Trading Card Authenticator

ML2 Final Project

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Introduction

- Authentication is the process of verifying the originality or genuineness of a trading card. This task involves evaluating and inspecting whether a card is original or fake. A general job description of a card authenticator found in PSA Grader website is:

- *"Individual should be detail oriented, have good organization skills, and be able to focus on cards over long periods of time."*
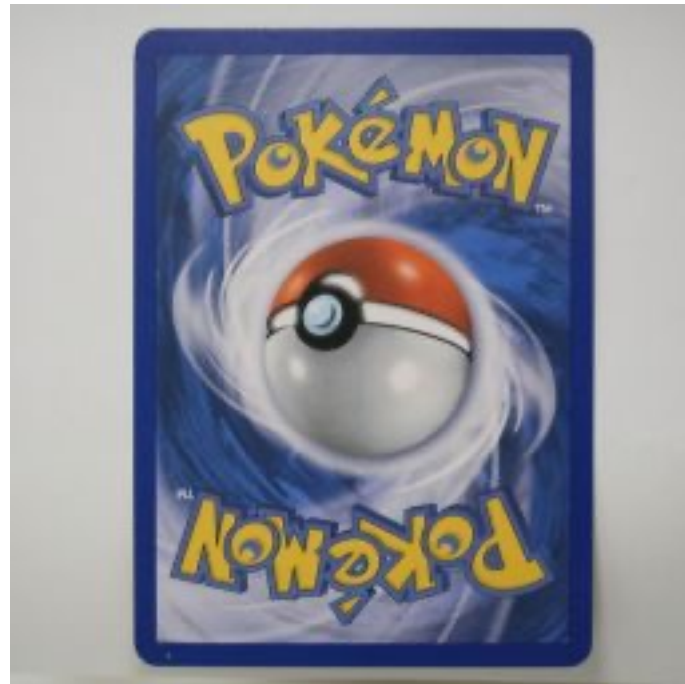
Dataset

- Kaggle Sourced - https://www.kaggle.com/datasets/ongshujian/real-and-fake-pokemon-cards

- Pre-defined train-test split (85:15) – 451 images

- Added additional training dataset for 3rd class (invalid input class) – 52 images

- Created a stratified validation dataset from the train dataset (90:10)

Classes
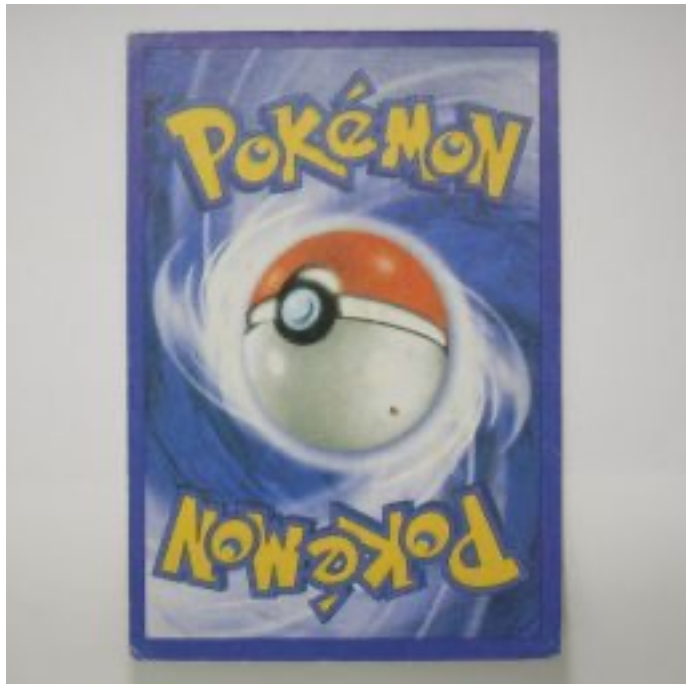
Fake

Real

Invalid Input

Custom CNN Model

- Developed a custom CNN model – 4 Conv2D Layers with AvgPooling and Dropouts and 1 Dense Layer

- Model Architecture

- Hyperparameters:
  - ➢ Learning Rate - 0.0001
  - ➢ Batch Size - 32
  - ➢ Optimizer - Adam
  - ➢ Epochs - 200
  - ➢ Patience - 40 epochs
  - ➢ Dropout - 0.2
  - ➢ Kernel Size - (3, 3)
  - ➢ Pool Size - (2, 2)

```
Model: "sequential"
_____
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 254, 254, 16)      448

 average_pooling2d (AverageP (None, 127, 127, 16)      0
 ooling2D)

 dropout (Dropout)           (None, 127, 127, 16)      0

 conv2d_1 (Conv2D)           (None, 125, 125, 32)      4640

 average_pooling2d_1 (Averag (None, 62, 62, 32)        0
 ePooling2D)

 dropout_1 (Dropout)         (None, 62, 62, 32)        0

 conv2d_2 (Conv2D)           (None, 60, 60, 64)        18496

 average_pooling2d_2 (Averag (None, 30, 30, 64)        0
 ePooling2D)

 dropout_2 (Dropout)         (None, 30, 30, 64)        0

 conv2d_3 (Conv2D)           (None, 28, 28, 64)        36928

 average_pooling2d_3 (Averag (None, 14, 14, 64)        0
 ePooling2D)

 dropout_3 (Dropout)         (None, 14, 14, 64)        0

 flatten (Flatten)           (None, 12544)             0

 dense (Dense)               (None, 3)          |      37635

=================================================================
Total params: 98,147
Trainable params: 98,147
Non-trainable params: 0
```

Result

- Overall Accuracy: 96.62%
- Overall F1-score: 0.9719
- Confusion Matrix

	Fake	**Real**	**Invalid Input**
Fake	26	2	0
Real	1	49	0
Invalid Input	0	0	11

Demo

- We created an application to deploy our model

- Streamlit is an open source app framework in Python language

- Demo

Conclusion

- Model is successfully able to identify Fake/Real Cards and Invalid Inputs

- We can visualize important areas in the image for image classification using Grad CAM

- Future Scope: Building an ensemble model with front-side images of cards so that the model can decide based on both front and backside of the cards

- Ideas: Detecting other counterfeit items like currency notes and have a real-world impact