Using Neural Translation Machine (NTM) Algorithm To Bridge Language Barrier for Igbo Students in China.

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ABSTRACT

Understanding a course which is taught in a language, not known to students is the major hitch in international education. This poses a measure challenge that generates concerns among foreign students who are mostly subjected to learning the foreign language of the institutional host country, thereby adding a year or more to the programme depending on when the student successfully scrambles over the language huddles. This paper reviewed related literature and presented a Neural Machine Translation algorithm which converts a speech made in Chinese language, through an audio input device, into Igbo Language. The study recommends that this technology be harnessed and implemented as to make learning seamless, especially for visually impaired Igbo students in China.
Keywords: Audio, Text, Translator, Classroom, language.

INTRODUCTION

Igbo Language is a language used by one of the major ethnic groups in Nigeria called the Igbos. Schools in some part of the world, especially in non-English speaking countries, subject Nigerian students through Language learning programmes. In China, a foreign student has to learn Chinese basics (HSK2), a programme which takes more than a month to be completed [2]. But if it was to be a programme within Nigeria, this would not have been an issue since English language is Nigerian educational language.

Meanwhile, Technology has tremendously reduced the challenges facing learning outcomes in the classroom. This ranges from Computer Aided learning, to Artificial intelligence enhanced classroom. Moreover, artificial intelligence (AI) is now enhancing tools and instruments used day by day in cities and campuses around the world. From Internet search engines, smartphone features and apps, to public transport and household appliances. For example, the complex set of algorithms and software that power iPhone's Siri is a typical

example of artificial intelligence solutions that became part of everyday experiences [1]. Personalized solutions are also closer than we imagined: 'new scientist' presented at the end of 2015 the initiative of Talkspace and IBM's Watson to use artificial intelligence in psychotherapy [4].

LITERATURE REVIEW

A. Text To speech Synthesizer

[6] Developed a useful text-to-speech robot (synthesizer) in the form of a simple application that converts inputted text into synthesized speech and reads out to the user which can then be saved as an mp3 file. Their TextToSpeech Robot (TTSR) had only a textual input through which a user enters text to be converted in an audio form, unlike our model which has a voice input of a Chinese speaker, which is further converted into an audible output through a speaker.

B. Microsoft Translator

Microsoft Translator is a powerful translational application offered by Microsoft Inc. With this application, users can **translate words of more than 1,000,000 characters [3].** This application can translate more than **50 languages already encoded into it**, excluding the Nigerian major Languages (Igbo, Hausa and Yoruba).

However, Microsoft translator translates in textual form only. One must be reading the translated text in real-time, through his device to be able to follow up with the teacher or speaker. This is the loophole identified in this application. But our model added immediate speech synthesis, real-time conversion, and immediate audio output production functionalities which Microsoft translator is still battling to procure.

C. Google Text-To-Speech

Google Text-to-Speech is a screen reader application developed by Google for the Android operating system. [7] powers applications to read aloud (speak) the text on the screen with support for many languages. This technology does translations in many languages. It provides an interface through which a text is entered in any language, then an option button for designated language is selected; and then a command button with audio icon is clicked, for that text to be read out audibly. This technology however cannot be used in real time scenario, especially in classroom setting. Our model has a better and faster solution when it comes to talking directly to students in the classroom. With our model, one just speaks in Chinese, and the voice input is synthesized and converted to its corresponding Igbo, Hausa or Yoruba language in real time.

D. Apple Text-To-Speech

Apple Text to speech produces natural sounding synthesized text from the words that you have entered in. With 82 different voices to choose from and the ability to adjust the rate and pitch, there are countless ways in which the synthesized voice can be adjusted [8]. This only converts inputted texts to voice output. So, it is just for pronunciation of words with difference voices. This in no way contributes to a classroom solution where a

Chinese teacher speaks and gets understood by Nigerian students who do not need to learn Chinese to cope. Hence, our model has more powerful functionalities than the apple solution.

E. Conference Interpreters

There exist language interpreters in so many conferences organized in foreign countries, including China. In this conferences, a person who understands the foreign language stands on a podium, or hides behind the scene, while interpreting the source language (China) to a destination language(English) in such a way that the attendees of the conference feels it is only one person speaking. According to [10], the mastery of the passive language in this case is always a problem. Interpreters need to understand speeches, which they perceive essentially through the speaker's voice, instantaneously, with practically no possibility of consulting documents or human sources. This and many other reasons make human interpretation cumbersome.

METHODOLOGY

Neural Machine Translation (NMT) approach was applied in the model in this study. [9] concludes that Neural machine translation has the advantage of deep learning, which is very suitable for dealing with the high dimension, label-free and big data of natural language when compared to Natural Language Processing. Therefore, its application is more general and reflects the power of big data and big data thinking. NMT is a machine translation approach that applies a large artificial neural network toward predicting the likelihood of a sequence of words, often in the form of whole sentences [5].

