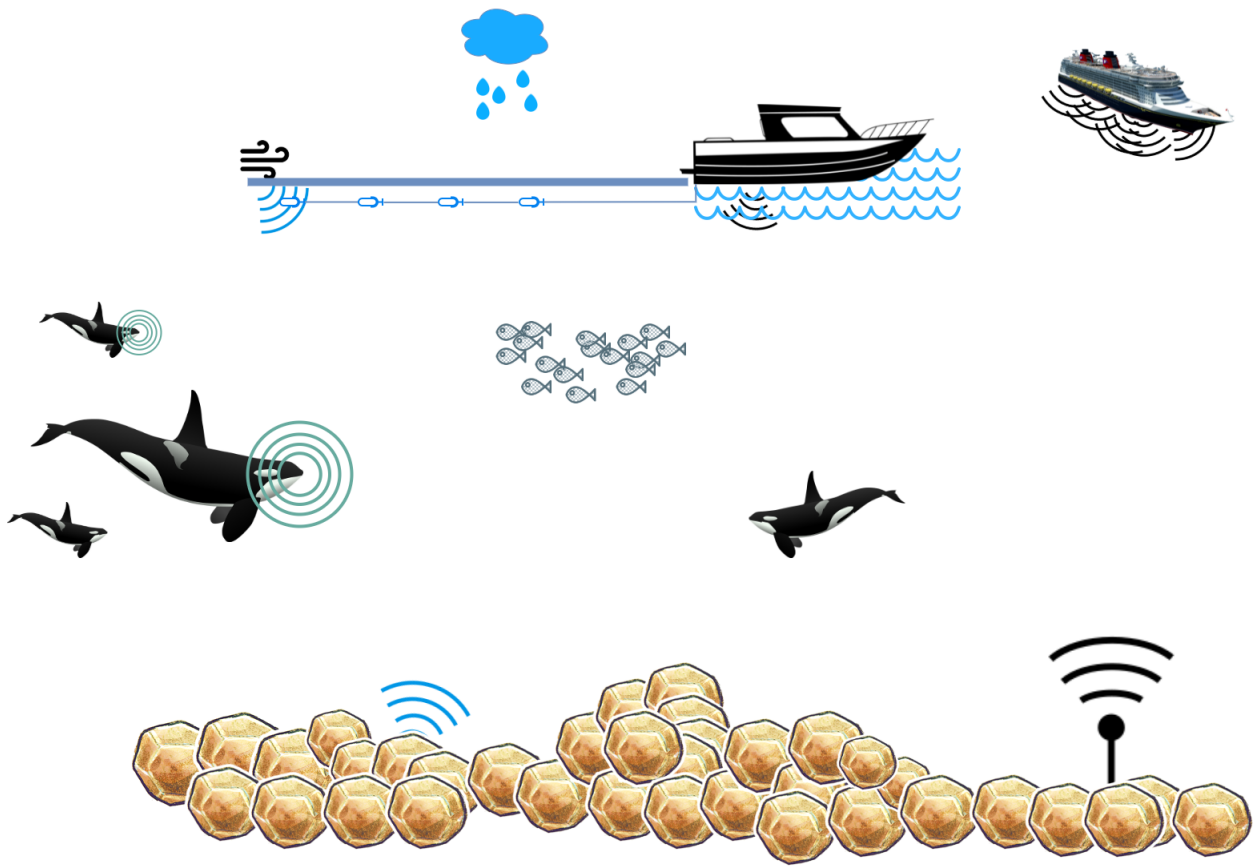
Measurement	Pod	Mean	C.V.	Min	Max	n
Duration (ms)	A1	1339	13.6	931	1772	26
Part 1:						
Dur (ms)	A1	212	14.1	130	274	26
SBI (Hz)	A1	161	13.2	120	203	18
Part 2:						
Dur (ms)	A1	117	20.5	78	160	26
Part 3:						
Dur (ms)	A1	1011	17.6	626	1373	26
SBI, start (Hz)	A1	870	17.7	515	1135	26
SBI, peak (Hz)	A1	1010	5.5	921	1119	26
SBI, mid (Hz)	A1	784	5.1	715	858	26
SBI, end (Hz)	A1	975	11.5	813	1263	26
Tone: f, start (Hz)	A1	4407	10.6	3305	5375	24

Source: John K B Ford, *A catalogue of underwater calls produced by killer whales (Orcinus orca) in British Columbia*, 1987

Orca Localization using Deep Learning

Master's Thesis (30 ECTS)

- Attribution of audio to individual or social group requires know the location of the audio source
- For orcas and other aquatic vocalizing animal this is difficult, in part, due to many possible confounding factors
- Goal: Extend, improve existing deep learning localization techniques
- Prerequisite Knowledge: Deep Learning
- Interested? Contact alexander.barnhill@fau.de



Source: Pexels License – taken from https://pexels.com/ – and recreated

Cross-dataset multi-organ segmentation in CT using deep learning method

Task:

1. Analysis of different public segmentation datasets on CT, regarding imaging region, annotation and etc..
2. Proposal and implementation of a cross-dataset multi-organ segmentation method for a whole-body organ segmentation task.
3. Evaluation with other state-of-the-art methods

Requirements:

1. Knowledge: image processing and CT imaging.
2. Programming: Python(Numpy, Pytorch)

5~10 ECTS possible.

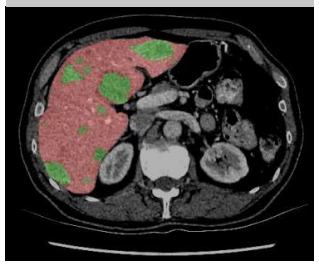
Contact: chang.ch.liu@fau.de

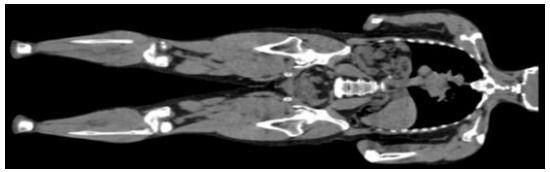
Public datasets

CT-ORG

AMOS22

LiTS





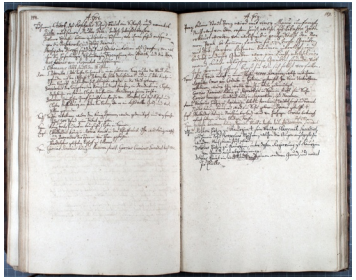
? Whole-body segmentation

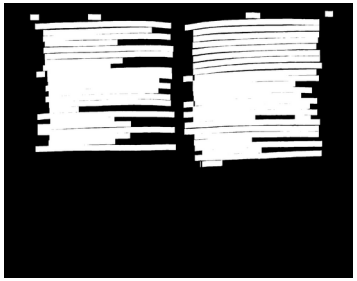
Self-supervised Learning for different Downstream Tasks

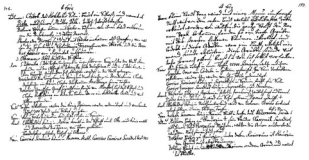
- Implement and evaluate SSL methods for different document analysis tasks
- Requirement: Deep learning knowledge
- 5/10 ECTS
- Contact: vincent.christlein@fau.de

Influence of different Preprocessing-Techniques for Writer Identification

- Evaluate different preprocessing techniques
  - Line-Segmentation
  - Binarization
  - Skeletonization
- Requirements: DL knowledge
- 5/10/15 ECTS Project
- Contact: vincent.christlein@fau.de





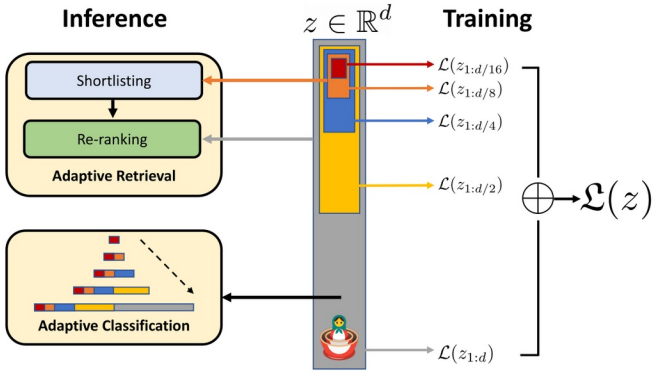


Representation Learning for Writer Retrieval

- Evaluate different representations/losses for Writer Retrieval
  - e.g. Kusupati et al “Matryoshka Representations for Adaptive Deployment”

Requirement: Deep learning knowledge

- 5/10 ECTS
- Contact: vincent.christlein@fau.de

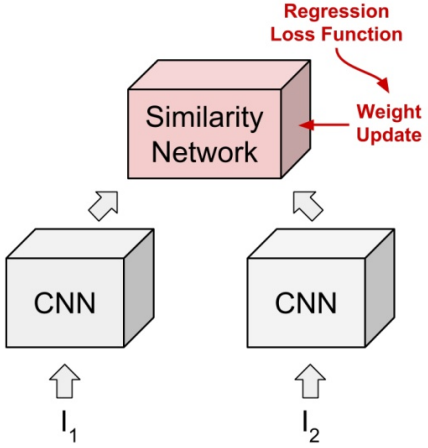


Similarity Learning for Writer Identification

Use similarity learning for writer identification instead of metric-based losses, s.

