



EE - 451 Coin Challenge

Vincent Roduit
Filippo Quadri



May 2024



O U T L I N E

Segmentation

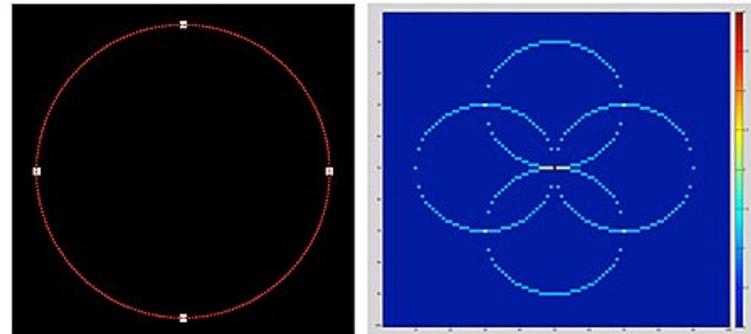
Features Extraction

Classification

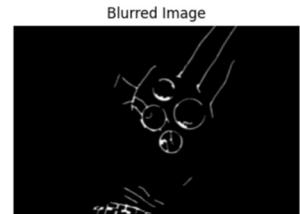
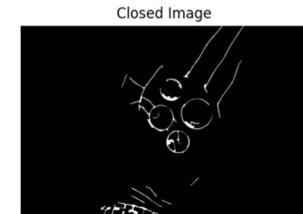
Limits and Solutions

Segmentation Idea

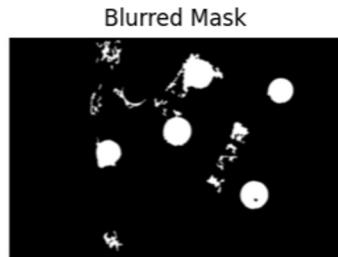
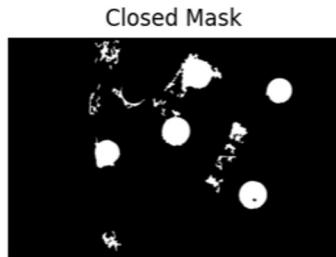
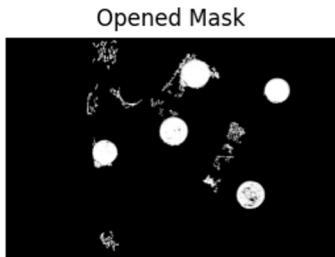
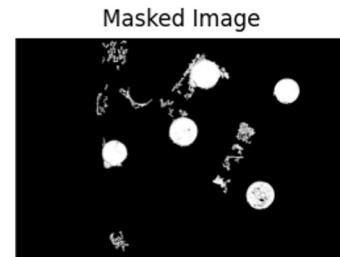
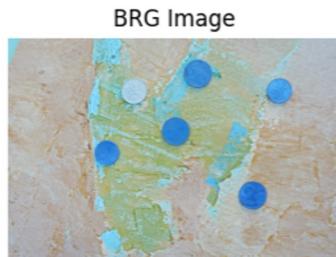
- Detect the background
 - Std. deviation of the grayscale image
 - Neutral distinguished
 - Std. deviation of the edges of the image
 - Noisy and hand distinguished
 - if the edge std. dev is too high (noisy background) some “extra help” is needed
- Circle detection
 - HoughCircles Algorithm



