



UNIVERSITÉ
PARIS
DESCARTES



BME PARIS
BioMedical Engineering
MASTER'S PROGRAM

Skin lesion classification

Medical Image Analysis

Project presentation - 19/12/2019

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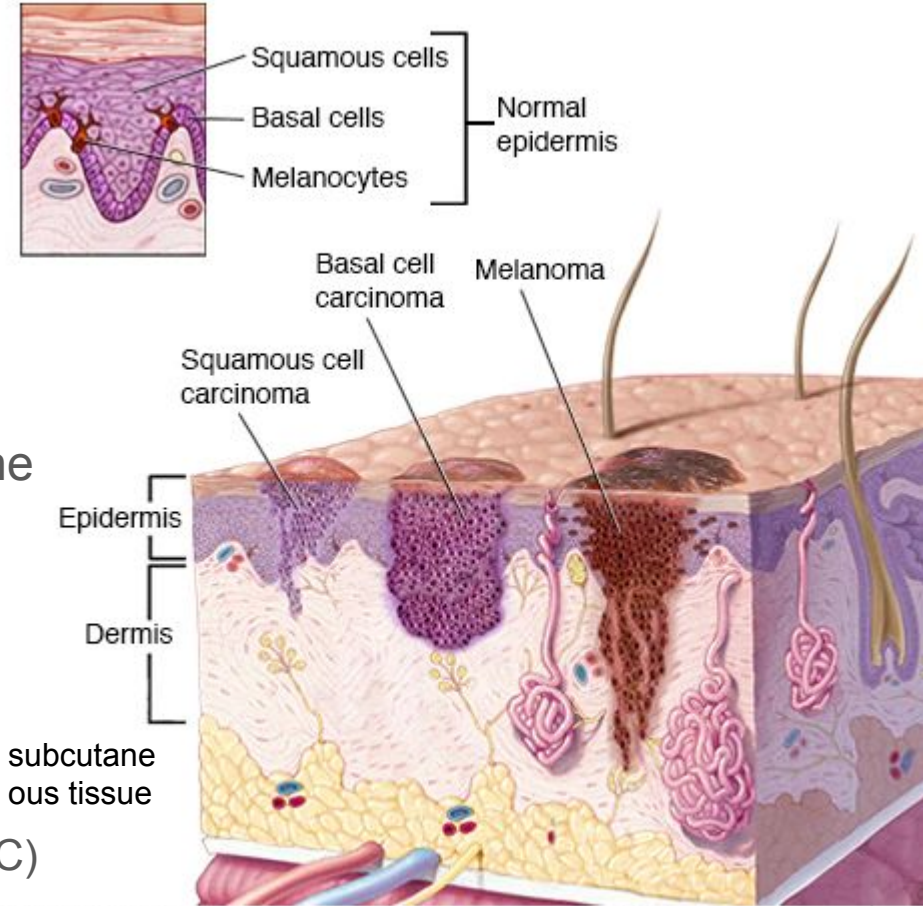
Introduction -skin cancer-

- Skin is the largest organ in the body.
- Skin is made up of 3 layers and many different cells
- The name of skin cancer is depending on the types of cells.




-Melanocyte→ Melanoma

-Basal cells →Basal cell carcinoma(BCC)

-Squamous cell→Squamous cell carcinoma(SCC)

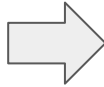


Introduction -Category of skin cancer-

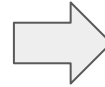
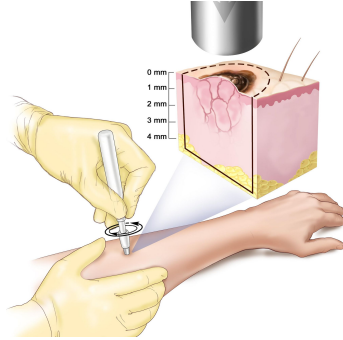
Type	Malignant	Benign	
Subtype	Melanoma	BCC	SCC
appearance			
Morbidity	less than 2 % of all cases in skin cancer	Most frequent	Second frequent
Mortality	Most lethal	Curable	Curable

Introduction -typical diagnosis of skin cancer-

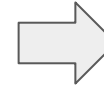
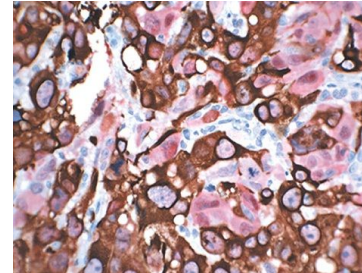
Dermatoscopy



