



# IEEE CCEM 2022

## Student Project Showcase

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### Product Recognition and Identification in Shops

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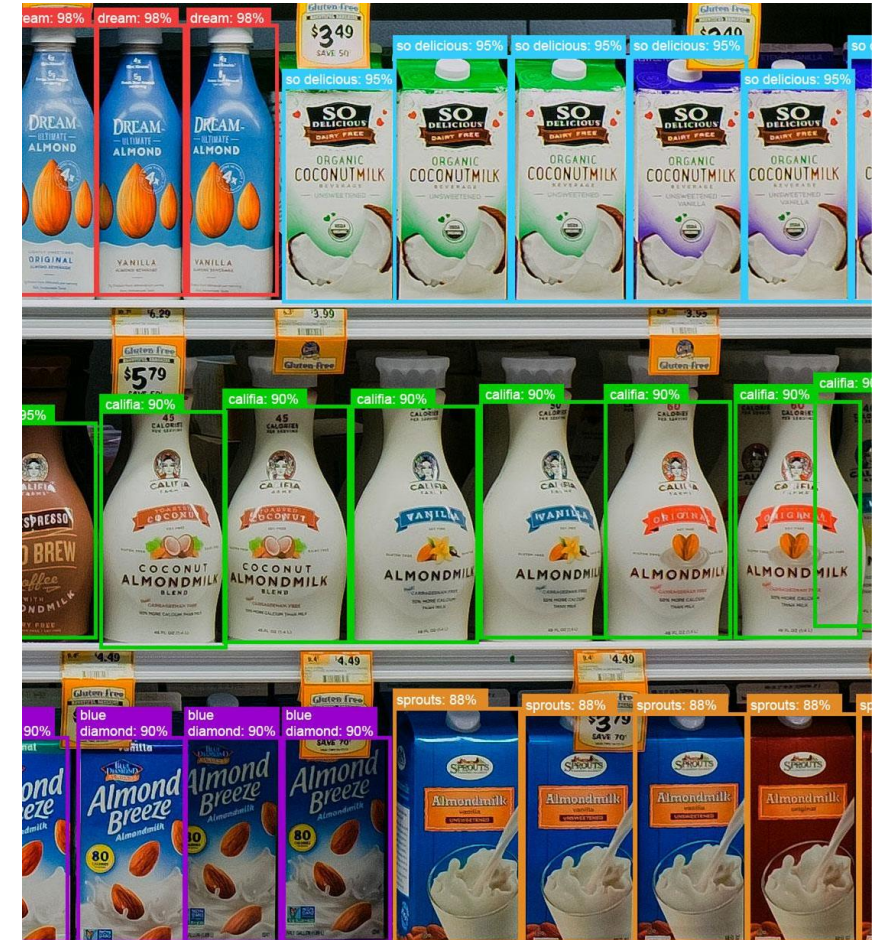
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# Product Recognition and Identification in Shops

- Shop owners struggle to digitize their products.
- Web (Mobile) Application to digitize products from shelf pictures.
- Identify products that haven't been saved into the system.