- Garcia & Vogiatzis “Learning Non-Metric Visual Similarity for Image Retrieval”

- Zhong et al. „Compact Deep Aggregation for Set Retrieval”



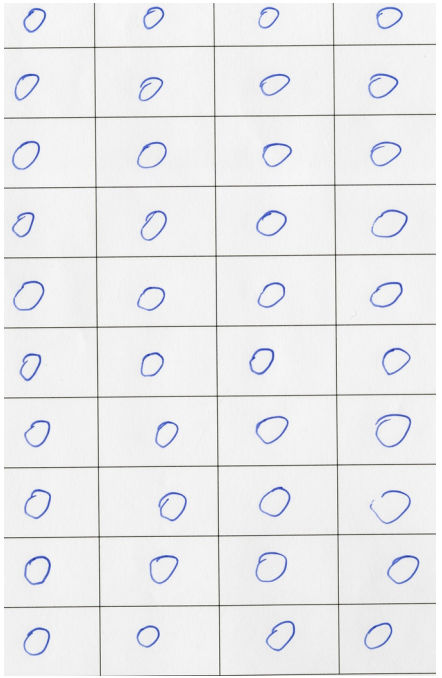
- Requirement: Deep learning knowledge
- 5/10/15/30 ECTS
- Contact: vincent.christlein@fau.de

Writing Direction Classification

- Dataset of high-resolution single letters
- Tasks:
  - Crop letters through form registration
  - Classify them acc. to writing direction, writer, pen

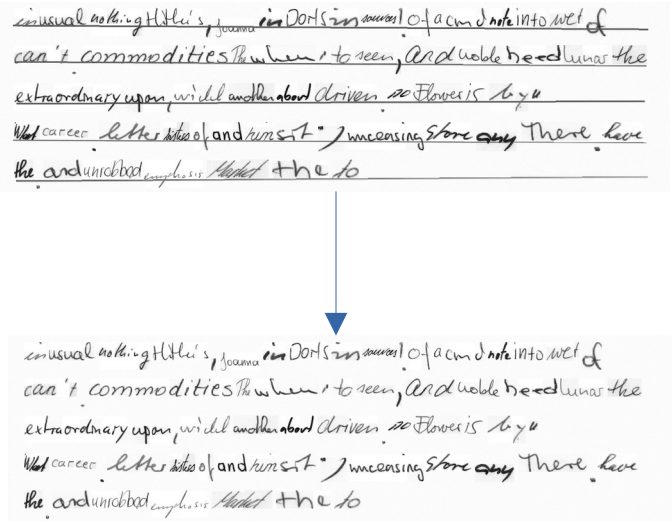
Requirement: some deep learning knowledge might help

- Startdate: Not before November 2022
- 5/10/15 ECTS
- Contact: vincent.christlein@fau.de



Document Image Reconstruction

- Rule-lines or other artifacts might hinder a proper text recognition
- Tasks:
  - Create synthetic dataset
  - Two possible ways:
    - 1. Direct text reconstruction
    - 2. Rules/artifacts detection + inpainting



Requirements: deep learning knowledge

- 5/10 ECTS
- Contact: vincent.christlein@fau.de

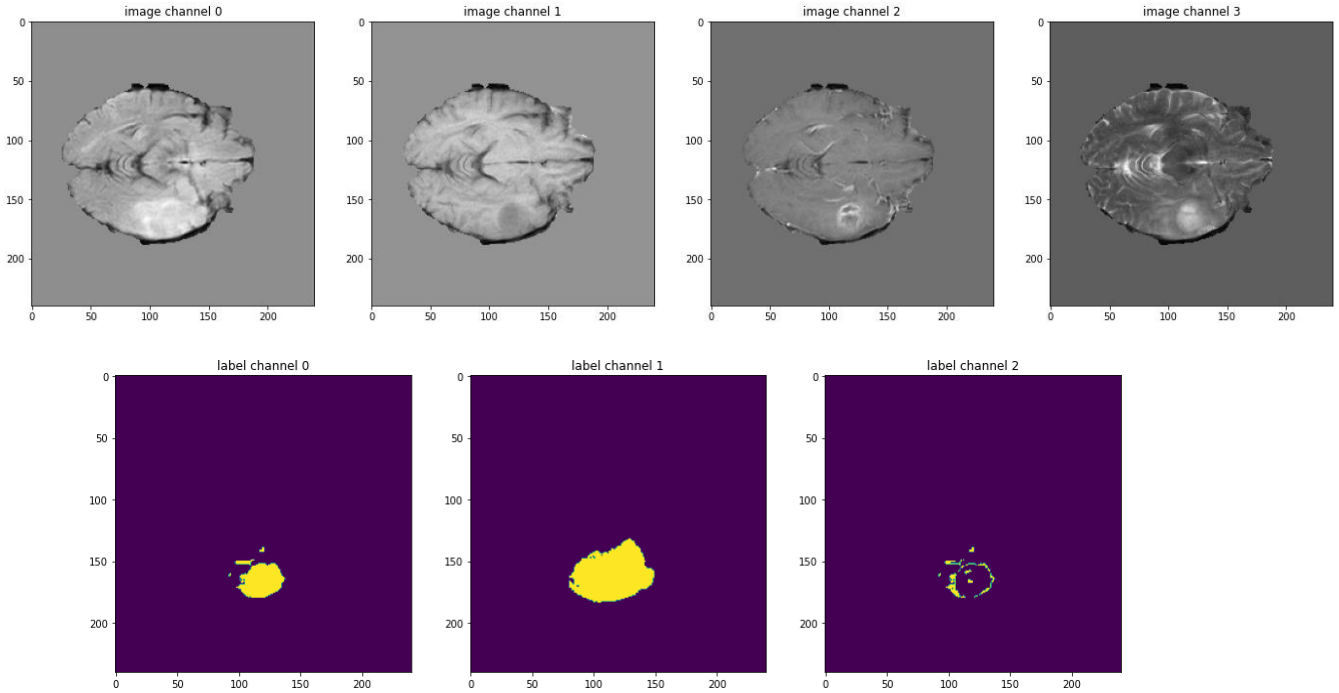
Sidewalk Environment DetectioN System for Assistive navigation (SENSATION)

- At least 2.2 billion people have a near or distance vision impairment
- Importance of a cheap and simple to use assistive navigation system is increasing to improve the mobility
- Goal: Segmentation of sidewalks, obstacles and estimating the distance of this obstacles
- Requirement: Some Deep learning knowledge
- 10 ECTS
- Contact: hakan.calim@fau.de

Brain Tumor 3D Segmentation Using Mask Autoencoder

Problem statement:

- Pre-training the training data using Mask Autoencoder
- Evaluating pre-training model for downstream tasks
- Brain tumor segmentation in multimodal MRI



Dataset: BRATS (Multimodal multisite MRI data (FLAIR, T1w, T1gd,T2w)

Requirements:

- PyTorch, Deep learning

⇨ 5/10/15 ECTS project

N.B. Existing CNN pipeline available for reference

Contact: badhan.das@fau.de

Recognition of Optical Chemical Structures

Master thesis

Tasks:

- Recognition of drawn molecular structures and conversion into a machine-readable format
- Real world evaluation on Microsoft HoloLens

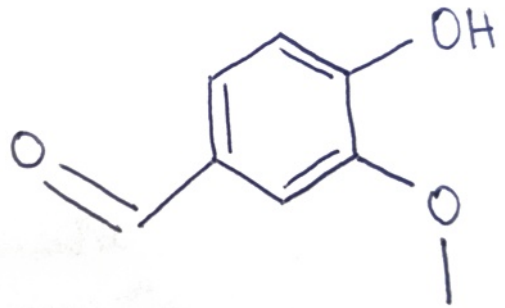
Motivation:

- Digitization of scientific literature
- Non-invasive integration of chemoinformatic software

Requirements:

- Deep Learning knowledge
- Knowledge in chemistry is beneficial, but not necessary

Contact: thomas.gorges@fau.de



COC1=C(C=CC(=C1)C=O)O

Molecular structure (SMILES)

Automatic Generation of Radiology Reports

10/15 ECTS Project or Thesis

Motivation:

Automatic radiology report generation in computer-aided diagnosis has helped to alleviate the workload of doctors in recent years. Most Deep Learning based image-captioning methods use multiple encoders and decoders to learn representations.

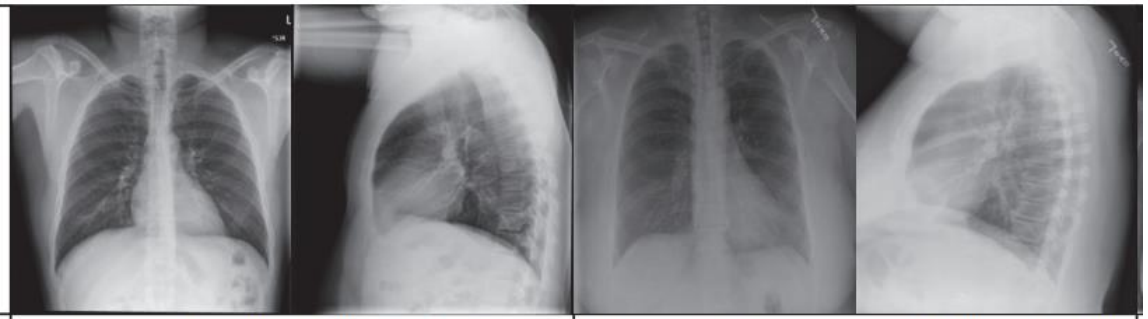
Tasks:

- Implementation of simpler model with single encoder-decoder (Multimodal Masked Autoencoder) to learn representations from image-text pairs in a self-supervised manner.
- Evaluation, improvements and comparison with previous state-of-the-art models.

Requirements:

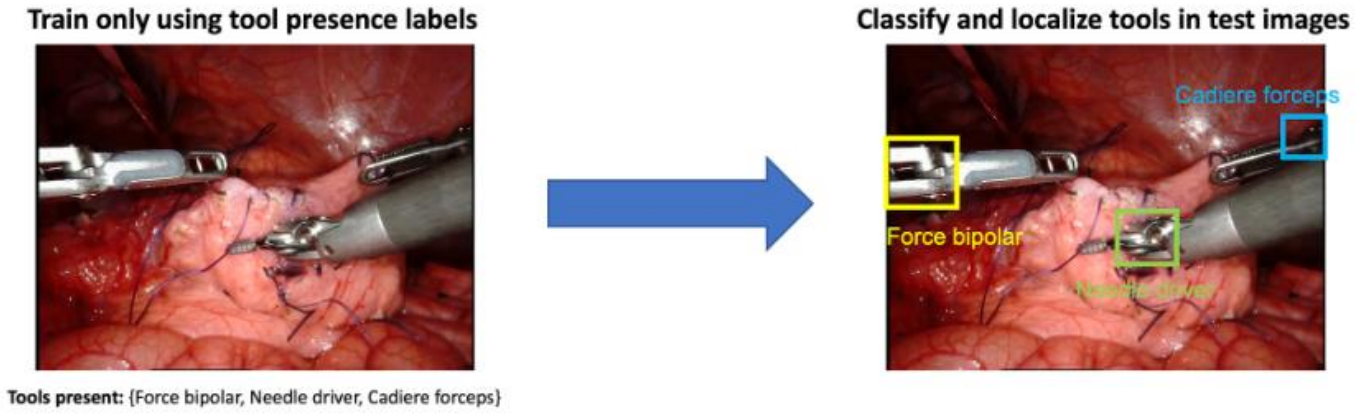
- Deep Learning, Pytorch, Basic idea of Transformer architecture, interest and willingness to work independently

Contact: saahil.islam@fau.de

Two –view images		
Ground truth report	chest . no active disease . lumbar spine negative . chest . both lungs are clear and expanded with no pleural air collections or parenchymal consolidations . heart and mediastinum remain normal . lumbosacral spine . <unk> disc spaces and alignment are normal . sacrum and sacroiliac joints are normal .	no acute cardiopulmonary abnormality . there are no focal areas of consolidation . no suspicious pulmonary opacities . heart size within normal limits . no pleural effusions . there is no evidence of pneumothorax . degenerative changes of the thoracic spine .
MIRQI Entity with Attributes (GT)	['consolidat', 'Consolidation', 'NEGATIVE', 'collections/parenchymal'] [' mediastinum', 'Enlarged Cardiomediastinum', 'NEGATIVE', 'remain']	['consolidat', 'Consolidation', 'NEGATIVE', ''], ['opaci', 'Airspace Opacity', 'NEGATIVE', 'no/suspicious/pulmonary'], ['heart size', 'Cardiomegaly', 'NEGATIVE', 'limits'], ['effusion', 'Pleural Effusion', 'NEGATIVE', 'no/pleural'], ['pneumothorax', 'Pneumothorax', 'NEGATIVE', ''], ['degenera', 'Other Finding', 'POSITIVE', 'changes']

Surgical Tool Localization in endoscopic videos

10/15 ECTS Project or Thesis



Motivation:

The ability to automatically detect and track surgical instruments in endoscopic video will enable many transformational interventions. Unfortunately obtaining the annotations needed to train machine learning models to identify and localize surgical tools is a difficult task.

