Bone Doctor

Team Bravo

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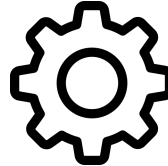
Problem background

- Assist clinicians with analysing X-rays in hospitals
- Often untrained staff

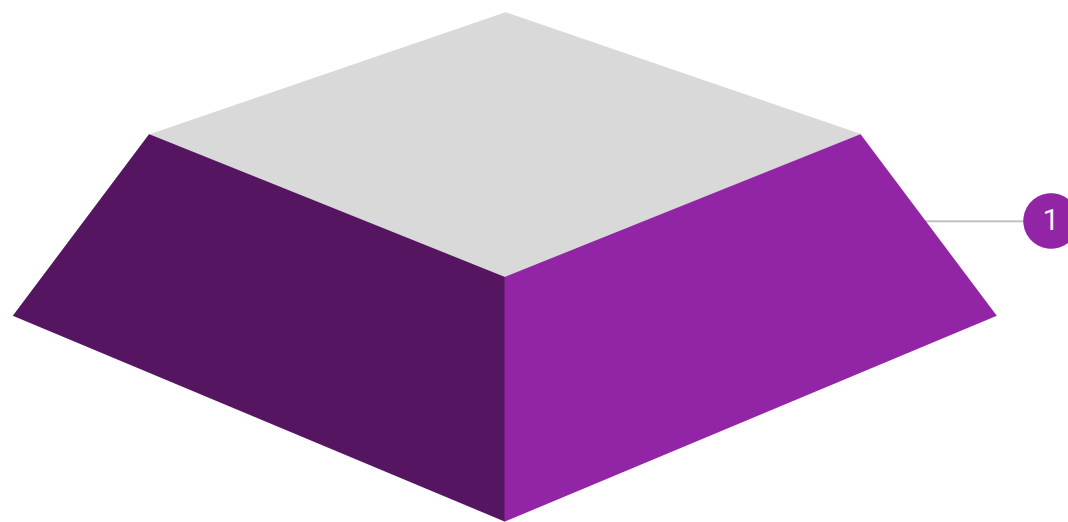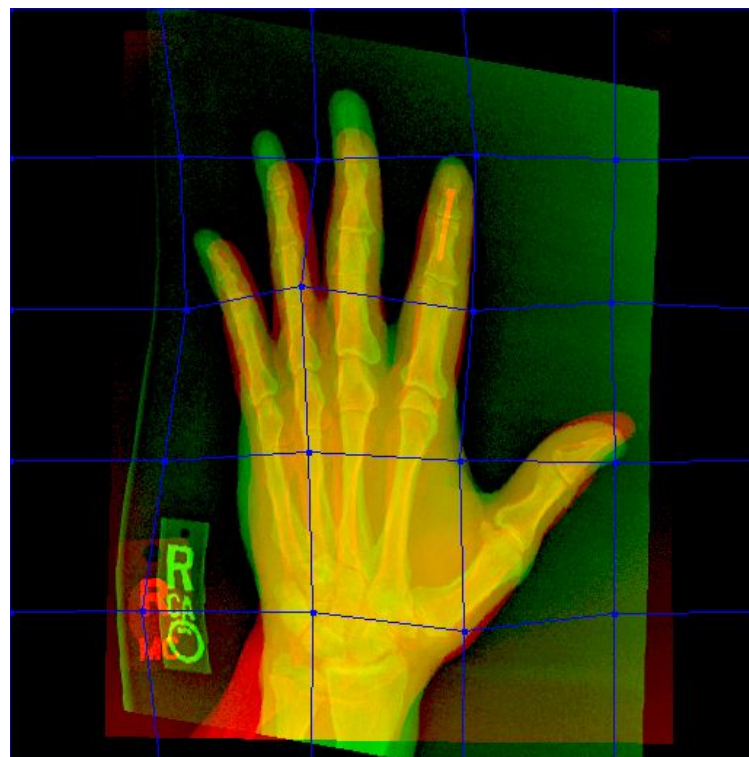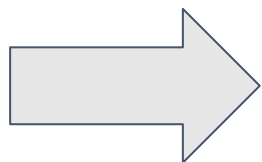| X-ray	Bone doctor	Review by a clinician
Patient comes X-ray is taken	Produce information useful for the clinician	Decide on next steps