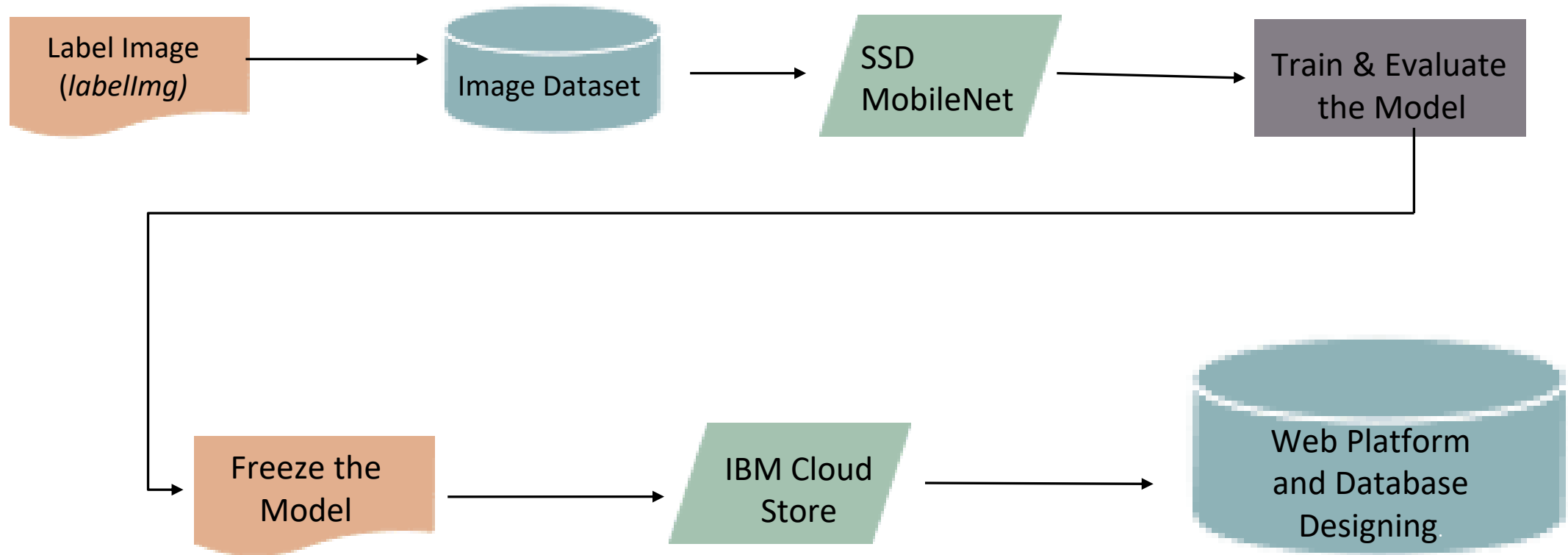
# Summary of Approaches Investigated

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1. Transfer Learning with SSD (Single Shot Detector) MobileNet
  - COCO (Common Objects in Context) SSD MobileNet
  - Web Platform and database design
    - React
    - Node.js
    - IBM Object Store
    - Firebase
2. Instance Segmentation with PixelLib based on Mask R-CNN (Region-based Convolutional Neural Network)
  - Comparison using SSIM (Structural Similarity Index)
3. Shelf label detection with Paddle OCR

# Transfer Learning with SSD MobileNet

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## COCO SSD MobileNet

- Only need to take one single shot to detect multiple objects.
- Download TF model pre-trained models from *Tensorflow Model Zoo* ([SSD MobileNet V2 FPNLite 320x320](#))
- SSD MobileNet V2 FPNLite 320x320 detects objects in **22ms** with **22.22** COCO mean Average Precision(mAP).
- Update configurations for Transfer Learning
- Train & Evaluate the model
- github:  
<https://github.com/cihansakman/ObjectDetection.git>

Original Dimensions : (480, 640, 3)  
Resized Dimensions : (480, 640, 3)



# Demonstration Web Application

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- Freeze last checkpoint to save model
- Convert frozen model to TFJS (TensorFlow Javascript) library to use the model directly in Node.js
- Deploy model to **IBM** *object store*
- Detect objects and check the information from database by label
- Display object to the user
- Web application is developed with React and Firebase