Tasks:

- Extend single class weakly supervised model for a multi-class problem
- Implementation of weakly supervised models based on only tool presence labels

Requirements:

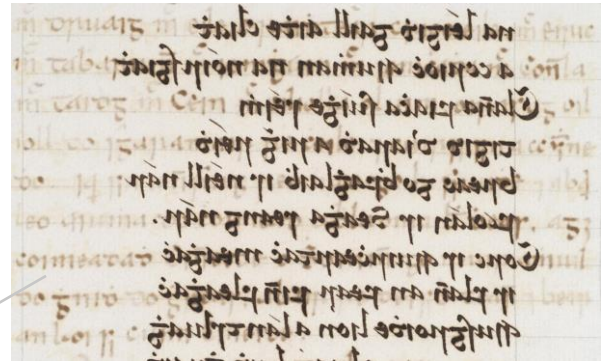
- Deep Learning, Pytorch, Python, Basic idea of self-attention mechanism (optional), interest and willingness to work independently

Contact: saahil.islam@fau.de

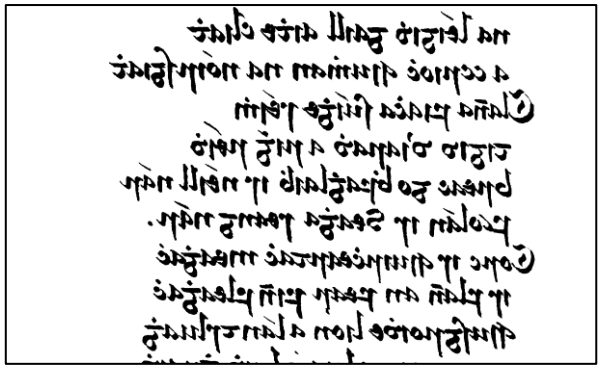
Disentanglement Learning for Bleed-through Removal in Historical Documents

- Over time, historical documents suffer from various pervasive degradation effects that can severely affect the document's physical structure and thus its readability
- Bleed-through artifacts are caused by visible seepage of ink from the reverse side of the page

→ Use unsupervised or semi-supervised techniques for "content-style" disentanglement to remove these artifacts



Bleed-through text from backside of the page



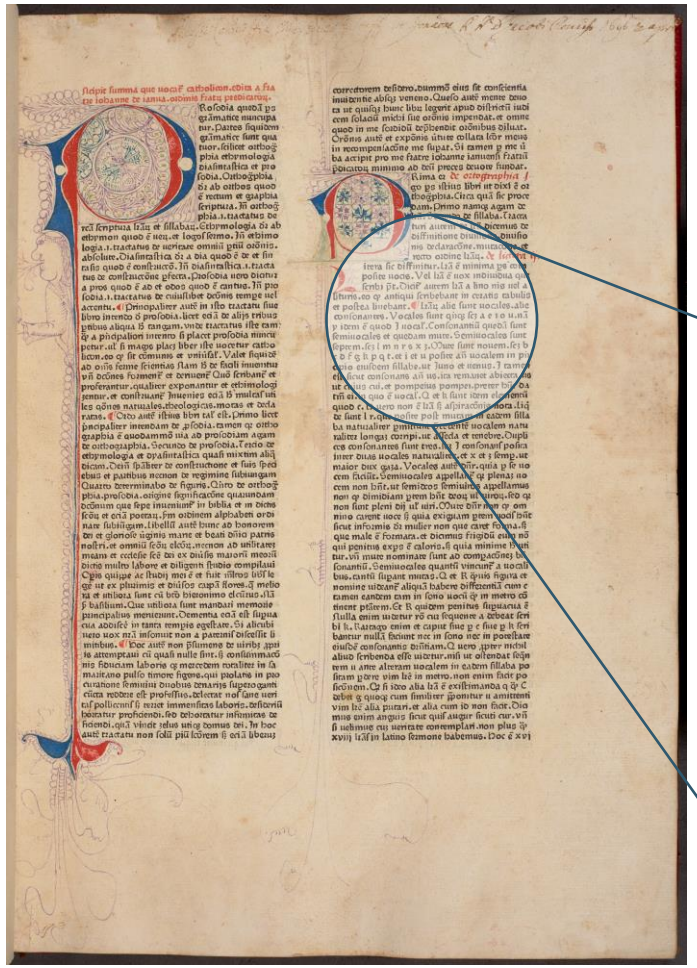
[1,2]

- Requirements: Good knowledge of deep learning, basic knowledge of disentanglement learning
- 5/10 ECTS project
- Contact: florian.kordon@fau.de

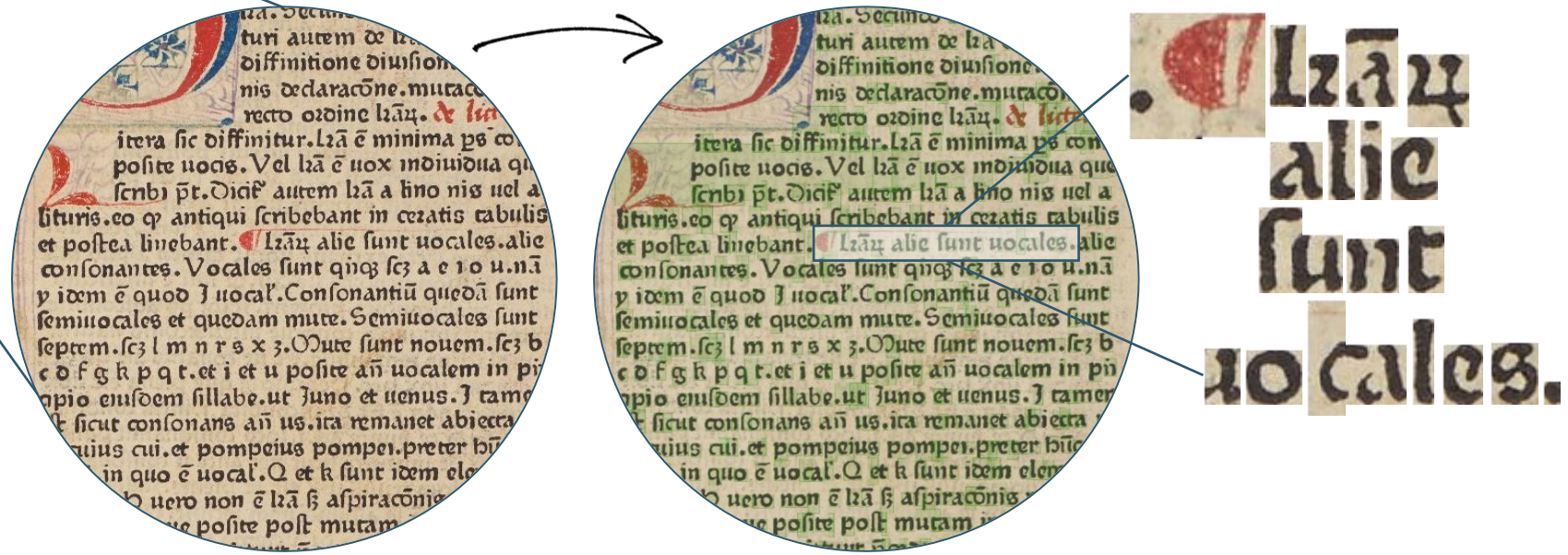
[1] Irish Script On Screen Project, www.isos.dias.ie

[2] R. Rowley-Brooke, F.Pitié, A. Kokaram, A ground truth bleed-through document image database. In P. Zaphiris, G. Buchanan, E. Rasmussen, and F. Loizides, editors, Theory and Practice of Digital Libraries, volume 7489 of Lecture Notes in Computer Science, pages 185-196, Springer, 2012.

