Master's Thesis / Diplomarbeit

AI-Based Imaging Analysis of Arthritis (RA, PsA, OA) from X-ray Data

Host Institute: Medical University of Vienna, Department of Rheumatology
Supervision: Jana Eder in collaboration with the AutoPiX consortium (Daniel Aletaha, Peter Mandl & Georg Langs)

Duration: 6 months
Start: Flexible

Background

X-ray imaging is one of the most widely used modalities for assessing structural changes in rheumatic diseases, including rheumatoid arthritis (RA), psoriatic arthritis (PsA), and osteoarthritis (OA).
AI-based image analysis offers new opportunities for automated detection of joint damage, pattern recognition, and quantitative assessment.

This thesis investigates how machine learning methods can support the analysis and classification of arthritis-related structural changes in X-ray images.

Research Questions

• Can AI models identify and classify joint damage patterns in RA, PsA, and OA?
• Which radiographic features are most informative for distinguishing these diseases?
• How interpretable and clinically meaningful are the explanation methods?

Methods and Approach

• Use anonymized X-ray data from the Department of Rheumatology.
• Perform data cleaning, preprocessing, and quality checks.
• Train and evaluate machine learning models for classification and/or feature extraction.
• Apply explainable AI (XAI) techniques to understand model predictions.

Required / Beneficial Skills

• Python experience (PyTorch, NumPy, pandas)
• Interest in radiology, musculoskeletal imaging, and AI
• Familiarity with image analysis or machine learning is an advantage

Timeline and Deliverables

Months 1–2: Literature review, data preprocessing, baseline model development
Months 3–4: Implementation and comparison of XAI methods
Months 5–6: Model refinement, evaluation, visualization, and thesis writing

Supervision and Environment

This project is part of the **IHI AutoPiX initiative**, a European collaboration between academic and industrial partners aiming to improve imaging for patient benefit in arthritis. You will work in an interdisciplinary environment with close interaction between clinical and technical experts.

Additional Thesis Opportunities

Beyond this specific topic, several other projects are available:

Further AutoPiX-related topics

AI-based image interpretation, image–text matching, data harmonization, quality control, and explainable AI.

Medical Imaging & Pediatric Oncology (St. Anna Children's Hospital)

Projects involving pediatric oncology, data processing, medical imaging, and AI-driven analytics in cooperation with St. Anna Children's Hospital.

AI & Knee Osteoarthritis (with academic and industry partners)

AI-based image analysis, segmentation, and biomarker development in knee osteoarthritis in collaboration with Paracelsus Medical University, Chondrometrics, and industry partners.

Student-initiated ideas

Students with their own project ideas are very welcome, **particularly those involving rheumatology data** or related imaging and AI topics.

If you are interested in any of these areas, please feel free to contact me:

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