

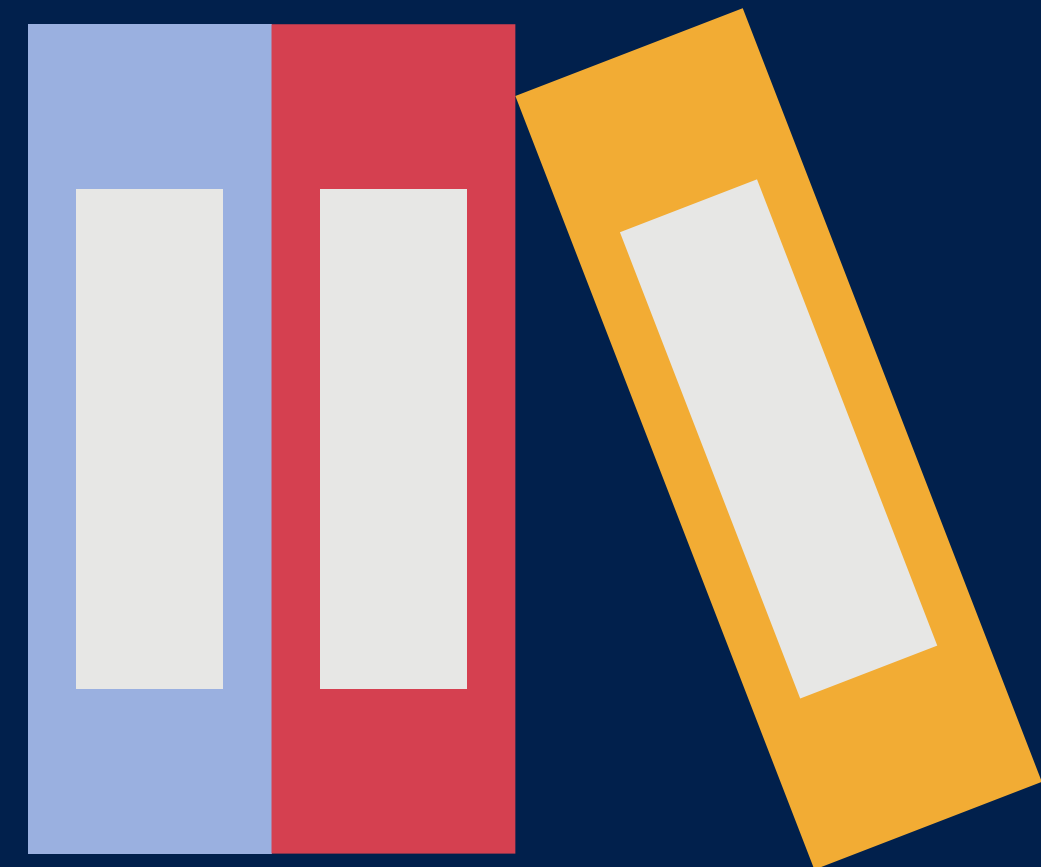
# **TURKISH LETTERS HANDWRITING RECOGNITION**

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# HOW DID I TRAIN MODEL?

