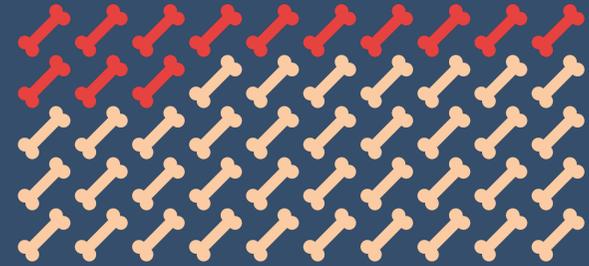# MACHINE LEARNING:

DETECTING MISMARKED KNEE X-RAYS

We found 13.2 % mismarked knee x-rays examinations in a pilot study at the University of Copenhagen Hospital, Bispebjerg and Frederiksberg Hospital

RSNA Poster #QI03-B-HC1

25.8 % OF KNEE X-RAY EXAMINATIONS
WERE MISMARKED IN OUR RECENT RETROSPECTIVE STUDY

MISSING MARKERS

Methods

A research dataset of 8,596 knee clinical production radiographs from 2015 to 2018 at Bispebjerg and Frederiksberg Hospital was randomized and split into a training (83%) and test set (17%). Two readers annotated 1,515 radiographs for conflicting and missing laterality markers not coherent with the accepted marking. An arbitrator consulted inconsistencies between the readers for a final decision. Two images were excluded based on 1) a severe rotated dislocated femur fracture and 2) a blank image. The study was approved by the Danish Patient Safety Authority #3-3013-3040/1.

A Danish health tech company developed and trained a convolutional neural network model (machine learning) to detect knee anatomical structures and markers. An additional number of images (> 15,000) from other sources were included for model improvement. Finally, the research team evaluated the model against the reference dataset and provided the performance metrics. The research team and company reviewed the reference and machine learning model discrepancies for possible explanations.

Accepted marking

PA/AP — AT LEAST ONE MARKER

SKYLINE — AT LEAST ONE MARKER

LATERAL

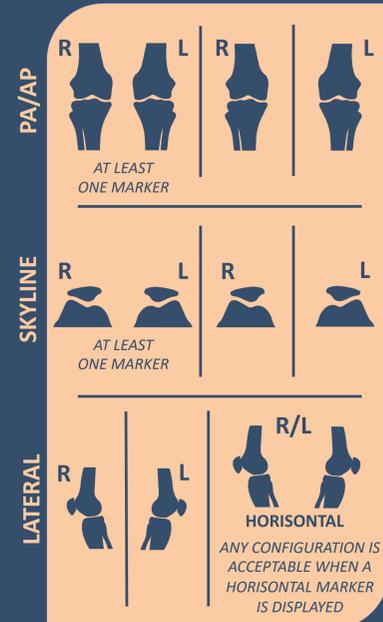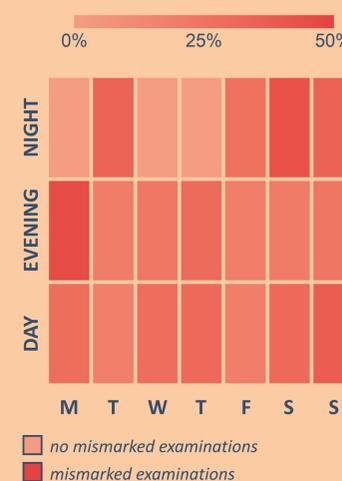**HORISONTAL** — ANY CONFIGURATION IS ACCEPTABLE WHEN A HORISONTAL MARKER IS DISPLAYED

Objectives

I. to investigate the number of conflicting and missing knee x-ray laterality markers at a Danish hospital

II. to develop and evaluate a machine learning model that detects these conflicting and missing laterality markers

Retrospective study

	INCLUDED	POPULATION	MISMARKED
	1,513 X-RAYS	**252 / 225** FEMALES / MALES	**17.3 %** X-RAYS
	532 EXAMINATIONS	**48 years** MEDIAN AGE	**25.8 %** EXAMINATIONS
	477 PATIENTS	**8–103 years** AGE RANGE	**27.5 %** PATIENTS

MISMARKED EXAMINATIONS FROM 2015 TO 2018

LEAD MARKER USE AWARENESS

- 34.2 % — 2015
- 22.5 % — 2016
- 19.5 % — 2017
- 25.2 % — 2018

There was a significant decrease in mismarked examinations from 2015 to 2017 (p < 0.05)

MISMARKED EXAMINATIONS DURING WORK SHIFTS AND WEEKDAYS/WEEKENDS

0%　25%　50%

NIGHT / EVENING / DAY

M T W T F S S

☐ no mismarked examinations
☐ mismarked examinations

Machine learning model

SENSITIVITY 97.3 %

BAL. ACCURACY 98.0 %

SPECIFICITY 98.8 %

MISMARKED
(Ve in Danish = LEFT)
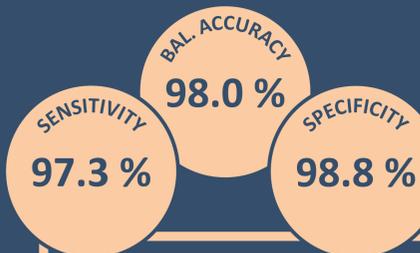
POTENTIALS OF THE MODEL

- ✓ Immediate alert system
- ✓ Clinical quality assurance
- ✓ Patient safety improvement
- ✓ Workflow optimizing
- ✓ Research tool

1.5 % of the images were classified as 'unknown' by the model and removed from the performance metrics

Disclaimer

CONTACT ME HERE

LinkedIn QR code

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REGION H
Bispebjerg og Frederiksberg Hospital