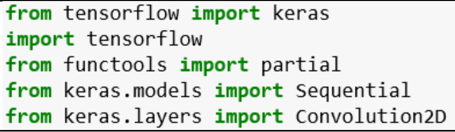
Name: David Adeniji *UKID: doad224* *CS-460G Kaggle Competition, Fall 2019*

Competition:	*Tiny Image Competition*
Kaggle Username:	*Shadowless*
Best Performing Classifier:	*Convolutional Neural Network*

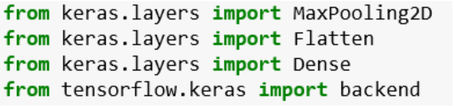
Optimized Parameter and Values

Parameters	***Value***
Layers	3
Learning rate	0.01
Rate_decay	0.01
Optimizer	Adam

External Libraries



```
from tensorflow import keras
import tensorflow
from functools import partial
from keras.models import Sequential
from keras.layers import Convolution2D
```



```
from keras.layers import MaxPooling2D
from keras.layers import Flatten
from keras.layers import Dense
from tensorflow.keras import backend
```

Cross Validation

5-fold cross validation was done using Random Forest and LGBM, however only a Train/Val/Split was done using the CNN model.

Hyperparameter Search

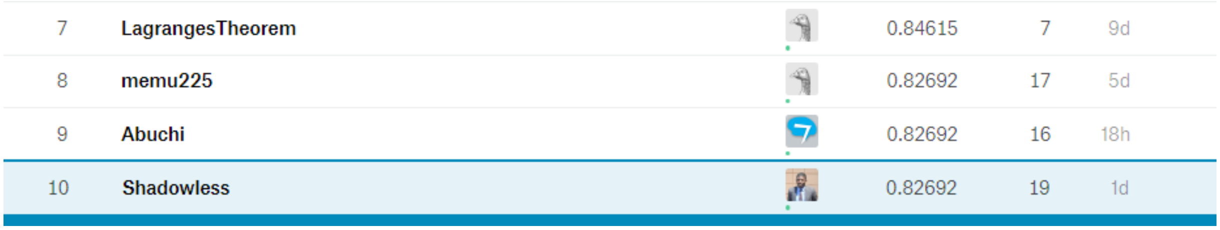
The CNN hyperparameter was randomly tuned, and the accuracy performance for each test were observed to arrive at the best model. The RandomizedSearchCV was used on the KNN classifier.

Summary

Random Forest, Decision Tree, K-Neighbour and LGBM Classifier were tried on the data however none of these gave a significant improvement on the baseline score. Since this is an image classification project, a CNN model was built using Keras. The image was first preprocessed using Sklearn Min-Max Scaler and Histogram of Gradient. The processed data was then passed to a dense 3-layer CNN Model with Relu, Relu, SoftMax activation respectively and Adam optimizer.