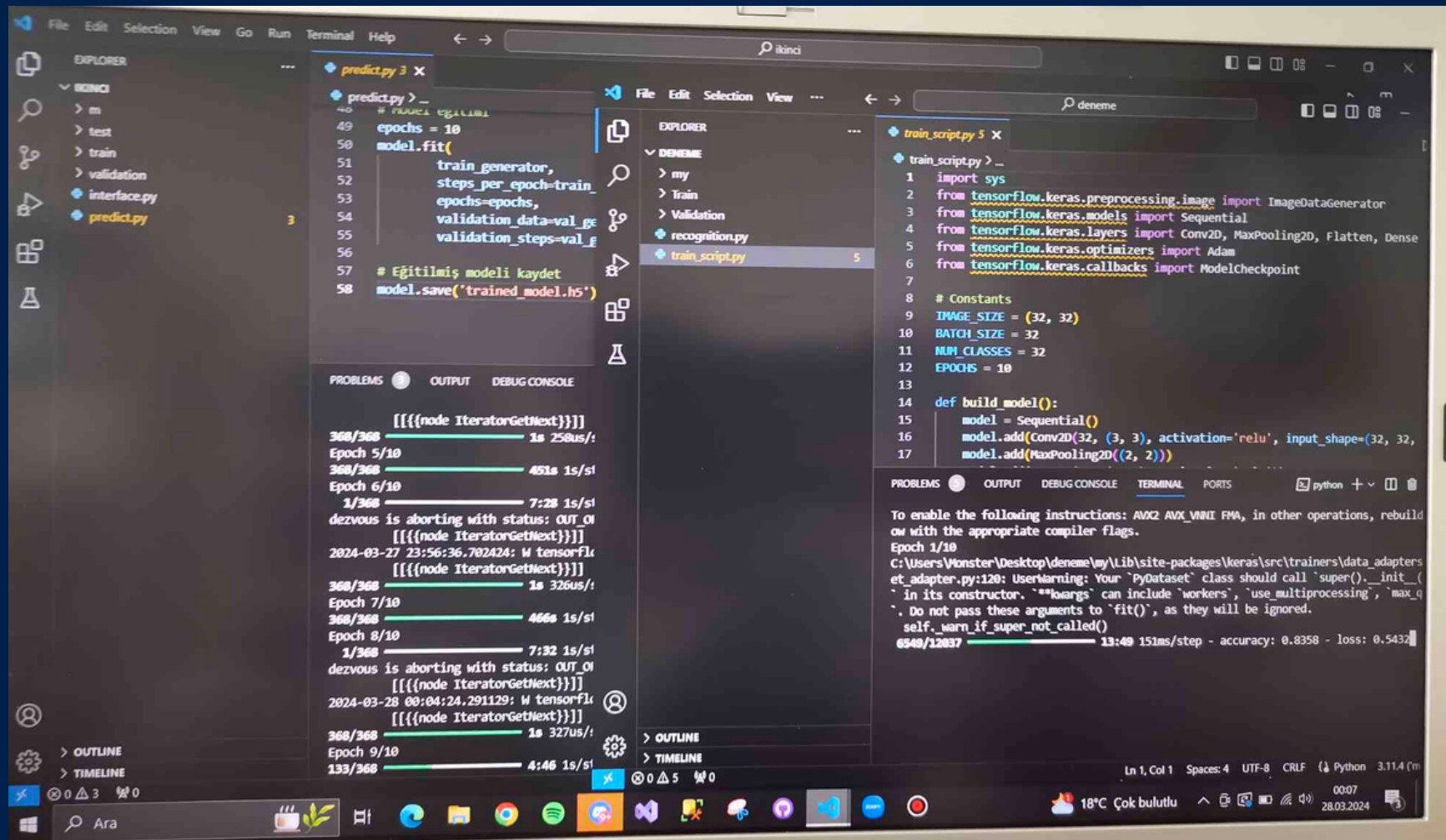
I acquired a dataset consisting of 835,750 images encompassing 46 distinct characters, comprising both English and Turkish characters, numbers, and symbols. Utilizing the cv2 package, I processed the image contents to enhance computer comprehension and processing speed. Subsequently, leveraging the tensorflow and keras packages, I constructed a model for training on the dataset,

project link : [https://github.com/elif1906/src\\_5\\_2\\_hand/tree/main](https://github.com/elif1906/src_5_2_hand/tree/main)



# TRAINING PROCESS

We use Conv2D layers for image filtering and MaxPooling for value reduction and size consistency. Increasing depth enhances focus on finer details. Flattening yields a single pattern array, followed by a Dense layer for compression and another for outputting class predictions. We compile with Adam optimization for efficiency. Using ImageDataGenerators, we feed data and await results.



```
predict.py 3 X
49 epochs = 10
50 model.fit(
51     train_generator,
52     steps_per_epoch=train_
53     epochs=epochs,
54     validation_data=val_ge
55     validation_steps=val_f
56
57 # Eğitilmiş modeli kaydet
58 model.save('trained_model.h5')
```

