“Quick, Draw!” Image Classification: A Hybrid Deep Learning Model

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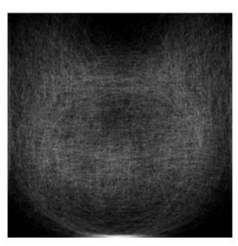
Introduction

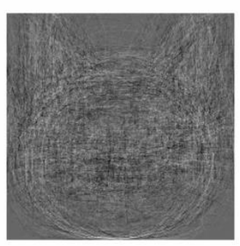
“Quick, Draw!” is a Kaggle competition developed by Google.

It challenges competitors to guess what these hand drawn images represent.

How AI Perceives the World



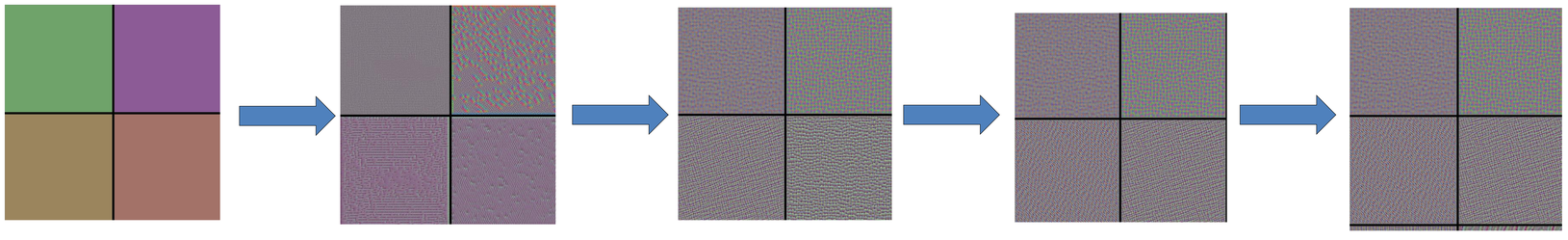
mean face



eigenface

First, we generated the mean face from 1000 cat pictures. We applied the **Principal Component Analysis (PCA)** to create eigenfaces, from which we can observe a blurry shape of a cat’s face when we project 20 eigenvectors.

Unlike eigenfaces, the features extracted by the **Convolutional Neural Network (CNN)** may not be perceivable for human beings. However, AI can identify these “magpies,” and classify this picture correctly.

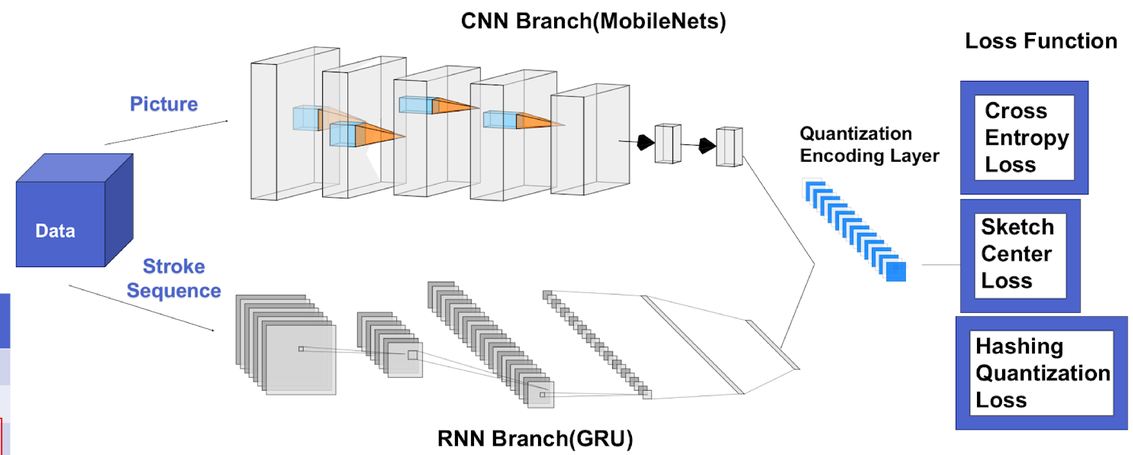


Conv 1 **Conv 2** **Conv 3** **Conv 4** **Conv 5**

Methodology

We used a hybrid structure in this project, which is a **parallel** neural network consisting of **MobileNets** and **GRU**. The result below shows that the testing accuracy of this hybrid structure outperforms a single MobileNets or VGG.

Model	Training Accuracy	Validation Accuracy	Testing Accuracy
MobileNets	0.813	0.705	0.710
VGG	0.984	0.603	0.603
Hybrid Model	0.896	0.887	0.803



Conclusion

1. The parallel structure of CNN and GRU surpasses a single transfer learning model.
2. Non-linear transformation employed by CNN can detect complex features of images.

Reference

[1] Chollet, Francois. “How Convolutional Neural Networks See the World.” *The Keras Blog*, 30 Jan. 2016, blog.keras.io/how-convolutional-neural-networks-see-the-world.html. Accessed 2 Dec 2018.
[2] Jana, Reena, and Josh Lovejoy. “Exploring and Visualizing an Open Global Dataset.” *Google AI Blog*, 25 Aug. 2017, ai.googleblog.com/2017/08/exploring-and-visualizing-open-global.html. Accessed 2 Dec 2018.
[3] Nguyen, Huyen. “Combining CNN and RNN.” *Kaggle*, 28 Nov. 2018,www.kaggle.com/huyenvyvy/fork-of-combining-cnn-and-rnn. Accessed 2 Dec 2018.
[4] Beluga. “Greyscale MobileNet” *Kaggle*, 27 Nov. 2018, www.kaggle.com/gaborfodor/greyscale-mobilenet-lb-0-892. Accessed 2 Dec 2018.