# Demo Video

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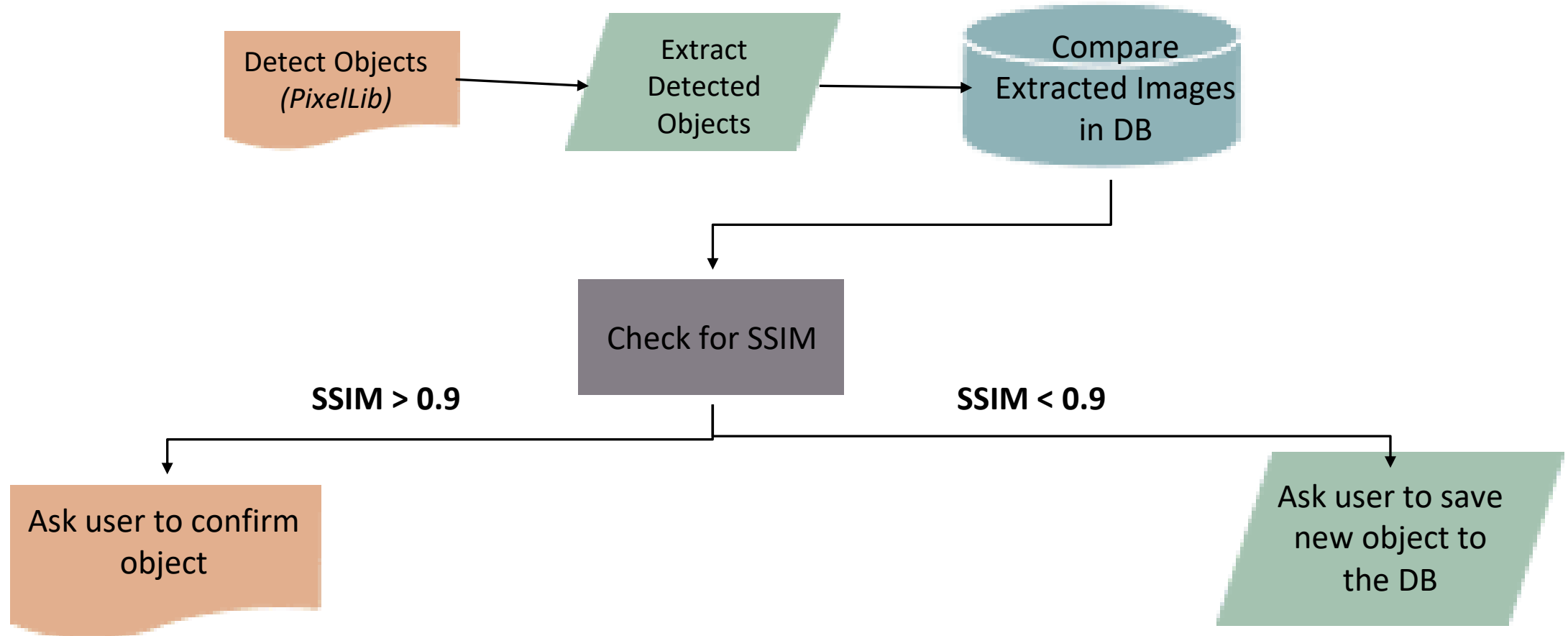
Main shortcoming of the  
approach

Cannot detect  
unseen object



# Instance Segmentation with *PixelLib* based on *MaskRCNN*

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# Structural Similarity Index (SSIM)



SSIM is a perception-based model that considers image degradation as perceived change in structural information.