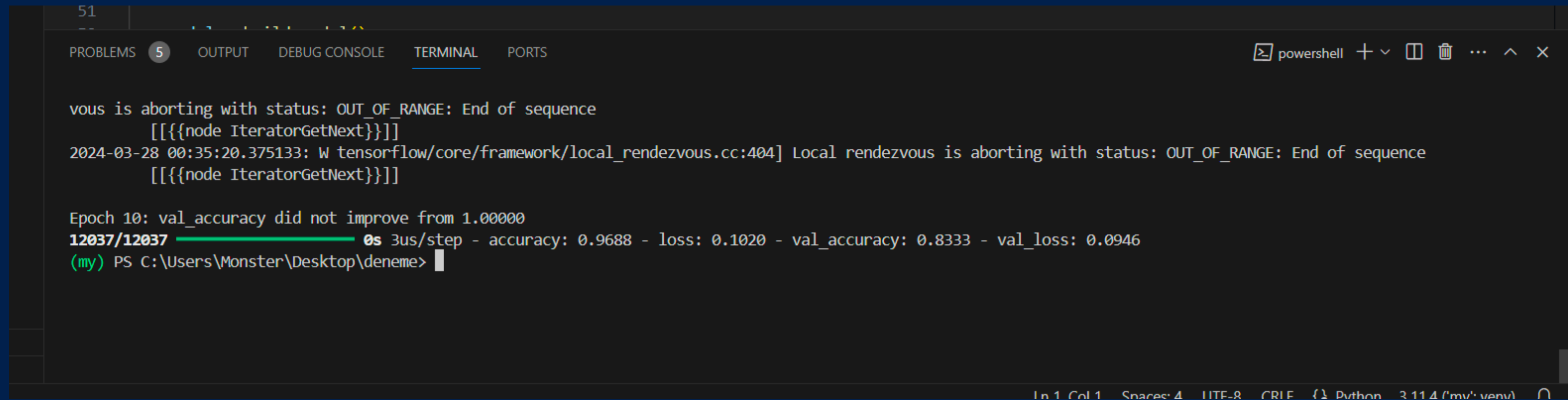
```
train_script.py 5 X
1 import sys
2 from tensorflow.keras.preprocessing.image import ImageDataGenerator
3 from tensorflow.keras.models import Sequential
4 from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense
5 from tensorflow.keras.optimizers import Adam
6 from tensorflow.keras.callbacks import ModelCheckpoint
7
8 # Constants
9 IMAGE_SIZE = (32, 32)
10 BATCH_SIZE = 32
11 NUM_CLASSES = 32
12 EPOCHS = 10
13
14 def build_model():
15     model = Sequential()
16     model.add(Conv2D(32, (3, 3), activation='relu', input_shape=(32, 32, 3)))
17     model.add(MaxPooling2D((2, 2)))
```

```
PROBLEMS OUTPUT DEBUG CONSOLE
368/368 Epoch 5/10 1s 258us/
368/368 Epoch 6/10 451s 1s/s!
1/368 7:28 1s/s!
devious is aborting with status: OUT_0
2024-03-27 23:56:36.702424: W tensorflow
368/368 Epoch 7/10 1s 326us/
368/368 Epoch 8/10 466s 1s/s!
1/368 7:32 1s/s!
devious is aborting with status: OUT_0
2024-03-28 00:04:24.291129: W tensorflow
368/368 Epoch 9/10 1s 327us/
133/368 Epoch 9/10 4:46 1s/s!
```

```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
To enable the following instructions: AVX2 AVX_VNNI FMA, in other operations, rebuild
ow with the appropriate compiler flags.
Epoch 1/10
C:\Users\Monster\Desktop\deneme\my\Lib\site-packages\keras\src\trainers\data_adapters
et_adapter.py:120: UserWarning: Your 'PyDataset' class should call 'super().__init__
' in its constructor. '**kwargs' can include 'workers', 'use_multiprocessing', 'max_q
'. Do not pass these arguments to 'fit()', as they will be ignored.
self.warn_if_super_not_called()
6548/12837 13:49 151ms/step - accuracy: 0.8358 - loss: 0.5432
```

# TESTING PROCESS

Assigning labels with corresponding indexes, we prompt the user for an image path. We then feed this path to the model to obtain a list of predictions with individual character accuracies. Filtering the maximum accuracy among them determines the predicted letter.



```
51
--
PROBLEMS 5 OUTPUT DEBUG CONSOLE TERMINAL PORTS powershell + - [ ] [X] ... ^ X

vous is aborting with status: OUT_OF_RANGE: End of sequence
[[{{node IteratorGetNext}}]]
2024-03-28 00:35:20.375133: W tensorflow/core/framework/local_rendezvous.cc:404] Local rendezvous is aborting with status: OUT_OF_RANGE: End of sequence
[[{{node IteratorGetNext}}]]

Epoch 10: val_accuracy did not improve from 1.00000
12037/12037 ██████████ 0s 3us/step - accuracy: 0.9688 - loss: 0.1020 - val_accuracy: 0.8333 - val_loss: 0.0946
(my) PS C:\Users\Monster\Desktop\deneme> |
```