Department of Computer Applications
School of Computer Sciences
Chitkara University, Punjab Campus

CHITKARA UNIVERSITY

WALL FOR ALL

March 2015, Volume 2, No. 2

Contents

Contact Information

Dr. Jaiteg Singh

jaiteg.singh@chitkara.edu.in

Mr. Preetinder Singh Brar

preetinder.brar@chitkara.edu.in

Mr. Vikas Rattan

vikas.rattan@chitkara.edu.in

Evaluating Artificial Intelligence

- Ms. Neelam Rani, Asstt. Professor,
  Department of Computer Applications, Chitkara University, Punjab

ABSTRACT

There is a developmental evaluation procedure for artificial intelligence that is based on two assumptions: that the Turing Test provides a sufficient subjective measure of artificial intelligence, and that any system capable of passing the Turing Test will necessarily incorporate behavioristic learning techniques.

1. Introduction

In 1950 Alan Turing considered the question “Can machines think?" Turing's answer to this question was to define the meaning of the term `think' in terms of a conversational scenario, whereby if an interrogator cannot reliably distinguish between a machine and a human based solely on their conversational ability, then the machine could be said to be thinking. Originally called the imitation game, this procedure is nowadays referred to as the Turing

Test. The field of artificial intelligence (AI) has largely ignored this strict evaluation criterion. Today AI encompasses topics such as intelligent agents, chatter bots, pattern recognition systems, voice recognition systems and expert systems, with applications in medicine, finance, entertainment, business and manufacturing. It could be said that the field is currently in a contentious state. Even though important work has been conducted in terms of the sophistication and expertise of programs, the vision which motivated the birth of AI has not yet been fulfilled: there is neither sufficient cooperation nor agreement amongst its researchers. The unfortunate result of this trend is that true advancement is inhibited. We believe that a new approach is required. In this paper we shall demonstrate that the Turing Test is a sufficient evaluation criterion for artificial intelligence provided that the expectation level of the interrogator is set appropriately. We propose to achieve this by complementing the Turing Test with objective developmental evaluation. The logical flow of this paper reflects the necessary steps one must take when trying to establish evaluation standards for artificial intelligence: we begin with a definition of artificial intelligence, we continue with a discussion of the theory and methods which we believe are an essential prerequisite for the emergence of artificial intelligence and we conclude with our proposed evaluation procedure.

2. The Turing Test

The Turing Test is an appealing measure of artificial intelligence because, as Turing himself writes, it : has the advantage of drawing a fairly sharp line between the physical and the Intellectual capacities of a man. The Loebner Contest, held annually since 1991, is an instantiation of the Turing Test. The sophistication and performance of computer programs entered into the contest, or lack thereof, bears out our introductory remark that the Turing Test has been largely ignored by the field. In a recent thorough review of conversational systems, Hasida and Den emphasize the absurdity of performance in the Loebner Contest. They assert that since the Turing Test requires that systems talk like people", and since no system currently meets this requirement, the ad-hoc techniques which the Loebner Contest subsequently encourages make little contribution to the advancement of dialog technology. Although we agree wholeheartedly that the Loebner Contest has failed to contribute to the advancement of artificial intelligence, we do believe that the Turing Test is an appropriate evaluation criteria, and therefore our approach equates artificial intelligence with conversational skills. We further believe that engaging in domain-unrestricted conversation is the most critical evidence of intelligence.

2.1. Turing's Child Machine

Turing concluded his classic paper by theorizing on the design of a computer program, which would be capable of passing the Turing Test. He correctly anticipated the limitations of simulating adult level conversation, and proposed that instead of trying to produce a program to simulate the adult mind, why not rather try to produce one which simulates the child's? If this were then subjected to an appropriate course of education one would obtain the adult brain. Turing regarded language as an acquired skill, and recognized the importance of avoiding the hard wiring of the computer program wherever possible. He viewed language learning in a behavioristic light, and believed that the language channel, narrow though it may be, is sufficient to transmit the information which the child machine requires in order to acquire language. It is indeed unfortunate that this promising line of work was mostly abandoned by the field. Today we find ourselves at a crossroads-a paradigm shift is in the air, and many AI researchers are returning to the behavioristic approach that Turing favored.