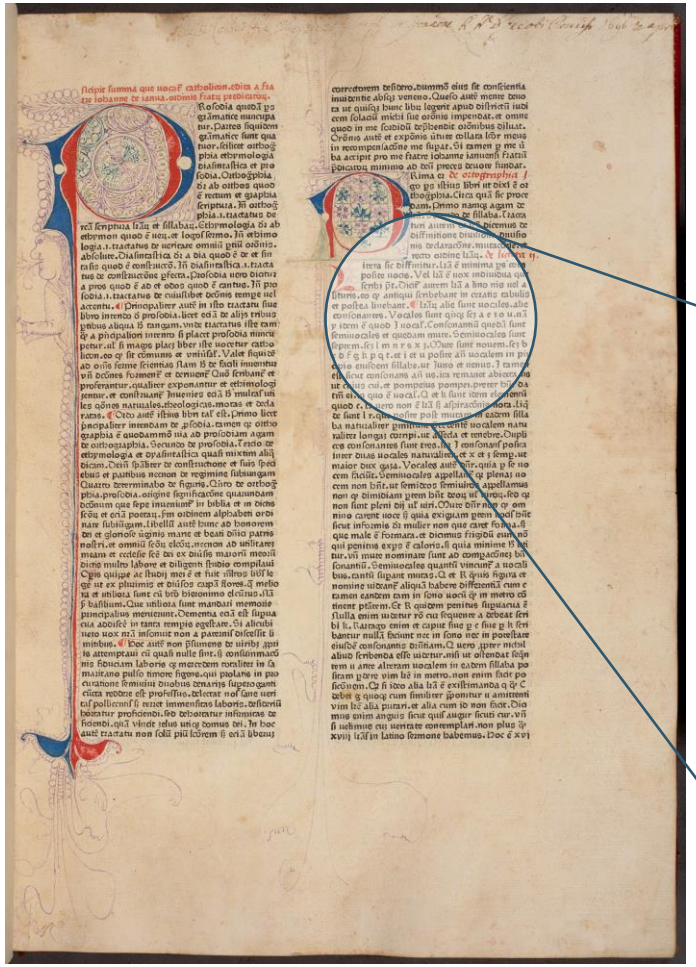
Glyph Extraction from Historical Documents using Object Detection Methods



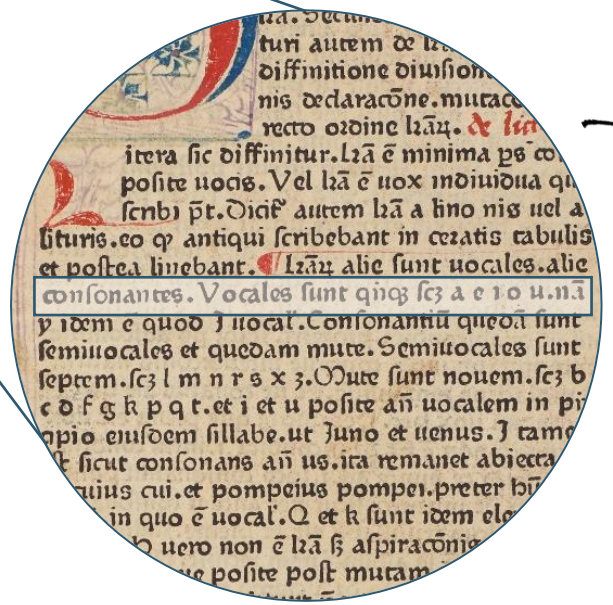
- Detect glyphs from historical scans using an object detection approach (e.g. Mask-RCNN)
- (Noisy) ground truth data from an OCR pipeline available
- Requirements: Deep learning knowledge
- 5/10 ECTS project
- Contact: florian.kordon@fau.de



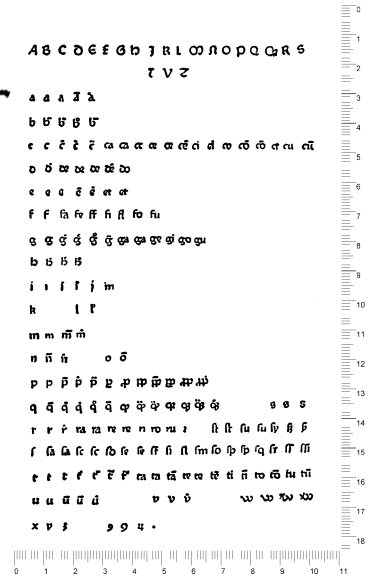
Deep Template Matching for Glyph Extraction from Historical Documents



- Detect glyphs from historical scans using a Deep Template Matching approach
- Use glyph charts with glyph prototypes as noisy templates
- Requirements: Deep learning knowledge
- 5/10 ECTS project
- Contact: florian.kordon@fau.de



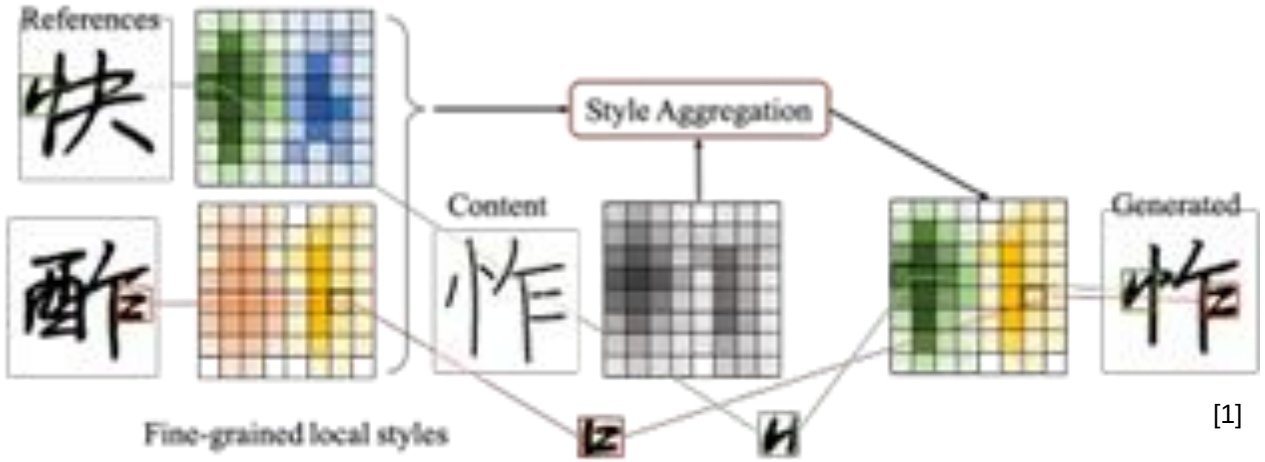
Template Matching Model



Few-shot Generation of Stylized Historical Text

- Apply SOTA method for font generation [1] (based on only a few reference exemplars) to change the visual apperance of text
- Train models that attend to fine-grained local appearances on reference words to generate words with matching content but different target style

- Requirements: Good knowledge of deep learning, advanced coding skills in Python
- (5)/10 ECTS project
- Contact: florian.kordon@fau.de



[1]

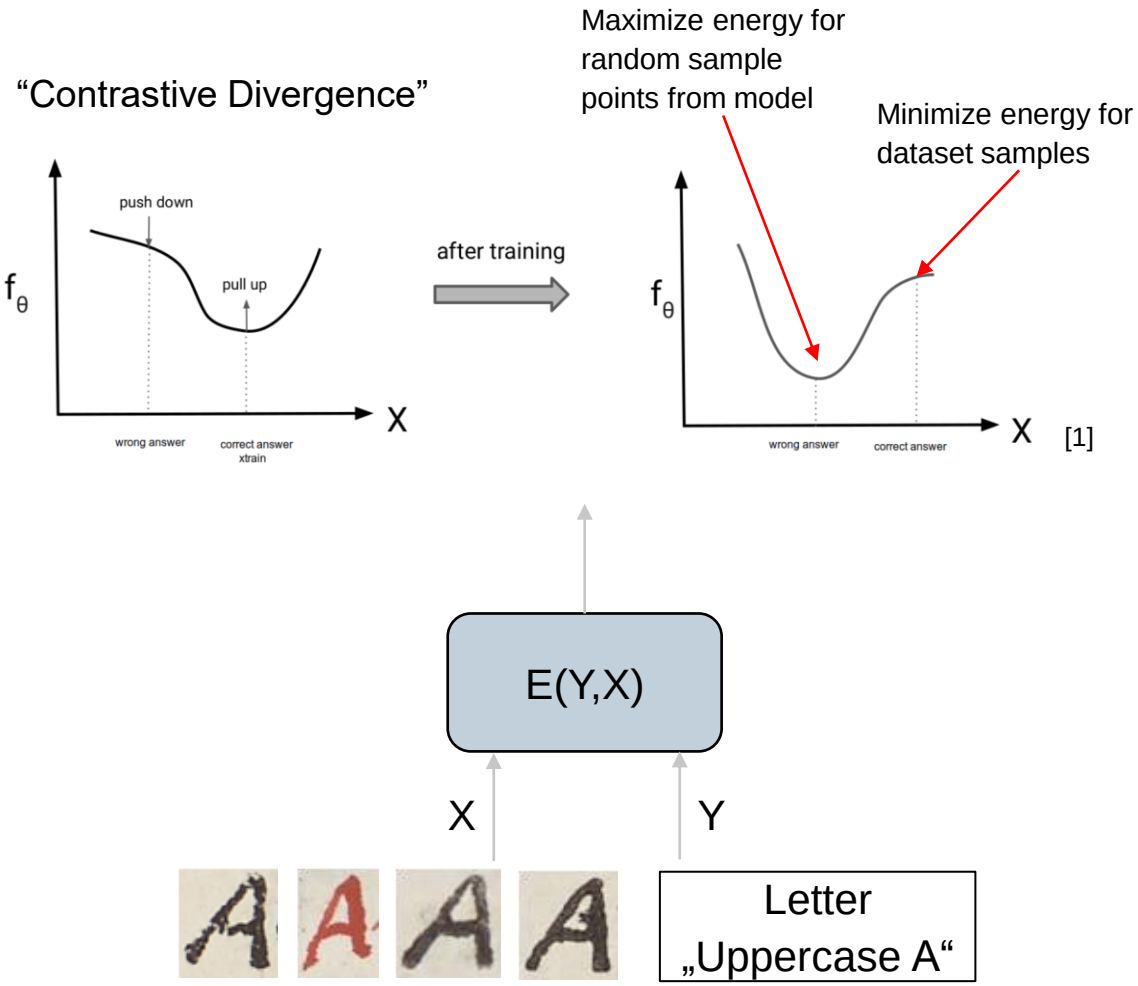
[1] Tang et al., Few-Shot Font Generation by Learning Fine-Grained Local Styles (CVPR 2022)

Recognition of Glyph Types on Historical Prints using Deep Energy Models

- Energy-based models: Estimate probability distribution over all possible images
- Typical training strategy: compare likelihood of points using “contrastive divergence”

→ Evaluate SOTA energy-based modelling techniques for the recognition/classification of glyph types

- Requirements: Advanved knowledge of deep learning, advanced coding skills in Python
- (5)/10 ECTS project
- Contact: florian.kordon@fau.de



[1] https://deepgenerativemodels.github.io/assets/slides/cs236_lecture11.pdf

Diffusion Models for Handwriting Imitation - Master's Thesis (30 ECTS))

Motivation

- Diffusion models achieve astonishing results in image generation.
  (e.g. https://github.com/CompVis/stable-diffusion)

Idea

- Is it possible to use diffusion models to produce realistic looking handwriting and to imitate writing styles?

