Japanese Character Classification

日本文字の分類

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“相手の理解できる言語で話せば、その人の頭に入る。相手の言語で話せば、その人の心に届く。”

–If you talk to a man in a language he understands, that goes to his head. If you talk to him in his own language, that goes to his heart.

Introduction

Business Questions Asked & Answered

Firstly

Can a viable product model be created to accurately transcribe, read, and identify Japanese text for the archiving of important literary works? This can be used to preserve the surviving texts of endangered languages from the Ainu and Ryukyu minority groups in Japan.

Secondly

Can this be expanded to create an accurate API that recognizes written Japanese characters for touchscreen devices (ie. dictionaries, translation apps).
Target audience is Japanese and English research orgs, higher learning institutions, linguistic preservation societies, and language students.

Data & Info

Sourcing & Formatting

Source

The data is from the ETL Character Database, which includes over a billion total of Japanese characters hand-written and reorganized by the National Institute of Advanced Industrial Science and Technology (AIST).

Data Properties

Each file contains 5 data sets except ETL8G_33.
Each data set contains 956 characters written by a writer.
Each writer wrote 10 sheets (genkouyoushi) per data set.

Motivations

My background in linguistics provided the platform to dive into computational linguistics for this project. Project to be expanded to create an accurate API that recognizes written Japanese characters for touchscreen devices (ie. dictionaries, translation apps).

Japanese Writing Systems

Kanji

Brought to Japan from China in the 8th century. Pictographs that convey meaning (anthropomorphic and abstract).

Hiragana

Phonetic ‘alphabet’ used for participles and to inflect verbs and adjectives.

Katakana

Same phonetic sounds as hiragana. Angular components from kanji. Used for foreign words, sounds, & onomatopoeia.

