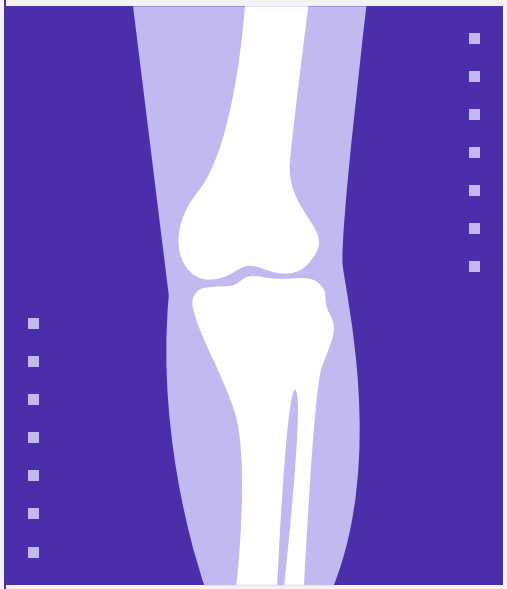
FINAL



BONES DETECTION

Image Processing

Jacopo Caratti and Cyrill Rohrbach

TABLE OF CONTENTS

SOURCE

Segment bones in the given hand radiography images

MAGIC

OUTPUT

3

IMPLEMENTATION

I MASK GENERATION

Create mask of the bones

Preprocessing 1

Normalization
Transform pixel values to values between 0-255

Clahe Histogram Equalization
Adaptive histogram equalization

Butterworth High Pass Filter
Removes low-frequency (hand) preserving high-frequency components (bones)

Preprocessing 2

Make bright brighter

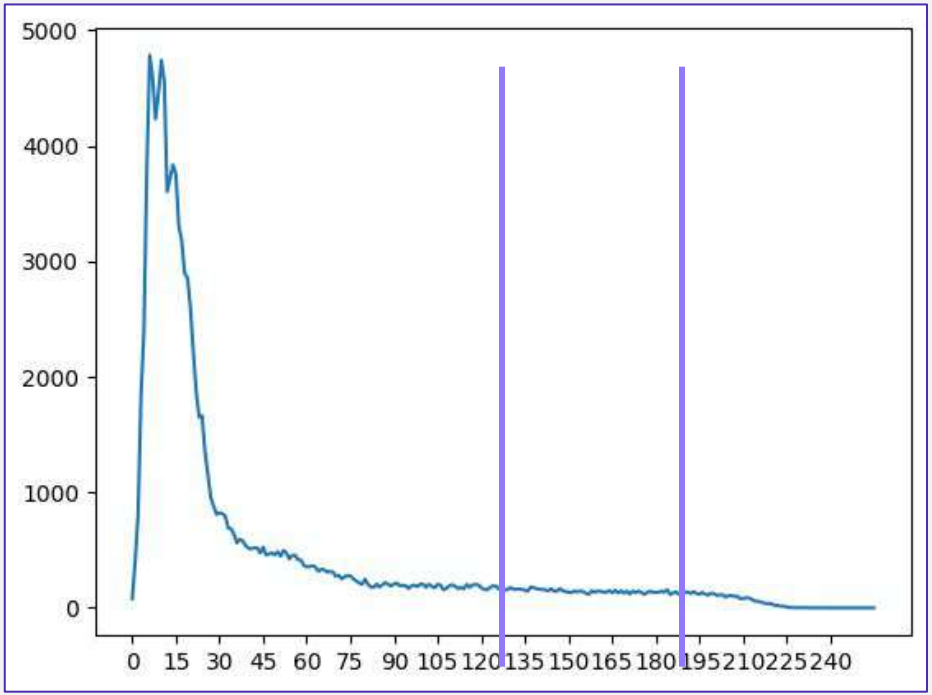
Highlight the bones
Multiply by 0.5 all pixel values less than a threshold