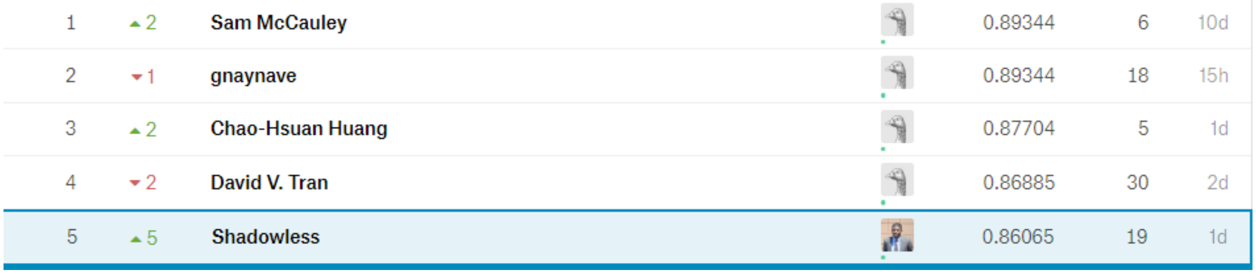
Kaggle Leaderboard

Public Leaderboard



7	LagrangesTheorem	0.84615	7	9d
8	memu225	0.82692	17	5d
9	Abuchi	0.82692	16	18h
10	Shadowless	0.82692	19	1d

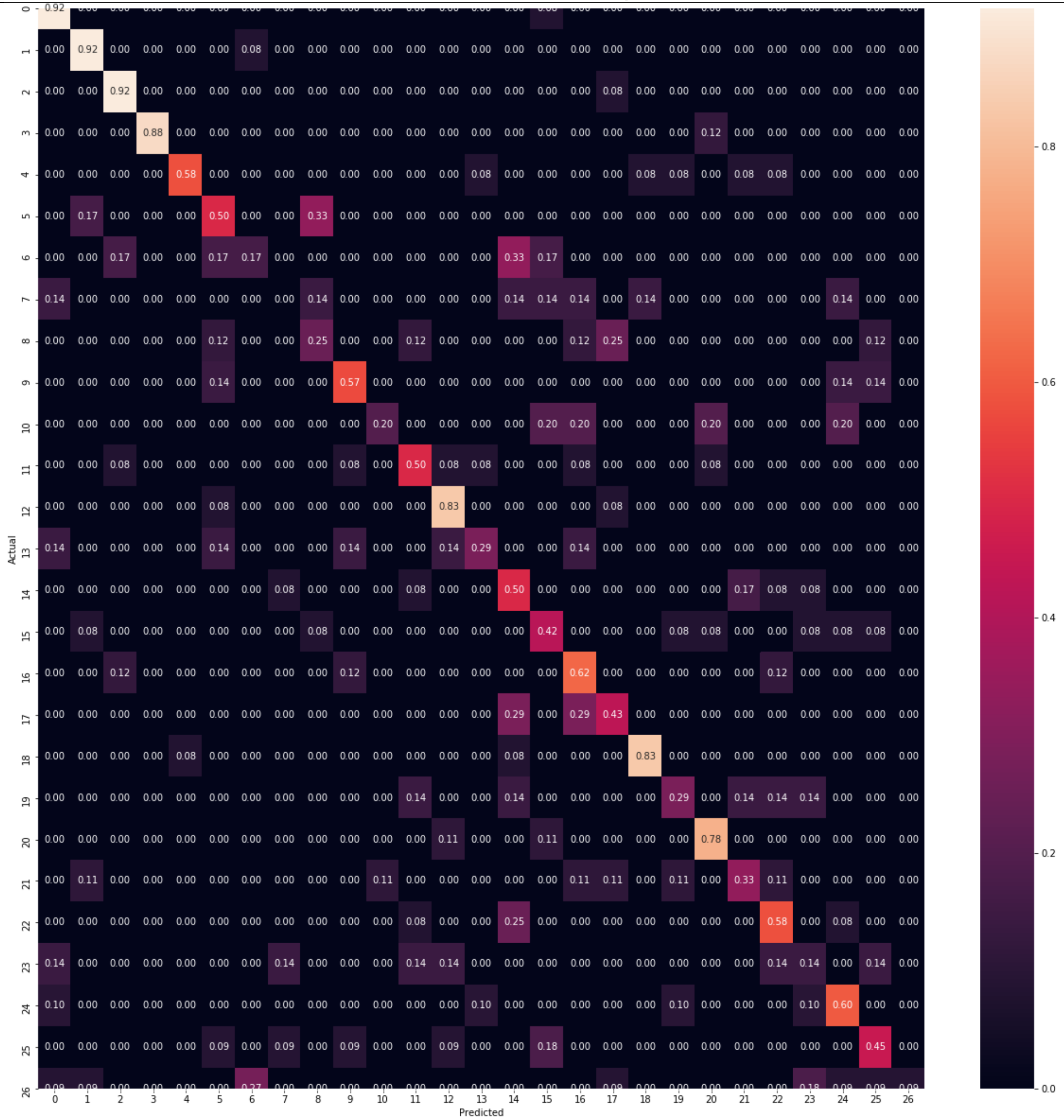
Private Leaderboard



1	▲ 2	Sam McCauley	0.89344	6	10d
2	▼ 1	gnaynave	0.89344	18	15h
3	▲ 2	Chao-Hsuan Huang	0.87704	5	1d
4	▼ 2	David V. Tran	0.86885	30	2d
5	▲ 5	Shadowless	0.86065	19	1d

My best kaggle public score was ***82.692% and 86.065%*** on the private leaderboard

Confusion Matrix using Sklearn



Actual \ Predicted	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
0	0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.00	0.92	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.08	0.08	0.00	0.08	0.08	0.00	0.00	0.00	0.00
5	0.00	0.17	0.00	0.00	0.00	0.50	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.17	0.00	0.00	0.17	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.14	0.14	0.14	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.25	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.12	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00
9	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.14	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.20	0.20	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.20	0.00	0.00
11	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.50	0.08	0.08	0.00	0.00	0.08	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.14	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.14	0.00	0.00	0.14	0.29	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.08	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.08	0.08	0.00	0.00	0.00
15	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.08	0.08	0.00	0.00	0.08	0.08	0.08	0.00
16	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.29	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.29	0.00	0.14	0.14	0.14	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.78	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.11	0.11	0.00	0.11	0.00	0.33	0.11	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.00	0.08	0.00	0.00
23	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.14	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.14	0.00	0.14	0.00
24	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.10	0.60	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.09	0.00	0.09	0.00	0.00	0.09	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00
26	0.09	0.09	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.18	0.09	0.09	0.09