

The background features a dark blue gradient with a subtle pattern of white dots. Overlaid on this are several circular and semi-circular elements. A prominent feature is a large circular scale on the left side, with numerical markings from 140 to 260 in increments of 10. Other elements include various concentric circles, dashed lines, and arrows, some of which are partially visible or cut off by the frame. The overall aesthetic is technical and scientific.

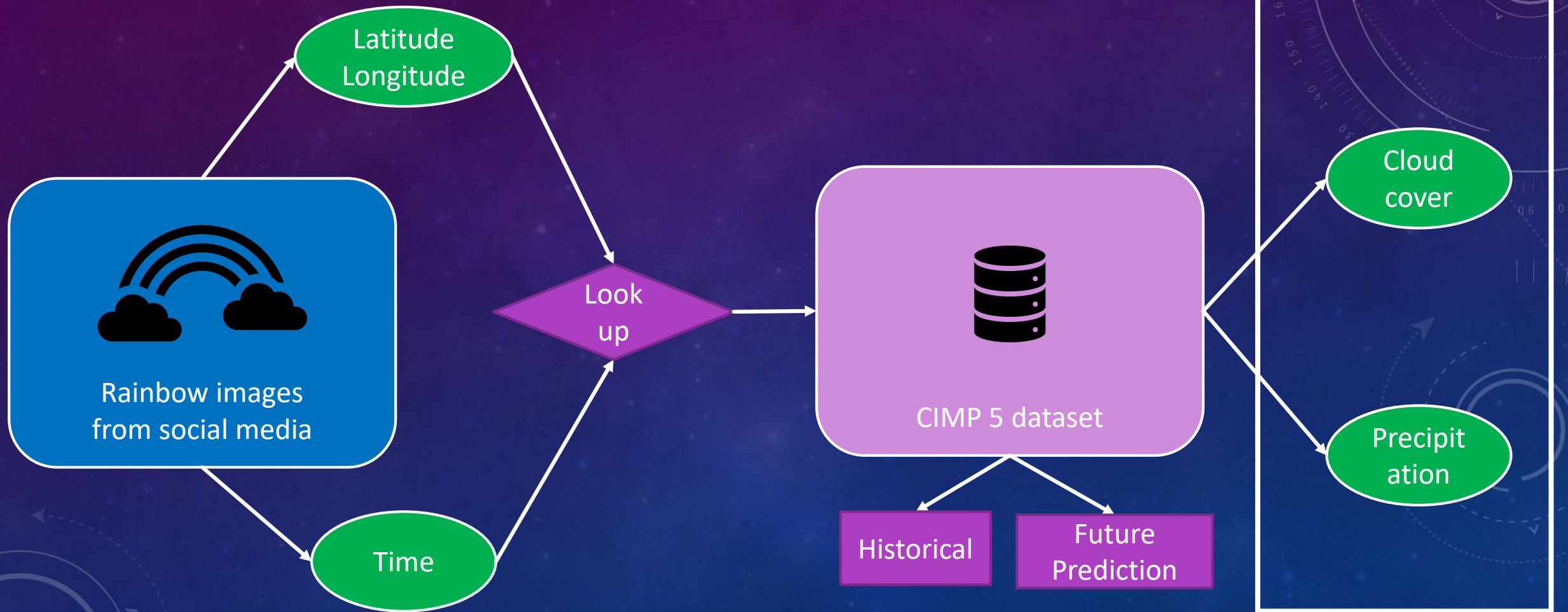
TRANSFER LEARNING USING MOBILENET FOR RAINBOW IMAGE RECOGNITION

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PROJECT



Independent variables

DATA

- Social media images (Flickr)
- Geotagged (latitude, longitude)
- Resolution: 500 * 375
- Keywords: 'rainbow' ¹
- Training & validation ratio: 80% - 20%
- Manually classified labels (criteria follows)