Make dark darker

Hide the hand
Multiply by 3 all pixel values higher than a threshold

Challenge: Determine the thresholds

Thresholds Calculation



Bright threshold

Target the brightest 2.5 % of the pixels

Dark threshold

Target the darkest 90 % of the pixels

Preprocessing 3

Binarization

Pixels should either be 0 or 255

Threshold: Bright 12.5 % should be 255 others 0

Fill the holes

Floodfill

Fill all components

Smooth

Smooth the image using Gaussian blur to get more closed components

II MASK APPLICATION

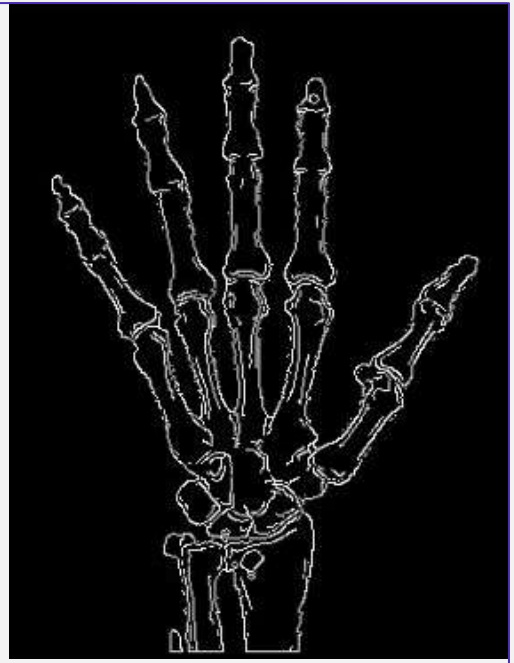
Apply the mask to the original image

III EDGE DETECTION

Detect bones in masked image

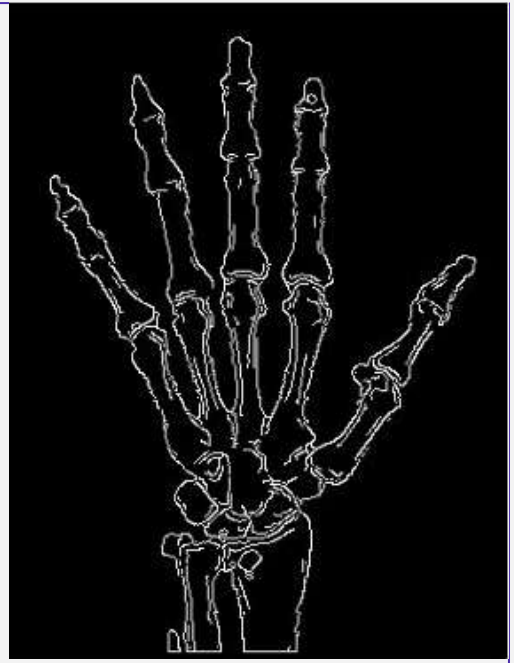
Canny filter

Gaussian filter; Sobel filter;
Non-maximum suppression;
Double thresholding; Hysteresis



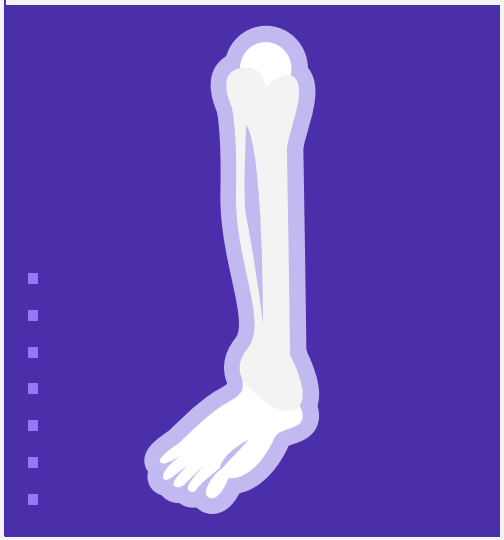
Small segments removal

Discard little not connected white spots



Draw Red Lines

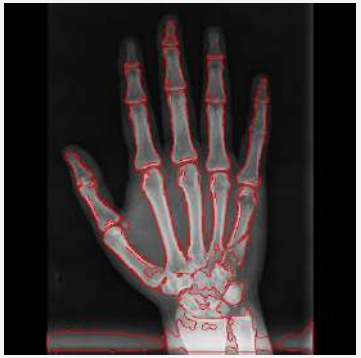
Take the original image and color each pixel that is white in the edge map.