Features

Features

1

Refine the X-ray
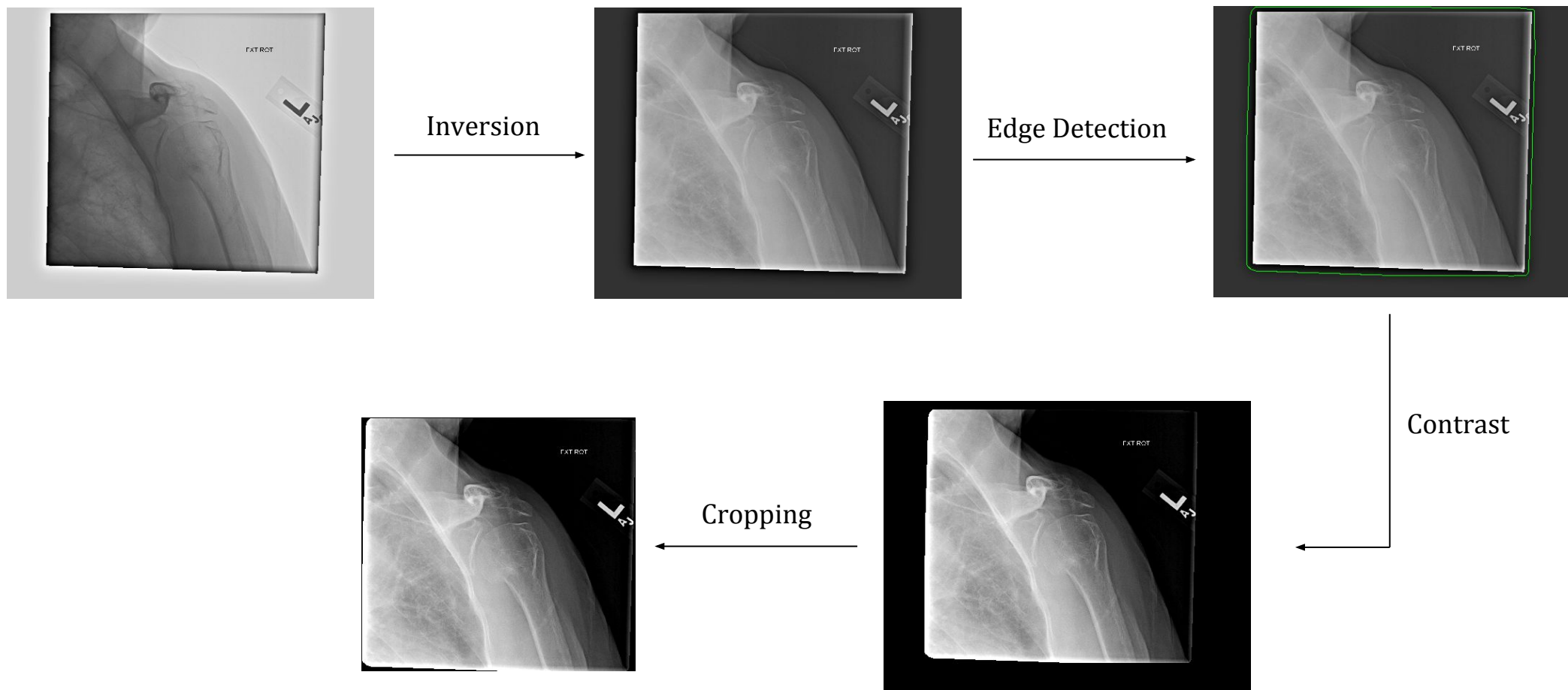
Make the X-ray more
readable for the clinician