Biopsy



Histological staining



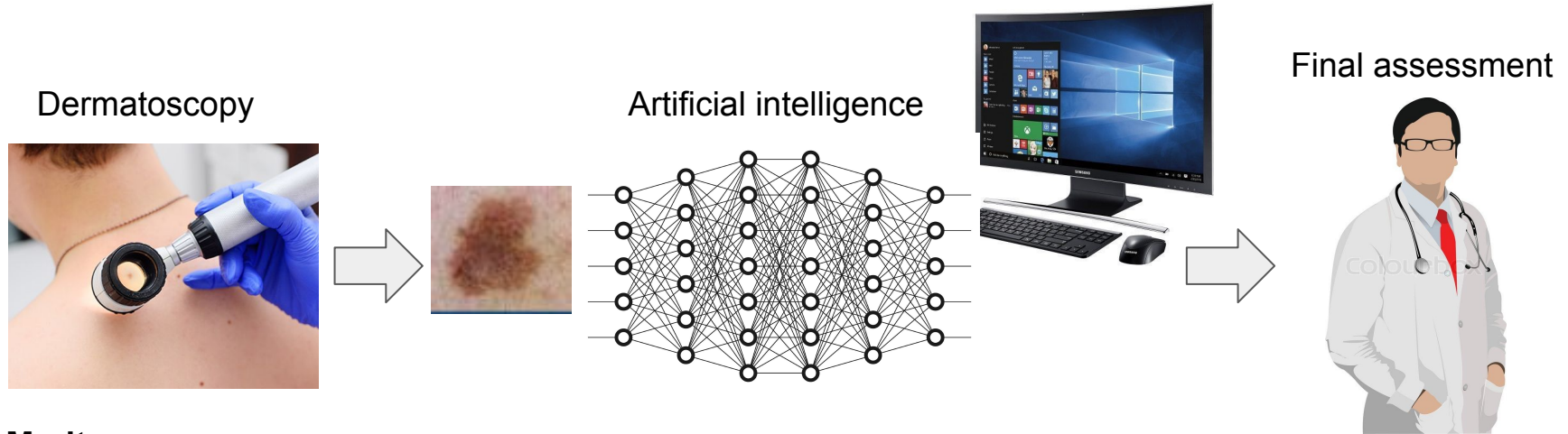
Final assessment



Drawbacks

- Invasive method
- Time and cost consuming
- Human errors

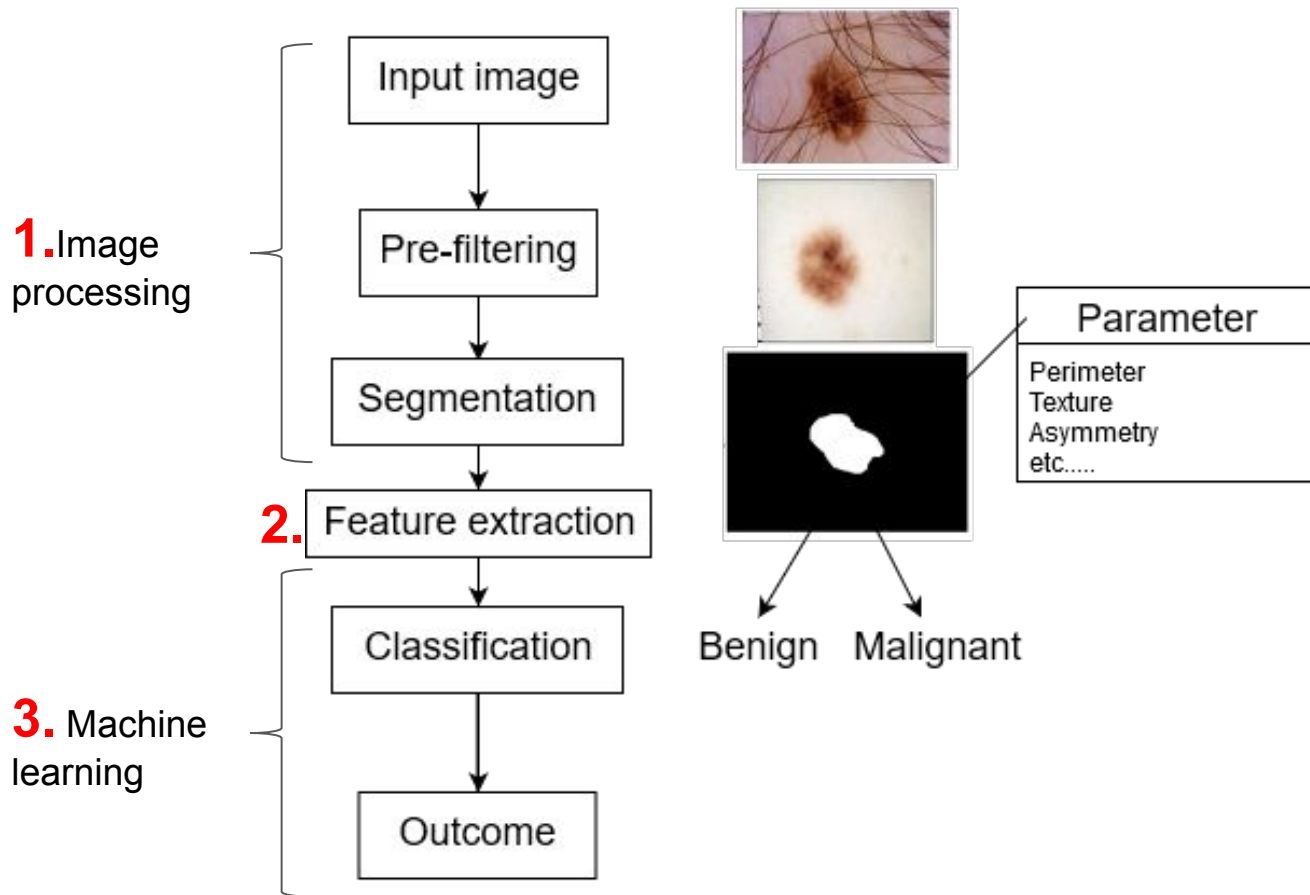
State of the art -Computer aided diagnosis(CAD)-