Total	Training set	Validation set
22,135	17,708	4,427

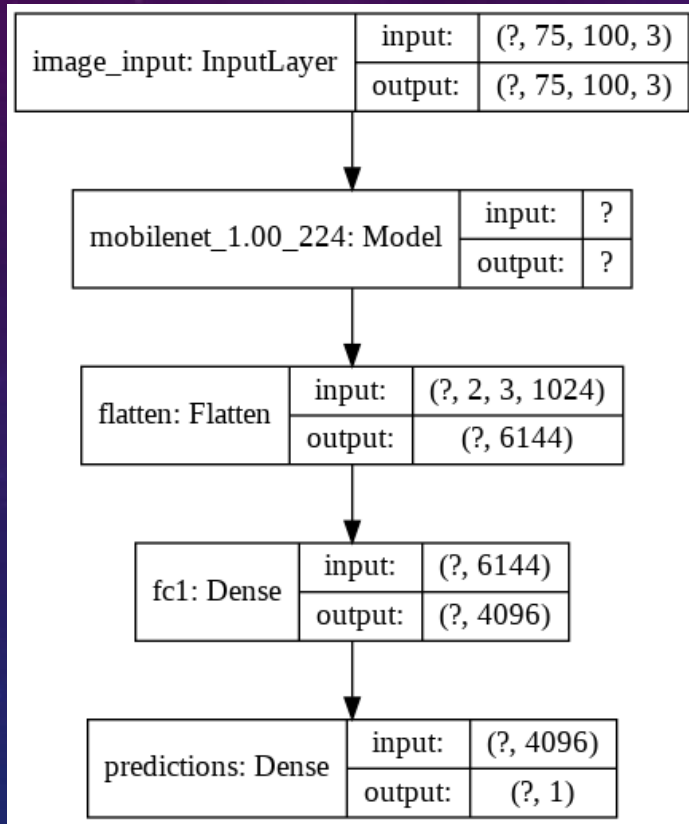
1. <https://www.flickr.com/services/api/flickr.photos.search.html>

CRITERIA

- Rainbow above horizon
- Not near waterfall
- No fake rainbow
- No altered pictures (must be consistent with real taken time)



IMPLEMENTATION



Sigmoid to get value from 0 to 1 in the last layer

Layer (type)	Output Shape	Param #
image_input (InputLayer)	(None, 75, 100, 3)	0
mobilenet_1.00_224 (Model)	multiple	3228864
flatten (Flatten)	(None, 6144)	0
fc1 (Dense)	(None, 4096)	25169920
predictions (Dense)	(None, 1)	4097
=====		
Total params: 28,402,881		
Trainable params: 25,174,017		
Non-trainable params: 3,228,864		

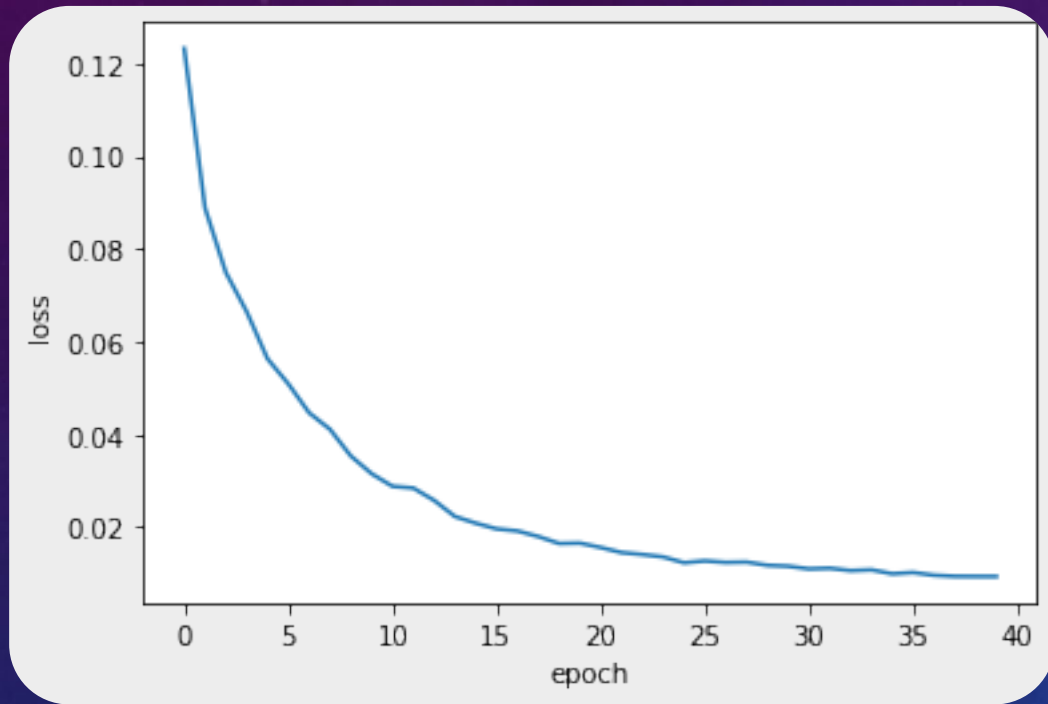
Layer (type)	Output Shape	Param #
image_input (InputLayer)	(None, 75, 100, 3)	0
mobilenet_1.00_224 (Model)	multiple	3228864
flatten (Flatten)	(None, 6144)	0
fc1 (Dense)	(None, 4096)	25169920
predictions (Dense)	(None, 1)	4097
=====		
Total params: 28,402,881		
Trainable params: 28,380,993		
Non-trainable params: 21,888		

