Bone Abnormality Detection

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Motivation

- Detecting bone abnormalities is the first task for triage units.
- Essential in determining severity level.
- Requires expert knowledge to accomplish reliably.
- Not all emergency staff may have this knowledge.

The solution

- Develop a model which can reliably detect musculoskeletal abnormalities.

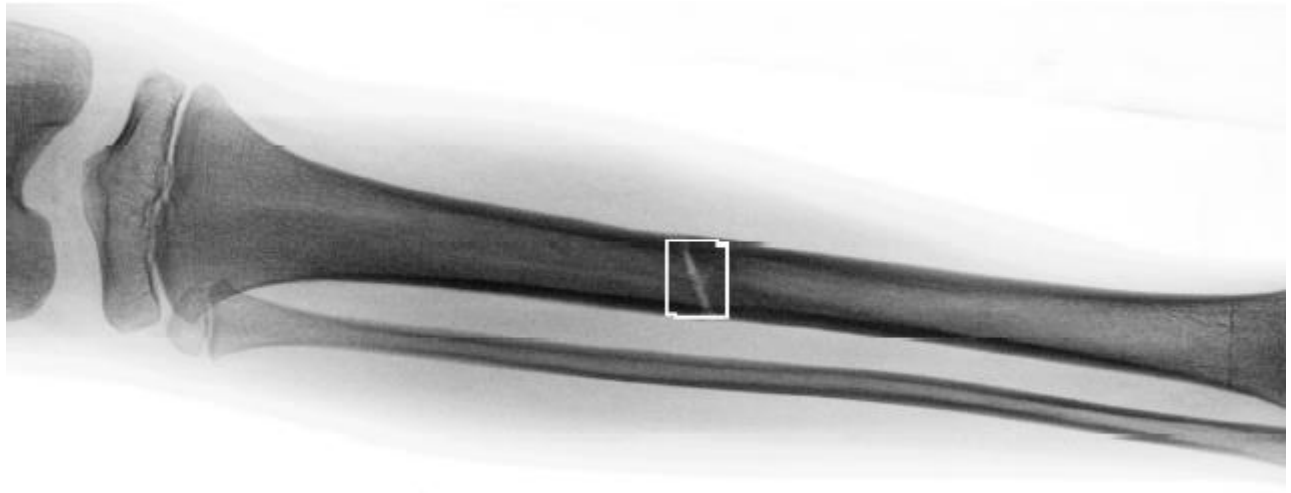


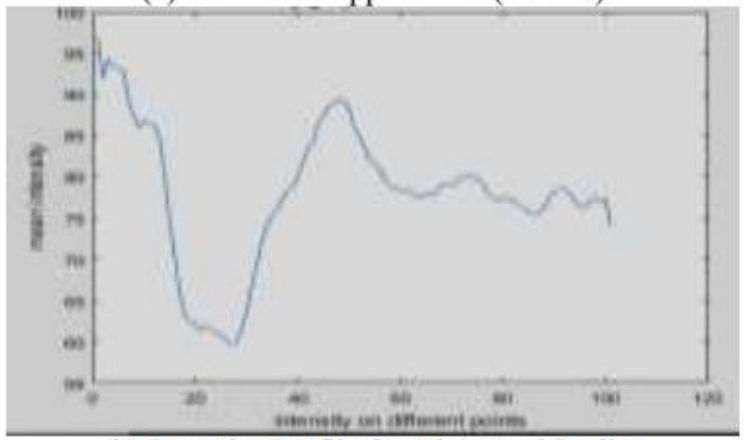
Image from:

Martin Donnelley, Greg Knowles, "Automated bone fracture detection," Proc. SPIE 5747, Medical Imaging 2005: Image Processing, (29 April 2005); doi:10.1117/12.594449

Previous Work

- Most other work uses Deep Learning
  - This requires large datasets and intensive training processes
- Other existing classical computer vision methods are specialised to one type of X-ray location
  - This is to allow the use of specialised features for the region

(a) Abnormal Upper Bone (Radius)



(b) Intensity Profile for Abnormal Radius

Image from:

Afzal, Mashal & Moazzam, M. & Badar, Rizwan & Narejo, Sanam. (2020). Automatic Detection of Elbow Abnormalities in X-ray Imagery. International Journal of Advanced Computer Science and Applications. 11. 10.14569/IJACSA.2020.0111248.

