State of the art: There is no method to predict Accelerated Knee Osteoarthritis (AKOA) using a baseline X-ray image.

Research Question: "Is it possible to classify Knee Osteoarthritis (KOA) progression into fast and slow progression (defined as Joint Space Narrowing (JSN) per year) using Convolutional Neural Networks (CNN)?"

Contribution: As a first study I considered only slow- and fast-progressing KOA in a classification model. This in comparison to previous studies is clinically more relevant due to the low availability of knee radiographs of non-progressing patients.

Methods: To train the CNN, I used two different approaches to defined the ground truth. The models were evaluated with the Area Under the Receiver Operating Characteristic Curve (AUC - ROC), where 100% is the best result.

Image data: X-ray

Numeric data:
- Gender
- Body mass index (BMI)
- Age
- WOMAC (Western Ontario and McMaster Universities Arthritis Index) score
- KL (Kellgren-Lawrence) -grade
- Contralateral KOA

CNN, based on a Residual Network 50 (1), pre-trained from Image Biopsy Lab

KOA class definitions:
- Non-progressors: remaining KL-grade during study period
- Slow-progressors: < 20% JSN
- Fast-progressors: > 20% JSN

Approach 1: Excluding non-progressors, according to my research question

Non-progressors  Slow-progressors  Fast-progressors

Approach 2: Including non-progressors in order to compare my models with previous studies

Non-progressors  Slow-progressors  Fast-progressors

Conclusions:
The models I investigated in this thesis can serve as a supportive decision tool for physicians in diagnosis with an AUC of at least 68.78%. Although previous studies achieved higher results (2,3) when including non-progressing patients, not differentiating non-progressors is clinically more relevant due to the low availability of knee radiographs of the group of non-progressing patients.

References: