Logo/Not Logo

Thurs 6:30pm Session 6

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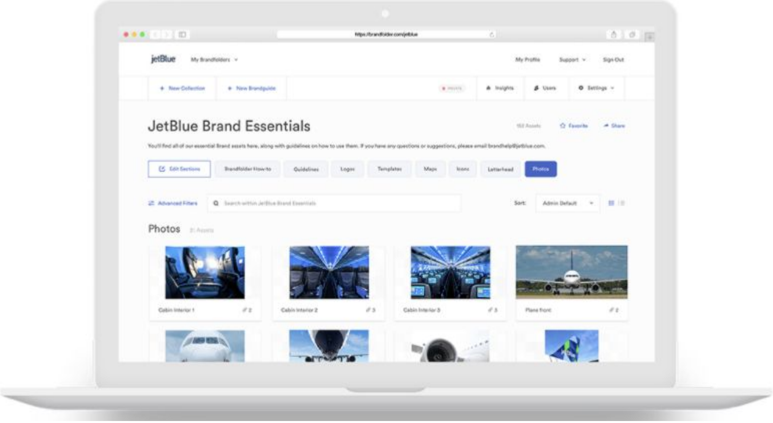
Motivation

- Brandfolder is a digital asset management company
- Companies upload thousands of different media files
- Goal is to save time spent organizing files by automatically identifying those files that are logos

Brandfolder

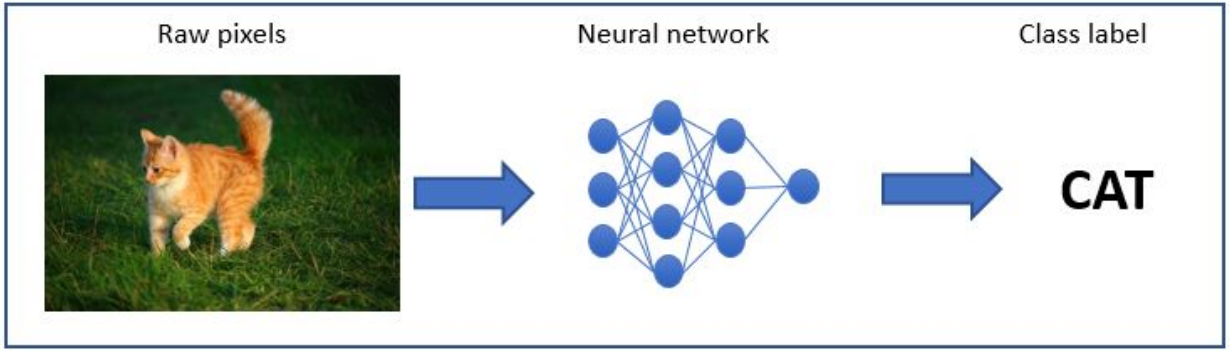


JetBlue Brand Essentials

You'll find all of our essential Brand assets here, along with guidelines on how to use them. If you have any questions or suggestions, please email brandhelp@jetblue.com.

Literature

- Binary classification is a common problem solved with machine learning



Our Contribution

- Directly impacts Brandfolder
- Brandfolder does not currently have a method for logo recognition

