

IAPR 2024 - Project

Coin Detection Challenge

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Grading

100 points

- **Project Report (60 points)**
 - Segmentation (20 points)
 - Feature extraction (20 points)
 - Classification (20 points)
- **Performance of your model (20 points)**
 - Beat *Pattern Matching* baseline (10 points)
 - Beat *ML* baseline (10 points)
- **Final Presentation (20 points)**
 - Quality of the presentation (10 points)
 - Quality of the answers to the questions (10 points)
- **Kaggle Ranking** (10 BONUS points on the project):
 - 1st=10pts | 2nd=7pts | 3rd=5pts | 4th=4pts | 5th=3pts | 6th=2pts | 7th=1pt

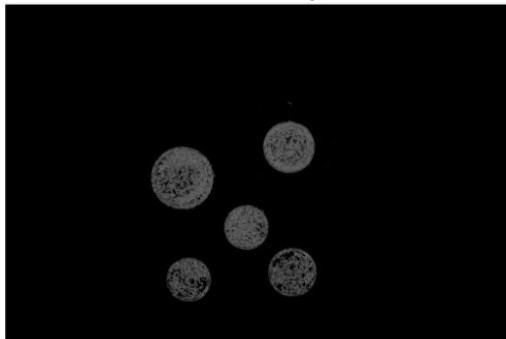
Segmentation

Segmentation

First try: Simple **thresholding** method ❌

Second try: detection of the background + **Canny** algorithm

Neutral Canny



Hand Canny



Noisy Background Canny



Noisy background issue: back to **thresholding**

Approach:

- **H and S** channels
- Try to capture **every pixels of the pieces** for the 2 channels
- Add an '**&**' between the two **binary images**

Noisy Background Tresholding

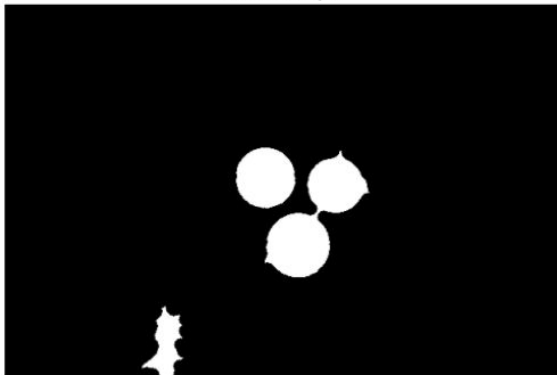


Time for morphology

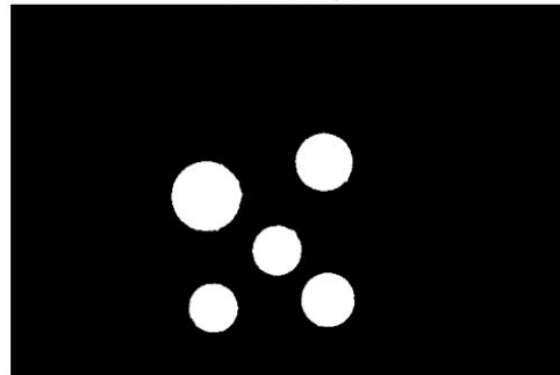
Noisy Background Morph



Hand Morph



Neutral Morph



Still not perfect -> **Hough transform**

Segmentation

e.g. L1010506 - Detected background: Hand

original image



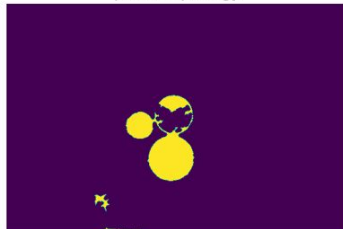
extracted edges



dilated image



post morphology



Number of coins: 3



e.g. L1010462 - Detected background: Noisy

original image

extracted edges

dilated image

post morphology

Number of coins: 4



Feature Extraction

Data Augmentation

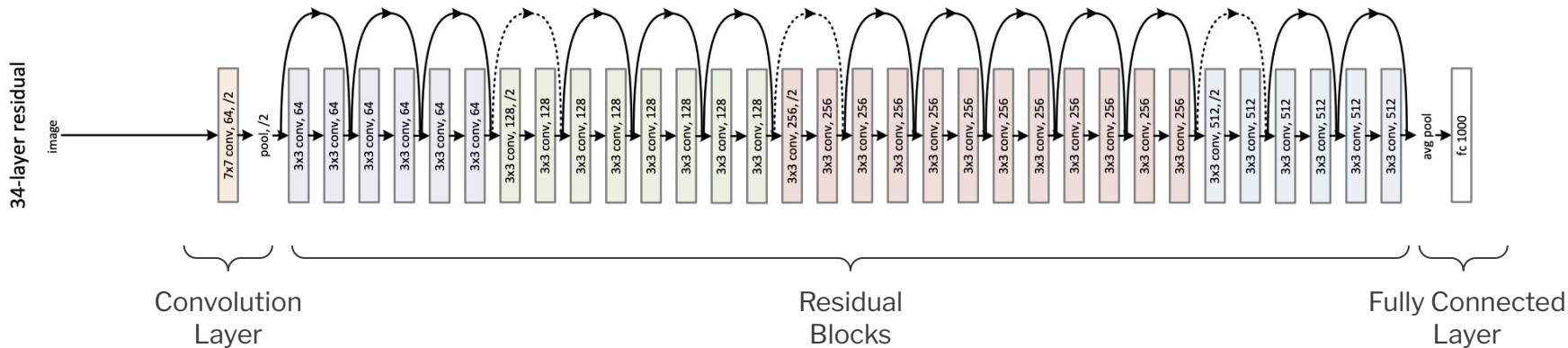


- Horizontal/Vertical flip (50%)
- Rotation between $[-25, 25]$ degrees
- Brightness factor between $[0.8, 1.2]$
- Gaussian with variance with std between $[0, 0.05 \cdot 255]$
- Crop by up to 10% of image size



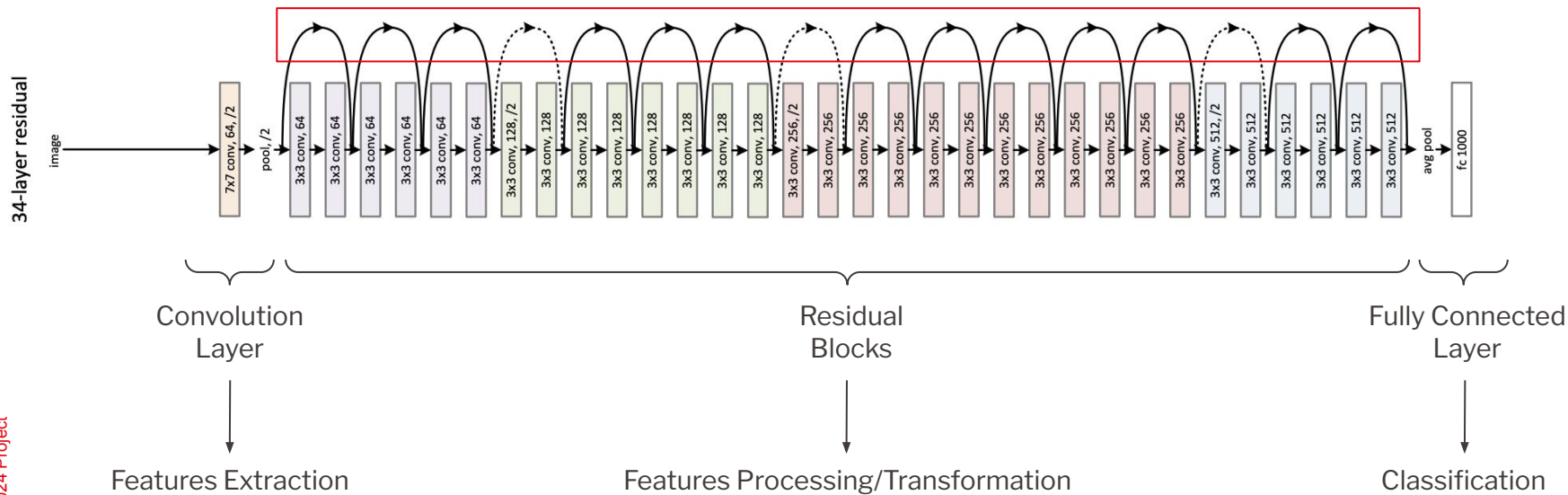
ResNet 50

ResNet50



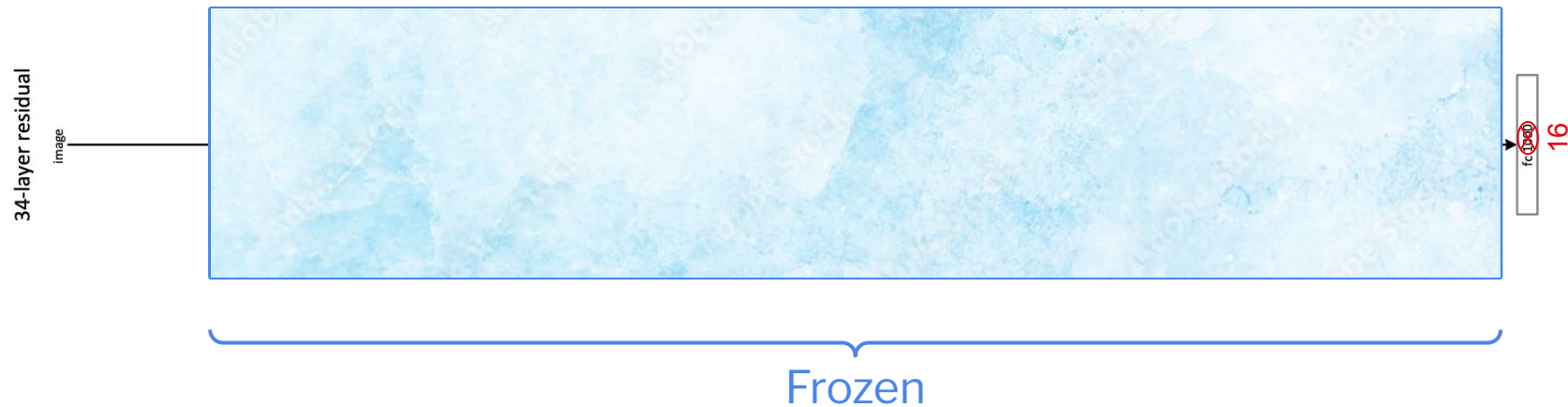
ResNet50

Skip Connections



Classification

ResNet50



Training

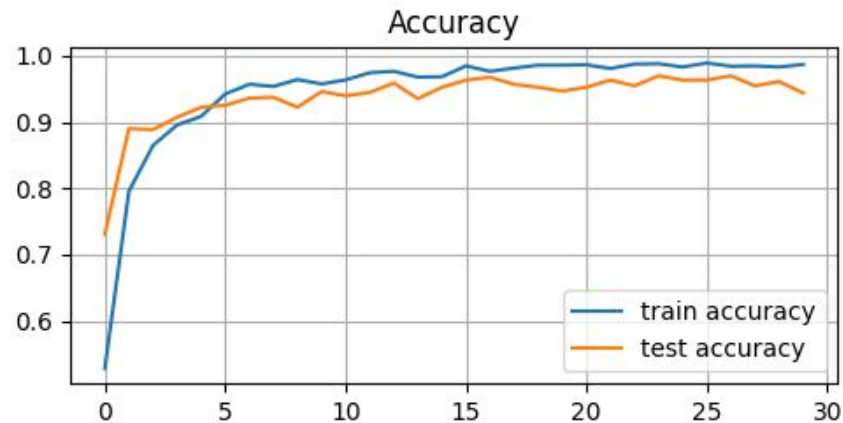
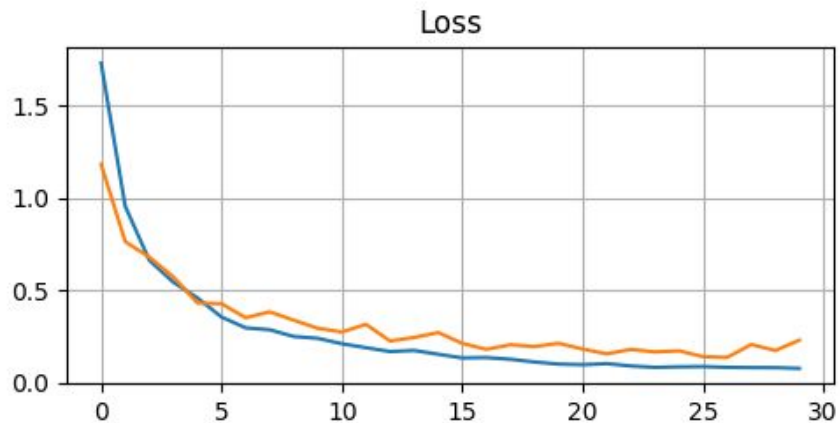


