Examining the Runtime of NLTK and Tensorflow Algorithms for a Chatbot Based on intents.json Length

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AUTHOR BIO

Rishi Hariharaprasad is a student programmer at Brandeis High School. He worked on the app “Disabled Health,” which helps provide tech and health information to disabled people for this app. He was named a Congressional Award Winner. Rishi was born and raised in Texas, while his parents were born in India. Currently, he is working on creating a website to showcase Disabled Health and working on a UI/UX design for the application itself. He seeks to better understand the machine learning (ML) algorithm that is used in his app and find the most efficient way to read data from an intents.json file.

EXPANDED ABSTRACT

Today, over 1.4 billion users worldwide are using chatbots. (1) The chatbots that we use today are made by large companies with funding. People who want to create chatbots using their own system have issues compiling neural networks. Currently, the most popular module to use in Python for pre-made machine modules is TensorFlow. (2) This research paper also utilizes NLTK for neural networks; although it is not the industry standard, it is suitable for academic purposes. (3) I created a chatbot that provides health assistance to the disabled, and I observed a huge issue with epochs and how long it takes to train models. I wanted my system to be dynamic, but to be dynamic you would have to retrain each new tag in the intents.json file, and this takes a long time based on the byte size of your addition. Thus, I wanted to find out if the relationship between byte size and training length was linear or exponential. The purpose of this work is to find whether the runtime is linear or exponential, but also to find more efficient ways to train epochs based on byte size. The least squares regression line ended up being $\hat{y} = 914.90212X - 1291.32081$; the relationship between byte size and training runtime is linear, and thus, after calculating, it has an O(N) runtime. In this study, we sought to answer the question “what is the relationship between intents.json length and the tensorflow/nltk epoch runtime?” to find ways to maximize the efficiency of chatbot algorithms based on different usage. Hypotheses tested were all 1000 epochs, as large intents.json files take incredibly long to run after certain byte sizes. The present information is expanded upon in a forthcoming research paper.

Keywords: Computer Science; Algorithms; Runtimes; NLTK; TensorFlow; ChatBot; intents.json; Epochs; Byte-Analyzation; Relationships in CS; Machine Learning; AI; Deep Learning; Deep Speech.

GitHub: https://github.com/Rishi-prog731/disabledhealth
Code and Data

Code

Import Statements

```python
1 import nltk
2 from nltk.stem.lancaster import LancasterStemmer
3 stemmer = LancasterStemmer()
4
5 import numpy
6 import tensorflow
7 import random
8 import json
9 import pickle
```

ML/TF Code

```python
with open("intents.json") as file:
data = json.load(file)

try:
    with open("data.pickle", "rb") as f:
        words, labels, training, output = pickle.load(f)
except:
    words = []
    labels = []
    docs_x = []
    docs_y = []

for intent in data["intents"]:
    for pattern in intent["patterns"]:
        words.extend(pattern)
        docs_x.append(pattern)

        if intent["tag"] not in labels:
            labels.append(intent["tag"])

    words = [stemmer.stem(word) for word in words if word != "]"]
    words = sorted(set(words))

    labels = sorted(labels)

    training = []
    output = []
    out_empty = [0 for _ in range(len(labels))]
```

Chat Function

```python
while True:
    inp = input("You: ")
    if inp.lower() == "quit":
        break

    results = model.predict([bag_of_words[imp, words]]
    results_index = numpy.argmax(results)
    tag = labels[results_index]

    for tg in data["intents"]:
        if tg["tag"] == tag:
            responses = tg["responses"]

    print(random.choice(responses))
```

Data

Table 1
Note: I ran 3 different experiments with these specific byte sizes, and all of them came out to this runtime; thus, I did not feel the need to copy-paste this same chart for simplicity.

Graph with Calculation Summary:

REFERENCES

