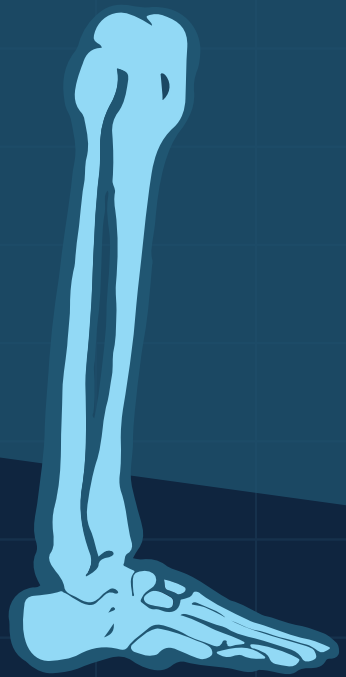
Detection of bone fractures

Applied machine learning project

10cm



Introduction

One of the most important problems in orthopedics is undiagnosed or misdiagnosed bone fractures. Our model predicts whether there is a fracture present in a x-ray photo, and provides a bounding box to locate the fracture. This could be used as a tool for surgeons to speed up the examination and to improve accuracy.

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Preprocessing

Little work

Our dataset

The Bone Fracture Detection dataset already divided data in test/train/validate

The ratio was: 3631 train / 348 / 169 test

87,5% train / 8,4 val / 4,1% test

Preprocessing

Our model, YOLOv11, could use any type of image, regardless of their format

Augmentation

We augmented the data images to be flipped horizontally and vertically, rotated and darken or lighten the value within a range.

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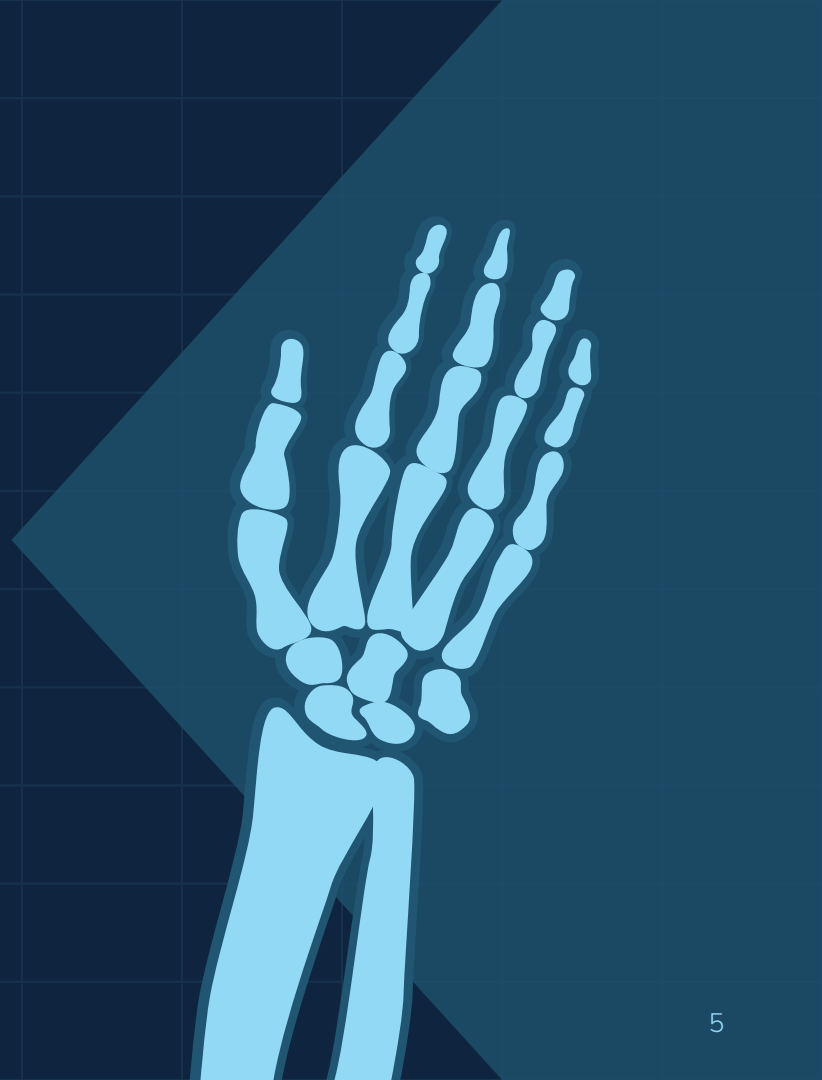
Our models

Baseline model

- Sliding-window CNN

Final model

- YOLOv11



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Final model

YoloV11

- Developed by Ultralytics
- Computer vision tasks
- User friendly
- Oriented Bounding Box
- Confidence score

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Final model

Hyperparameter tuning, regularization

- Built-in method
- Train and validate on different hyperparameters
- E.g. Initial learning rate and Weight decay
- 10 times for 50 epochs -> Time consuming