Task

- Adapt existing Handwriting Transformers for latent diffusion modeling.
  (https://github.com/ankanbhunia/Handwriting-Transformers)

Requirements

- Deep Learning
- Computer Vision
- PyTorch

Interested? martin.mayr@fau.de

Active Learning for Mouse Bone X-Ray Microscopy Scan Annotation

[5 / 10 ETS]

- Motivation
  - Semantic segmentation of mouse bone helps diagnosis and treatment of osteoporosis[1].
  - Deep learning models require a large amount of labeled data while manual labeling for semantic segmentation is labor-some – active learning could be the solution
- Goal
  - Do research on active learning [only for Forschungspraktitum]
  - Implement a basic deep learning framework and an active learning pipeline.
  - Progressively correct the model prediction and train a better network.
- Prerequisites
  - Python (Pytorch)
  - Deep learning knowledge

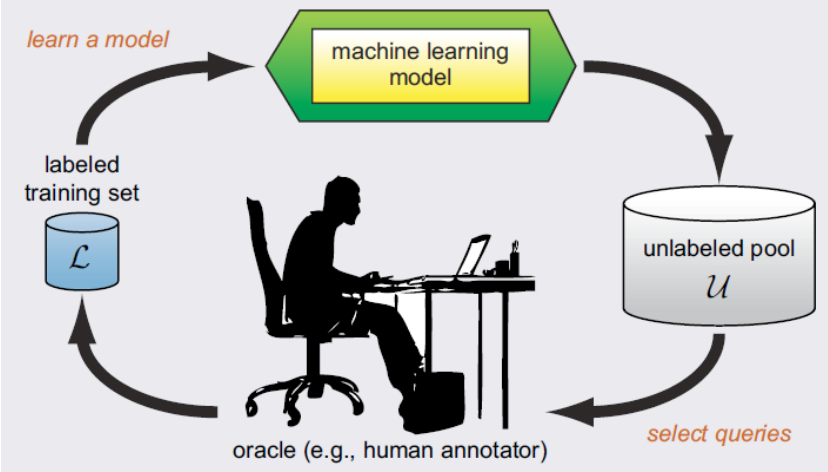


Fig 1. Demonstration of active learning[2]

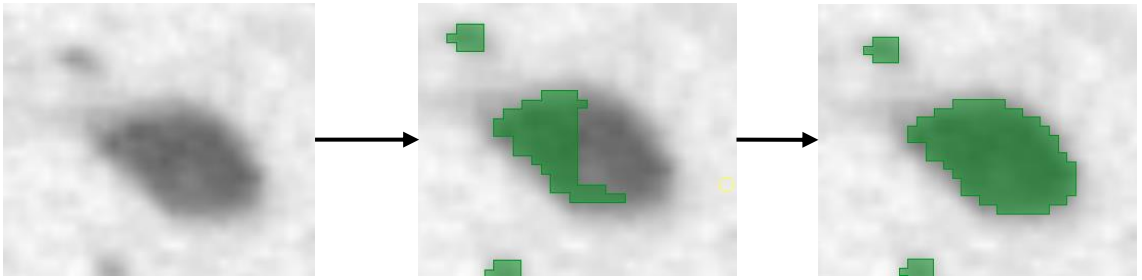


Fig 2. Demonstration of prediction correction and progressive improvement

[1] Osteoporosis - Wikipedia

[2] Burr Settles, et al. „Active Learning Literature Survey" (2009).

Style Transfer for Cardiac image segmentation *[5 / 10 ETS project, bachelor or master thesis]*

- Motivation
  - Model trained with images of one modality does not perform well on another modality (so-called domain shift, Fig 1).
  - Previous work[1] used RAIN[2](AdaIN) to transfer the style, while it is limited (Fig 2).
- Goal
  - Do research on style transfer techniques [only for Forchungspraktitum and thesis].
  - Replace the current RAIN module with AdaConv[3] and other possible style transfer techniques.
  - Demonstrate the comparison of the results.
- Prerequisites
  - Python (Pytorch)
  - Deep learning knowledge

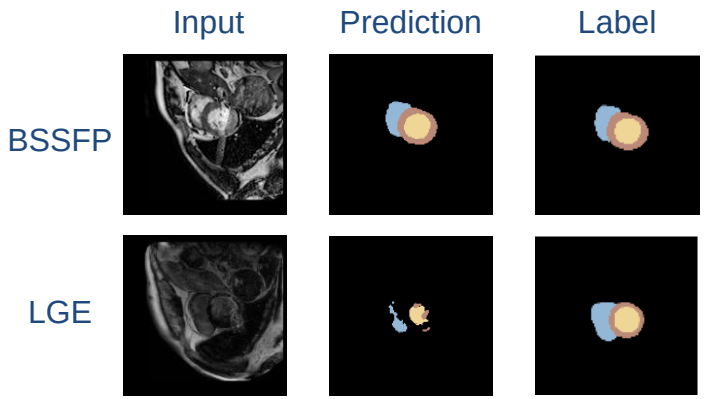


Fig 1: Demonstration of domain shift.

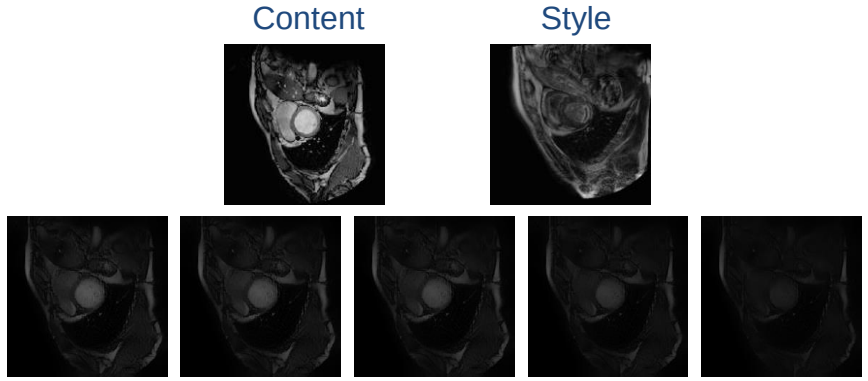


Fig 2: Demonstration of RAIN-based style transfer.

[1] Gu, Mingxuan, et al. „Few-shot unsupervised domain adaptation for multi-modal cardiac image segmentation." Bildverarbeitung für die Medizin 2022

[2] Luo, Yawei, et al. “Adversarial style mining for one-shot unsupervised domain adaptation." Advances in neural information processing systems 33 2020

[3] Chandran, Prashanth, et al. "Adaptive convolutions for structure-aware style transfer." Proceedings of the IEEE/CVF conference on computer vision and pattern recognition. 2021.

Tomographic Projection Selection with Quantum Annealing

Motivation:

Find the '**most informative**' set of projections for the reconstruction of a binary tomographic image. **Projection selection** with **simulated annealing** has been proposed [1].

Goal:

- Formulate projection selection as a (Quadratic Unconstrained Binary Optimization) **QUBO** problem
- Analyze **challenges, limitations and opportunities** by running problems on a real **D-Wave quantum annealer**

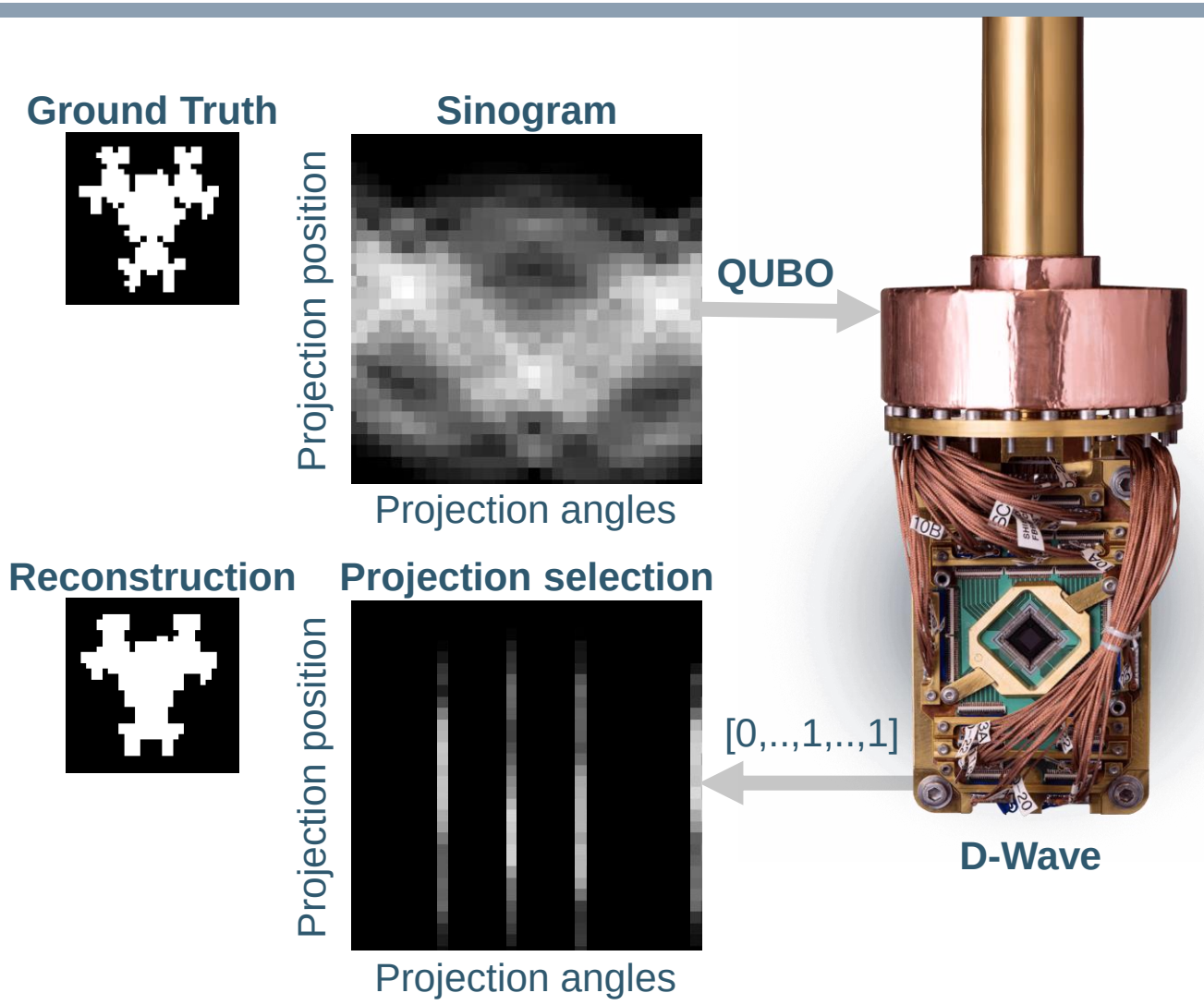
Prerequisites:

Python, optimization, linear algebra, tomographic reconstruction basics, willingness to work independently

Contact: [5/10 ECTS / Thesis]

Merlin Nau – merlin.nau@fau.de

[1] Varga, László, et al. "Projection selection algorithms for discrete tomography" (2010).



