KEYBOARD CLASSIFICATION

WITH TENSORFLOW

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Executive summary

The purpose of this investigation is to put to the test a TensorFlow image classification model. The trained model objective is to properly identify the keyboard format (100%, TKL, 60% and number pad).

The model will first be trained with a reduced number of data gathered from the internet, then it will be retrained with a larger dataset of CGI and a small amount of images gathered from the internet.

Google Colaboratory and Blender were the tools used in this project.

Introduction

This project explores the benefits of using CGI to generate data used in the training of an image classification model. There are four classes that will be used in this investigation: 100% (refer to image 1), Ten Key Less also known as TKL (refer to image 2), 60% (refer to image 3) and Number pad (refer to image 4).

Image 1.

Image 2.

Image 3.

Image 4.

To train a model that identifies a keyboard format by itself is already interesting since visually they all are very similar, leading to think that it's a difficult task for a model to have a high accuracy. The key differences between these formats are the number of keys that the keyboard contains.

A 100% has all the keys that exist in a regular keyboard (Fn keys, arrows and above, numbers and a number pad), TKL as it name suggests has all the normal keys except for the number pad, 60% lacks arrows and above, Fn keys and a number pad, and finally the number pad is a modular component that suits those who lack a number pad on their keyboard but still need one.

120 images gathered from the internet were used for the first model and for the second model 1,700 CGI were added to the 120 that were previously used.

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Training results

We used data augmentation since there are a small number of training examples. Data augmentation takes the approach of generating additional training data from the existing examples by augmenting them using random transformations that yield believable-looking images. This helps expose the model to more aspects of the data and generalize better. 20% of the images will be used for validation.

<u>Results for 120 non CG images before and after data augmentation</u>:

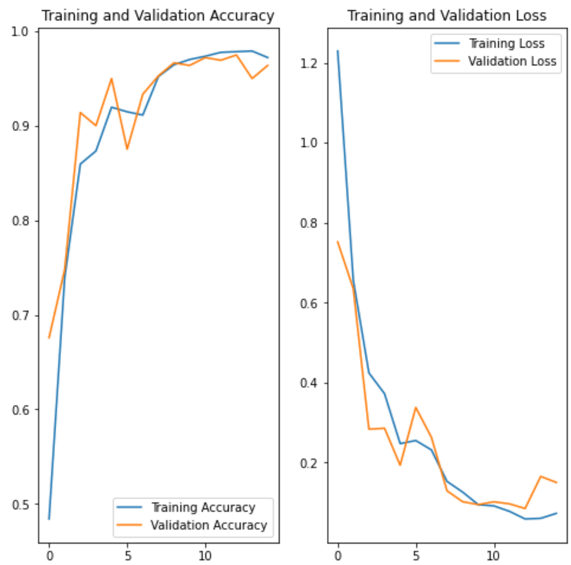
10 epochs - before DA

15 epochs - after DA

<u>Results for 1,800 images with CG before and after data augmentation</u>:

10 epochs - before DA

15 epochs - after DA



CG data was generated in blender. First a 120 frames animation in which the keyboard was visible from multiple angles was rendered. Then the 120 frames were exported as single images to be used in the model training. After training, an image from the renders and an image from the internet that were not used for validation or training were used for testing predictions.

FORMAT	ABBREVIATION
100%	100pc
TKL	TKL
60%	60pc
Number pad	NP

Expected value: 60pc

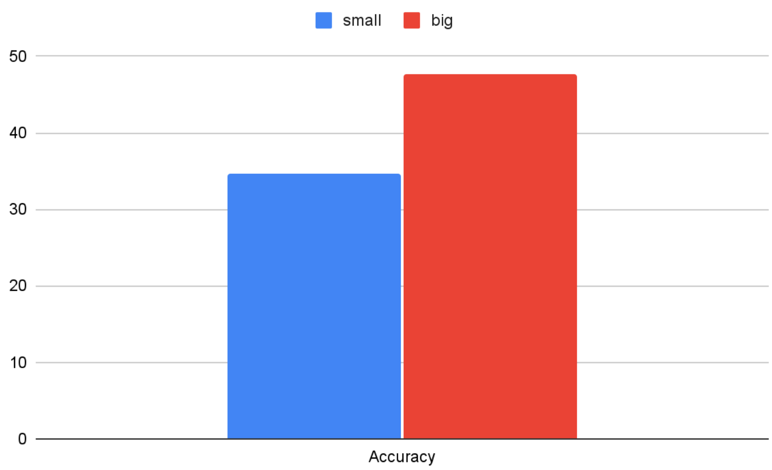
Small data set model:
This image most likely belongs to **100pc** with a 69.36 percent confidence.

Big data set with CGI model:
This image most likely belongs to **60pc** with a 95.36 percent confidence.

Expected value: 60pc

Small data set model:
This image most likely belongs to **TKL** with a 74.36 percent confidence.

Big data set with CGI model:
This image most likely belongs to **TKL** with a 78.96 percent confidence.