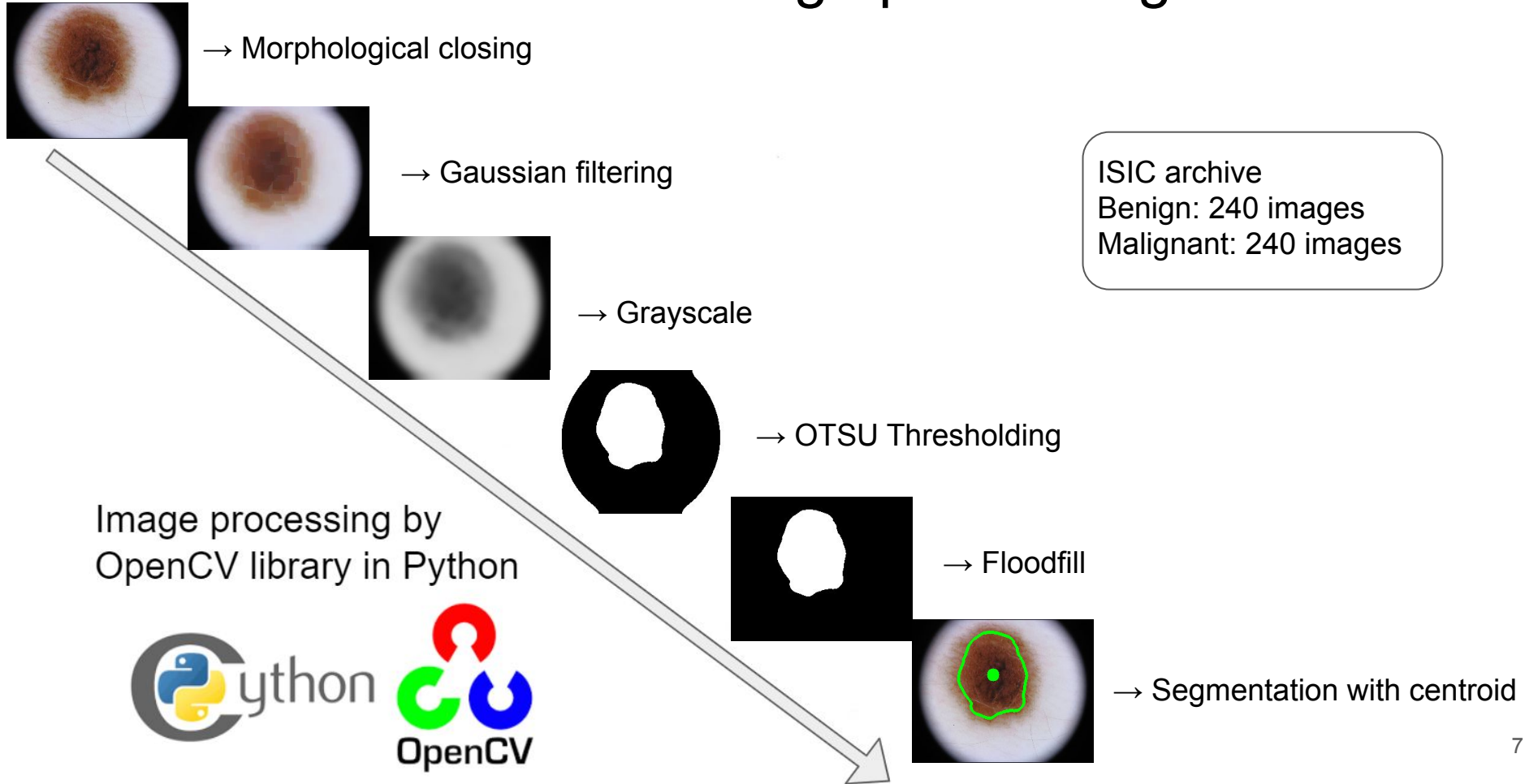
Merit

- Noninvasive method
- Quickly
- Precise decision

Our approach



Scheme of Image processing



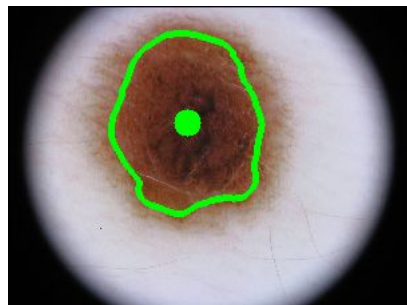
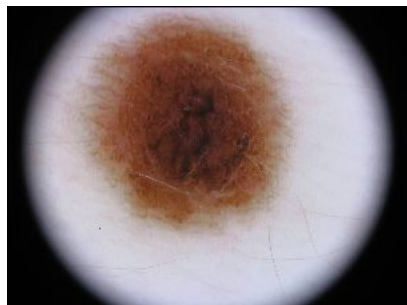
Prefiltering and segmentation - results

Good segmentation

One contour

Benign: 79,16%

Malignant: 50%



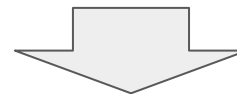
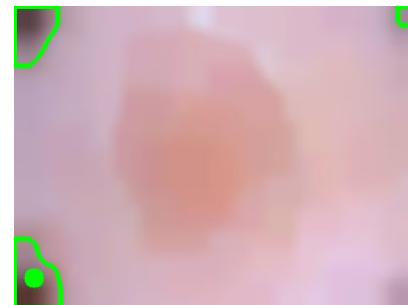
Feature measurement

Bad segmentation

Zero or multiple contours

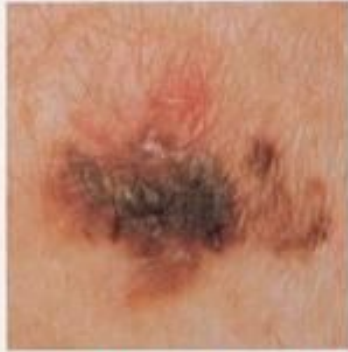
Benign: 20,84%

Malignant: 50%



Filtered out

THE ABCDs OF MELANOMA



A ASYMMETRY

one half unlike
the other half



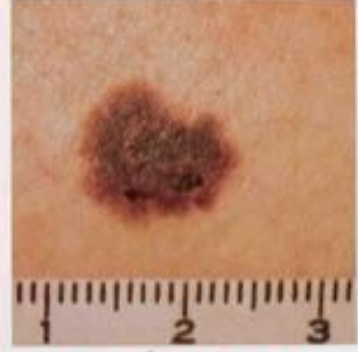
B BORDER

irregular, scalloped
or poorly
circumscribed
border



C COLOR

varied from one
area to another;
shades of tan and
brown, black;
sometimes white,
red or blue



