Neural Machine Translation for Medical Care

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Introduction

Sub-saharan African region has been interested in telemedicine for several decades. Amongst those countries we have Senegal(2001),Mali(2000), Ghana(2020),Kenya(2001), Cameroon (2012). All those countries are willing to improve the population's access to better health care (*Communicate with medical experts without traveling or meet a doctor when the first sign of sickness shows*). However the diversity of language reduces the impact of those projects, why? Most of the medical staff are trained in foreign languages such as English, French, Chinese whereas most of the population are not used to those languages. Therefore, during the consultations patients struggle to communicate with the medical staff and cannot make full use of the telehealth system. In order to overcome the language barrier, we propose to use Neural machine Translation.

This initiative, which is aimed at African countries, will be carried out based on certain hypotheses, with the problem focused not only on the lack of medical experts, but mostly on the linguistic barrier.

We will assume that the countries included in our project are those that have previously advanced in the field of remote medicine. This is accomplished through the use of telemedicine, a monolingual practice in which a patient or a health center can communicate in the language of the specialist who is meant to speak the same language. Our project aims to respond to the question: "what if one partner doesn't speak the other's language, especially when expert physicians are frequently foreigners?"

Data

As we are working in a very sensitive area of research(medical science). We will need a lot of data and these will be of different types: Clinical Data, Patient-generated data, Public Health Data. This will be provided by different sources like government agencies, research studies, EHR, … Some data sources links will be presented in the slide annexed of the current report. Those annotated data are divided into three types (voice- text, text-text, text-voice)

Training

The proposed model will realize 3 tasks. The first one is the speech to text recognition, the second one is the text to text translation and the third one is the text to speech. In the second task, we propose to add a ***back translation*** to increase the quality of the translation. Each task can be trained separately. For the first task a XLSR pretrained model based on Wav2vec2.0 seems the best choice since we lack data and give good results with small amounts of data even if it tends to overfit. Concerning the T2T task the joeyNMT model can be used with a back translation. For the third task the transformer text2speech has been selected due to the small amounts of data.

Evaluation

1. Human evaluation – **Mean Opinion Score (MOS)** –
2. Automatic evaluation – **NIST** (to insist on rare words), **BLEU**, **WER** (speech recognition).

Challenges and Risks

Amongst the challenges, we have: access to annotated data (voice-text. text-text) in the medical field. For example, medical reports in Africa are not available in the local language. To overcome this problem, we propose to build artificial data with existing translation systems like google translation. Due to the lack of data, the model will have problems handling rare words. We can also face delay in the response since the model is deployed with internet connection or some difficulties while training the model. In terms of risk, we have misdiagnostic due to incorrect S2T or T2S output which lead to mistreatment of the patient or a disqualification of a doctor. We will encounter biais in the model since there is no record in the African language.

Innovation

Our contribution is the idea of NMT in telemedicine, the use of back of translation in text to improve the translation and the combination of existing models to get a S2S model.

Perspectives

Since our system only supports 5 African languages(Igbo, Yoruba, Zulu, Swahili, Wolof), we plan to extend it to other local languages as the telemedicine system expands across the continent.

Slides link