Expected value: 100pc

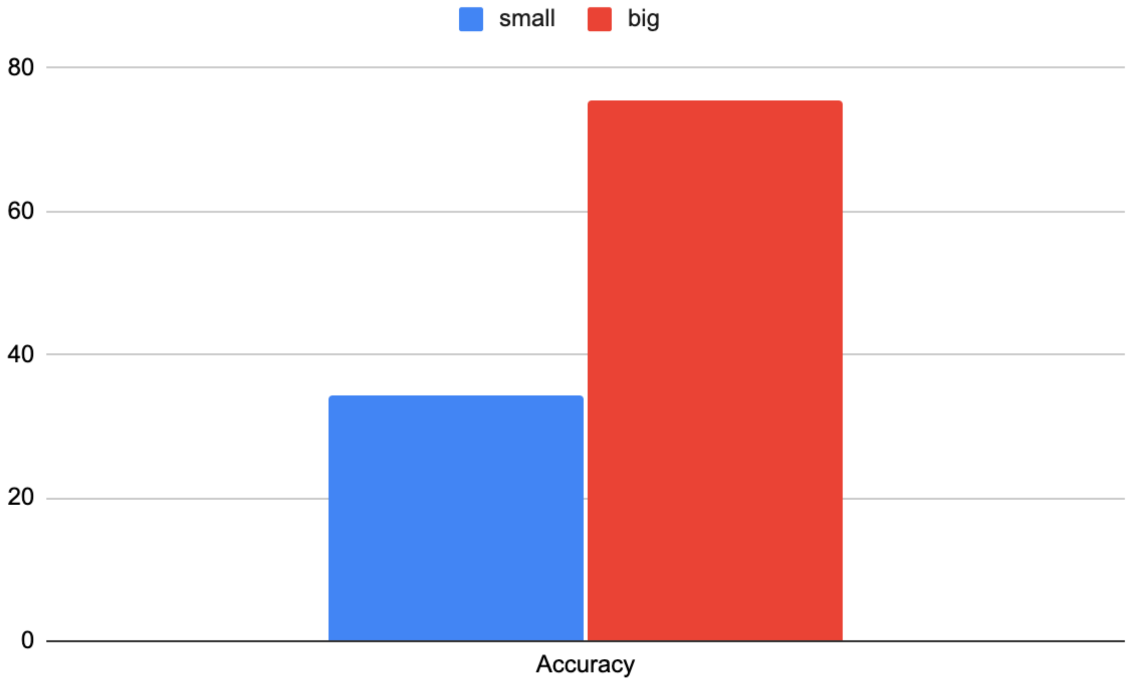
Small data set model:
This image most likely belongs to **100pc** with a 68.58 percent confidence.

Big data set with CGI model:
This image most likely belongs to **100pc** with a 99.29 percent confidence.

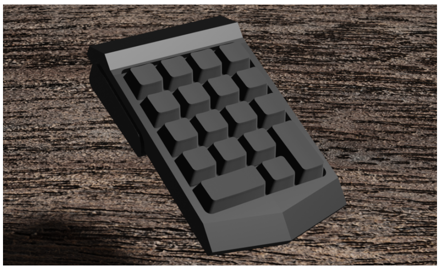
Expected value: 100pc

Small data set model:
This image most likely belongs to **TKL** with a 71.95 percent confidence.

Big data set with CGI model:
This image most likely belongs to **100pc** with a 51.54 percent confidence.



Expected value: NP



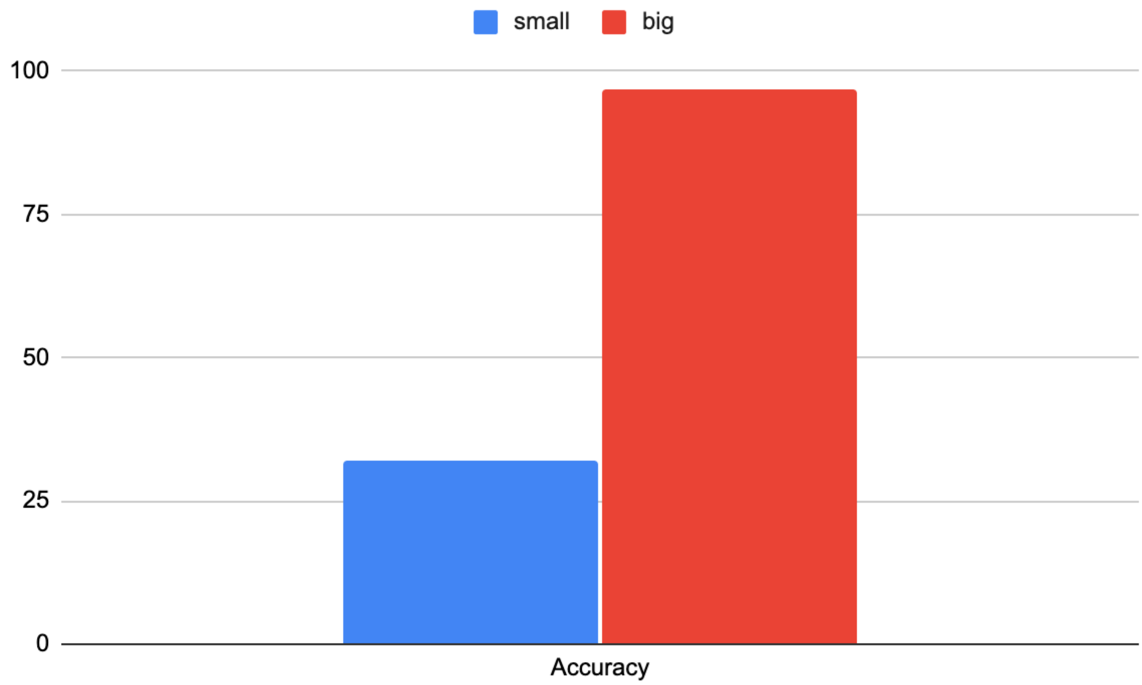
Small data set model:
This image most likely belongs to **100pc**
with a 61.41 percent confidence.