D DIAMETER

larger than
6mm as a rule
(diameter of
pencil eraser)

Computed values

Size	Shape features	Color features
Diameter	Asymmetry index $AI = \frac{height}{width}$	Histogram analysis (mean, standard deviation)
Perimeter	Circularity index $CI = \frac{4 \times perimeter}{area^2}$	Ratio of highly pigmented region to low pigmented regions area
Area	Border irregularity $BI = \frac{perimeter^2}{area}$	-
-	Compactness $C = \frac{perimeter^2}{4 \times \pi \times area}$	-

Evaluation of extracted features

- Neglect incorrect segmented images
- Calculate and compare feature values for both benign and malignant skin lesions

-	Area	Perimeter	Diameter	AI	CI	BI	C
Benign	10730.63	385.46	124.37	1.13	0.25	16.25	1.29
Malignant	10646.86	381.86	116.98	1.15	0.23	18.98	1.51

AI - Asymmetry Index; CI - Circularity Index; BI - Border Irregularity; C - Compactness

Classification using supervised learning algorithms

Cross validation

Data division to training (80%) and test (20%) sets for mixed malignant and benign lesion.



Supervised learning classification

1. Linear Discriminant Analysis
2. Quadratic Discriminant Analysis
3. K-nearest neighbor (for multiple k)



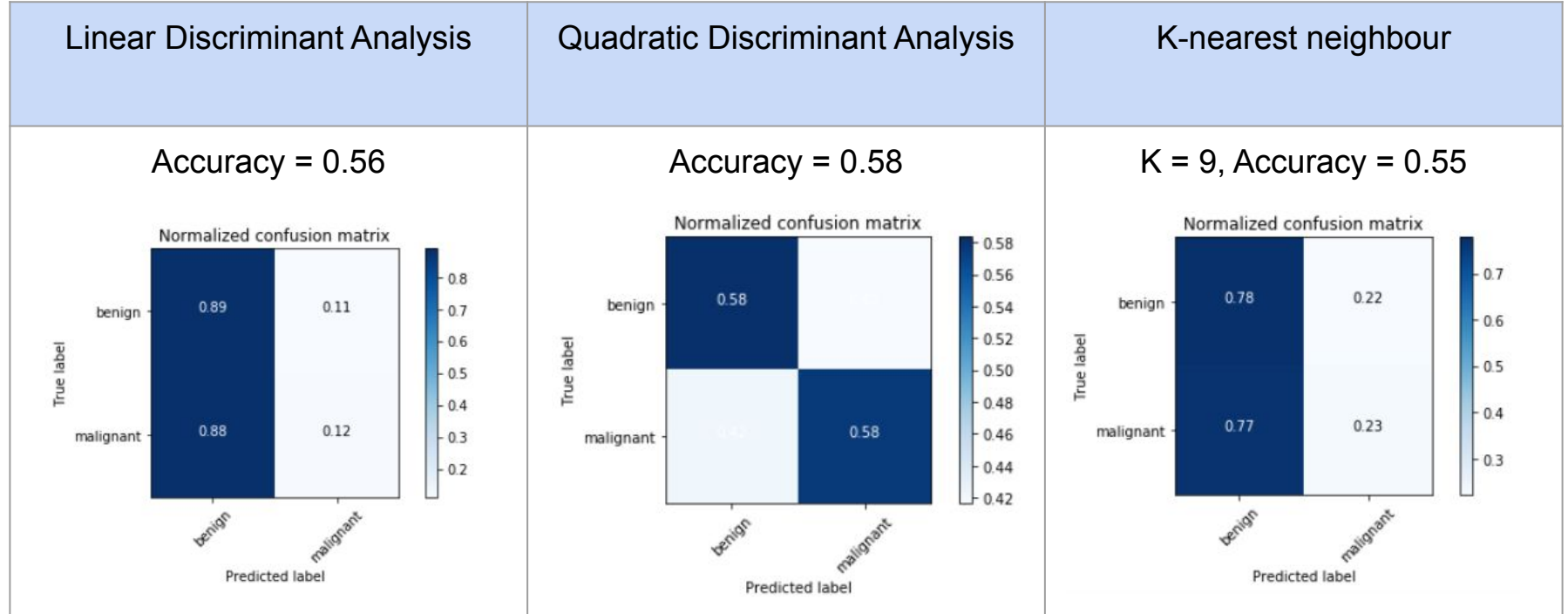
Classification of benign and malignant skin lesions

