



Real-Time Pattern Matching



Neural Network Agent for
Competitive Dobble Play

Computer Vision Project

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Where we started

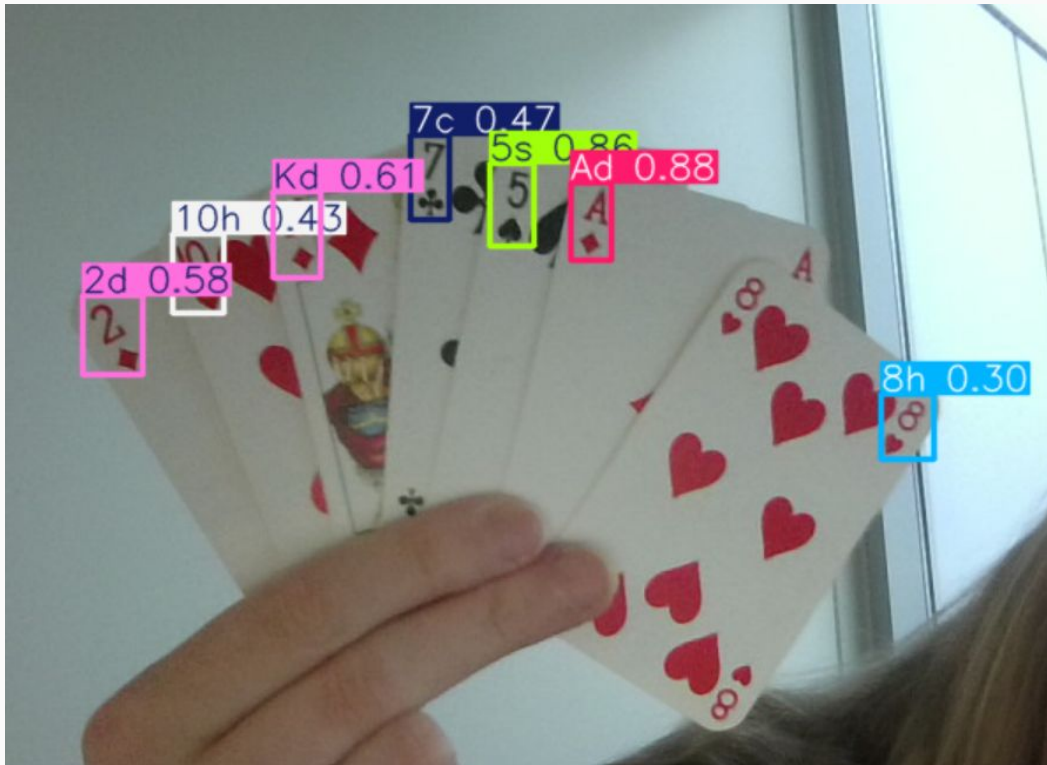
Playing card classification

- Detect rank, suit and bounding box of a hand of up to 7 playing cards anywhere inside RU in real-time

When the work started

- Found dataset on kaggle and notebook to train a model
- Model worked almost perfectly without any alterations needed
 - Only card orientation that had slight problems

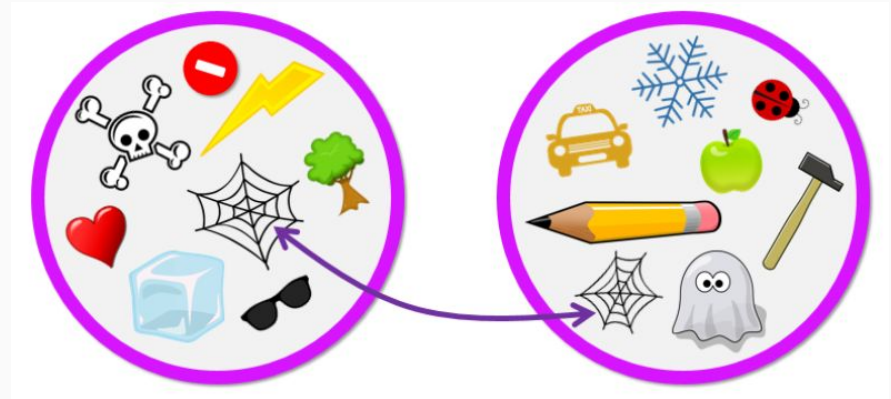
Need for broadening the scope -> Dobble card classification



An example output of the playing card detection

Dobble - Playing cards

- Each card contains 8 symbols
- 55 cards in total in the deck
- Always one, and only one symbol in common between any two cards
- In total there are 57 different symbols
- Many versions exist of Dobble





Project Idea

Identification

Accurately identify all of
the images on the
Dobble card

Find a match

Find matching symbols
of known class labels
between two or more
Dobble cards

Generalize

Use a different method
to find any matching
symbols between two
or more Dobble cards

Goals

Min goal

- ✓ Detect all learned symbols on two dobble cards and find the pair
- ✓ Model trained on pre-existing dataset found online on dobble cards, using YOLOv8

Max goal

- Detect all learned and unlearned symbols on two dobble cards and find the pair
- YOLOv8 model trained on our own dataset on dobble cards
- Pre-trained Siamese network



Background material

1

Paper - Playing Cards Classification and Detection using Sequential CNN Model

- Uses CNN model for playing card categorization, identifying both rank and suit
- Uses object detection models like YOLO, SDD and Faster R-CNN.
- These models generate bounding boxes and classify cards simultaneously

2

Article - Having Fun with YOLOv8: How Good Your Model in Detecting Playing Card?