Results

The MURA Dataset
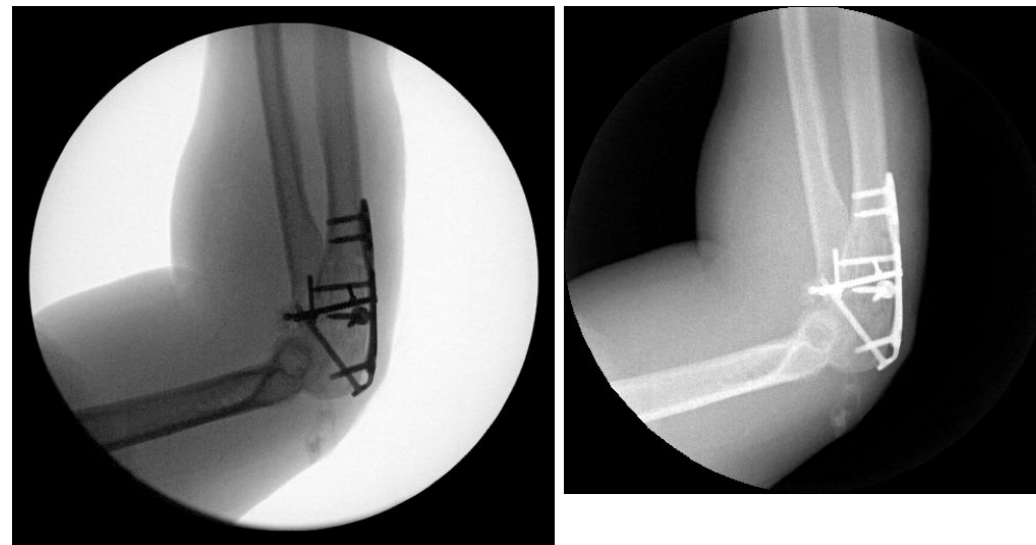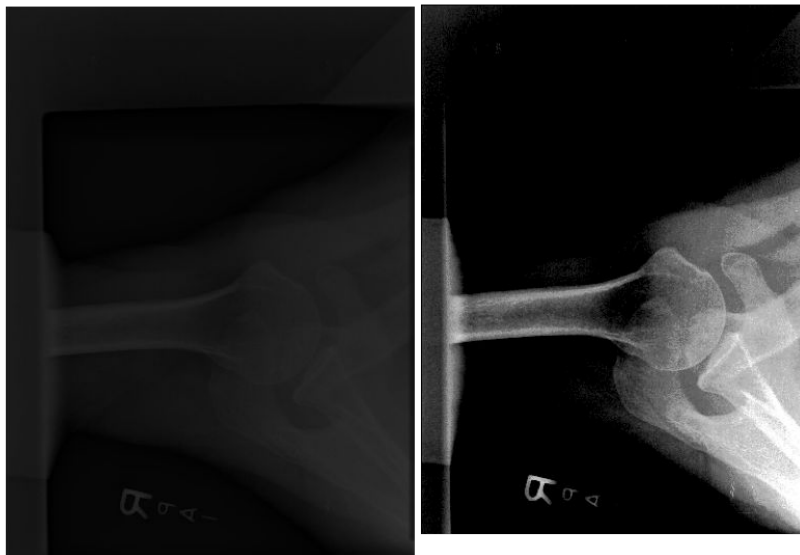
- Classified body parts
- Classified normal / abnormal
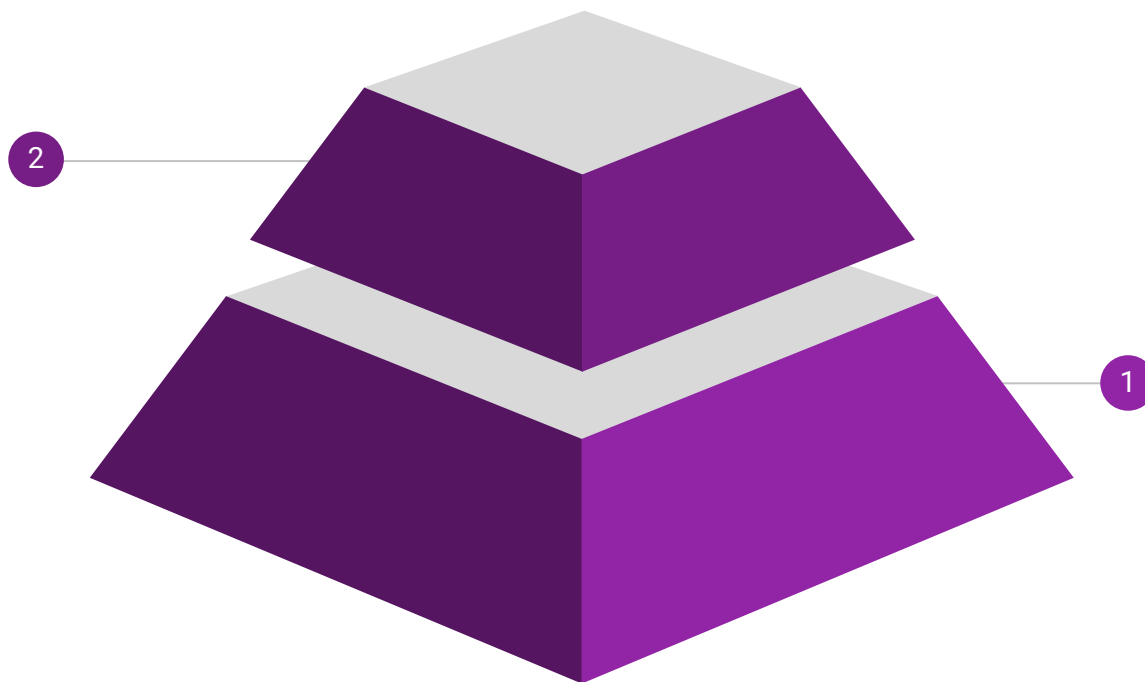
Refining the X-ray

Refining the X-ray

Features

Find a fracture

Classify normal / abnormal,
highlight abnormalities

2

Refine the X-ray

Make the X-ray more
readable for the clinician

1

Classification of Normal/Abnormal

- A binary classification model to distinguish between normal and abnormal X-ray images.

