



Shapely

Purpose Statement

Teach children how to draw and identify different shapes.



Dataset

How did we generate our data?



30%



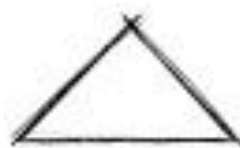
10%



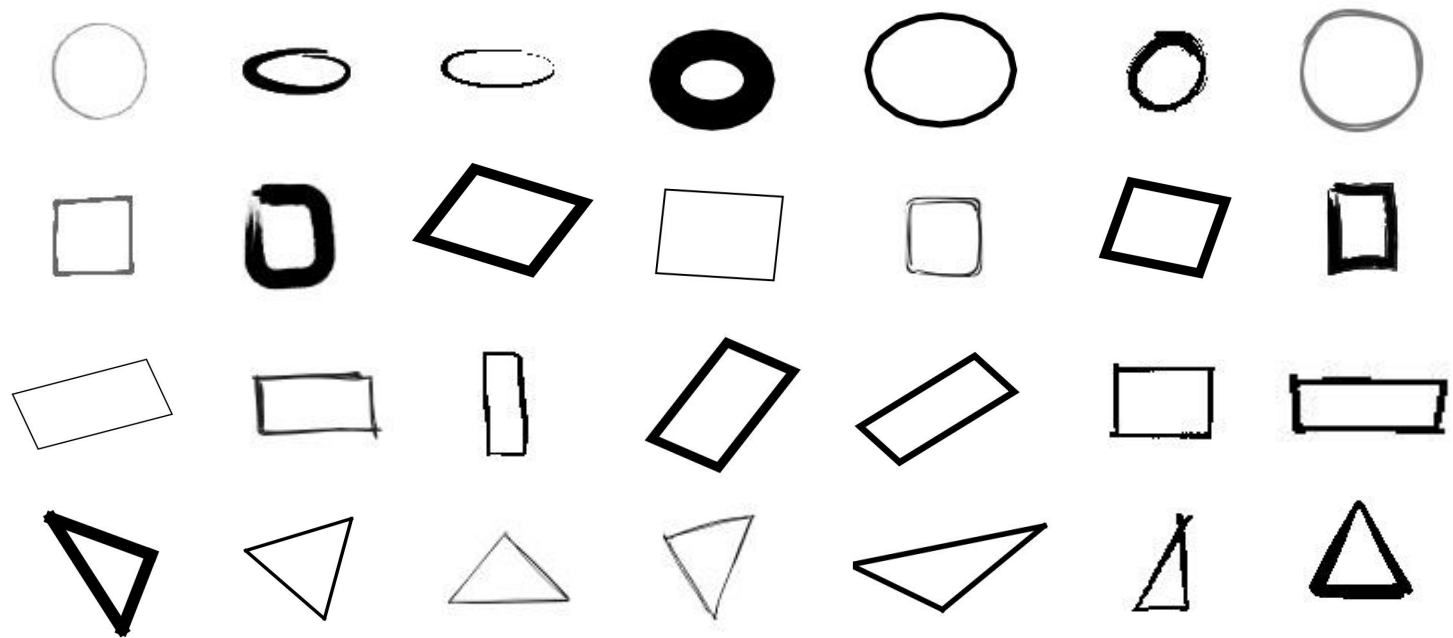
60%

Dataset

- Self-generated.
- 2,741 jpg images.
- 80 x 80 pixels.
- Grayscale.
- 4 different classes:
 - Circle or Ellipse (883)
 - Square (725)
 - Rectangle (518)
 - Triangle (615)