Output: final diagnosis



ISIC

Evaluation of classification algorithms



Conclusions

- Segmentation rate was low especially for malignant cancer datasets
- Extracted features of benign and malignant skin lesions had on average similar values (except of border irregularity and compactness)
- Classification of skin lesion was not completely achieved
(Accuracy is around 0.56) → "Quadratic
Discriminant Analysis" was the highest accuracy algorithm

Challenges of this project

1. Segmentation methods

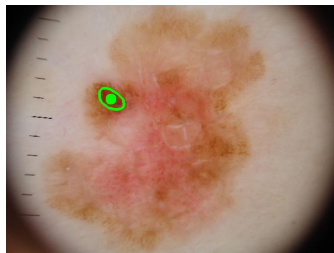
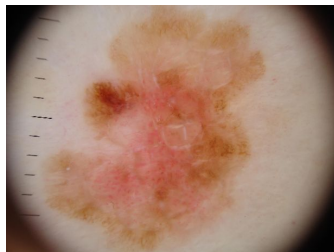
Malignant segmentation were difficult to perform due to their diversity.

Raw
Image



Result

Filtered out
(Due to multiple
segmentation)



Uncorrected
segmentation

2. Lack of features

- Not enough extracted features (7 features)

Ex) in the paper^{[4] [5]}, 29 features were extracted

3. Other algorithm for supervised learning,
or usage of Deep learnings(ex.CNNs)

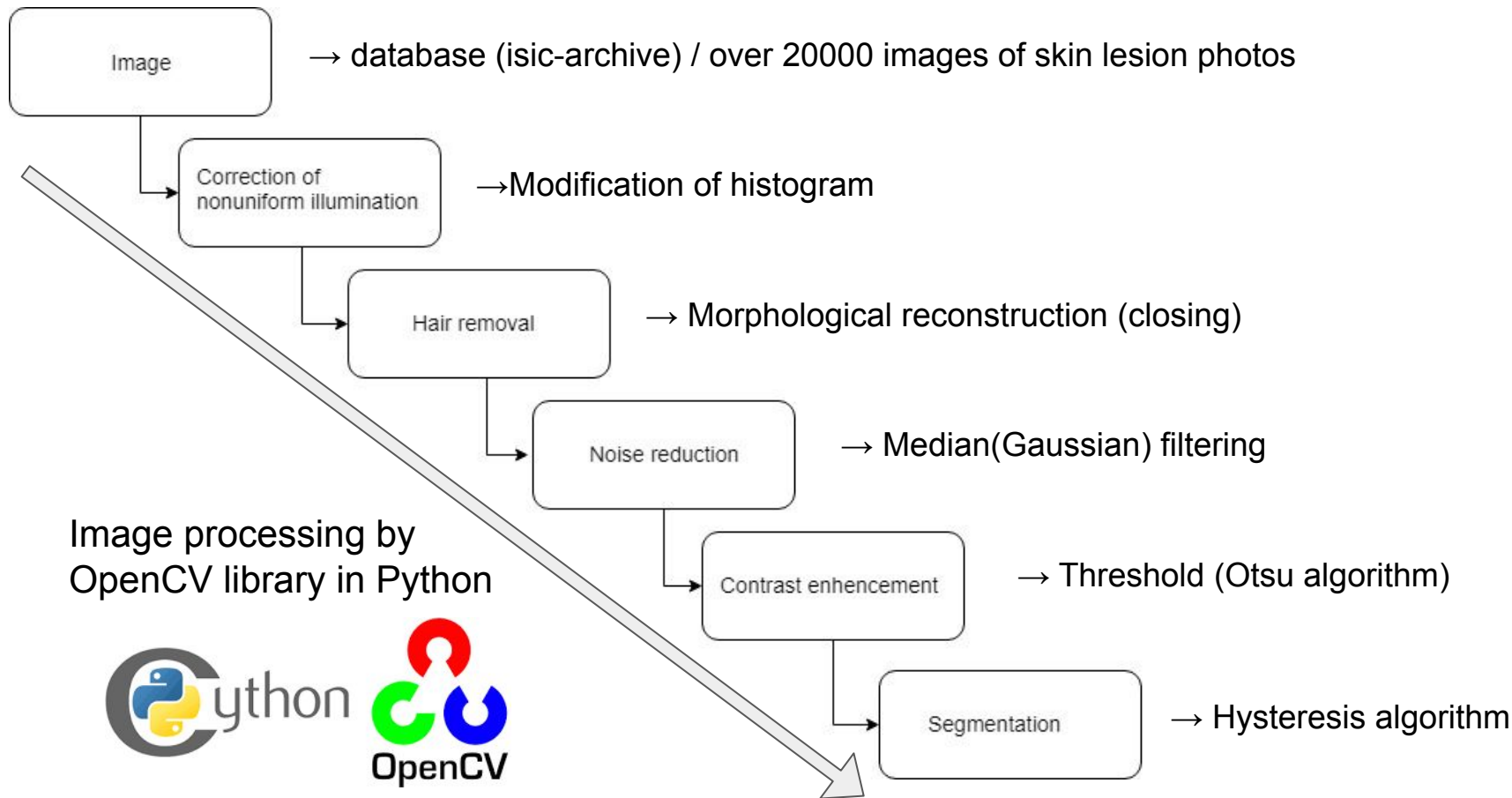
4. Increasing the number of datasets

Bibliography

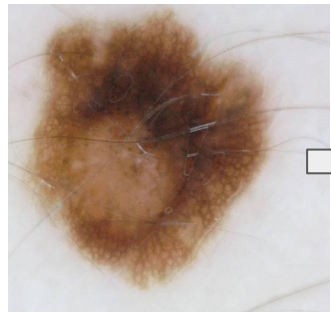