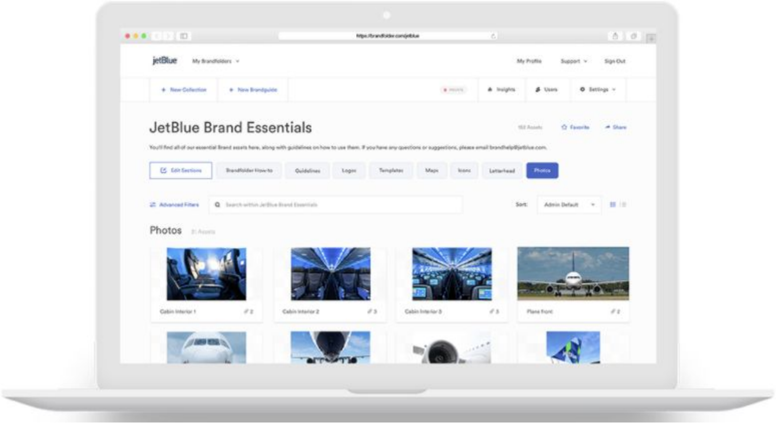
Process

1. Data collection
2. Pre-processing
3. Logistic regression
4. Single layer neural net
5. Multilayer neural net

Data Source

- Images are randomly selected from public Brandfolders

Brandfolder



https://brandfolder.com/jetblue

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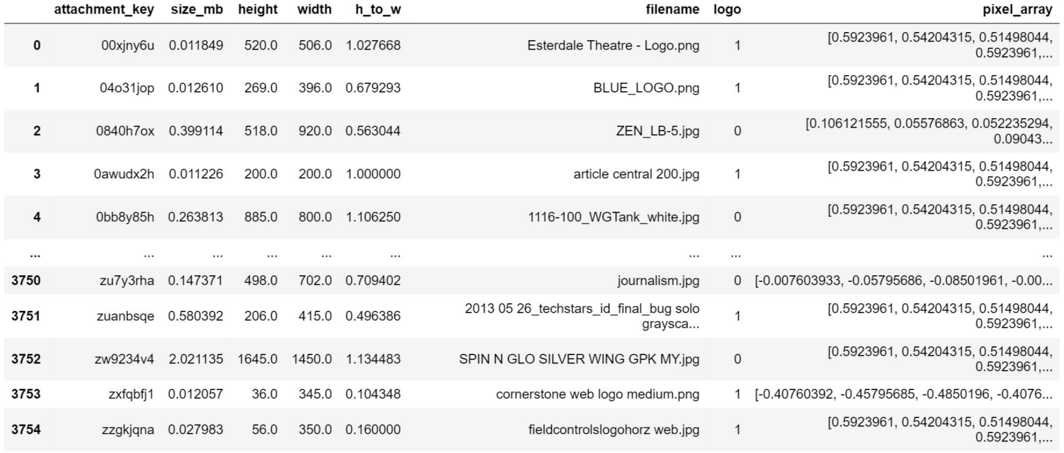
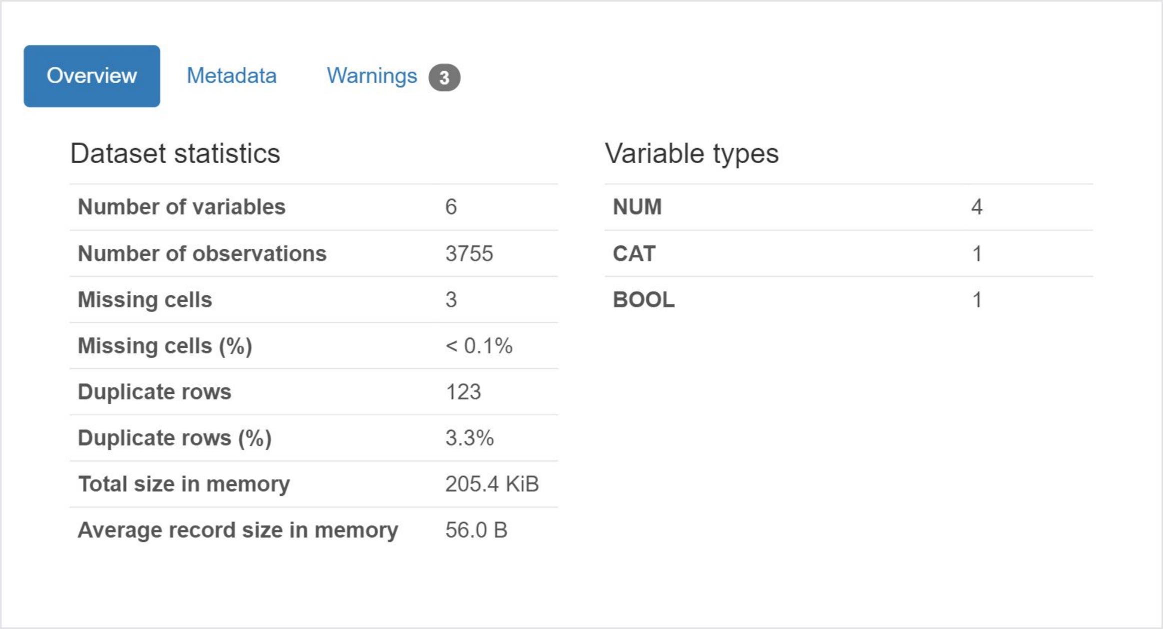
Data