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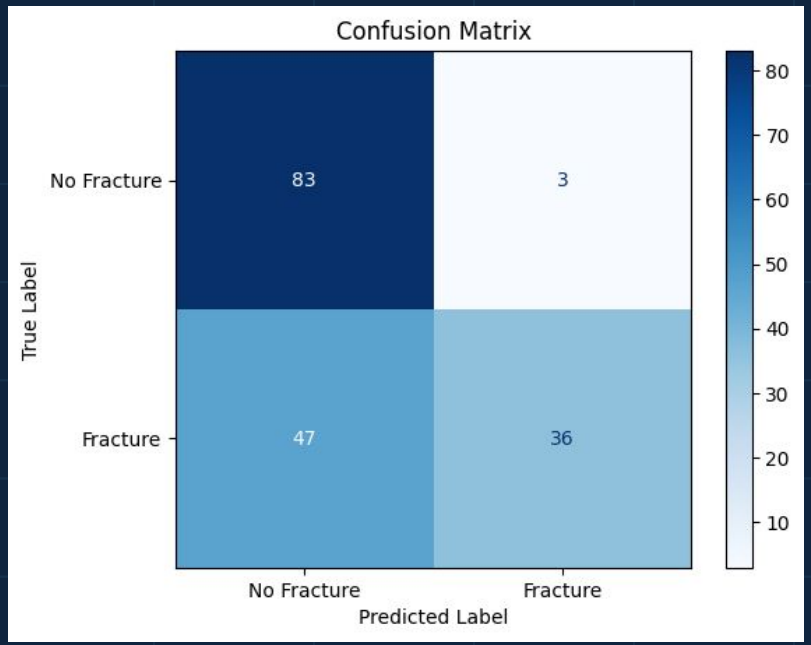
Performance

Metrics

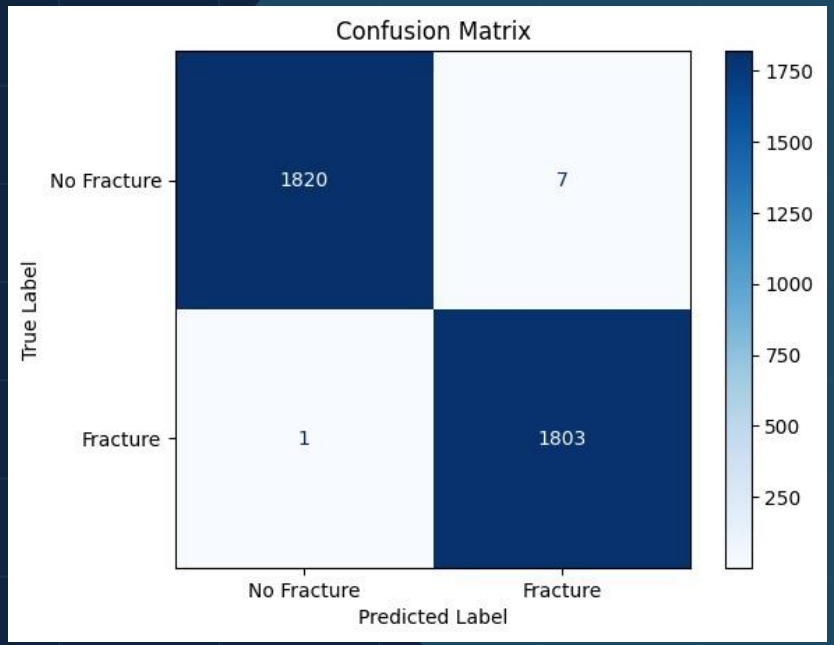
- IoU metric
- If selecting whole screen is better than bounding box prediction

Overfitting

Test data



Training data



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Professionality

Readme

Clear instructions

Dependency management

Installation

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Expert feedback

To ensure that our model has novelty and can be professionally employed, we designed a questionnaire and asked orthopedic surgeons to evaluate our model

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Their feedback

Evaluation of model assessment

False positives/ false negatives

Systematic errors

Obvious fractures are detected, difficult/ subtle fractures not

Bounding box

Location and size accurate

Reason for model misunderstandings

Bad/ not enough data
Low quality/ not centered on place of interest

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L
02


R
CT
XTL

Their feedback

Not helpful

Should be improved

Screening tool

For young/
inexperienced doctors
(in ER)

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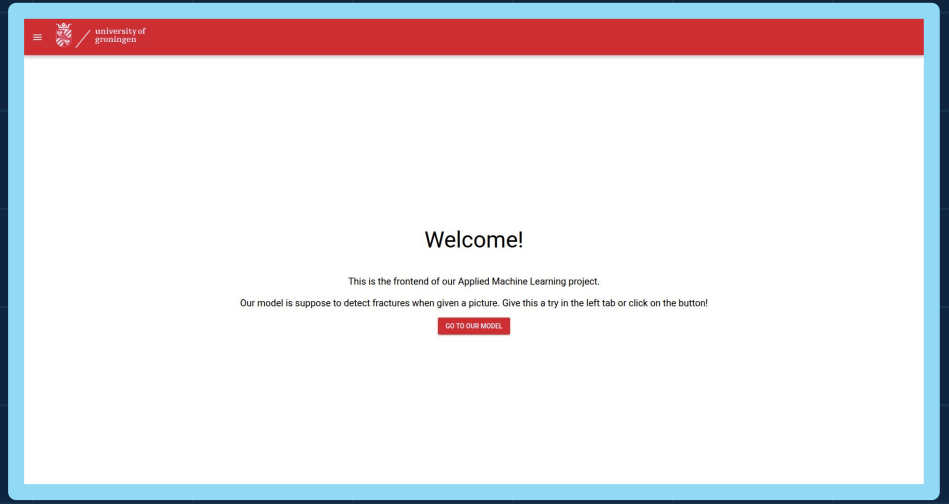
Front-end

To boost our grade, we created a front end for the model. This ensures that the model is user-friendly for doctors that aren't familiar with the back-end



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Conclusion

Insights gained

1. Understanding the process of developing a ML model
2. Importance of experts
3. Relevance of such a tool

Future improvements

1. Data
2. Reduce overfitting

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