Data Preparation

From Binary to Black & White

Example Katakana Table

Data read from binary code and saved to an .npz file to be re-read

Images reshaped from 32xx32 to 64x64 pixels

EDA

The story the data tells & insights

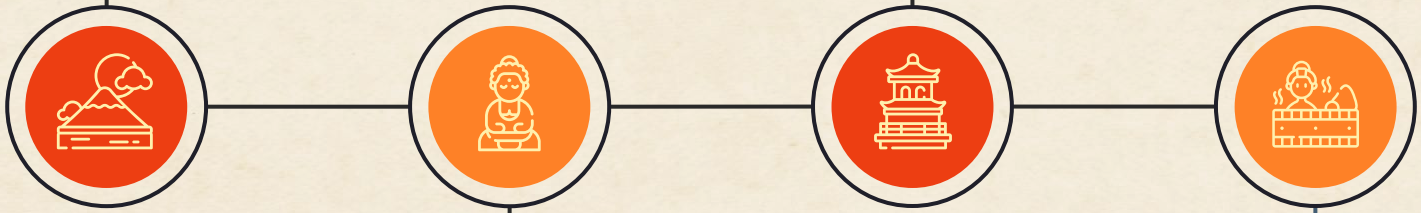
Initial Class Imbalance

Hiragana

71 unique hiragana characters (46 singular chars + 29 diphthongs)
113,60 images

Katakana

46 unique katakana characters
64,906 images



Kanji

883 unique kanji characters
139,680 images

Merged Data

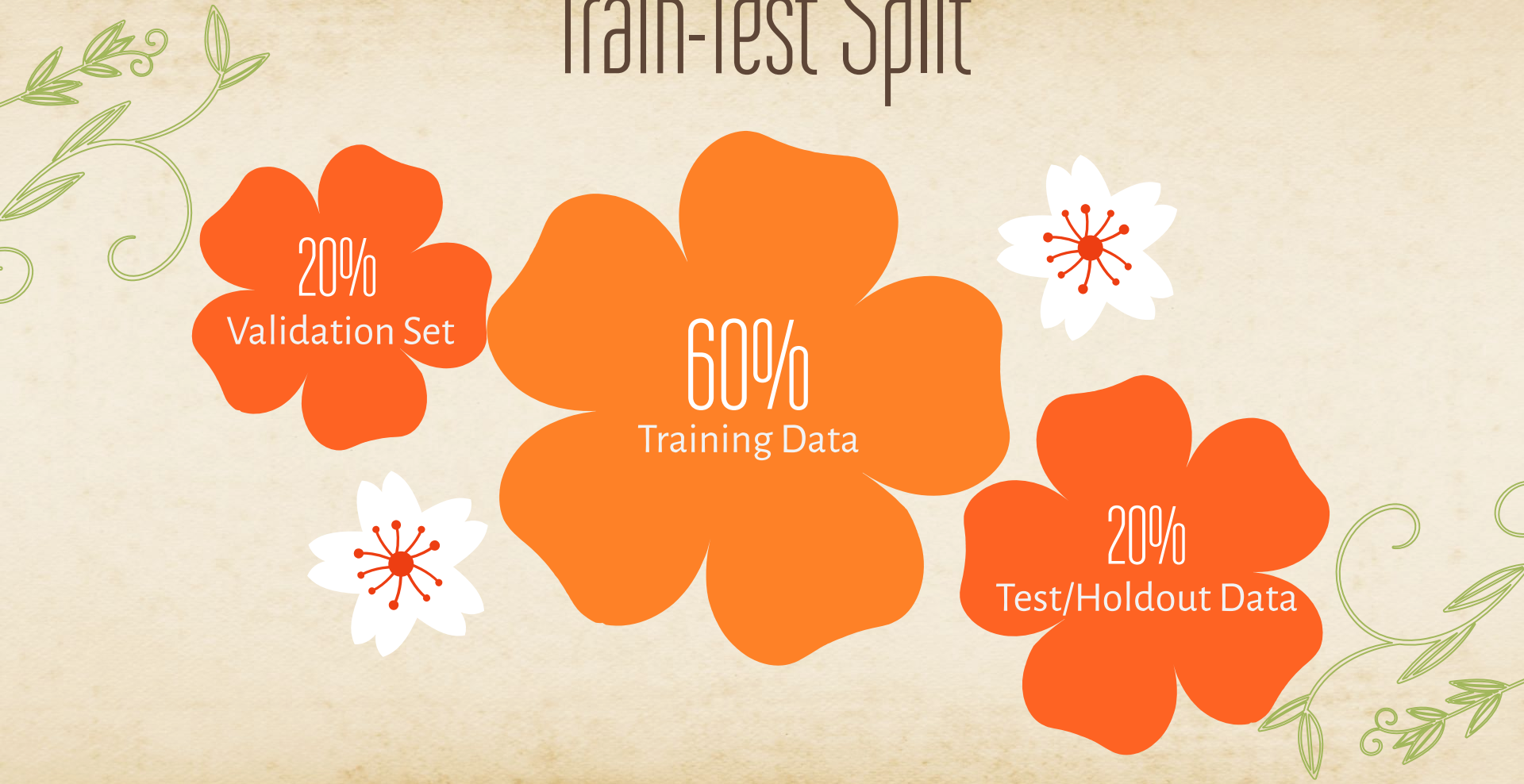
215,946 images from combined three datasets