- 3755 images in total
- Data selection:
  - Same image size (each image has a 224x224-pixel dimension by RGB)
  - Balanced Logo vs Non-logo count



	attachment_key	size_mb	height	width	h_to_w	filename	logo	pixel_array
0	00xjny6u	0.011849	520.0	506.0	1.027668	Esterdale Theatre - Logo.png	1	[0.5923961, 0.54204315, 0.51498044, 0.5923961,...
1	04o31jop	0.012610	269.0	396.0	0.679293	BLUE_LOGO.png	1	[0.5923961, 0.54204315, 0.51498044, 0.5923961,...
2	0840h7ox	0.399114	518.0	920.0	0.563044	ZEN_LB-5.jpg	0	[0.106121555, 0.05576863, 0.052235294, 0.09043...
3	0awudx2h	0.011226	200.0	200.0	1.000000	article central 200.jpg	1	[0.5923961, 0.54204315, 0.51498044, 0.5923961,...
4	0bb8y85h	0.263813	885.0	800.0	1.106250	1116-100_WGTank_white.jpg	0	[0.5923961, 0.54204315, 0.51498044, 0.5923961,...
...	...	...	...	...	...	...	...	...
3750	zu7y3rha	0.147371	498.0	702.0	0.709402	journalism.jpg	0	[-0.007603933, -0.05795686, -0.08501961, -0.00...
3751	zuanbsqe	0.580392	206.0	415.0	0.496386	2013 05 26_techstars_id_final_bug solo graysca...	1	[0.5923961, 0.54204315, 0.51498044, 0.5923961,...
3752	zw9234v4	2.021135	1645.0	1450.0	1.134483	SPIN N GLO SILVER WING GPK MY.jpg	0	[0.5923961, 0.54204315, 0.51498044, 0.5923961,...
3753	zxfqbfj1	0.012057	36.0	345.0	0.104348	cornerstone web logo medium.png	1	[-0.40760392, -0.45795685, -0.4850196, -0.4076...
3754	zzgkjqna	0.027983	56.0	350.0	0.160000	fieldcontrolslogohorz web.jpg	1	[0.5923961, 0.54204315, 0.51498044, 0.5923961,...

Overview



Dataset statistics

Number of variables	6
Number of observations	3755
Missing cells	3
Missing cells (%)	< 0.1%
Duplicate rows	123
Duplicate rows (%)	3.3%
Total size in memory	205.4 KiB
Average record size in memory	56.0 B