1. *Techniques and algorithms for computer aided diagnosis of pigmented skin lesions—A review* Sameena Pathana et al
2. *A simple weighted thresholding method for the segmentation of pigmented skin lesions in macroscopic images* Maciel Zortea et al
3. *Skin Lesion Segmentation in Dermoscopic Images with Combination of YOLO and GrabCut Algorithm* Halil Murat Ünver et al
4. *Automated melanoma recognition* Ganster et al
5. *Performance of a dermoscopy-based computer vision system for the diagnosis of pigmented skin lesions compared with visual evaluation by experienced dermatologists* Zortea et al.

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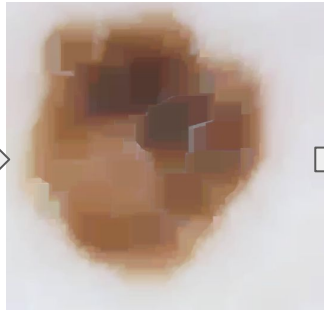
Scheme of prefiltering and segmentation



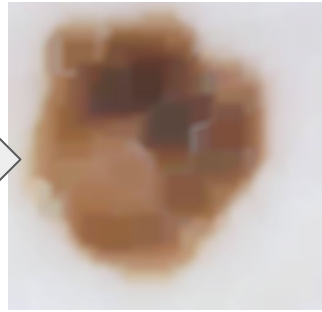
Results of prefiltering and segmentation



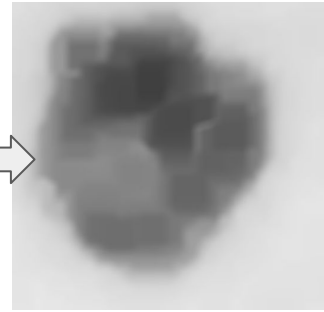
Input



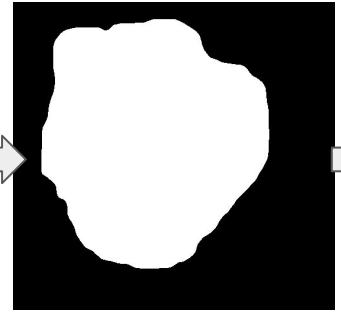
remove hair



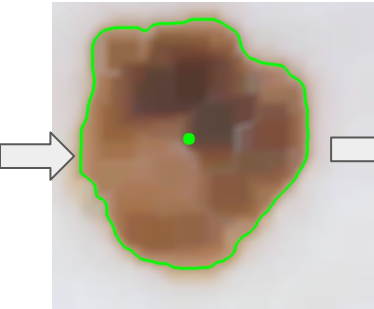
Gaussian blur



grayscale



binary



Contour & centroid



- Centroid: (231, 232)
- Area: 123205.5
- Perimeter: 1385.2



To Feature extraction...
ABCD for skin cancer
categorization