IMPLEMENTATION

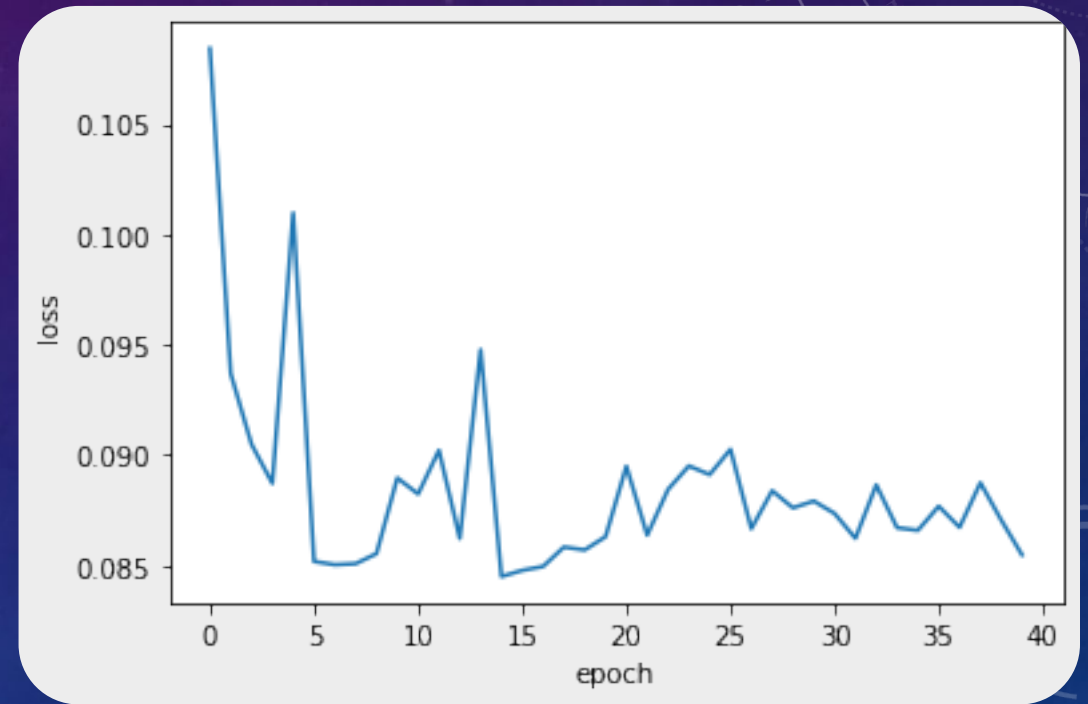
	Time	Epochs	acc	val_acc	loss	val_loss
First run	14 min	40	0.9759	0.7638	0.0224	0.1679
Second run	34 min	40	0.9898	0.8993	0.0094	0.0855

- First run with freezing layers in MobileNet
 - Took 14 min
 - Achieved 76.3% validation accuracy
- Second run with all free layers
 - Took 34 min
 - Achieved 89.93% validation accuracy

