Natural Language *Usable* User Interface

Sunil Kumar Kopparapu*

TCS Innovation Labs – Mumbai
Yantra Park, Tata Consultancy Services, Thane (West), 400 601 Maharatsra.
SunilKumar.Kopparapu@TCS.Com

Abstract: With increasing adoption of technology in day to day activity, it has become extremely important to build interfaces which are natural and convenient to use by all strata of the society. When human communicate, written or vocal, it is full of *intended meaning* and the language rules are generally tricky and complex. Even in this tricky scenario people can very easily unpack the many nuanced allusions and connotations in every sentence and decode what someone else is saying. While on one hand computers are good at number crunching; on the other hand when it come to language processing it gets hard on computers. Technologist believe that being able to understand a question posed in everyday human natural language, and respond with a precise answer is sort of a holy grail, because it would allow machines to converse more naturally with people, letting people ask questions instead of typing or speaking keywords. In this brief paper, we look at aspects of technologies that can allow humans to interact with machines as they would interact with another human using natural language.

1. Introduction

A language is a system of signs, most often symbols for encoding and decoding information. Language has several meanings and the most obvious ones are (a) spoken languages, (b) written languages and (c) other systems of visual symbols such as sign languages. In cognitive science, the word *language*, is often extended to refer to the human cognitive facility of creating and using language [1]. In essence language is a systematic creation and usage of a set of symbols, each pairing a specific sign with an intended meaning which is usually established through social conventions[1]. A key property of language is that its symbols are arbitrary and any grammatical rule can be mapped onto a symbol. Meaning, most languages make use of sound, but the combinations of sounds used do not have any inherent meaning; they are merely an agreed upon convention to represent a certain thing by users of that language [1].

Languages used by human are usually referred to as natural languages, and the science of studying them falls under the purview of linguistics. A common progression for natural languages is that they are considered to be first spoken and then written, and then an understanding and explanation of their grammar is attempted. While when it comes to machines one uses artificial entities called formal languages. Formal languages include programming languages and markup languages, and some languages that are more theoretical in nature. A programming language is a formal language endowed with semantics that can be utilized to control the behavior of a machine, particularly a computer, to perform specific tasks. Programming languages are defined using syntactic and semantic rules, to determine structure and meaning respectively. In a very coarse way, there is a need to try and understand the complexity of the natural language, either textual or spoken, using formal languages to enable machine to talk to humans *naturally*.

Question Answering (QA) systems in general are able to understand a question posed in natural language and respond with a precise, factual answer [2]. In other words, QA systems must do more than what search engines like Google [3] and Bing [4] do, which is merely point to a document where you might find the answer. QA systems have to pluck out the correct answer on its own. Technologists have long regarded this sort of artificial intelligence as a holy grail, because it would allow machines to converse more naturally with people, letting people ask questions instead of merely typing or speaking keywords. Deep Blue, for instance, was able to play chess well because the game is perfectly logical, with fairly simple rules; it can be reduced easily to math, which

---

* The ideas and thoughts expressed in this paper are that of the authors and not necessarily that of Tata Consultancy Services Limited.

1 Often the same string of symbols might have a different meanings in different social settings

computers handle very well [2]. But the rules of language are much trickier. At this time, the very best QA systems could sieve through news articles on their own and answer questions about the content, but they understand only questions stated in very simple language ("What is the currency of India?"). As humans, we can easily decode what someone else is saying, we can easily unpack the many nuanced allusions and connotations in every sentence. To understand natural language the way humans understand and interpret is hard for computers, because natural language is full of intended meaning.

2. Natural Language Interfaces

Language usage in general can be very tricky especially in a country like India because of the large socio-economic gap in the population, cultures, large number of languages, the difficulty in entering Indian languages electronically[2]. The complexity in building interfaces is compounded for spoken languages because of the additional large number of dialects, language accents, use of multiple languages in a single sentences and the noisy communication (telephone) channel. But luckily, for transaction like grammars; where the intent of the query is to obtain some relevant information for use (*What is the balance in my savings account?, When is the Kolkata Mail expected?*) there is only a finite number of different ways in which one can pose a question (textual or spoke). This makes it possible to do minimal parsing of the natural language query to understand the intent and be able to answer [5]. This intent identification can be achieved by identifying key concepts and key words in the natural language query and use them effectively to answer the query.

Designing interfaces that can effectively communicate with the people requires flexibility in terms of being able to understand the intent and hence the central theme of the query. Understanding language semantics enables the interface to fetch multiple entities in a single natural language query rather than seeking these information entities in a sequence to be able to get sufficient information to answer the query. This not only makes the interface natural for human to use but also convenient. For example, in a typical speech based query system that are being currently used in banking, the system asks for information in a sequence. First it asks for information to ascertain if the query is *savings account* or *current account* related and then depending on what the user spoke, would seek the next information entity say *balance* or *cheque book request* or *stop cheque request* etc. This is not the natural way in which a human would ask for this formation. For a natural language speech system the user would have the flexibility to say *What is the balance in my savings account* or *Could you please let me know my savings balance*. The ability to answer a wide variety of queries without ambiguity is possible when the (a) domain of transaction is restricted (banking, travel, etc) and (b) the system is able to analyze natural language query. A number of both textual and spoken natural language interfaces have been build in TCS Innovations Lab – Mumbai. The yellow pages interface allows queries like *Where is a coffee shop in Thane?*; the music search interface allows *I want to hear the song sung by Lata Mangeskar?* or the Self-Help natural language interface for insurance allows *When will my policy with you mature?* or in a natural Hindi language interface (Mandi Bhav) a query like *Thane market mein aaloo ka bhav kya hai?*

3. Conclusions

While natural language is complex and difficult for machines to interpret, it is possible to build usable natural language interfaces for use by masses. These interfaces are enabled through analysis of the natural language query especially because of the constrained domain and the limited number of ways in which queries of transactional grammar in nature can be asked by humans.

4. References

[1] http://en.wikipedia.org/wiki/Language
[2] NYtimes, June 14, 2010 What Is I.B.M.'s Watson?
[3] http://www.google.com
[4] http://bing.com
[5] Sunil Kumar Kopparapu, Akhilesh Srivastava, P. V. S. Rao: Minimal Parsing Key Concept Based Question Answering System. HCI (3) 2007: 104-113

2 Efforts are on to enable Indian language text entry on mobile phones easy though the special interest group for Indian Language SMS