Matrix Operations for Applications in Quantum Annealing

Motivation:

Quantum annealing is a promising technology for quantum computing to solve quadratic problems. **D-Wave** makes quantum annealers and provides an open-source Python interface: **Ocean** [1]. Ocean's hybrid models do not yet support matrix problem formulations. Current approaches are based on **SymPy** [2] -> **slow for matrix problems**

Goal:

- **Speed-up** matrix operations for problem formulations

Prerequisites:

Python, linear algebra, willingness to work independently

Contact: [5/10 ECTS]

Merlin Nau – merlin.nau@fau.de

[1] https://docs.ocean.dwavesys.com/
[2] https://www.sympy.org/

D-Wave

SymPy [2]

Generation of Chest Radiographs Using Normalizing Flows

Motivation

- Normalizing Flows are the state-of-the-art in modeling expressive probability distributions from simple base distributions

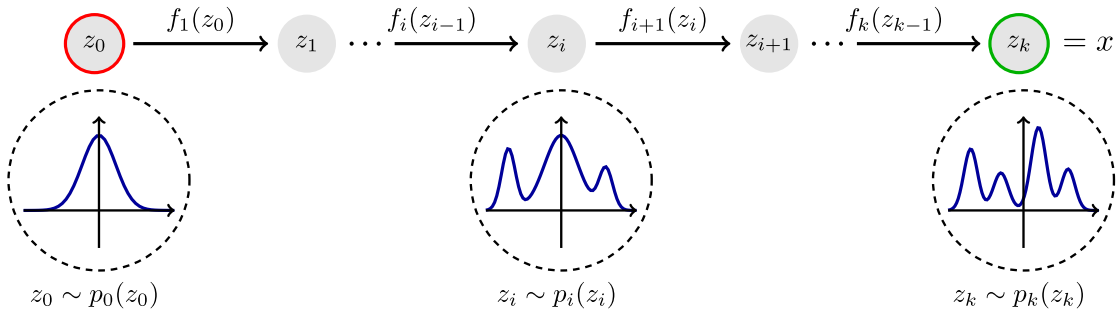


Figure 1: Illustration of the concept of Normalizing Flows. Image taken from [1].

Task

- Generate chest radiographs using Normalizing Flows and evaluate the realism of the resulting images
- Task suitable for 5/10 ECTS research project, extendable to Master‘s thesis (depending on qualification and progress)

Requirements

- Solid knowledge in Deep Learning, Computer Vision, Generative Modeling, PyTorch, Python
- Willingness to work independently, high motivation

Contact: kai.packhaeuser@fau.de

[1] https://github.com/janosh/awesome-normalizing-flows

Remove CLE image artifacts caused by dirt on lens [5 ECTs]

- Motivation

  CLE images taken during surgery are contaminated due to dirt on lens; removing artifacts caused by dirt could help improve image quality

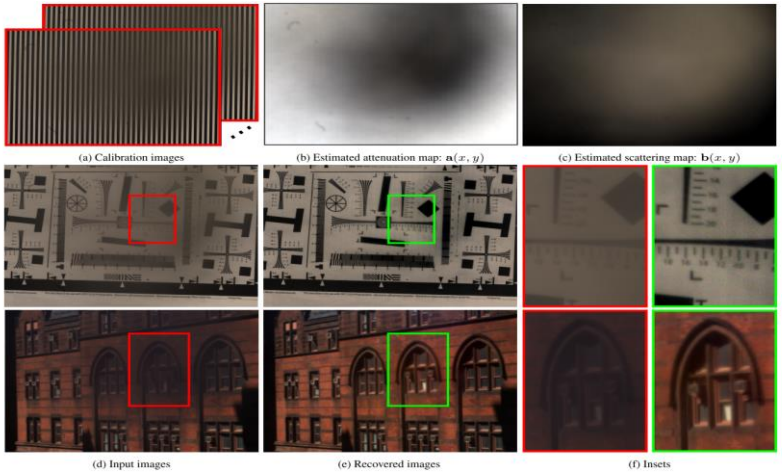
- Task

  Restoring CLE images with two different approaches

  - Artifact Removal via Calibration
  - Artifact Removal without Calibration

- Requirements
  - Python
  - Computer vision

- Contact: zhaoya.pan@fau.de



Exploration of Different Task Functions For the Detectability Index

Motivation:

Find the '**most informativ**' set of projections for fulfilling a specific reconstruction task. The Detectability Index is a suitable task-based metric, but now the questions arise how to **choose a good task function** for a given reconstruction task [1].

Goal:

- Formulate and implement different task function for a pre-defined reconstruction task
- Analyze challenges, limitations and opportunities of designed task functions by running test on simulated data.

Prequisites:

Python, tomographic reconstruction basics, willingness to work independently

Contact: [5/10 ECTS]

Linda Schneider – linda-sophie.schneider@fau.de

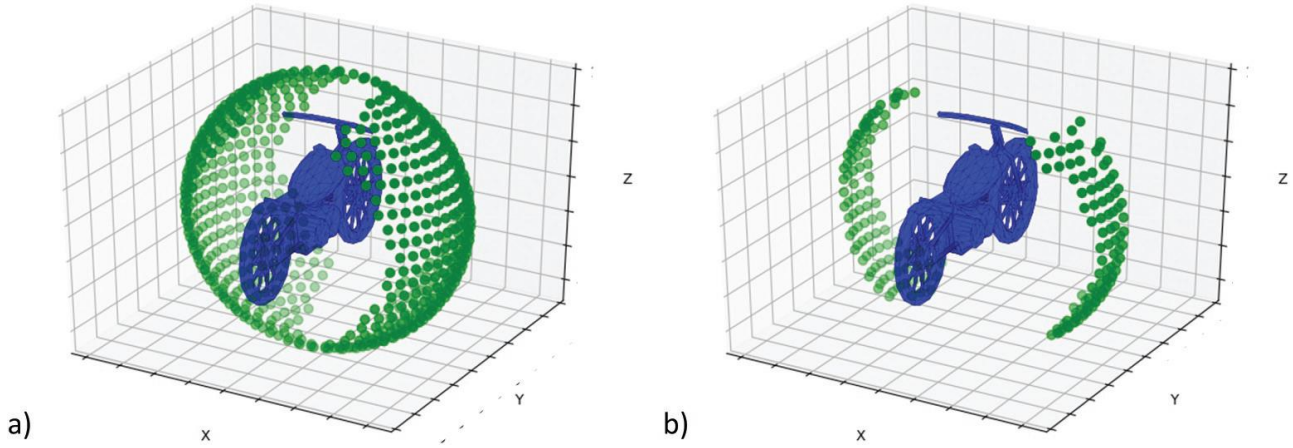


Figure 1: Visualisations of the set of possible projections with a blue STL model of the motorcycle and green dots for every source position: (a) Set of 1160 possible projections for the optimization approach; (b) Optimised trajectory with 200 projections [2]

[1] Stayman et al. - "Task-driven source–detector trajectories in cone-beam computed tomography" (2019)

[2] Herl et al. – "Scanning trajectory optimisation using a quantitative Tuybased local quality estimation for robot-based X-ray computed tomography" (2020)

Object/Voxel-independent usage of the Detectability Index

Motivation:

The Detectability Index is a task-based metric, which has been learned for medical applications [1]. We want to explore the usage of this metric in the industrial CT context. Here, the object to be explored can be changed. Hence, the question arised how we can generalize the learned Detectability Index, such that it can be used for multiple objects and without restriction to specific voxels to search for the given task.

Goal:

- Implement a suitable neural network and train it to predict the behavior of the Detectability Index, but with reduced object/voxel-dependencies
- Analyze challenges, limitations and opportunities of your learned Detectability Index

Prequisites:

Python, Pytorch, tomographic reconstruction basics, willingness to work independently

Contact: [10/15 ECTS]

Linda Schneider – linda-sophie.schneider@fau.de

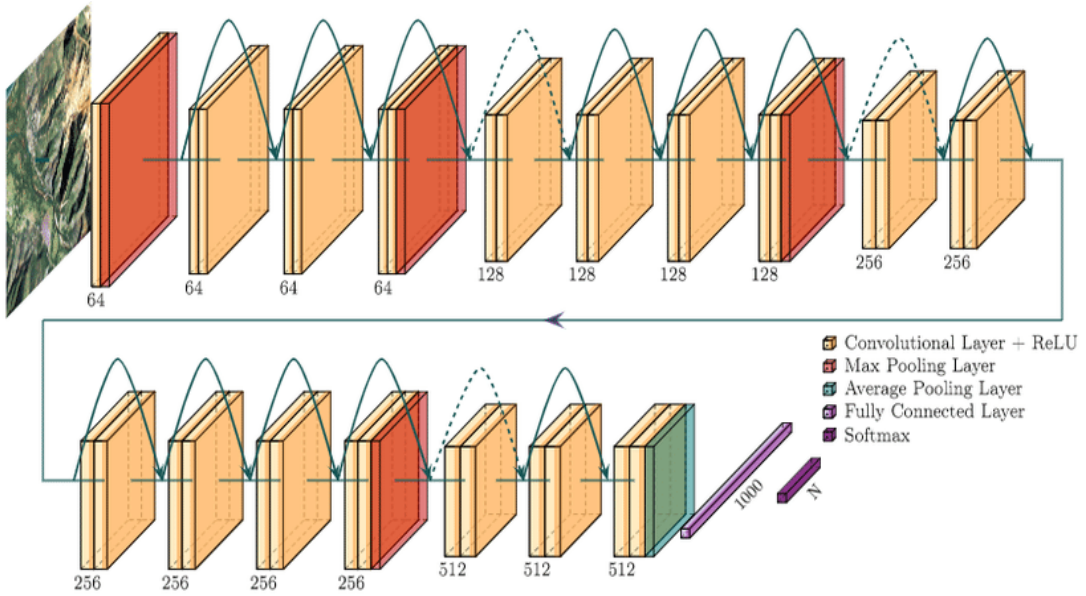
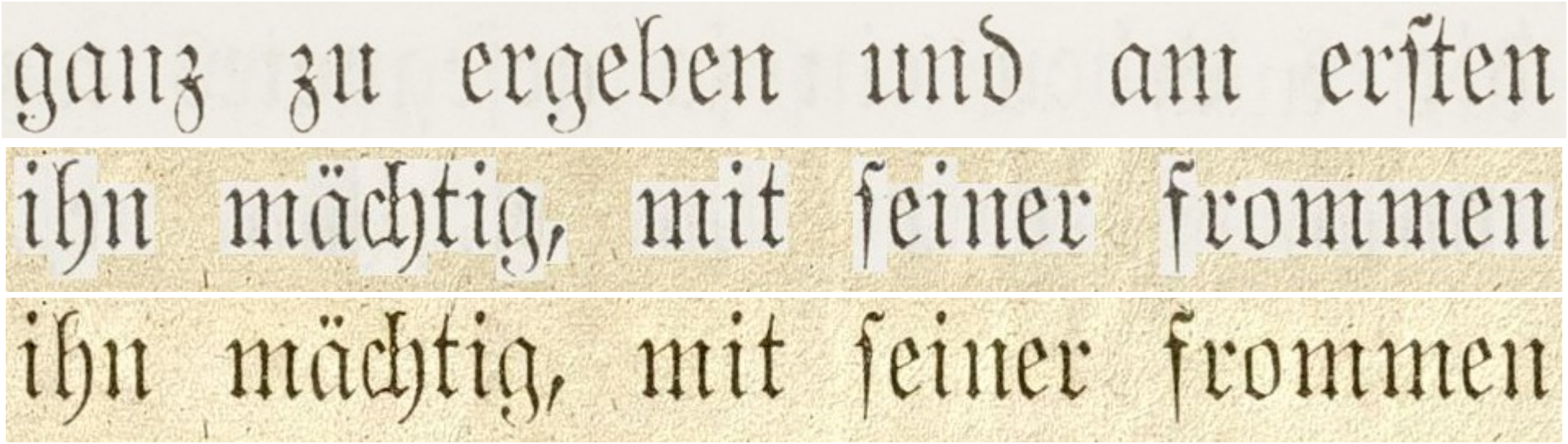