Difference Highlighting

- We use our matched image in order to highlight abnormalities in the original image.
- In order to do this, we found a way to encode each pixel in a training image into a hashset so that the highlighter only has to do a lookup to determine if a pixel is abnormal.
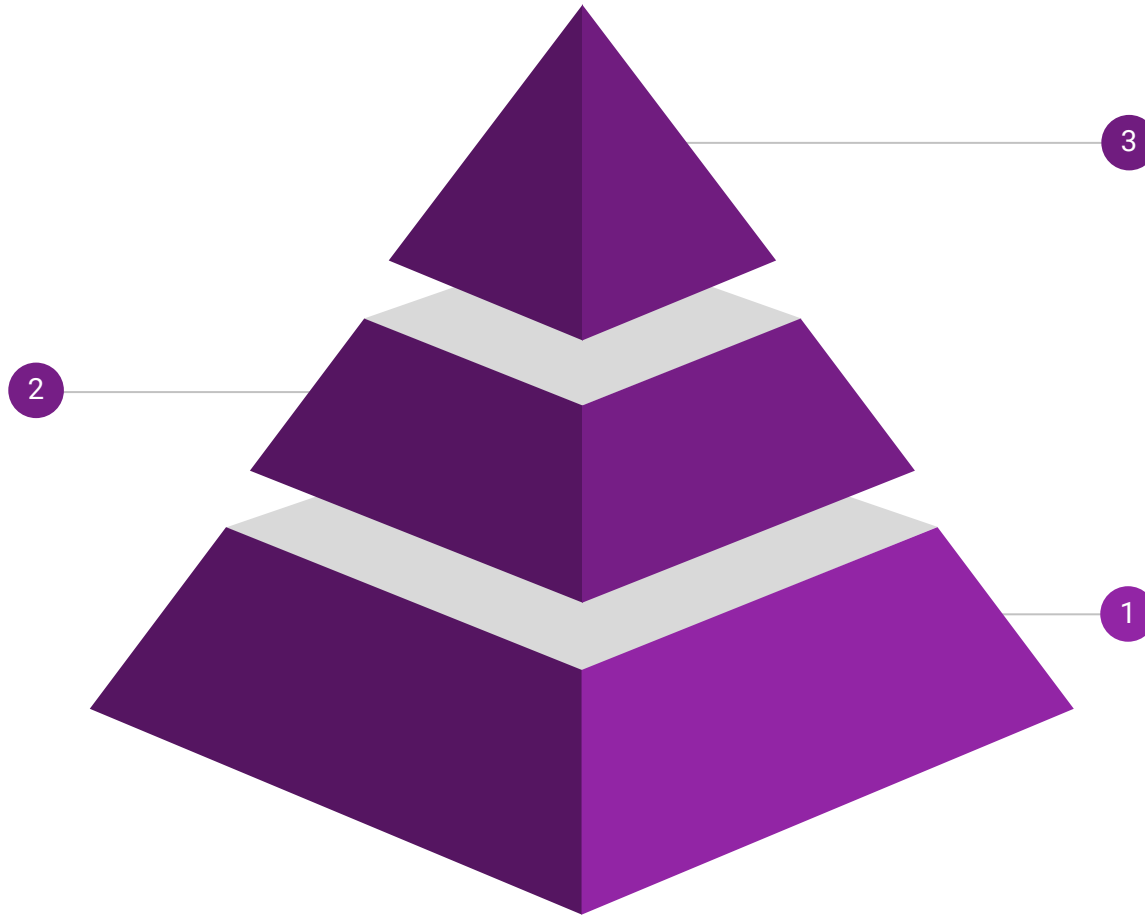
Features