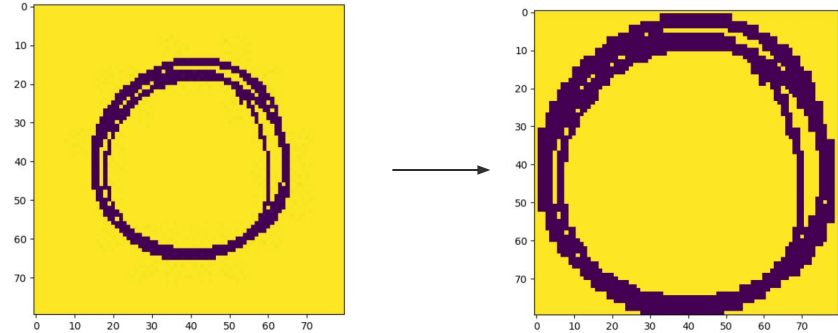


Dataset



Data Preprocessing

- cv2
- Read
- Shape detection (find contours)
- Crop
- Threshold
- Resize to 80 x 80 pixels



Data Augmentation

80%

Train Set

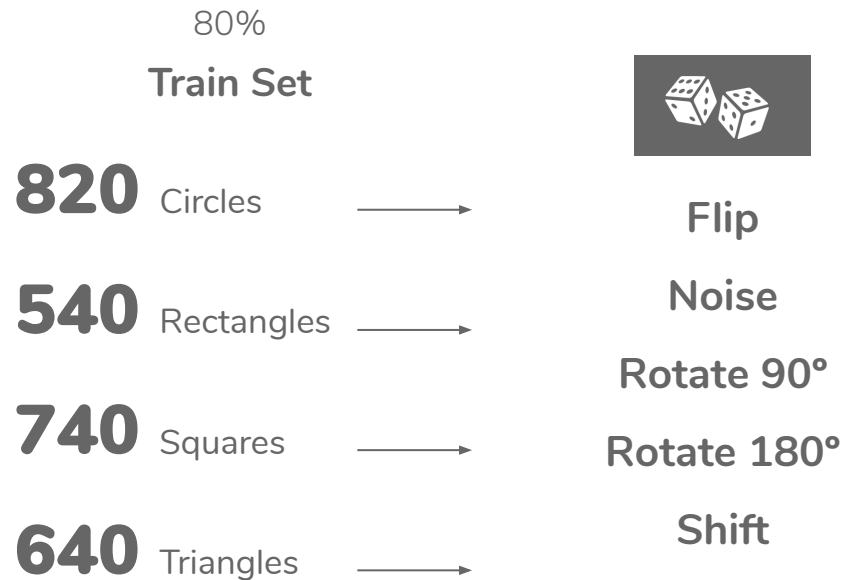
820 Circles →

540 Rectangles →

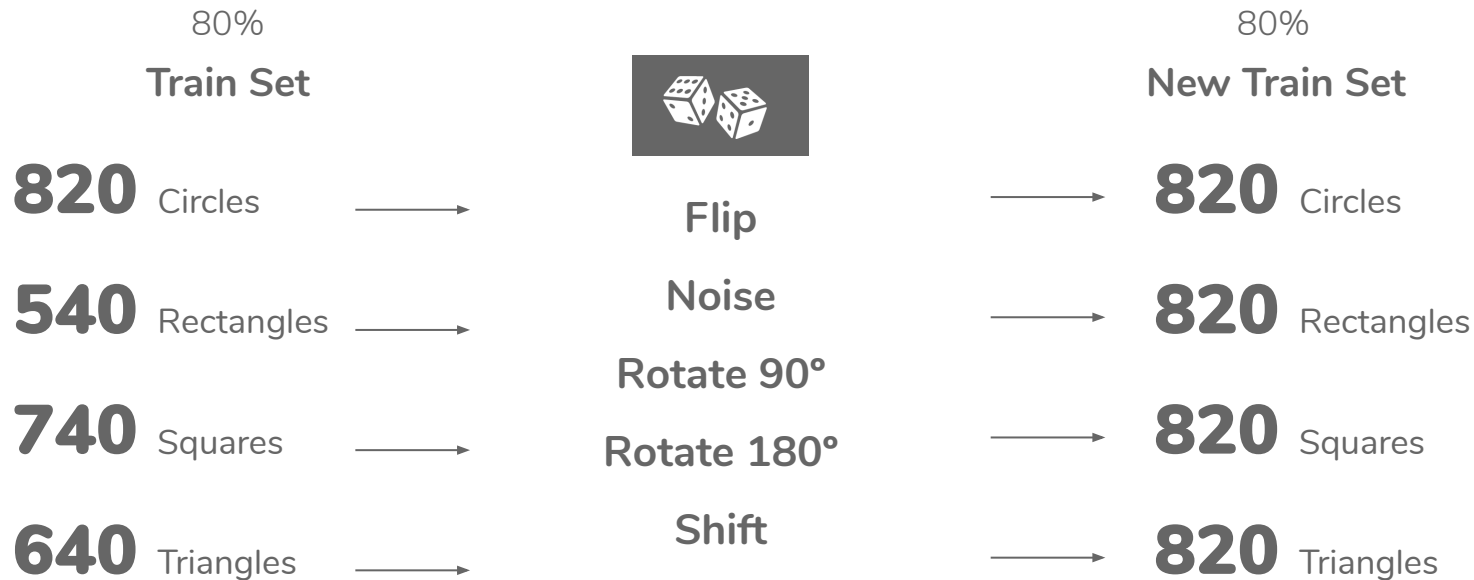
740 Squares →

640 Triangles →

Data Augmentation



Data Augmentation

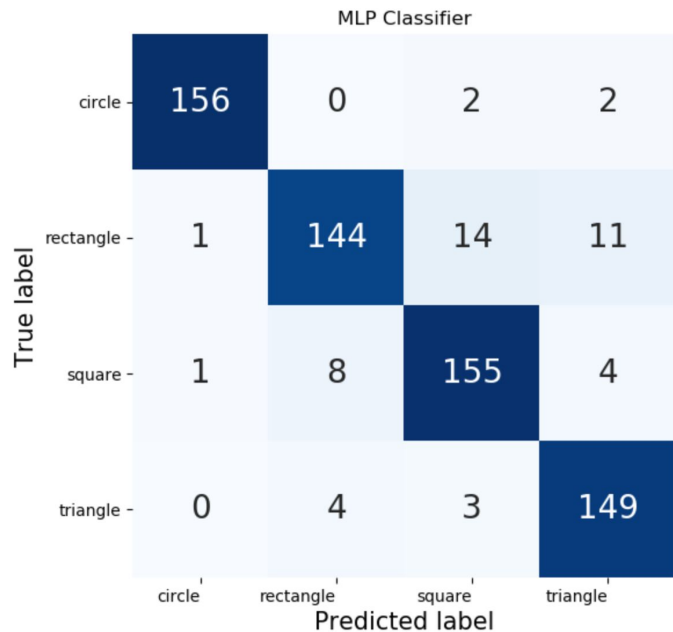


Model

- Multi-Layer Perceptron
- Stochastic gradient descent
- 6400-100-1
- Hidden Layer Size = 100
- Alpha = 0.0001
- Activation Function
 - $a = f(x) = \max(0, x)$

```
# Provide a start timer for MLP run
start = timeit.default_timer()
# Create a MLP Classifier
clf = MLPClassifier(solver='sgd',          # MLP will converge v
                   alpha=.0001,          # alpha is con
                   hidden_layer_sizes=(100,),
                   random_state=1)
# Train the model using the training sets
clf.fit(x_train, y_train)
# Predict the response for test dataset
y_pred = clf.predict(x_test)
```

Results



Data augmentation completed.

Training data shape x : (2614, 6400)

Test data shape x : (654, 6400)

Accuracy of MLP : 0.927

```
[[156  1  2  1]
 [ 0 149 15  7]
 [ 1  9 152  7]
 [ 0  3  2 149]]
```

	precision	recall	f1-score	support
0	0.99	0.97	0.98	160
1	0.92	0.87	0.89	171
2	0.89	0.90	0.89	169
3	0.91	0.97	0.94	154
accuracy			0.93	654
macro avg	0.93	0.93	0.93	654
weighted avg	0.93	0.93	0.93	654

Next steps

- Run it more often
 - Do we trust people drawing?
- User interface / App interface
 - Android/iOS compatible
 - Swift - React Native - Kotlin - Node JS
- Gamify, expand the capabilities
- Deaf/Blind compatible
- Not only shapes: words, letters, numbers, colors