What I want to do

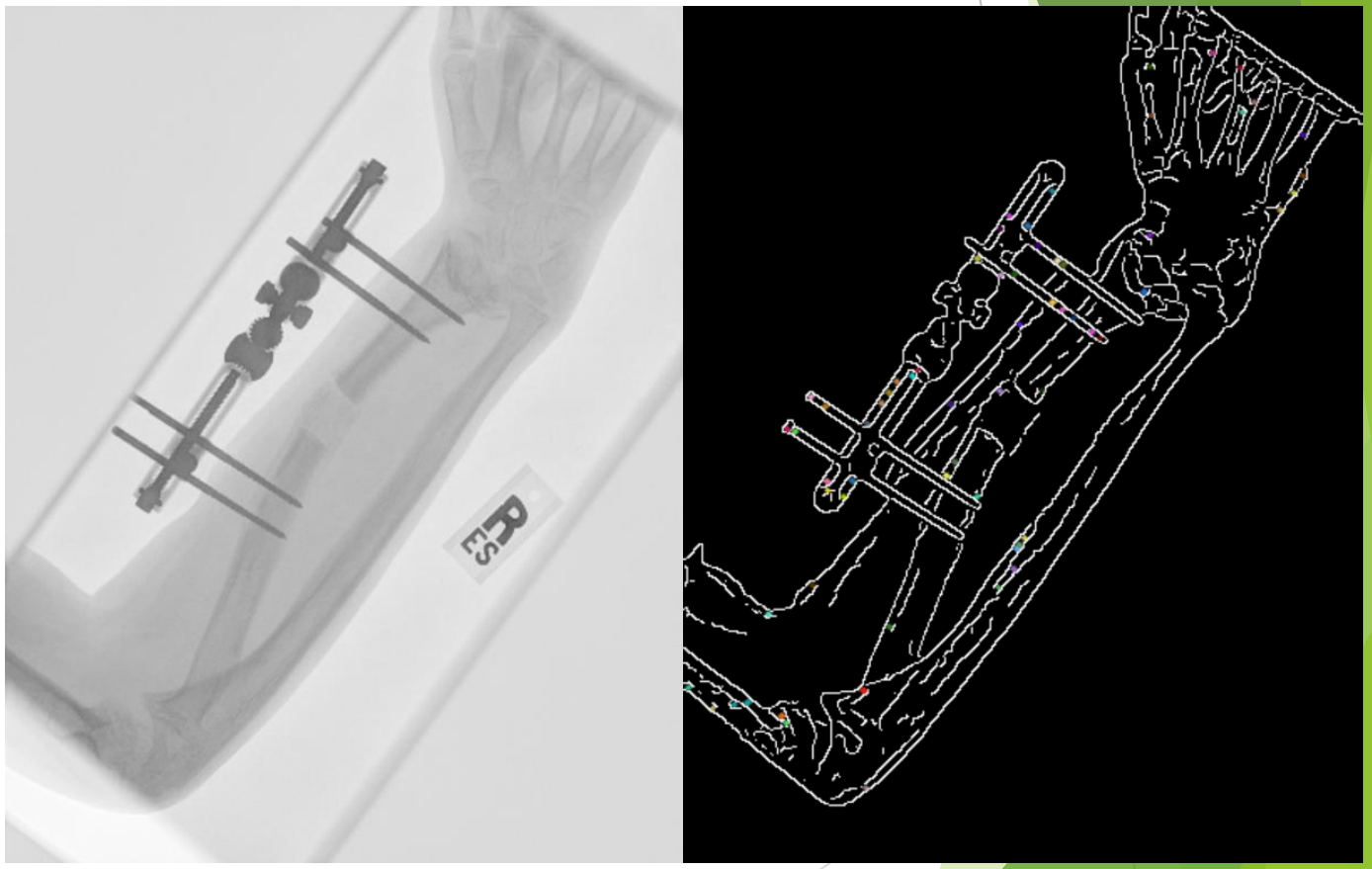
- Create a set of features which are not specific to the X-ray type to classify bone abnormality.
  - No targeted joint/bone detection
  - One set of calculations