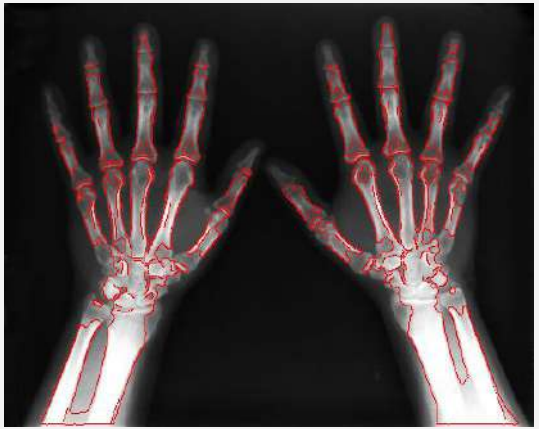
4

RESULTS





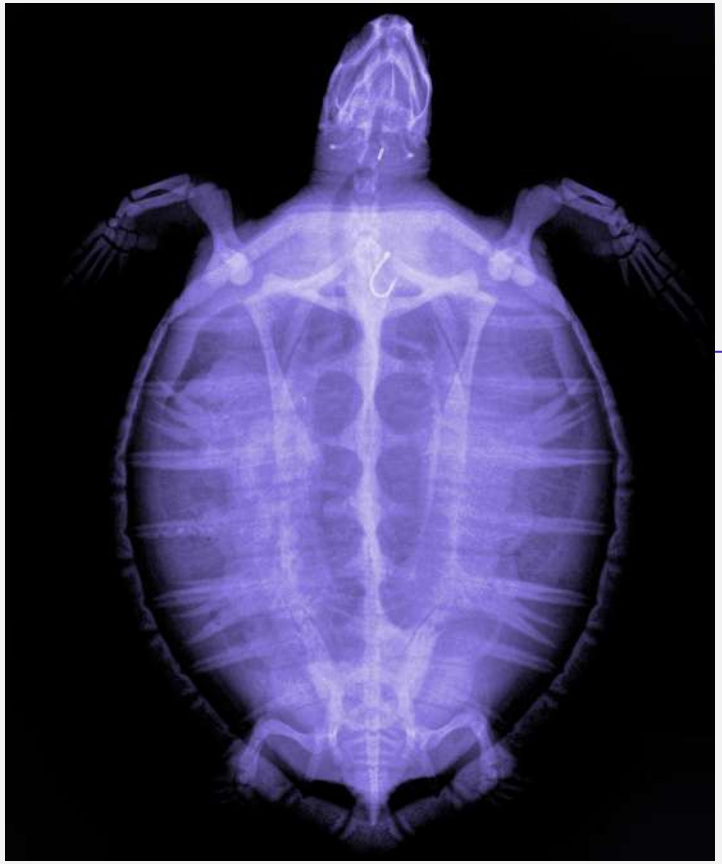

RESULTS


A DEMO IS WORTH A THOUSAND WORDS

CONCLUSIONS

- Recognized to be a tricky task
- Satisfied of the results
- Possible improvements, such as better hyperparameters tuning



LEARNINGS

- Explore numerous techniques
- Mix/Adaptation existing techniques
- Parallelize techniques
- Canny edge detector
- Here it is important to have similar images

Thank you for the attention!

Please clap and don’t make difficult question

SOURCES

IMAGES

- Provided radiography dataset

SLIDES

- This presentation template was created by Slidesgo, including icons by Flaticon, infographics & images by Freepik

INFORMATION

- Lecture slides
- Geeksforgeeks
- Wikipedia
- Opencv documentation