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**Introduction**

Many businesses in Ghana make use of customer service call centers to respond to the queries of customers and resolve any issues they may have. A simple search on-line would produce .a list of jobs available said call centers. In principle, these centers are very instrumental to the business operations as they serve as a contact point to customers who are revenue drivers for the business. However, practicality dictates otherwise. In some cases, the numbers provided for customer service are no longer in service (some have been changed but not updated), in other cases the call experience is marred by the emotional state of calling customers or the receiving agents at a given point in time. Even beyond these issues exist a larger problem of cost. For companies, as they scale up and acquire more customers, there is a need to hire more customer service personnel to cater to the needs of customers.

An already existing solution to this problem is the use of automated conversational systems to respond to the queries of customers. Intelligent systems exist that can quickly serve numerous customers at any given time before deciding if human intervention is needed. An example of a working solution is MTN’s Facebook chatbot. Querying this chatbot exposed some flaws as its responses as it could not properly understand what was being asked hence disbursing useless information for the given domain. A domain in this case is simply the scope of questions, statements and classes that all communication can be categorized under.

This projects main contribution is to create an intelligent chatbot that can give suitable responses to a wide range of customer queries in a given domain. Chalkboard Education, a startup that hosts an education platform would be used as the host company. Chalkboard education allows schools to make all their content digital and enrolls their students unto a platform to access it. This results in many schools and individual students constantly calling and direct messaging Chalkboard’s customer service support line for help. The company currently have only one person available for this job. By the end of this project, the goal is to build full-functioning chat bot to handle all of Chalkboard’s support issues.

**Annotated Biblography**

Joseph Weizenbaum. ELIZA-a computer program for the study of natural language communication between man and machine. Retrieved September 26, 2018 from <https://dl.acm.org/citation.cfm?id=365168>

This paper talks about ELIZA, one of the first artificial intelligence dialogue systems created. It

worked by analyzing input sentences by decomposing them based on a set of rulles and

responding by reassembling words triggered by key words in from the input. The paper

explored the technical problems associated with ELIZA including the identification of context,

choice of appropriate transformations, generation of responses in absence of key words and the

identification of key words among others. Key words are given RANK or precedence numbers

and constitute the script for a particular class of conversation though it does not form a part of

the program itself – its merely data. This ensures that ELIZA is not restricted to any particular

set of patterns. The latter parts of the paper discuss the some of the issues pertaining to the

development of dialogue systems like ELIZA and some suggestions for future work. It

discusses dialogue systems like Eliza building up belief structures to detect conversation

rationalizations, contradictions and context among other advances.

David B.1995. Deployment of human-machine dialogue systems. (October 1995). Retrieved September 26, 2018 from <http://adsabs.harvard.edu/abs/1995PNAS...9210017R>

This paper explores the applications that speech technology can support today given the gap between laboratory performance of speech software and ‘real-world’ performance. They introduce the concept of the degree of difficulty to characterize the varying demands placed and expectations on the technology. The paper represents the human-machine dialogue system as a four step process consisting of: speech recognizer, language analyzer, computer and speech synthesizer. The success of a dialogue system depends on the difficulty faced at each of these steps. The paper explores different dimensions of the Language-Understanding Task namely: Grammar complexity and ambiguity, Language variability and rejection of ‘off-the-subject’ input. The author then outlined the procedure used for deployment of speech applications making mention of a key iterative process in training the application. The paper concludes that the concept of degree of difficult is key can be used to evaluate the feasibility of a human-machine dialogue system. It signals that for future systems to get better, humans must cope with the errors made by the machine as machines cope with human errors. This iterative training process would help improve human-machine dialogue systems.

Pavel Král and Christophe Cerisara. 2014. Automatic dialogue act recognition with syntactic features. (February 2014). Retrieved September 26, 2018 from <https://link.springer.com/article/10.1007/s10579-014-9263-6>

The article is predominantly concerned with the importance of syntatic information in dialogue act recognition. It also discusses and proposes research directions to build more effective dialogue and speech recognition systems. Important to the article is the understanding of the structure of spontaneous dialogues characteristics such as dialogue acts. The paper creates a dialogue act model that involves creating a general principle to decompose sentences into individual words, training and pre-processing to create a model and testing to obtain dialogue acts. It then uses majority counts to obtain the highest frequency dialogue acts from the previous step and finally evaluating by comparing to real world dialogues. In their results, the obtained evidence to support their claim of the importance of syntactic information in dialogue act recognition. They also found out the syntactic information has not been as widely used due to the “difficulty to reliably parse speech and dialogues as well as the complexity of syntactic material among others. They concluded overall that syntactic information might be important for dialogue act recognition and suggested that the challenge that needs to be overcome is with increasing its robustness to speech recognition errors.

Chao Wang, Grace Chung, and Stephanie Seneff. Automatic Induction of Language Model Data for A Spoken ... Retrieved September 26, 2018 from <http://groups.csail.mit.edu/sls/publications/2005/ChungSeneffWang.pdf>

This paper addresses the issue of generating language model training data when little to no real data is available. The paper finds this out by taking “linguistic constructs from out of domain sentences are harvested and integrated with artificially constructed in-domain phrases.” Next, a synthetic corpus is filtered to obtain a probability distribution of semantic content. They go on to create a seed corpus together with previously collected flight corpus of utterances to yield new domain sentences. Overall, their experiments showed a reasonable performance can be obtained n absence of real data using synthetic training data. In the future the researchers intend to embed their created system into deployed spoken dialogue systems to greatly reduce the percentage of out-of-domain utterances spoken by real users

Andy Aaron, Ellen Eide, and John Pitrelli. Conversational Computers: 9780471657088 ... - amazon.com. Retrieved September 26, 2018 from <https://www.amazon.com/Conversational-Computers-W-D-Orr/dp/0471657085>

The article discusses attempts being made to make computer-generated speech closer to that of real humans with similar tone and expression. Current systems have evolved from the stilted and cold speech of old to more intelligible and easier to listen. The paper makes mention of past advances in computer-generated speech through synthesized speech over the years such as in the 1700s when a Speaking Machine was able to produce rudimentary words through to 1978 when a mechanical sounding Speak & Spell toy and beyond. It also goes on to explain how computer generated speech voices can be created by concatenating human speech from dozens of candidate speakers. It then selects sounds to give a response although this is complex given the sounds the precede and follow it. The article ends by enumerating the number of areas in which improvements can be made such as building a system that can exploit human social and communication skills such as contrasting human spoken ‘morning’ with ‘evening’ as a response.