Segmentation Steps



Segmentation Noisy Background





O U T L I N E

Segmentation

Features Extraction

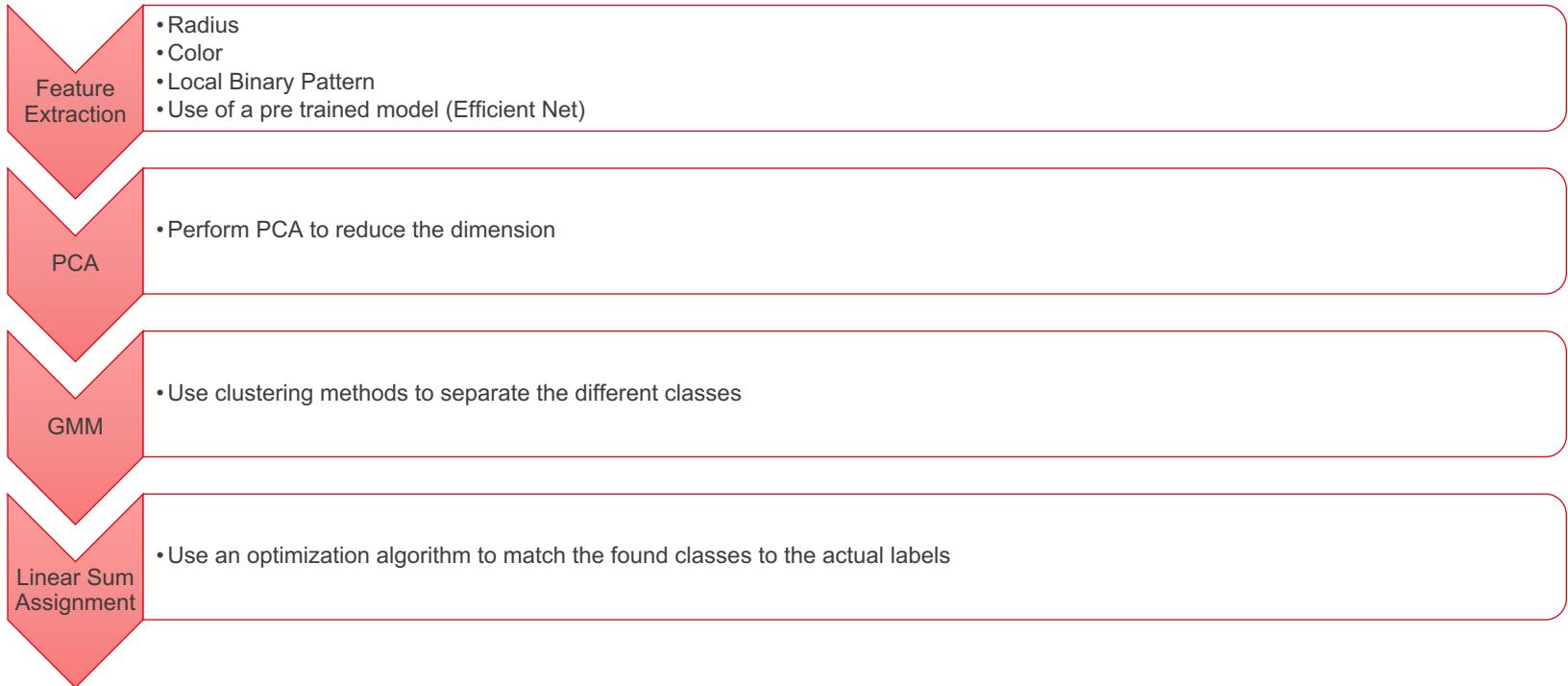
Classification

Limits and Solutions

Weak Supervision

How to address this problem

- Label available for the whole picture and not for every pixel
- **Solution 1 (suboptimal) : Hand Labelling**
- **Solution 2 : Automatic labeling via pipelining process**



Comparison between the two methods

▪ Hand Labeling

- ✓ Potentially 100% accuracy

Time expensive

Inefficient for large train data

▪ Automatic Labeling

- ✓ Generalize for large dataset
- ✓ Time Saving

Need to have a very powerful model to have a good classification



O U T L I N E

Segmentation

Features Extraction

Classification

Limits and Solutions

Data Augmentation

- 382 training samples : too low for training a Neural Network
- **Solution** : Data Augmentation
- Techniques :
 - Rotation: solve the problem of coin orientation
 - Gaussian Blur: solve the problem of image quality
 - Gamma Correction: solve the problem of luminosity
 - Histogram Equalization: solve the problem of variance in color inside a class