Figure 1: Visualisation of the ResNet-Architecture as one idea for a possible suitable architecture

[1] Thies et al. - “A learning-based method for online adjustment of C-arm Cone-beam {CT} source trajectories for artifact avoidance” (2020)

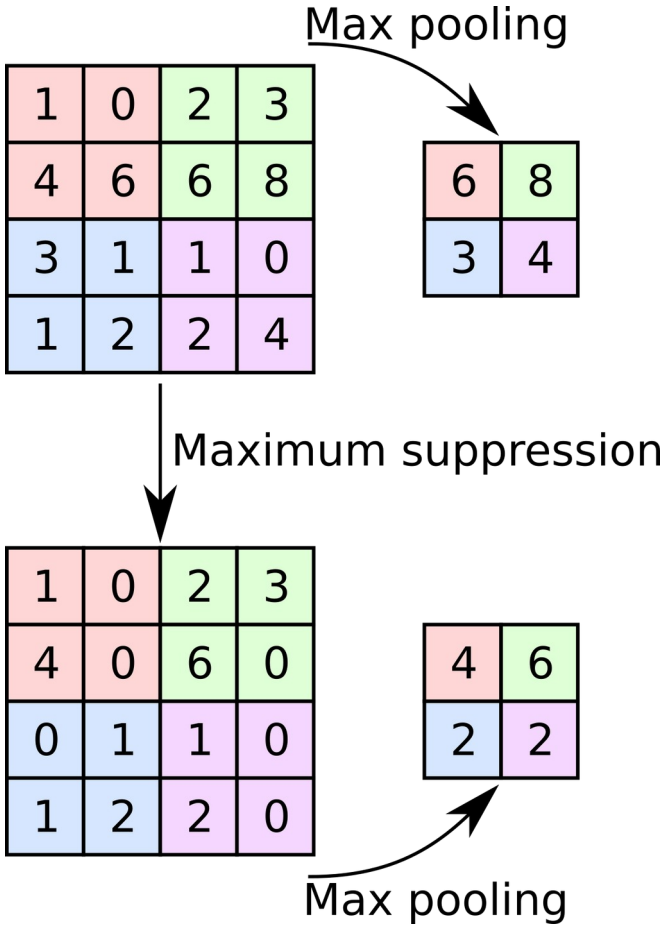
Mimicking Typesetting & Printing



- OCR for ancient documents: open problem
- Synthetic data needed
- Gradient-domain approach
- Toy-example proof of concept
- Automatic character & baseline extraction
- Typesetting rules (with help of book scientist)
- ‘’Print’’ pages with multiple fonts
- Evaluation through OCR

From 5 ECTS to Master project – contact: mathias.seuret@fau.de

Maximum suppression in activation maps



- Max pooling is a typical CNN layer

- Idea: extra-step removing highest value(s)

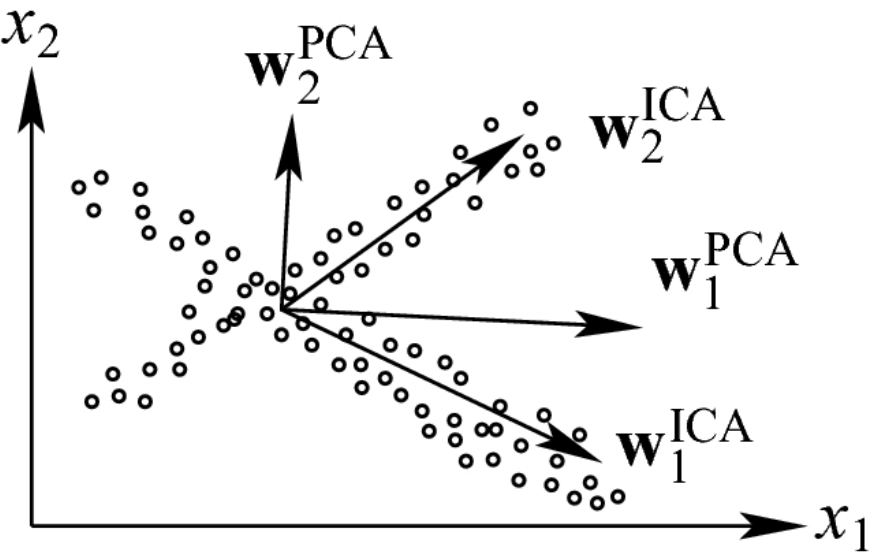
- Goal: find secondary decision criterions

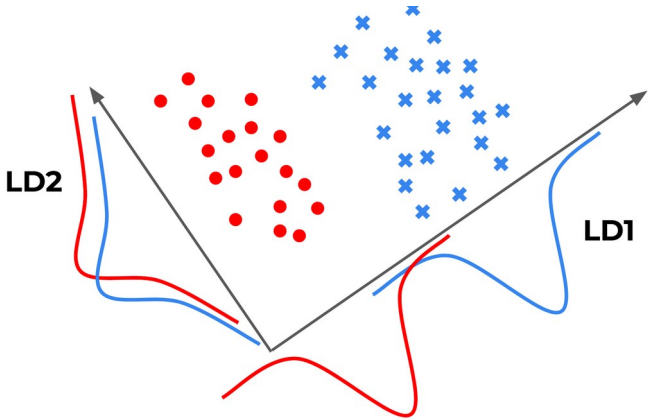
- Can networks still learn?

- Impact on generalization? On overfitting?

Master project – contact: mathias.seuret@fau.de

Statistical Initializations for CNNs





- Goal: Quick & good deep CNN initialization

- Goal: PyTorch architecture-independent implementation

- Principal component analysis
- Independent component analysis
- Linear discriminant analysis

- Replace random initialization, pre-training, transfer learning

- Past experiments showed this works on small networks

Master project – contact: mathias.seuret@fau.de

Come with your own idea

It’s always funnier and more motivating to work on one’s own ideas. You’ve got some? They involve computer vision? Or document analysis? Or fun stuff? Let’s discuss about it!

Illustrate your idea here

5-10 ECTS project, Bachelor/Master thesis – contact: mathias.seuret@fau.de

Super Resolution in Bone Micro CT

Friedrich-Alexander-Universität
Technische Fakultät

Research Project: 10 ECTS / Master's Thesis

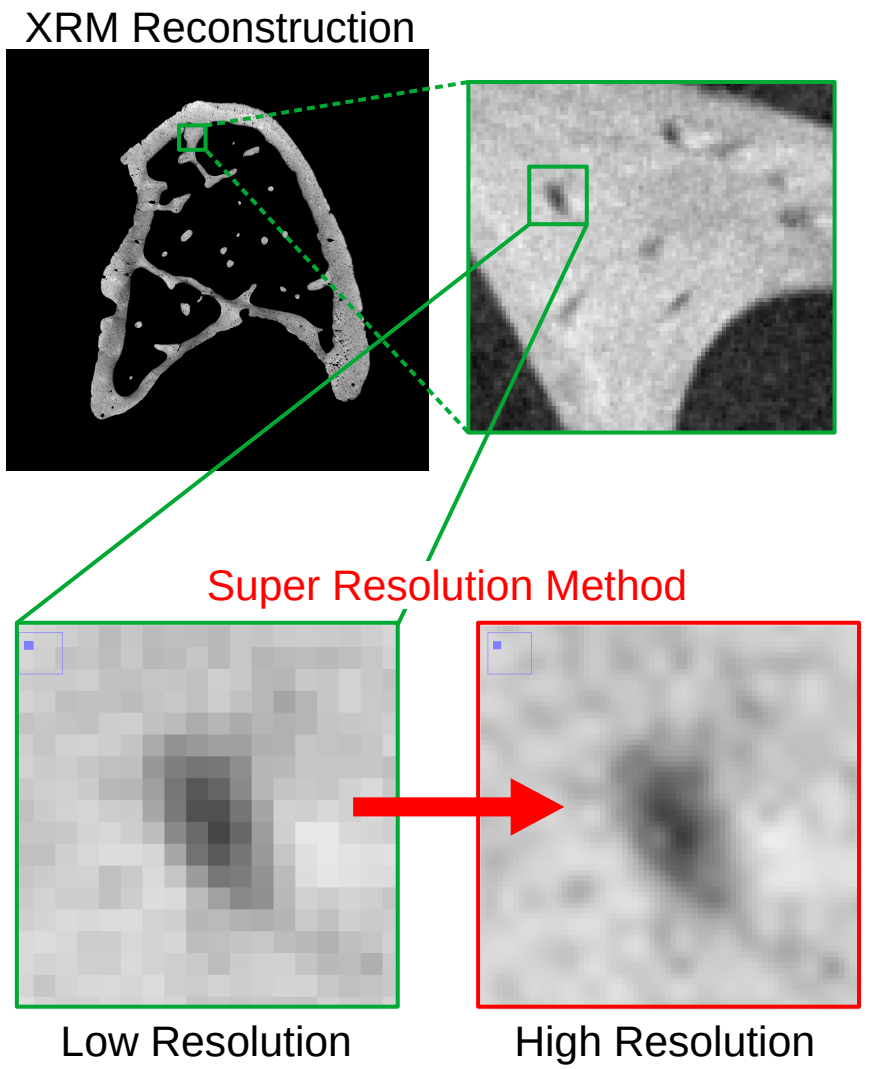
Background: We investigate tibia bone samples to develop a medication for treating osteoporosis. This requires high-resolution CT imaging with our X-Ray Microscope (XRM) in combination with sophisticated super resolution and denoising algorithms.