Musculoskeletal Radiographs (MURA) dataset.

- Developed by the Stanford ML Group
- Contains radiographs of multiple upper-arm locations (Elbow, Finger, Hand, Forearm, etc.)
- Binary classification, on a ‘study’ basis, detecting abnormalities.
- Studies can have any number of radiographs.

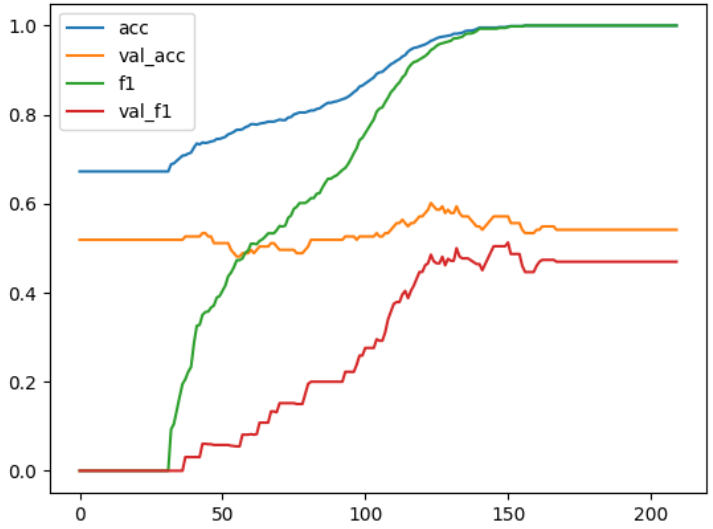
Current progress:

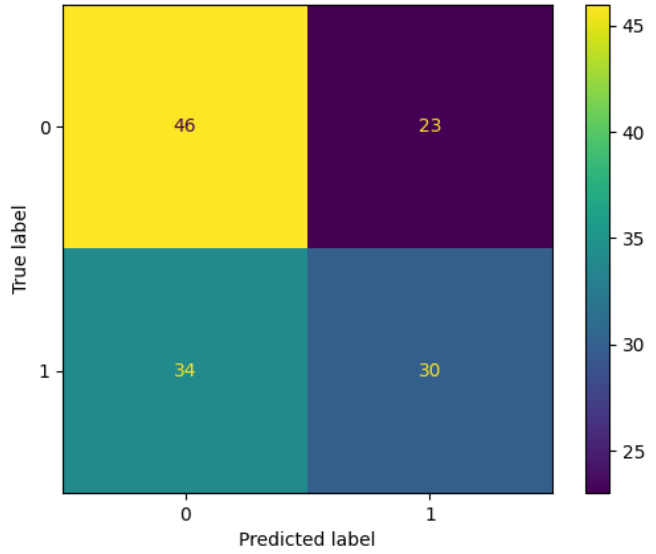
- Features:
  - 100 SIFT keypoint features
    - Colour inversion: white background, black lines
    - Gaussian Blur and Greyscale Morphology
    - Background removal
    - Canny Edge detection
  - PCA dimension reduction



Current progress:

- Classifiers:
  - Forearm RBF-kernel SVM, Top-50 PCA components, C= 654.4
  - Validation F1 score: 0,51





Planned Classifiers

- MLP
- Random Forest
- Ensemble Statistical classifiers
- CNN (if time permits)

Thanks!

Questions?