Rotated



Blurred



Histogram Equalization



Gamma Correction



Classification

Models used

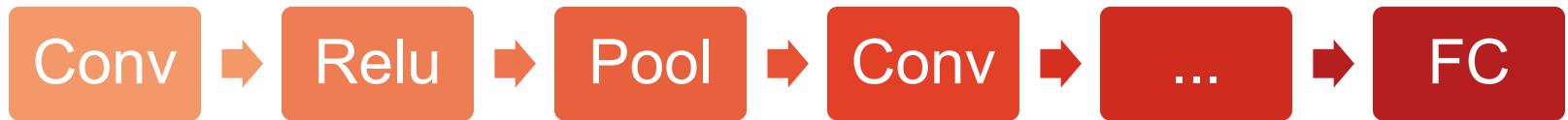
- General Idea beyond all models : Convolutional Neural Network
- Two approaches :
 1. “Handcrafted” Convolutional Network
 2. Pre trained Model

Classification

Handcrafted models

- Two models following the same structure

1. Basic Convolutional Neural Network



2. Advanced Convolutional Neural Network



Classification Results

Model	Radius	Image Size	Data Augmentation	F1-Score (Kaggle)
Basic CNN	No	200	Rotation	0.6142
Basic CNN	No	300	Rotation	0.722
Basic CNN	No	300	All	0.7741
Advanced CNN	No	200	Rotation	0.6804
Advanced CNN	Yes	200	Rotation	0.6242
Advanced CNN	Yes	300	Rotation	0.8133
Advanced CNN	Yes	300	All	0.7688
Advanced CNN	No	300	Rotation	0.8216
Advanced CNN	No	400	Rotation	0.8011
Advanced CNN	No	300	All	0.8415
Efficient Net	No	300	All	0.9883



OUTLINE

Segmentation

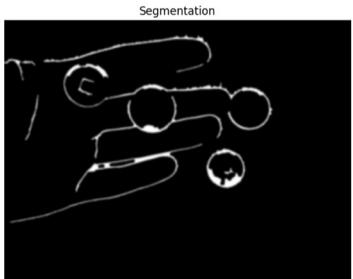
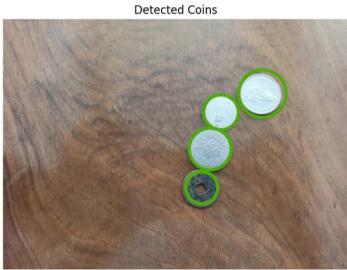
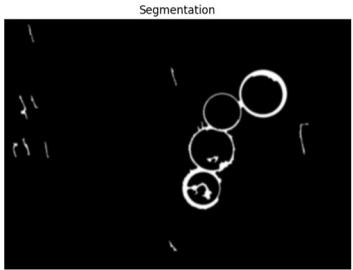
Features Extraction

Classification

Limits and Solutions

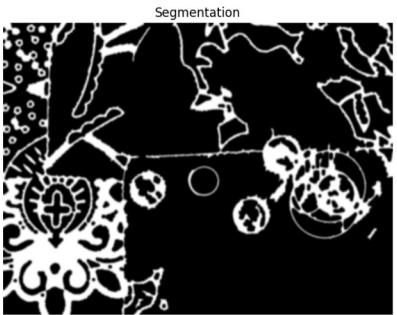
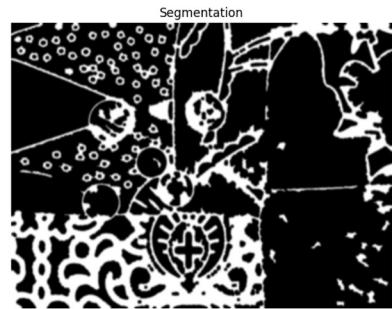
- Segmentation works well for these backgrounds...
 - But it could be less efficient for others, so some extra tests are required
- Hand labeling not suitable for bigger datasets

Limits and Solutions



Limits and Solutions

Extra tests





Thank
you

Vincent Roduit
Filippo Quadri