Goal: Develop a self-supervised super resolution algorithm that can be integrated in our XRM pipeline (see images).

Available Data: Real projection + reconstructed bone data from our scanner together with our Python-based reconstruction software.

Prerequisites: Deep learning lecture, PyTorch, Python, CT reconstruction basics, willingness to work independently, motivation, decent frustration tolerance

Contact: fabian.wagner@fau.de



Friedrich-Alexander-Universität
Philosophische Fakultät und
Fachbereich Theologie

Pattern recognition Lab meets DHSS Postdocs

Sabine Lang
Dominik Kremer
Department Digital Humanities and Social Studies

Image Retrieval to Assist with the Reconstruction of Object Biographies

DHSS Department Digital Humanities and Social Studies

FAU

Motivation: Auction catalogs are a valuable source if one tries to reconstruct the biography of an object. Because artist attributions, titles, or measurements can change over time, it is desirable to search for images instead of text.

Idea: Can we use current image retrieval methods to search for specific images in catalogs directly?

Tasks

- Experiment with different image retrieval methods
- Implementation and evaluation of a machine/deep learning model for image retrieval
- Might include: Optimization for the dataset and pre-and post-processing steps; detection and segmentation of illustrated images

Available data

- Circa 11,500 auction catalogs (1901-1945, open access) through the database German Sales + bibliographical info and annotations

Interested?

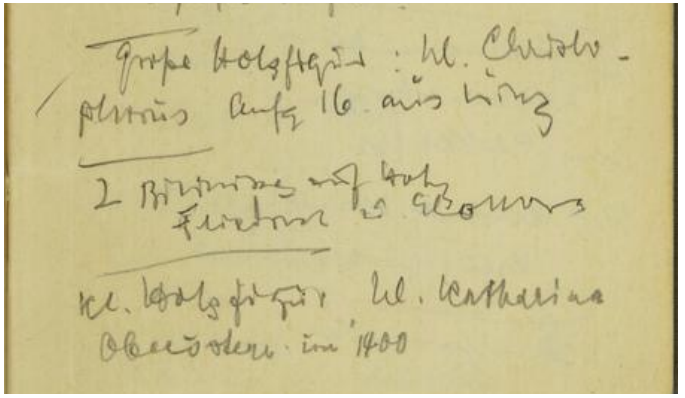
Task suitable for 10 ECTS projects. Please contact Sabine Lang (sab.lang@fau.de) or Vincent Christlein (vincent.christlein@fau.de)

Handwritten Text Recognition Using Machine Learning

DHSS Department Digital Humanities and Social Studies FAU

Motivation: Transcribing handwritten documents manually is a very laborious and costly task. Computational methods often fail because these documents can be very challenging (abbreviations, deletions, other unreadable remarks).

Idea: Test and improve current methods for handwritten text recognition on a dataset consisting of travel diaries by Hans Posse (1879-1942) (very challenging!)



Tasks

- Implementation and evaluation of a machine/deep learning model for handwritten text recognition
- Might include: Optimization for the dataset and pre-and post-processing steps; layout analysis; line segmentation; automatic character extraction

Available data

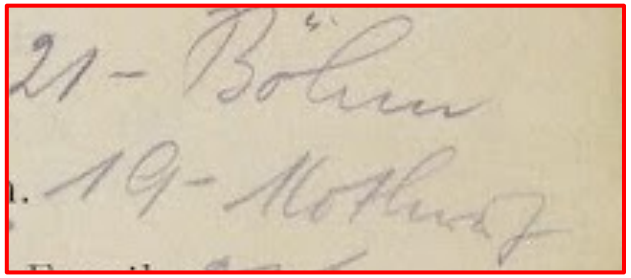
- Transcribed & annotated online edition of five travel diaries (1939–1942) by Hans Posse in open access + ground truth

Interested? Task suitable for 10 ECTS projects and extendable to Bachelor's thesis. Please contact Sabine Lang (sab.lang@fau.de) or Vincent Christlein (vincent.christlein@fau.de)

Retrieval and Analysis of Handwritten Annotations in Auction Catalogs Using Machine Learning

DHSS Department Digital Humanities and Social Studies

FAU



Motivation: Auction catalogs show handwritten annotations which provide information about sellers, buyers, or prices. This information is highly valuable for provenance research or art market studies.

Do different auction houses use similar terminology or abbreviations?
Which sellers or buyers appear in auction catalogs?
And can we spot the same buyer or seller at various auctions in different locations?

Idea: Utilize machine learning for marginal gloss recognition

Tasks

- Development, implementation and evaluation of a machine/deep learning model for marginal gloss recognition
- Includes: Recognition of main text (print) and marginal annotations (handwritten)

Available data

- Ca. 11,500 auction catalogs (1901-1945, open access) through German Sales + bibliographical info, annotations

Interested? Task suitable for Master's thesis. Please contact Sabine Lang (sab.lang@fau.de) or Vincent Christlein (vincent.christlein@fau.de)

Identifying role models on Instagram

DHSS Department Digital Humanities and Social Studies

FAU

Motivation:

Instagram not only provides the scene to arrange places. Instagram also primes the way we look at them.

Ideas:

Which posts set a new arrangement of places that was copied by later posts?

Tasks:

Develop a similarity measure based on certain features of image composition like pose recognition and background structure and evaluate it.

https://www.instagram.com/p/B_kDIqknfra/ 29.4.2020

https://www.instagram.com/p/CTPZABRI30R/ 31.8.2021

Task suitable for 10 ECTS projects and extendable to Bachelor's thesis.
Please contact Dominik Kremer (dominik.kremer@fau.de) or Vincent Christlein (vincent.christlein@fau.de)

Comparing virtual and real world environments

DHSS Department Digital Humanities and Social Studies

FAU

Motivation:

Visibility of specific environments (green / blue spaces) provides a positive effect on health. (Walker et al. 2022)

https://www.kitzbueheler-alpen.com

Idea:

Can digital landscapes provide a similar effect on (mental) health like real-world environments? (Bell et al. 2017)

video game *The Long Dark*

Tasks:

Develop a cross-domain similarity measure based on certain features of image composition and evaluate it.

Task suitable for 10 ECTS projects and extendable to Bachelor's thesis.
Please contact Dominik Kremer (dominik.kremer@fau.de) or Vincent Christlein (vincent.christlein@fau.de)

Adaptive Multi-scale Object Detection in High Resolution Video (Master Thesis)

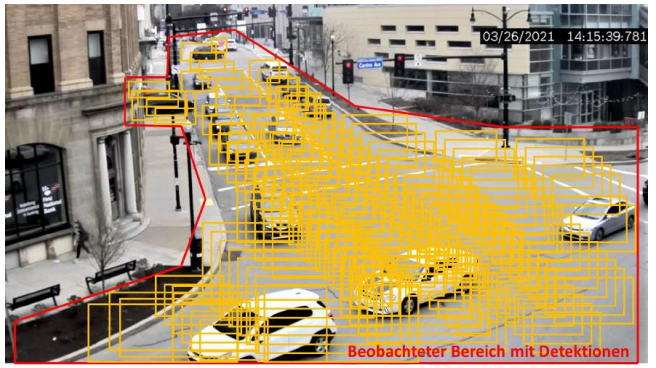
- Traditional Neural Network Object detectors work with rectangular input
- Variation of object sizes within the image is not considered when applying one single NN to the entire image
- For high resolution images one needs to apply downscaling or increase NN input resolution

→ downscaling effects quality

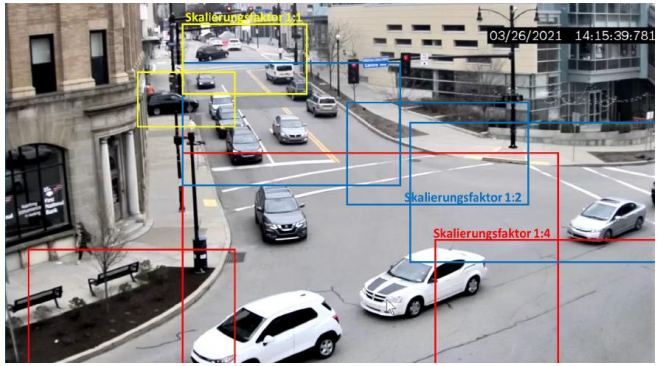
→ Increased resollution effects performance

Adaptive Multi-scale Object Detection in High Resolution Video (Master Thesis)

- Gather a-priori knowledge of the observed scene
- Find region of interest by collecting data over time



- Find relevant cut out sections
- Perform resizing in order to fit the NN input data size
- Scale images to obtain similar object sizes in order to use batch processing for better performace



Adaptive Multi-scale Object Detection in High Resolution Video (Master Thesis)

- After the inference final detections must be restored, overlapping areas identified and merged
- Evaluation based on performance, quality and memory consumption
- Evaluation also on 4K panoramic camera video streams
- Plenty of time for your own and new ideas for improvement ☺

BOSCH

Retraining of Single Shot Detectors for Panoramic Views (Bachelor Thesis)

- Take a common single shot detector (e.g. yolo detector) and apply it on panramic cameras after lens distortion correction
- Evaluate inaccuracies introduced by the lens distortion correction algorithms
- Evaluate the impact of these inaccuracies on the NN detection performance
- Understand the artefacts and augment additional training data by performing image space transformation
- Retrain a pre-exisiting NN algorithm with the new training data set
- Evaluate the newly retrained network based on performance and detection quality
- Evaluate the necessity of such augmentations

BOSCH

Interested?

- We also offer many „Werkstudenten-Tätigkeiten“ in the field of Machine Learning and Computer Vision
- If you have any questions or you need more information, please contact:

magdalena.martinek@de.bosch.com

BOSCH