Compare with similar cases

③ Use X-rays with similar views of the same body part to compare differences

Find a fracture

② Classify normal / abnormal, highlight abnormalities

Refine the X-ray

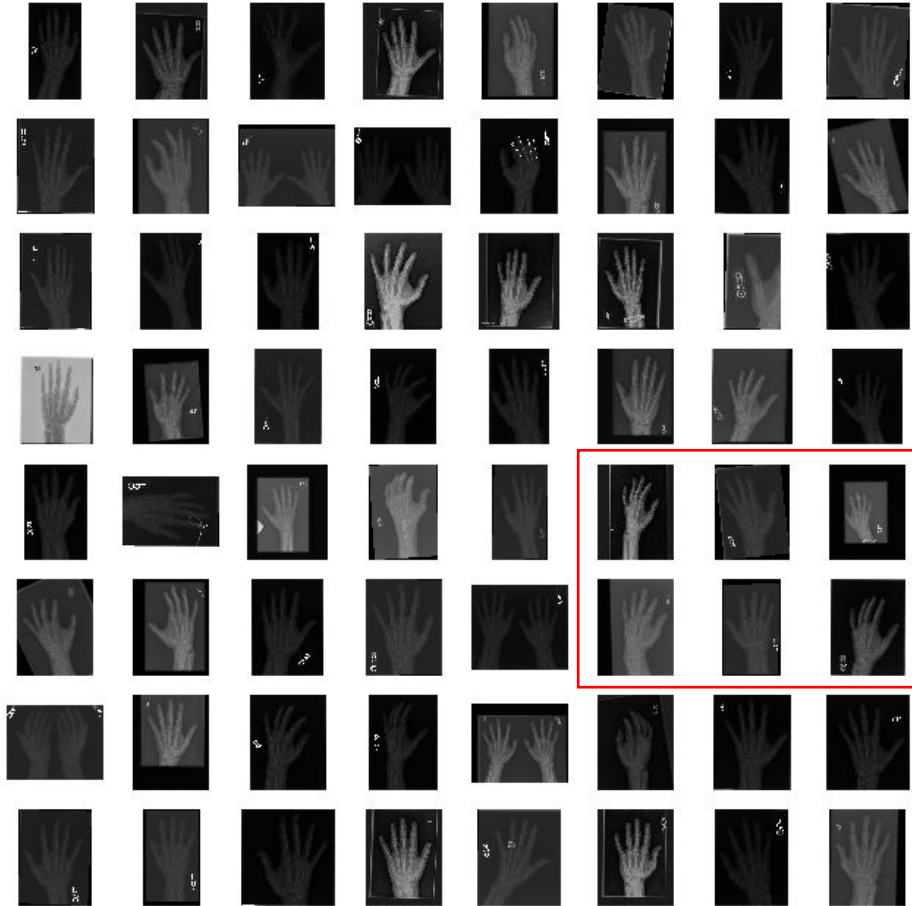① Make the X-ray more readable for the clinician
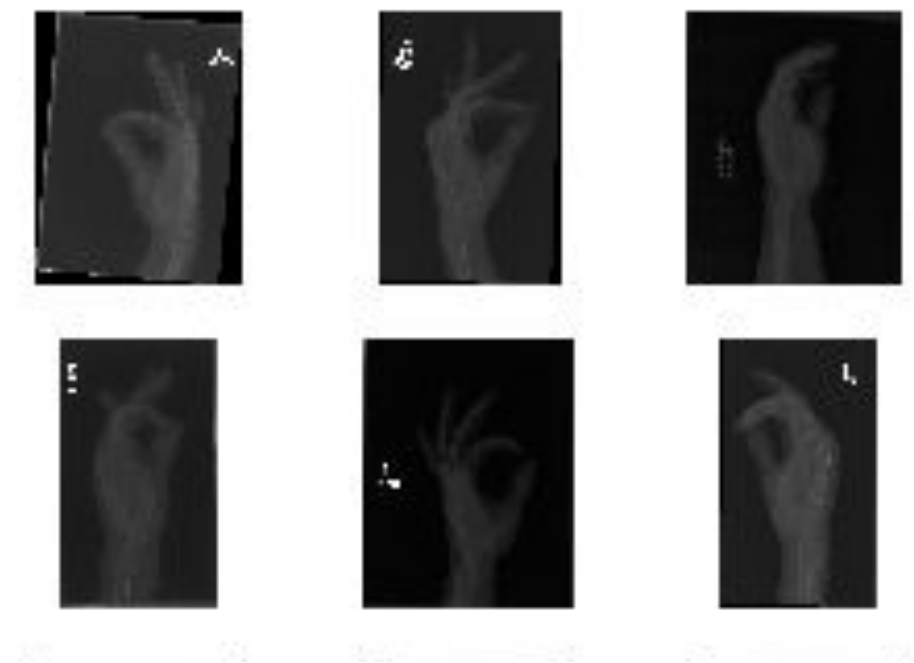
Clustering of Images

- Different views of each bone

- Unsupervised learning
- X-rays in dataset → feature vectors
- Input X-rays are assigned to pre-computed clusters
- Cluster quality evaluated by silhouette score (~+0.1)

Clustering of Images

Clustering of Images

Searching for Matching Images

- Using image hashing to locate the most similar subset of images.
- Given an input image, choose the most similar image from the subset by computing the cosine similarity of the images' feature vectors.
- Higher cosine similarity = greater visual similarity
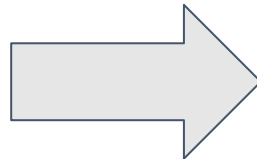
Input Image

High Score

Low Score

Image hashing

- 40,000 images
- Searching all would be impossible in real time
- We instead use a hash function in order to compress the images
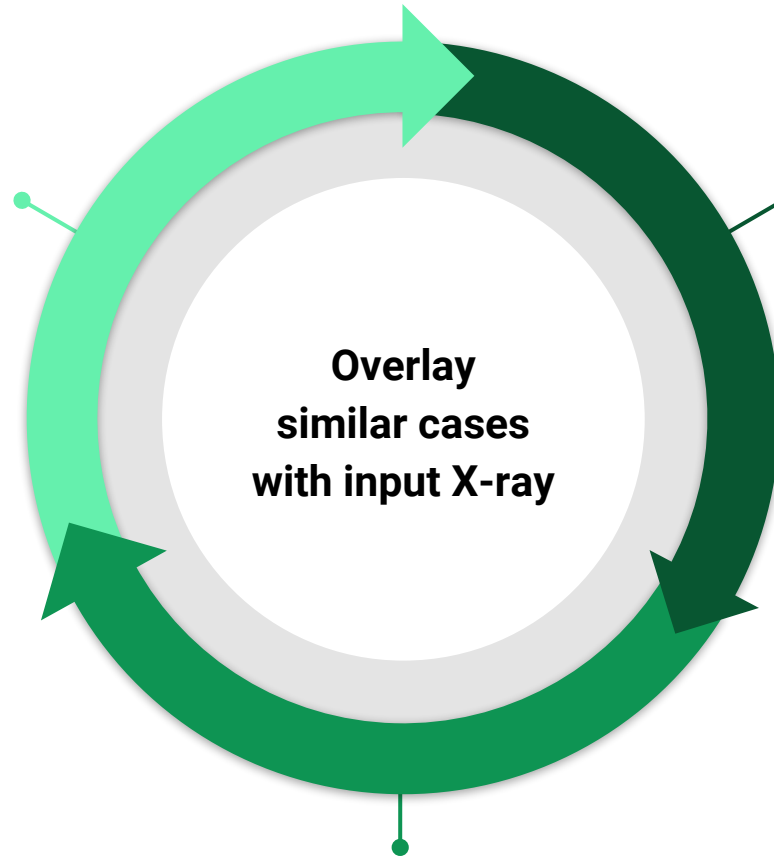- A perceptual hash is one where visually similar images hash to the same thing or almost the same thing