IMPLEMENTATION



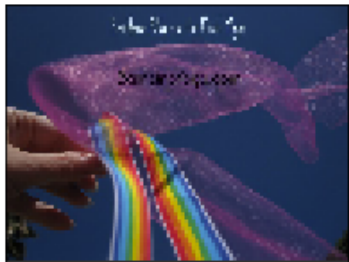
Training



Validation

RESULTS

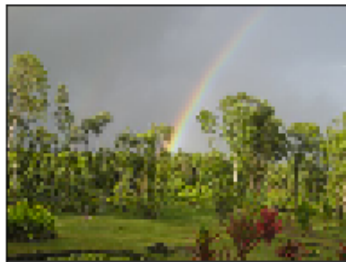
1.2978996e-06



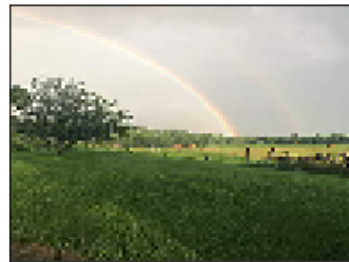
3.894381e-05



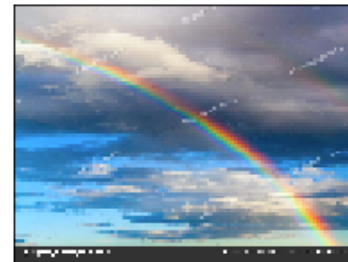
0.9951698



0.999954



0.003575383



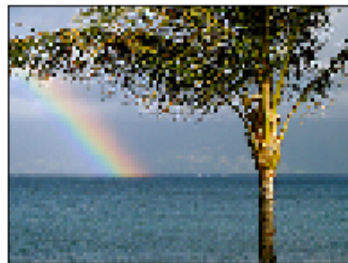
0.99520653



0.9998247



0.9966484



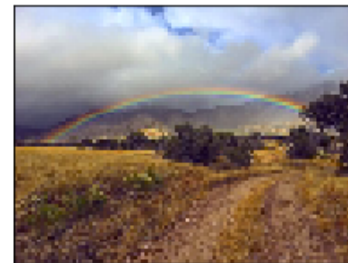
9.591619e-06



0.24281585



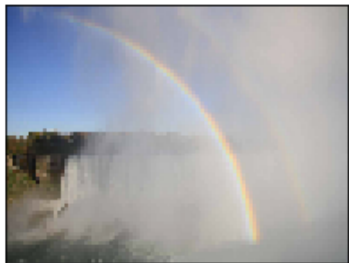
0.99570495



0.0



0.9990689



0.0045654746



0.028179152



3.636177e-05





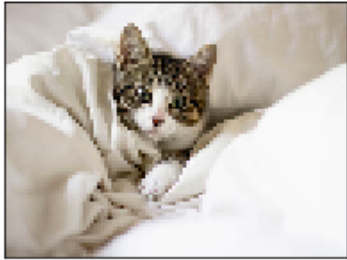
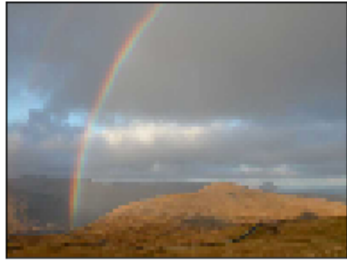


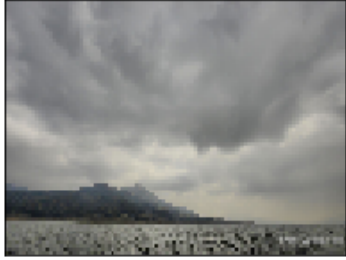

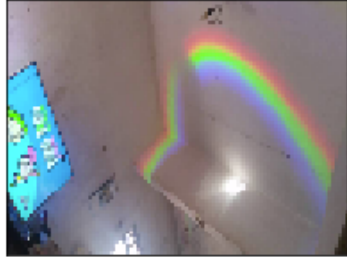
1.745011e-05



1.3059847e-07



RESULTS

0.16379257	0.98905075	4.0389263e-05	1.584993e-06	0.9998964	4.3343124e-07
					
0.9894357	0.59721583	0.26177862	0.021224424	0.9999931	5.5818673e-06
					

RESULTS

- 2 out of 30 random pictures (not included in training/validation set) were wrongly classified
- The trained model can achieve around 90% accuracy in validation set
- Accuracy achieved from the test set is 93.33%

Outcomes of the model	Fact (if is rainbow)	
	Positive	Negative
Positive	10 (TP)	2(FP)
Negative	0(FN)	18(TN)

SHORTCOMINGS AND FUTURE STEPS

- Limited resolution for processing
- Potential errors in manually classified labels
- Imperfect optimizer

- Set up mobile applications
- Add more pictures for training
- Seek better optimizer
- Apply this framework for other projects which need image recognition

DATA AVAILABILITY

- Preprocessing image data:
- https://colab.research.google.com/drive/17Uu_aRY_KgZDp7PK6m1fWdcp9OpYs6rs
- Training model and prediction:
- <https://colab.research.google.com/drive/1EueUHKScuaZu7FvfO2HVZDs-pOd7Vvl->

The background is a dark blue gradient with a subtle pattern of small white stars. Overlaid on this are several technical diagrams. In the top right, there is a large circular diagram with concentric rings and a scale from 0 to 210 degrees. In the bottom right, there is a smaller circular diagram with dashed lines and arrows. In the bottom left, there is another circular diagram with solid lines and arrows. The word "QUESTIONS?" is centered in the middle of the slide in a large, white, sans-serif font.

QUESTIONS?

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