Variable types

NUM	4
CAT	1
BOOL	1

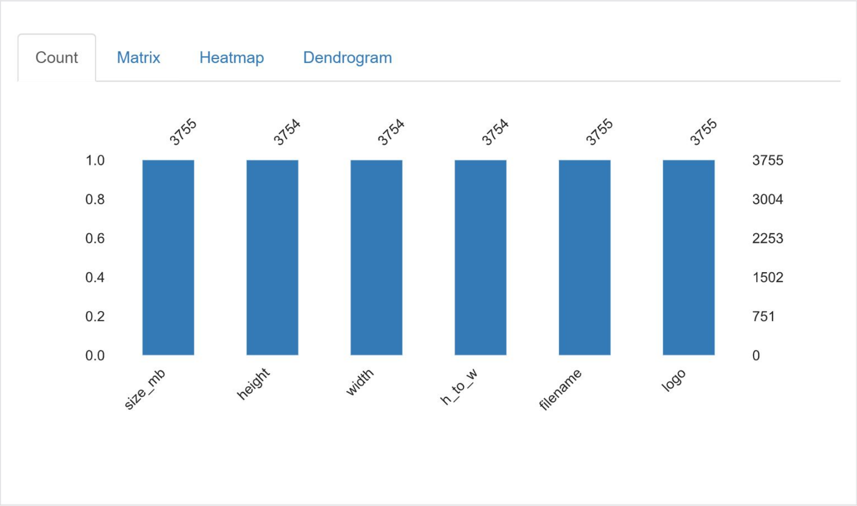
Pre-processing

○ Remove null data

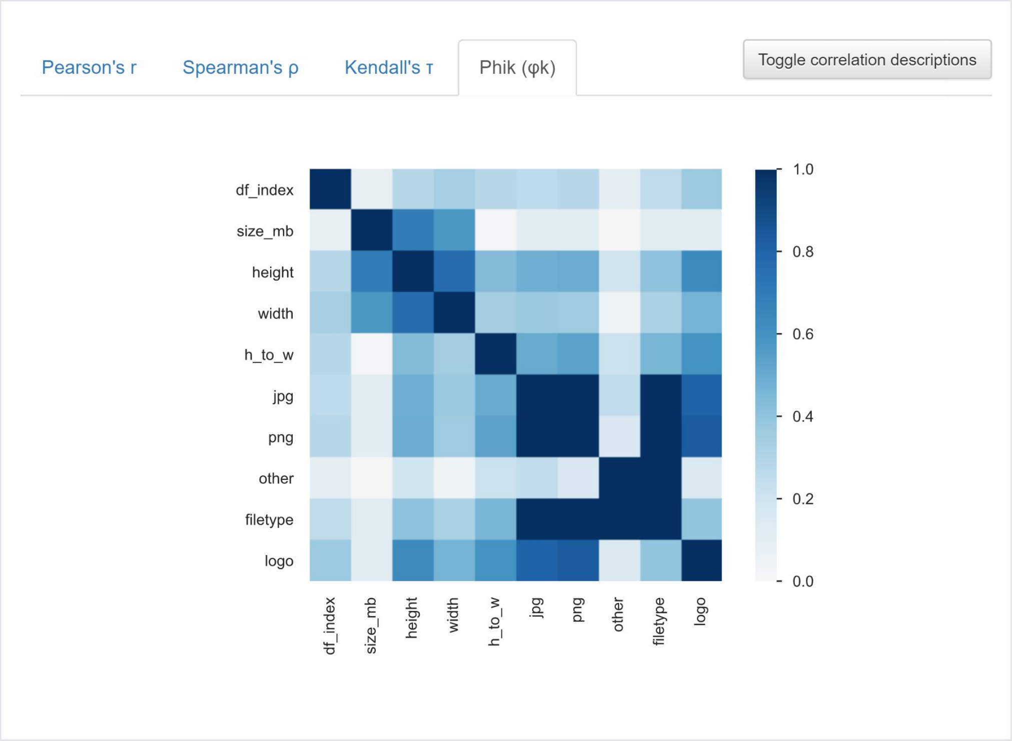
○ Standardized pixel data and metadata

○ Split datasets into training(60%), dev data(20%) and testing data(20%)