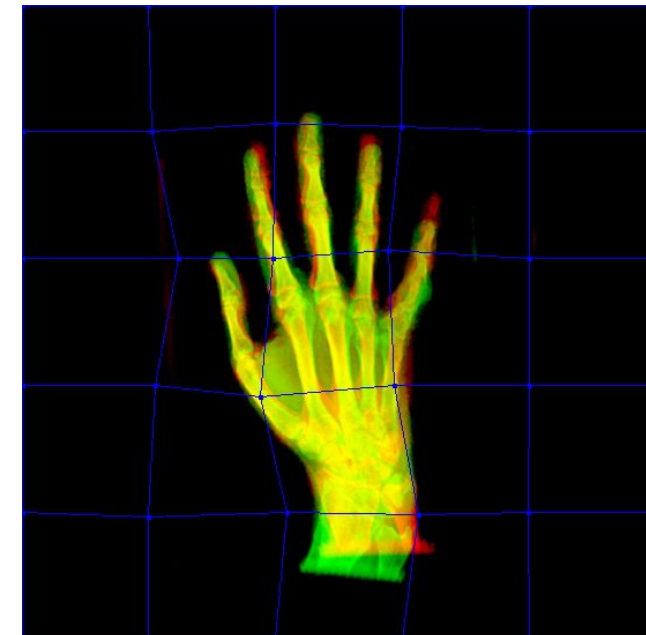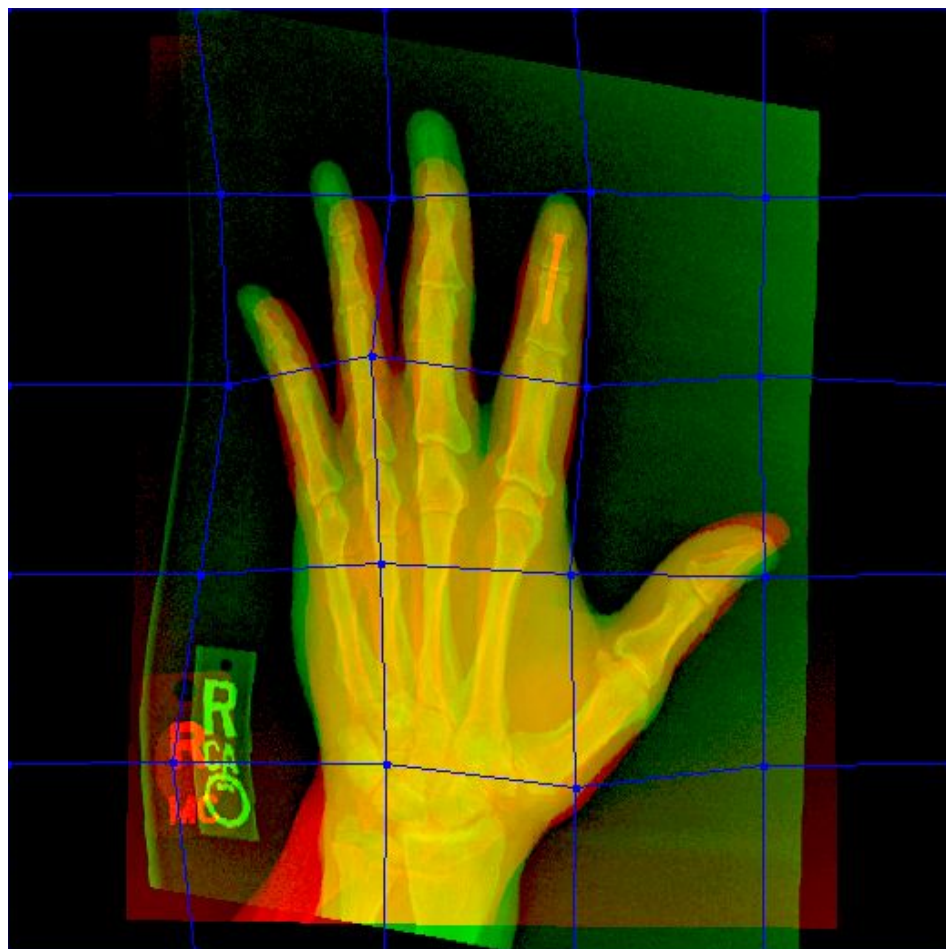# Found similar images