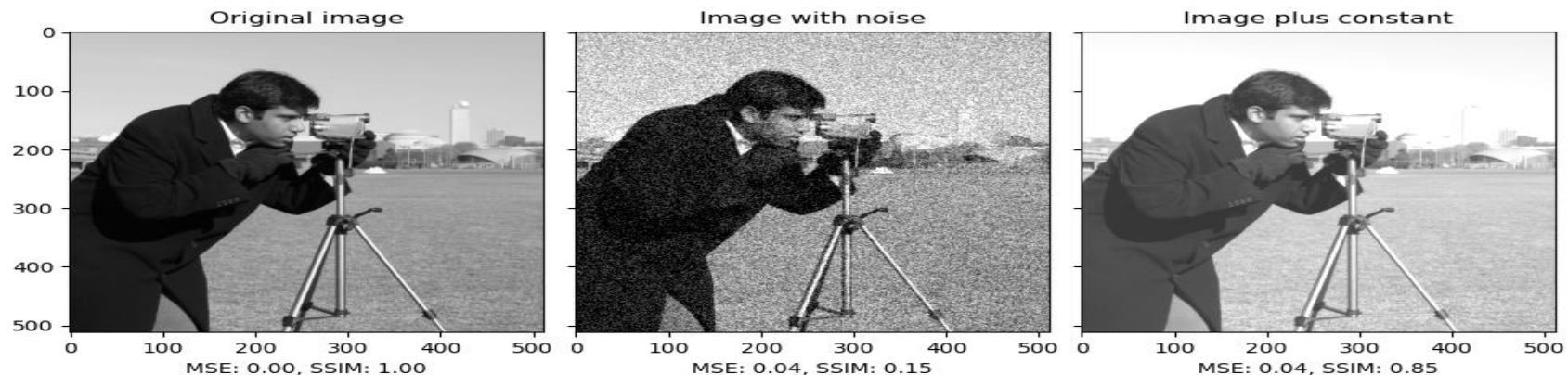


SSIM used for identifying the differences between images.



The extracted objects are compared with the objects in their category in the database.

If can not found SSIM > 0.9 ask information about that object and save it into database.





## Main shortcomings of the approach

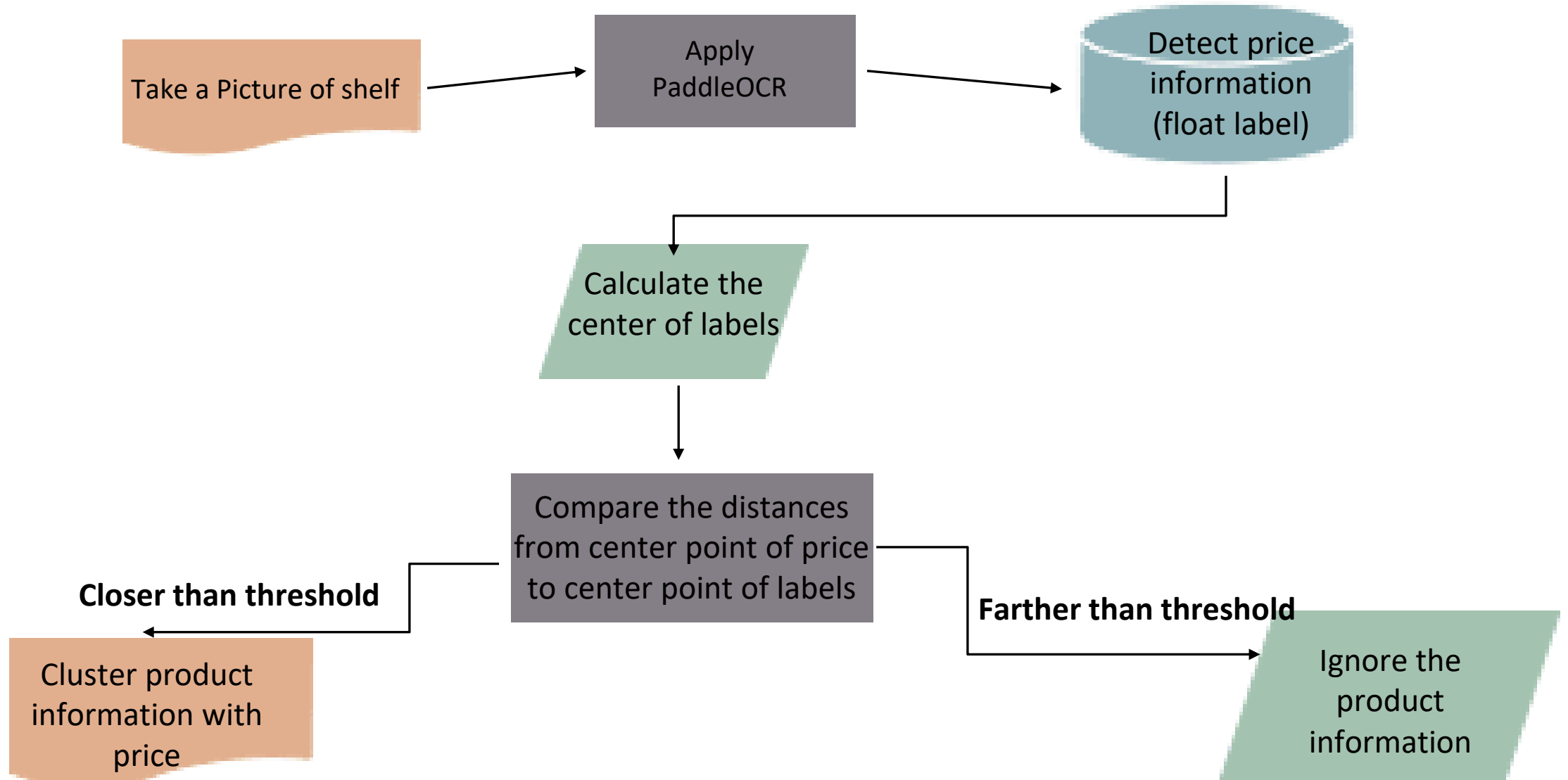
- SSIM is not well suitable to compare images.
- Not suitable for different markets because of the training data.
- Searching for images in the database is inefficient.