Check the words below, their numerical equivalence and wavelengths of their sounds using NMT algorithm.

ALPHABETS Y	ENGLISH X1	CHINESE X2	IGBO X3
A	1	9	1
B	2	3	2
C	3	4	5
D	4	5	3
E	5	6	4
F	6	7	7
G	7	8	8
H	8	0	0
I	9	11	6
J	10	10	10
K	11	12	11
L	12	14	15

M	13	13	12
N	14	15	16
O	15	16	17
P	16	18	18
Q	17	19	19
R	18	20	20
S	19	21	21
T	20	22	22
U	21	23	23
V	22	24	24
W	23	25	25
X	24	26	26
Y	25	27	27
Z	26	28	28

Table 1: Alphabets of 3 languages and their numerical equivalence.

Since English language is the centralized Nigerian language (lingua franca), this model first converts whatever speech into English language intrinsically, before it then locates Igbo language dataset for synthesis and conversion, using their numerical equivalence and wavelength. From the above table, translating the sentence "I am God" to a form that will be usable by the neural machine translator, we will have:

I=9
A=1
M=13
G=7
O=15
D=4
I am God =9..1.13..7.15.4 (In English Language).

Translating the above to Chinese language, NTM matching process will take place. Since the letter "i" translates to "Wǒ" in Chinese, from our table above Wǒ = 25.16

I am God = Wǒ shì shàngdì (我是上帝)

Wo=25.16, shi=21.0.11, shangdi=21.0.9.15.8.5.11

Therefore, Wǒ shì shàngdì = 25.16..21.0.11..21.0.9.15.8.5.11

The double dot (..) stands for space in the language dataset.

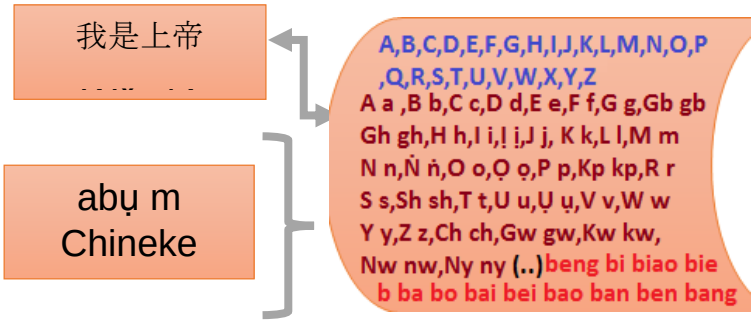

Figure 1: Some Dataset of Igbo, English and Chinese languages

The content of the dataset Y=X1+X2+X3

This content is finite and structured because Igbo languages has a finite character set which makes it up. According to [11], Igbo language has current orthography which has been in use since 1962 just as structured below:

A a	I i	P p	Y y
B b	Ị ị	Kp kp	Z z
C c	J j	R r	Ch ch
D d	K k	S s	Gw gw
E e	L l	Sh sh	Kw kw
F f	M m	T t	Nw nw
G g	N n	U u	Ny ny
Gb gb	Ṅ ṅ	Ụ ụ	
Gh gh	O o	V v	
H h	Ọ ọ	W w	

Table 2: Igbo Orthographic Table. [11]

GOD → shàngdì ≡ Chineke can be represented numerically in our model as in below:

7.15.4→21.0.9.15.8.5.11≡≡5.0.6.16.4.11.4

Figure 2: Neural Translation Machine translating Chinese to Igbo Language

DISCUSSION

The Neural Machine Translation algorithm in figure 1, makes it possible for words and sentences in Chinese language to be textually searched and matched with their corresponding words in Igbo language. These matched words are lookup in the voice recorded Igbo languages, their phonetic characteristics and corresponding sound waves in order to produce them as voice outputs. Just as the google text-to-speech application converts speech into text, this model accurately pronounces words in Igbo languages, a problem no translator has been able to solve. This model uses phonetic principles to match clauses and phrases into sentences, judging from the vowel and consonant characters in the dataset as shown in figure 2. Immediately after the audio sentence creation, the output will be sent to the students' earphones in real time. Therefore, as the Chinese teacher speaks, he creates vibration in the air in form of waves. These analog waves are converted into their digital form(s) by the help of voice analog-to-digital converter. The measurement of the wave frequency helps to correctly match with already stored waves in the character set as to put together meaningful sound(s) which the students listen to as the teacher teaches.

CONCLUSION

The paper has been able to explore translational applications already in existence, and then used Neural Machine Translation algorithm to model a system which could translate audibly from Chinese language to Igbo language. The model was able to audibly translate what the teacher was saying on the various devices of the students. The paper recommends that this model be materialized and implemented, as this will go a long way to not only bridge language barrier, but enhance the audibility of converted text, as to be listened to and understood by Igbo students studying in China.

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