Hyperparameters:

Optimizer=Adam
Learning Rate = $1e-3$
Epochs = 30

Training

K=1

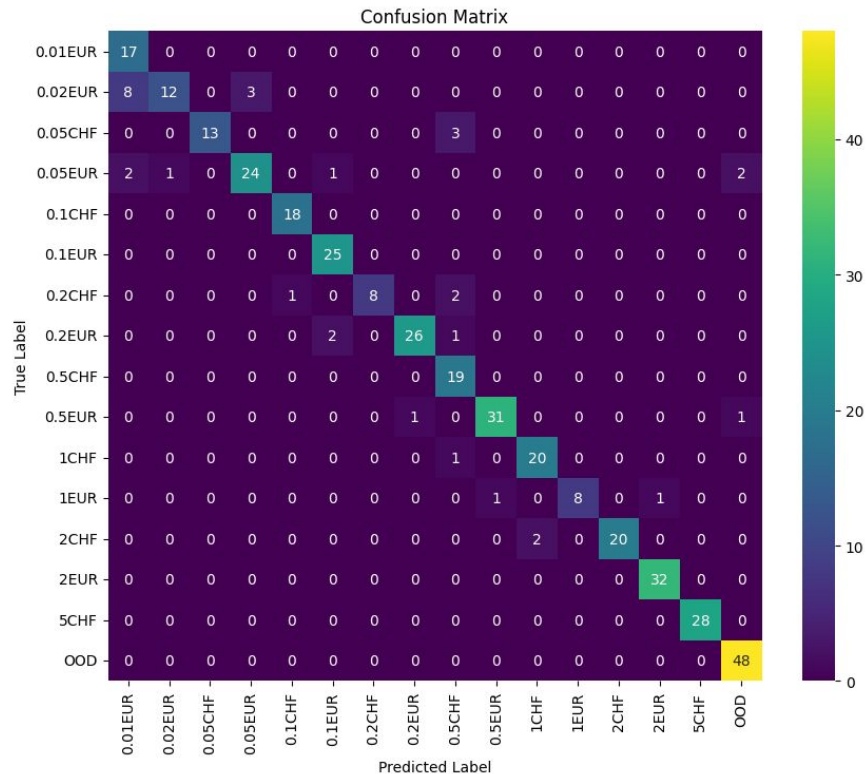


Final Training

Hyperparameters:

Optimizer=Adam
Learning Rate = $1e-3$
Epochs = 22

Results

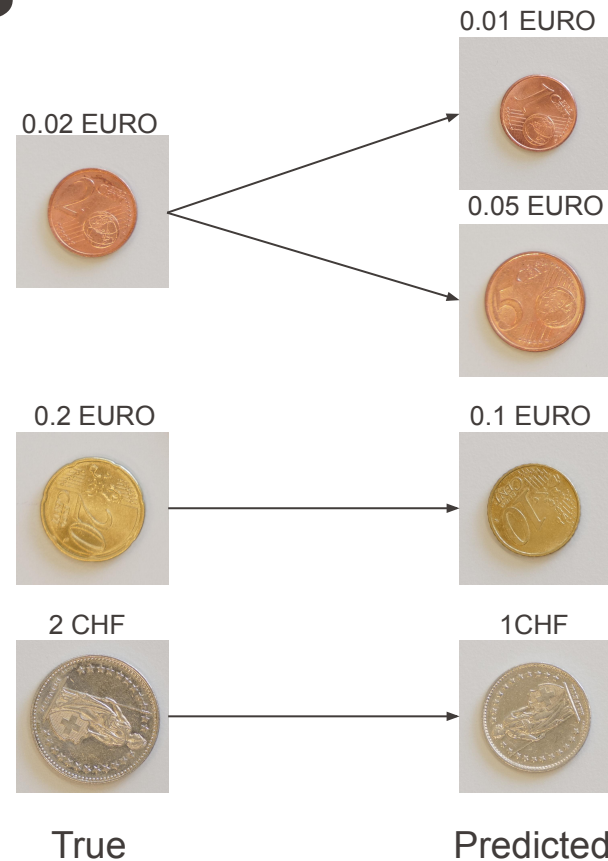
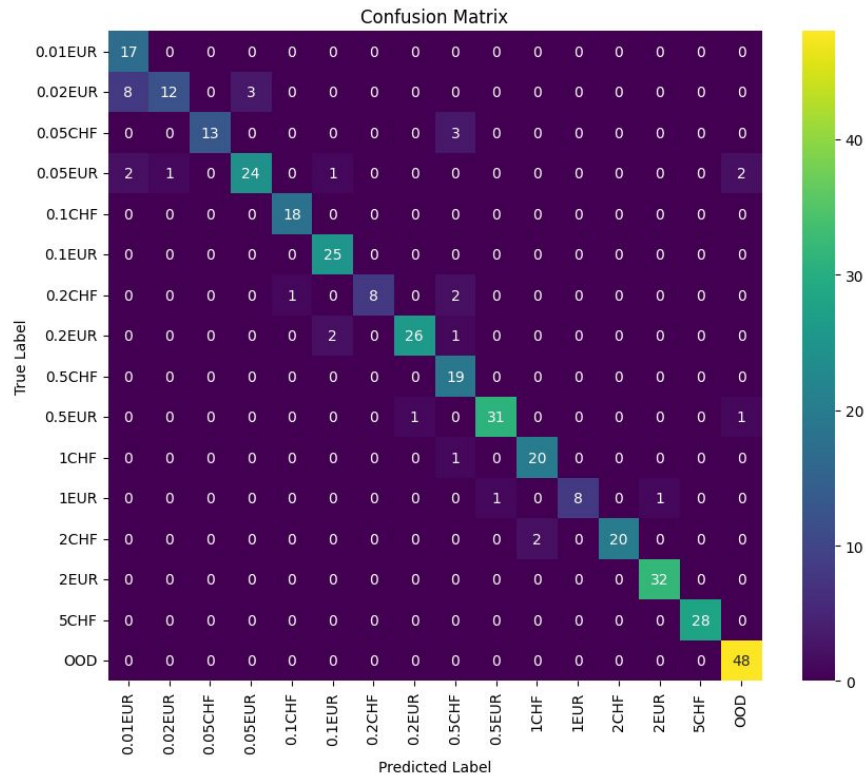


Private leaderboard score: 0.8364

Rank: #23

Beating Baseline ML

Results



Possible Improvements

- Add a grey-scale augmentation to the data to eliminate color confusion
- Encode a perimeter/area representative feature to eliminate confusion between coins with visual similarity

Conclusion

- We used classical image segmentation methods to extract coins for training and testing
- We used transfer learning to adapt a pre-trained deep learning model to the coins problem