# SHELF LABEL DETECTION

Some shops do not use ERP system and some of them use it but do not give access to data.



# SHELF LABEL DETECTION WITH PADDLEOCR





# Label Detection with Paddle OCR

- Detect product labels and transfer the information from image to text.
- PaddleOCR
- Github:  
<https://github.com/PaddlePaddle/PaddleOCR>
- Compare price information in the shelf and database



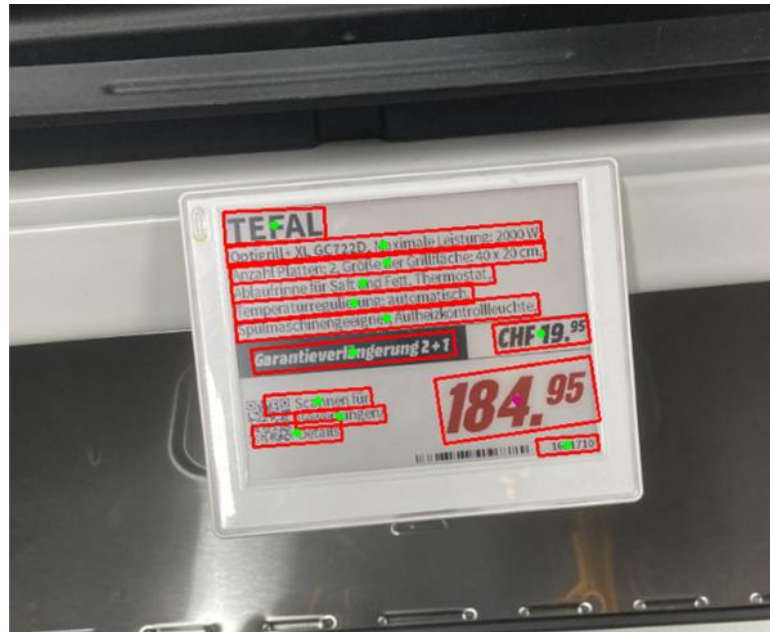
```
Choco Petit WERNLI Beurre au lait/ Butterherzli 125g/100g 55063 2.63/3.29/100g CH4 3.29
FINESTBAKERY Schoko- Butterkeks 279 2x125g Diverse Sorter 2.49
Mini-Doppelkeks FINEST BAKER 38677 1.20/100g 2.99
ovomaltine PETIY BEURRE Petit Beurre OVOMALTINE x 1459 720534 2.72/100g 3.95
Premium-Cookies INESTBAKER 712449 .93/-98/100 1.95
```

Backbone	Accuracy	Model Size (M)	Inference Time (CPU, ms)
MobileNetV3_small_x0.35	0.6288	22	17
MobileNetV3_small_x0.5	0.6556	23	17.27
MobileNetV3_small_x1	0.6933	28	19.15

*Compares the performance of the different back-bones for text recognition for number of channel 256.*

Main shortcoming of  
the approach

- Distance based algorithm is not suitable for different kinds of shops.