Overlaying of Images

Transform

Affine and Warp transforms

Minimise

using the BOBYQA optimising algorithm

Overlay similar cases with input X-ray
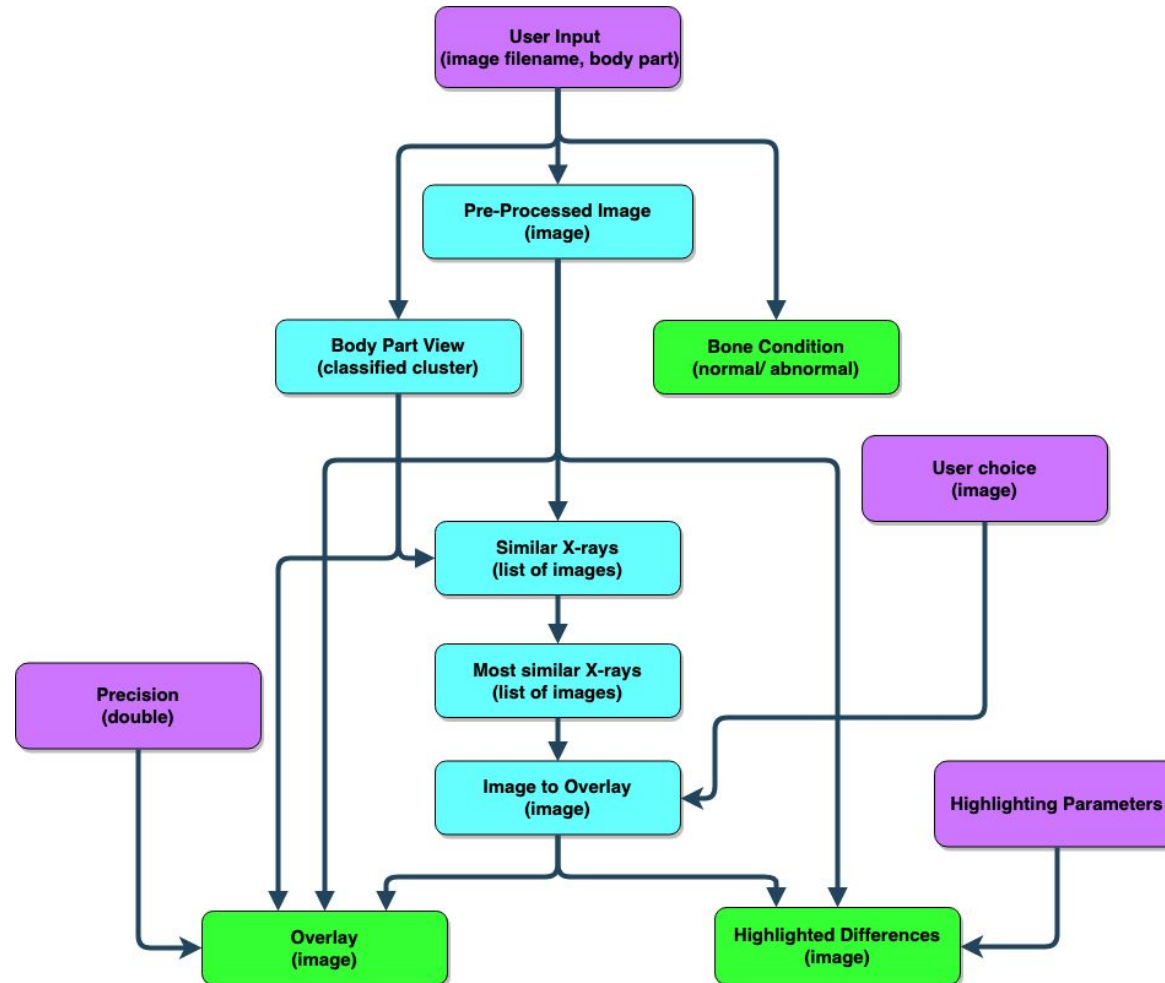
Evaluate