Missing values

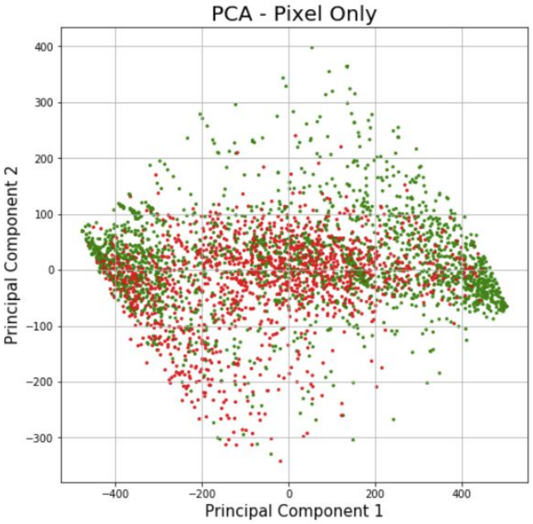


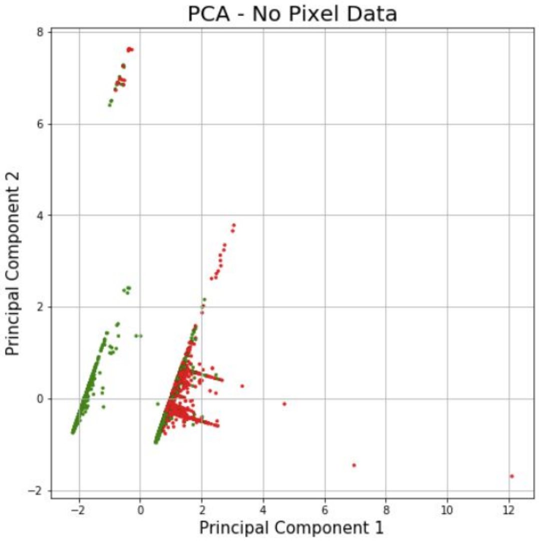
Correlations

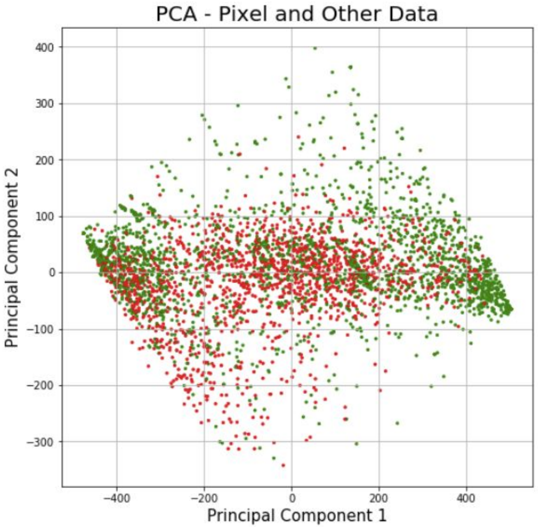


Pre-processing

○ Use PCA to fit and transform training and test data







Logistic Regression

1. Reduced pixel only data: 59.3% accuracy, c = 0.001
2. Metadata only: 84.8% accuracy, c = 0.1
3. Reduced pixel + metadata: 59.3% accuracy, c = 0.001

- Try using L1 penalty
- Try reducing dimensionality of pixel data *only* via PCA and append to original metadata

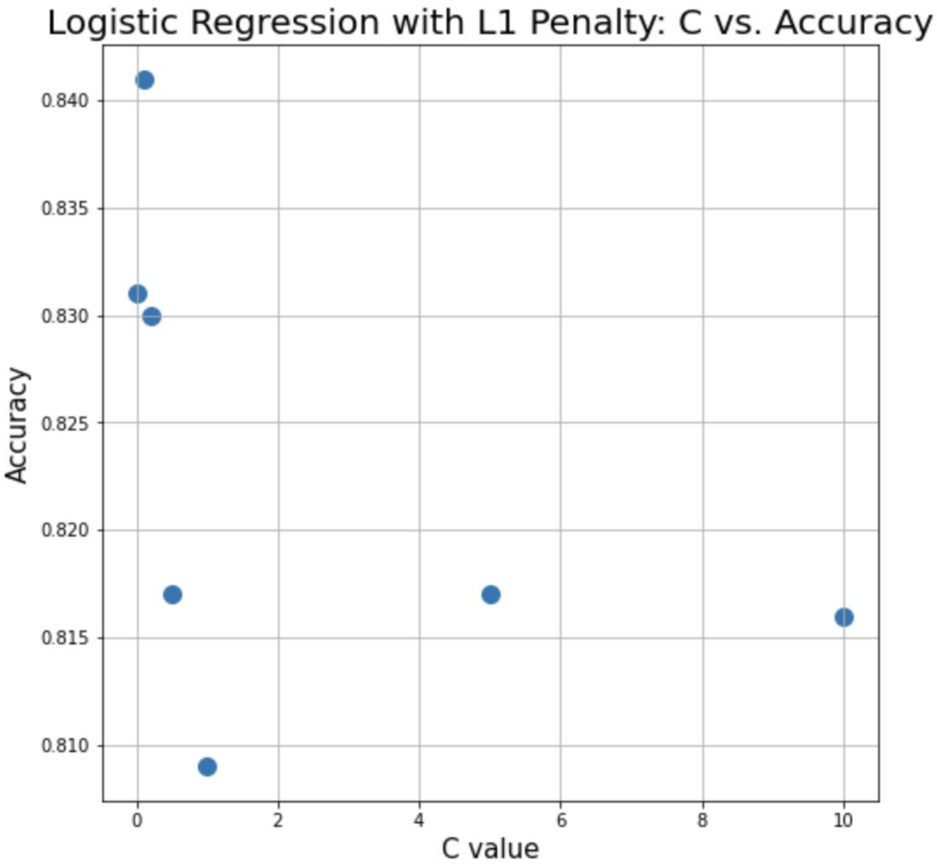
Logistic Regression

L1 Penalty

Dependent variable: logo dummy
Independent variables: full pixel array, file size, aspect ratio, filetype dummy variables