伍

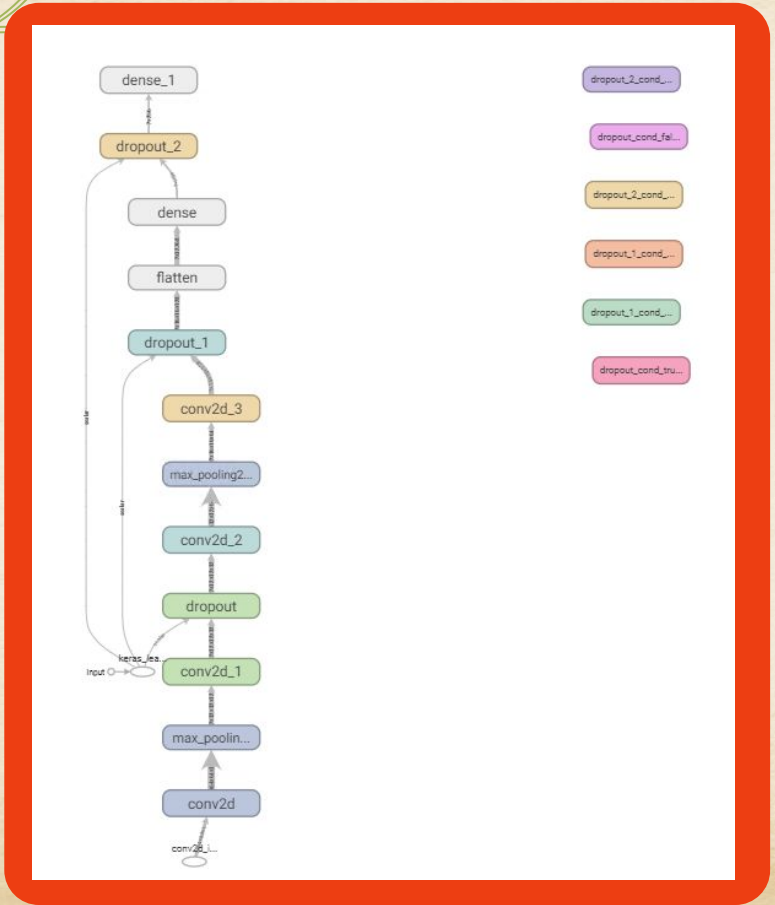
Modeling

Model preparation, techniques & results

Train-Test Split



CNN Model



- ImageDataGenerator used to create variation and prevent overfitting
- Models run on AWS EC2 instance using g4dn Nvidia Tesla GPU architecture
- Tensorboard used to live track the model across epochs
- Reduce Learn Rate on Plateau callback utilized to adjust learning rate on the fly if accuracy did not improve after 3 epochs
- Early Stopping callback used to stop model training if accuracy did not improve after 5 epochs

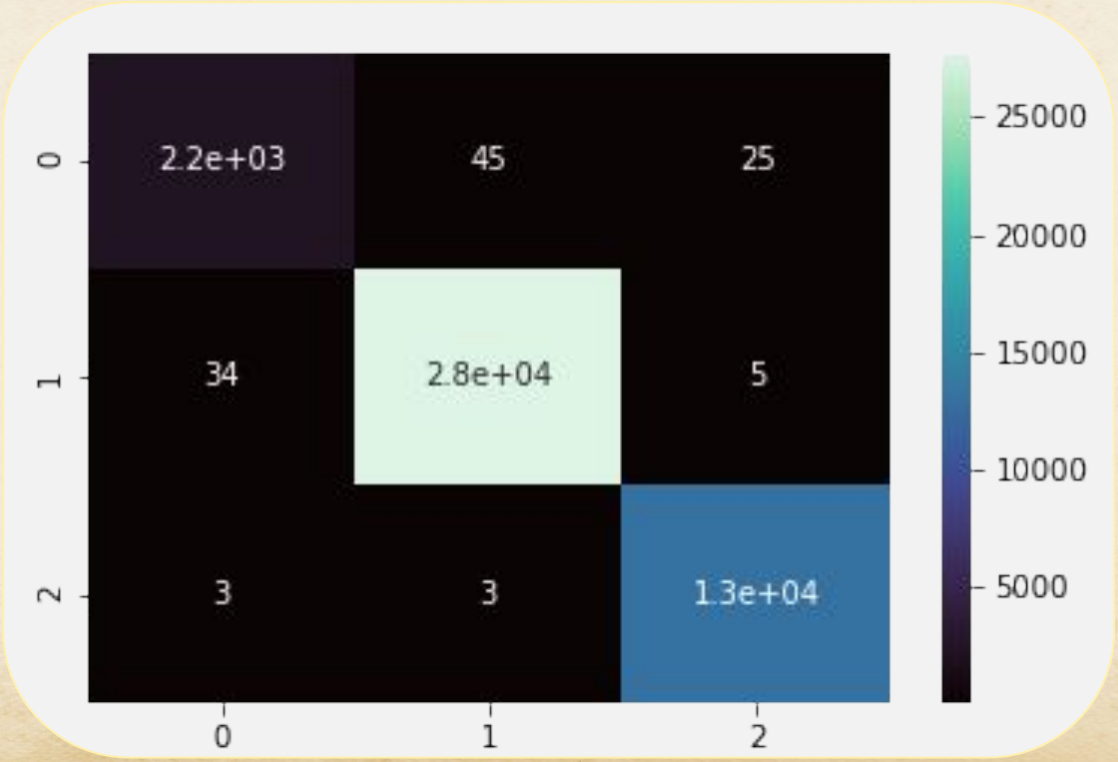
CNN Model Results

	Accuracy	Loss
Training	99.79%	0.68%
Validation	99.40%	3.2%
Test	99.73%	0.90%

Confusion Matrix

Mars

Despite being red,
Mars is a cold place



Conclusion & Next Steps

Stretch goals and further MVP analysis

Accuracy is Key

Over 200,000 unique characters trained to a recognition percentage of over 99% accuracy

Stretch Goals and Next Steps

Kuzushiji

Work with kuzushiji (Japanese cursive writing) KMINST dataset variations

OpenCV

For live model image recognition using webcam

iOS API

Handwriting recognition app using trained model

Linguistics ECI

The CUNY Endangered Language Initiative strives to preserve our dying languages around the world. Use model as a way to utilize computational linguistics and preserve precious texts and early written Japanese history

ありがとうございました

(Thanks!)

Questions are open!

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