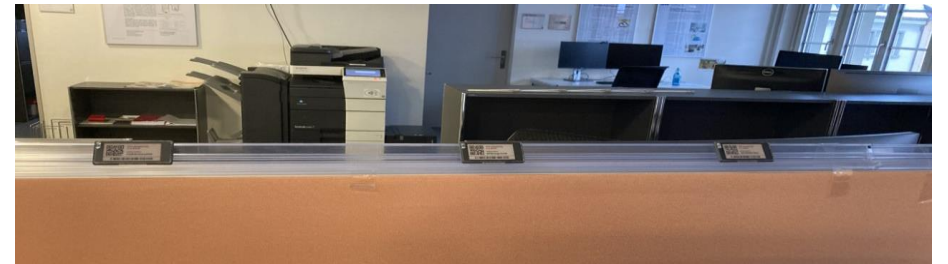
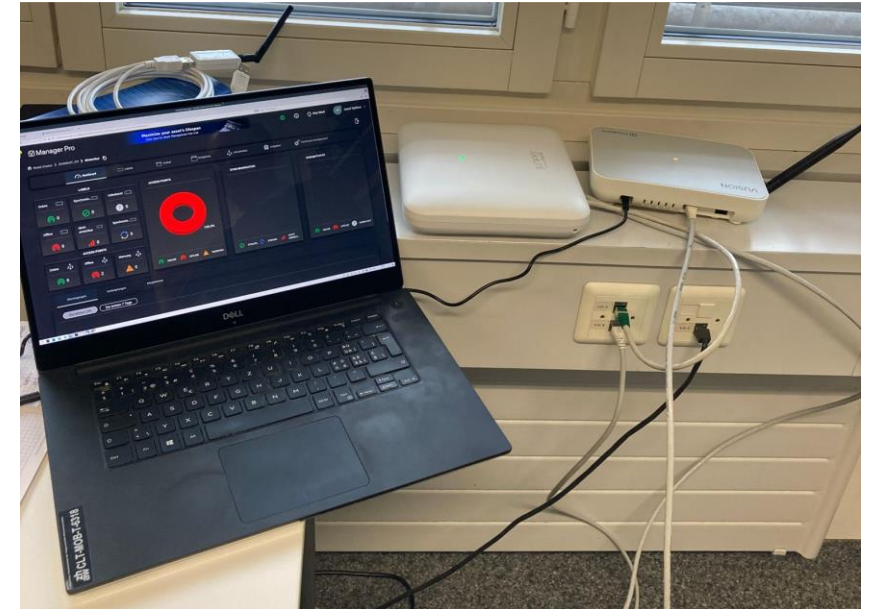


# Smart Shopping Research

## Context of Student Project

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- Distributed systems with sensors and beacons
- Contributions to smart cities and regions



# Thank You...

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## Useful Links

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Tensorflow Model Zoo:

[https://github.com/tensorflow/models/blob/master/research/object\\_detection/g3doc/tf2\\_detection\\_zoo.md](https://github.com/tensorflow/models/blob/master/research/object_detection/g3doc/tf2_detection_zoo.md)

PixelLib:

<https://github.com/ayoolaolafenwa/PixelLib>

PaddleOCR:

<https://github.com/PaddlePaddle/PaddleOCR>

Demo Video:

<https://youtu.be/JFo5K3UvDD8>

Demo Project:

<https://github.com/cihansakman/ObjectDetection.git>