- Uses YOLOv8 for playing card detection
- Includes instructions and examples
- Includes links to a dataset and a notebook for the code to train the model

[2], [3]



Background: Resources used

OpenCV

Used for image capturing and feature extraction

PyTorch

Backbone of the YOLOv8 model

Google Colab

Used to train the model to have GPU access

Roboflow

Access to existing open access dataset and dataset creation

Ultralytics

yolov8n.pt model from YOLO packet used as base model in training

Dataset

Existing dataset

- Dobble dataset found on Roboflow
- Contains 39 classes
 - 18 missing
- 4422 train, 6 valid, 111 test images



[4]

New dataset

- Includes all 57 classes of our dobble version
- 190 images, taken in different brightness
 - Dark, bright (no flash), bright (flash)
- Same background for all images
- Ideally we would like way more images and more variation in brightness and background



Two different methods of matching cards

Object detection

- YOLOv8 model
- Real-time video capture
- Identify different symbols
- Display bounding boxes, labels and confidences for each object
- If two or more objects belong to the same class in the current frame it is considered a match
- Green bounding box for a match
- Blue bounding box for other symbols
- Only works for symbols/class labels that the model knows

Pattern Matching

- Generalized object detection with YOLOv8
- Bounding boxes fed to Siamese network
- Bounding boxes with highest correlation are displayed
- Could be used on any Dobble deck, would not need to know the symbols



Performance measures and goals

For model:

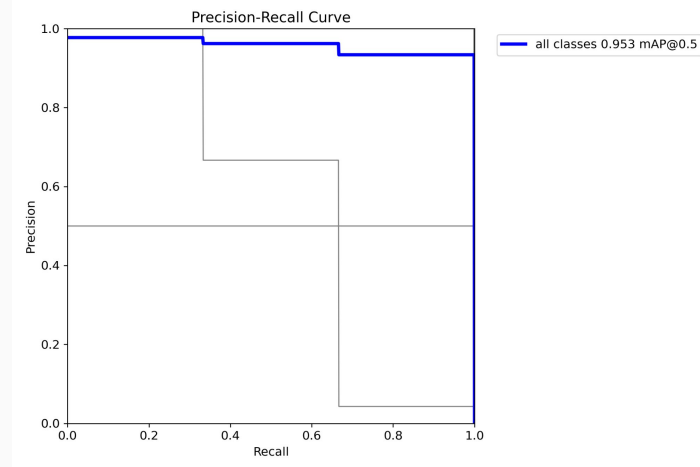
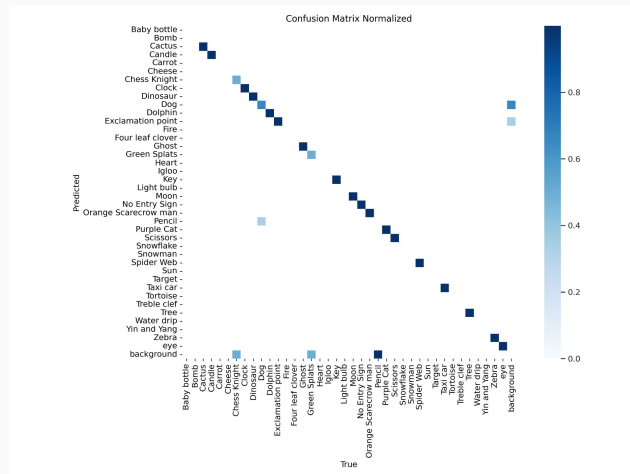
- Confusion matrix
- F1-score: 0.8
- Recall: 0.8
- Precision: 0.8

For real-time detection:

- Accuracy: 0.8
- Detection rate: 1.0
- Confidence: 0.8
- FPS: 60

Current performance of the model based on object detection method

- Confusion matrix
- F1-score: 0.55
- Recall: 0.5
- Precision: 0.9





★ Code Demonstration ★



Work involved: Division of labor

Elsa

- Image capture for dataset
- Creation of new dataset
- Labelling images
- Model training

Eypór

- Increase performance of general object detection network
- Set up and train siamese networks

Margrét

- Image capture for dataset
- Model training
- Detection and matching algorithm for object detection method



Work involved: Time and challenges

Challenges

- Balancing generalization and specialization
- No dataset found that included all the classes of our dobbble version
- Labeling datasets
- Maintaining open sessions on Colab to ensure finished runs

Time consumption

- Training datasets on Colab
- Labeling datasets in Roboflow



Going forward

- Continue work on Siamese datasets such that requirements are met
- Create our own dataset based on our Dobble deck version
- Train new model based on our new dataset



Thank you!
Any questions?





References

- [1] The Dobble Algorithm - 101 Computing, en-US, Dec. 2019. [Online]. Available: <https://www.101computing.net/the-dobble-algorithm/> (visited on 12/08/2024).
- [2] K. Mittal, K. S. Gill, R. Chauhan, M. Sharma, and G. Sunil, "Playing Cards Classification and Detection Using Sequential CNN Model Through Machine Learning Techniques Using Artificial Intelligence," in 2024 International Conference on E-mobility, Power Control and Smart Systems (ICEMPS), Apr. 2024, pp. 1–4. DOI: 10.1109 / ICEMPS60684 . 2024 . 10559365. [Online]. Available: <https://ieeexplore.ieee.org/document/10559365/?arnumber=10559365&tag=1> (visited on 12/02/2024).
- [3] Having Fun with YOLOv8: How Good Your Model in Detecting Playing Card? | by Saskia Dwi Ulfah | Medium. [Online]. Available: <https://medium.com/@sdwiulfah/having-fun-with-yolov8-how-good-your-model-in-detecting-playing-card-a468a02e4775> (visited on 12/08/2024).
- [4] Dobble Cards Object Detection - v2 2022-06-12 9:15am, en. [Online]. Available: <https://universe.roboflow.com/aravind-ellapu/dobble-cards-object-detection> (visited on 12/08/2024).