Optimized Variables
C = 0.1

Max F1 = 84.6%



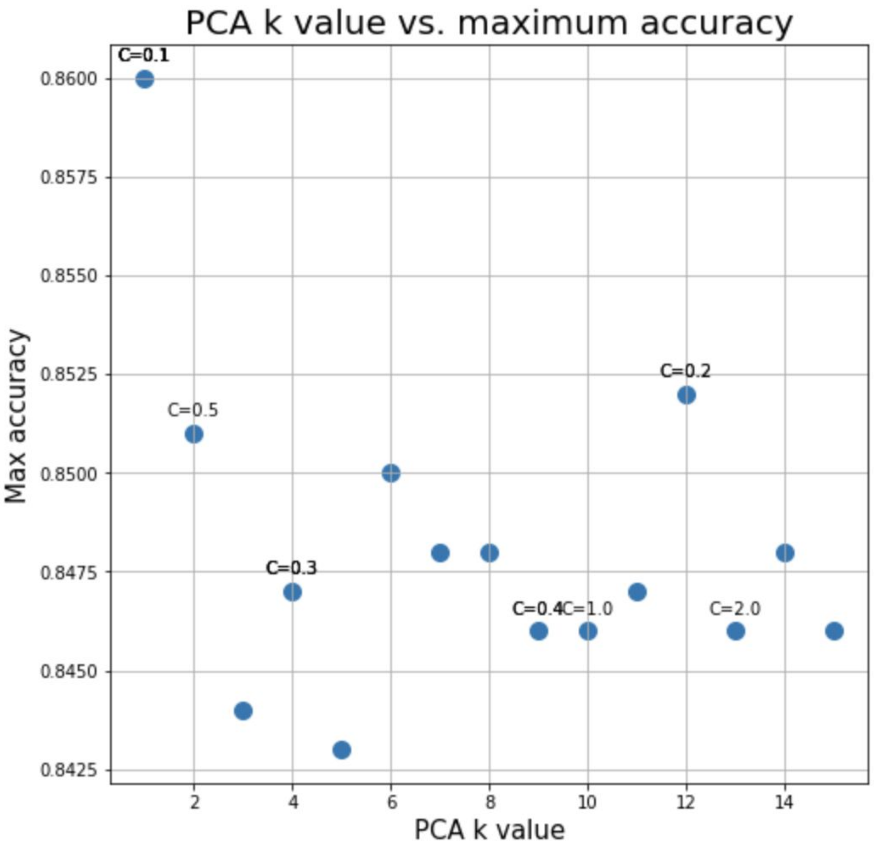
Logistic Regression

Pixel-only PCA dimension reduction

Dependent variable: logo dummy
Independent variables: k pixel PCA dimensions,
file size, aspect ratio, filetype dummy variables