Calculate difference between images

Results
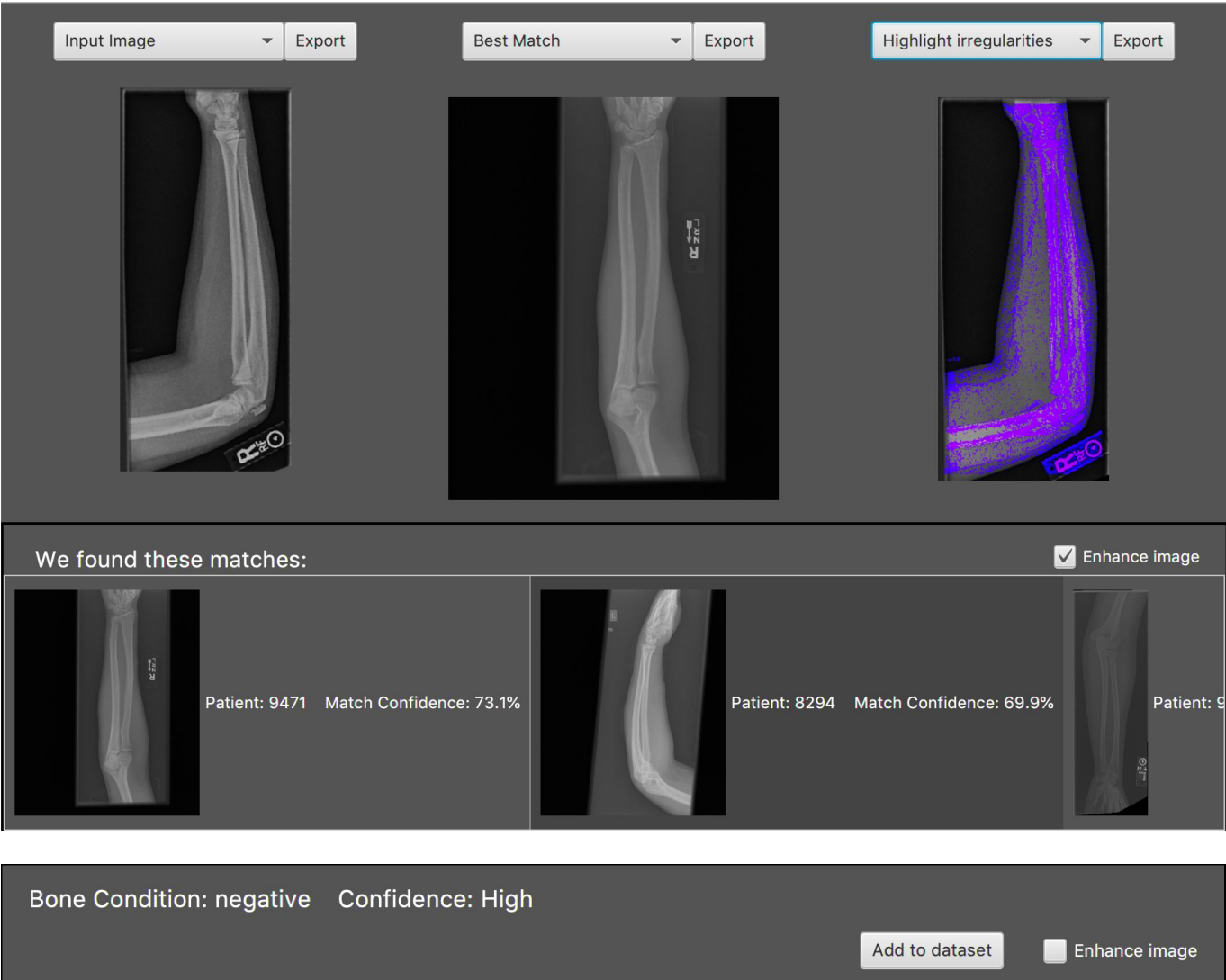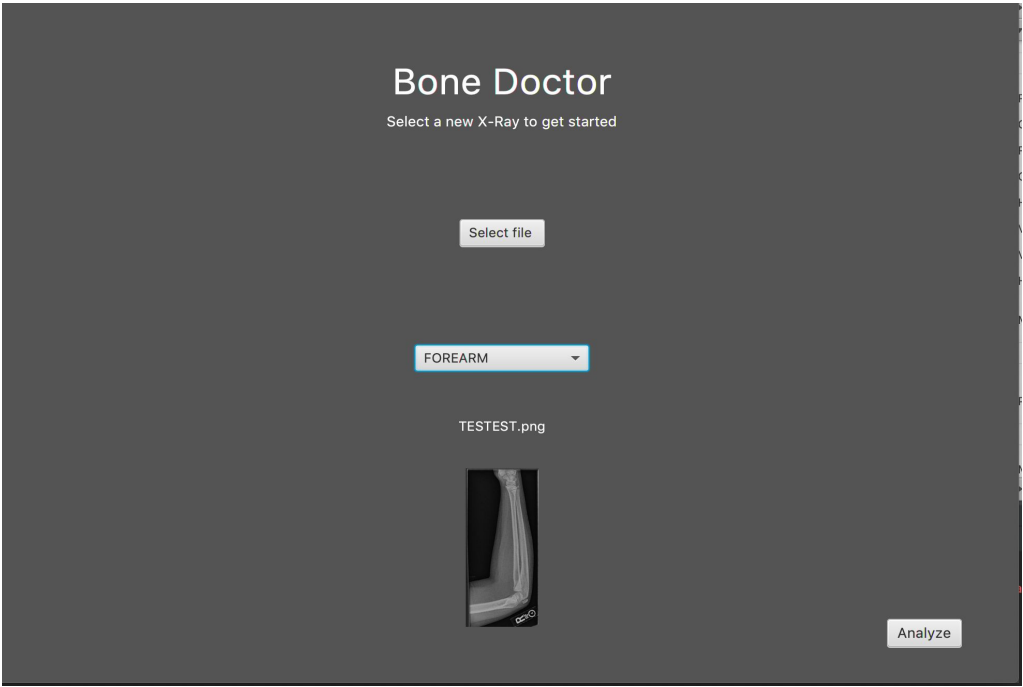
Connecting the components

The User Interface

Bone Doctor

… taking healthcare three steps further

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