Big data set with CGI model:
This image most likely belongs to **NP**
with a 99.91 percent confidence.

Expected value: NP

Small data set model:
This image most likely belongs to **NP**
with a 64.38 percent confidence.

Big data set with CGI model:
This image most likely belongs to **NP**
with a 93.83 percent confidence.



Expected value: TKL

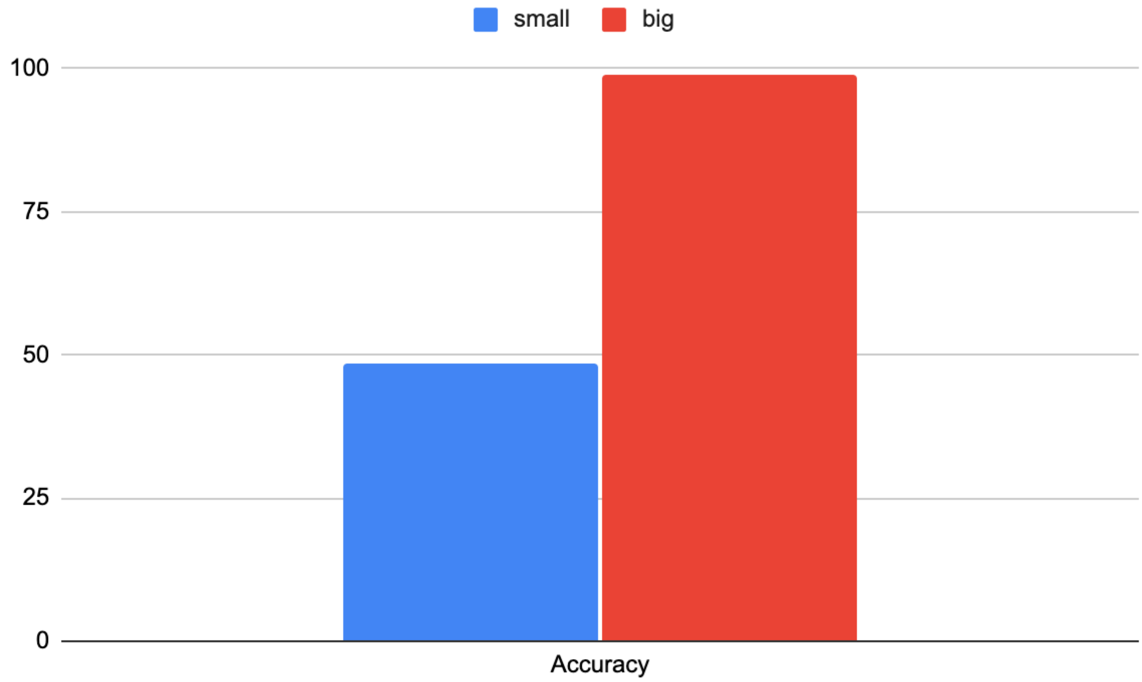
Small data set model:
This image most likely belongs to **60pc** with a 38.34 percent confidence.

Big data set with CGI model:
This image most likely belongs to **TKL** with a 99.98 percent confidence.

Expected value: TKL

Small data set model:
This image most likely belongs to **TKL** with a 97.10 percent confidence.

Big data set with CGI model:
This image most likely belongs to **TKL** with a 98.05 percent confidence.



Conclusion

This research was done in the limited time of a week but even with this limited time, it is clear that a model can be trained with CG data to help it recognize real data with more precision. This way of training fits the time of the project since it is more efficient and consistent to generate a lot of CG data and then alter that to create multiple variable input than to collect a lot data from the internet since that requires validation and a slow process of gathering.

Even though this model isn't the most accurate at recognizing this type of data, it showed great promise and improvement during the background general testing.

Bibliography

TensorFlow Authors. (2022). *Clasificación de imágenes.* July 28, 2022 , from tensorflow.org Web Site: https://www.tensorflow.org/tutorials/images/classification