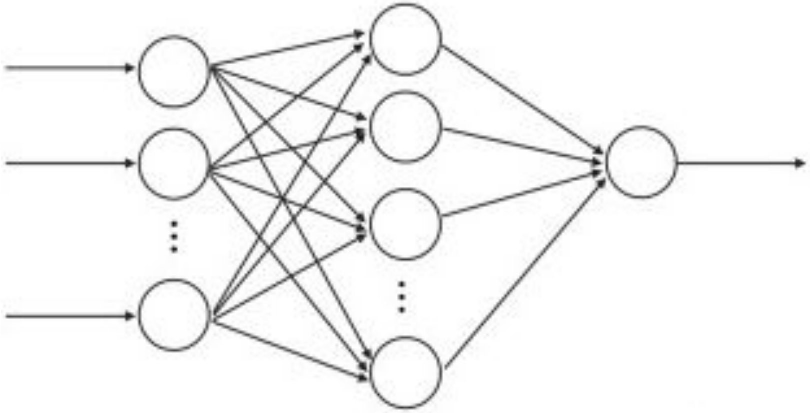
Optimized Variables
K = 1
C = 0.1

Max F1 = 86%



Neural Net - Features

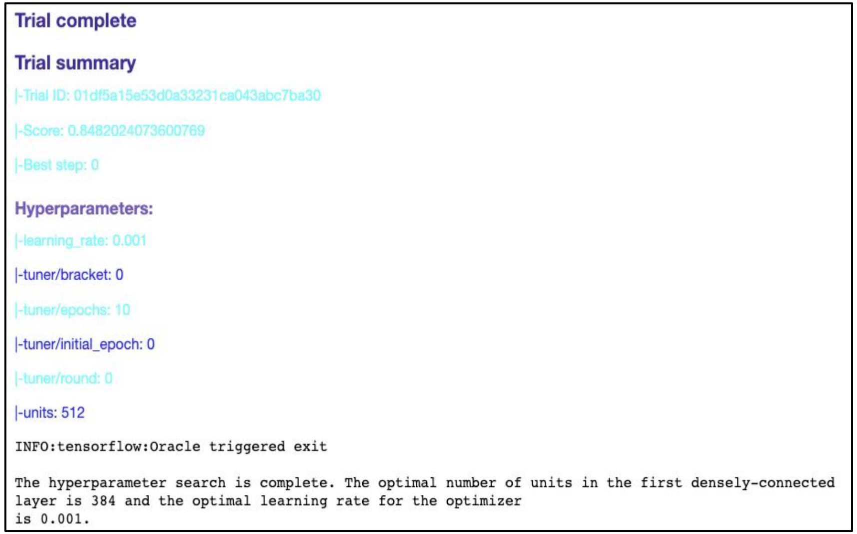
Features:
Pixel vector feature
h_to_w ratio
size
filetype dummies
  JPG
  PNG
  Other



Logo/
Not Logo

Neural Network

- Created model using TensorFlow and Keras Tuner so that we could easily tune hyperparameters
- Allowed us to tune the following hyperparameters:
    - Number of nodes in the first dense layer = varied from 32 to 512
    - Learning rate = varied from .01 to .001
- Best accuracy = 80.96%



```
Trial complete

Trial summary

|-Trial ID: 01df5a15e53d0a33231ca043abc7ba30

|-Score: 0.8482024073600769

|-Best step: 0

Hyperparameters:

|-learning_rate: 0.001

|-tuner/bracket: 0

|-tuner/epochs: 10

|-tuner/initial_epoch: 0

|-tuner/round: 0

|-units: 512

INFO:tensorflow:Oracle triggered exit

The hyperparameter search is complete. The optimal number of units in the first densely-connected
layer is 384 and the optimal learning rate for the optimizer
is 0.001.
```

Multilayer Neural Net

- 3 layers
    - Dense: hidden layers, activation function is relu
    - Regularization: dropout
    - Dense: 2 output nodes logo/not logo; activation function is softmax
- Varied hidden layers, epochs, and dropout rate
- Optimizer
    - Adam
    - Loss function: sparse categorical cross-entropy
    - Varied learning rate

Results

- Multilayer neural net has similar accuracies as logistic regression
    - Logistic regression could be a better choice due to computational cost

	Parameters	Accuracy
Logistic Regression	Regularization: c=0.1	Dev data: 86.0% Test data: 83.4%
2-Layer Neural Net	Hidden nodes: 480 Epochs: 10 Learning rate: 0.0001	Dev data: 80.0% Test data: 81.6%
3-Layer Neural Net	Hidden nodes: 401 Dropout rate: 0.5 Epochs: 50 Learning rate: 0.001	Dev data: 86.4% Test data: 84.8%

Conclusions

Model proves useful for:

- Brandfolder use
- Image classification in many domains
- Organization in many domains

Next Steps?

- Convolutional net
- Increase sample size/Spark
- Continue to tune existing model to optimize performance

Questions?