2.2. The Traditional Approach

Contrary to Turing's prediction that at about the turn of the millennium computer programs will participate in the Turing Test so effectively that an average interrogator will have no more than a seventy percent chance of making the right identification after five minutes of questioning, no true conversational systems have yet been produced, and none has passed an unrestricted Turing Test. This may be due in part to the fact that Turing's idea of the child machine has remained unexplored-the traditional approach to conversational system design has been to equate language with knowledge, and to hard-wire rules for the generation of conversations. This approach has failed to produce anything more sophisticated than domain-restricted dialog systems which lack the kind of exibility, openness and capacity to learn that are the very essence of human intelligence. As far as human-like conversational skills are concerned, no system has surpassed toddler level, if at all. Since the 1950's, the field of child language research has undergone a revolution, inspired by Chomsky's transformational grammar on the one hand and Skinner's behaviorist theory of language on the other. Computational implementations based on the Chomskian philosophy are the norm, and have yielded disappointing results. It is our thesis that true conversational abilities are more easily obtainable via the currently neglected behavioristic approach.

3. Verbal Behaviour

Behaviorism focuses on the observable and measurable aspects of behavior. Behaviorists search for observable environmental conditions, known as stimuli that co-occur with and predict the appearance of specific behavior, known as responses. This is not to say that behaviorists deny the existence of internal mechanisms; they do recognize that studying the physiological basis is necessary for a better understanding of behavior. What behaviorists object to are internal structures or processes with no specific physical correlate inferred from behavior. Behaviorists therefore object to the kind of grammatical structures proposed by linguists, claiming that these only complicate explanations of language acquisition. They favour a functional rather than a structural approach, focusing on the function of language, the stimuli that evoke verbal behavior and the consequences of language performance. We believe this to be the right approach for the generation of artificial intelligence. Skinner argues that psycholinguists should ignore traditional categories of linguistic units, and should instead treat language as they would any other behavior. That is, they should search for the functional units as they naturally occur, and then discover the functional relationship that predict their occurrence. Behaviorism focuses on reinforced training. Since language is regarded as a skill that is not essentially different from any other behavior, generating and understanding speech must therefore be controlled by stimuli from the environment in the form of reinforcement, imitation and successive approximations to mature performance. Skinner takes the extreme position that the speaker is merely a passive recipient of environmental pressures, having no active role in the process of language behavior or development. According to behaviorists, changes in behavior are explained through the association of stimuli in the environment with certain responses of the organism. The processes of forming such associations are known as classical conditioning and operant conditioning.

3.1. Classical Conditioning

Classical conditioning accounts for the associations formed between arbitrary verbal stimuli and internal responses or reflexive behavior. In classical conditioning, for example, the word “milk” is learned when the infant's mother says “milk" before or after feeding, and this word becomes associated with the primary stimulus (the milk itself) to eventually elicit a response similar to the response to the milk. Once a word or a conditioned stimulus elicits a conditioned response, it can become an unconditioned stimulus for modifying the response to another conditioned stimulus. For example, if the new conditioned stimulus `bottle' frequently occurs with the word `milk', it may come to elicit a response similar to that for the word `milk'. Words stimulate each other and classical conditioning accounts for the interrelationship of words and word meanings. Classical conditioning is more often used to account for the receptive side of language acquisition.

3.2. Operant Conditioning

Operant conditioning is used to account for changes in voluntary, non-reflexive behavior that arise due to environmental consequences contingent upon that behavior. All behavioristic accounts of language acquisition assume that children's productive speech develops through differential rein forcers and punishers supplied by environmental agents in a process known as shaping. Children's speech that most closely resembles adult speech is rewarded, whereas productions that are meaningless are either ignored or punished. Behaviorists believe that the course of languages development is largely determined by the course of training, not maturation, and that the time it takes children to acquire language is a consequence of the limitations of the training techniques. Operant conditioning is used to account for the productive side of language acquisition. Imitation is another important factor in language acquisition because it allows the laborious shaping of each and every verbal response to be avoided. The process of imitation itself becomes reinforcing and enables rapid learning of complex behaviors. Behaviorists do not typically credit the child with intentions or meanings, the knowledge of rules or the ability to abstract important properties from the language of the environment. Rather, certain stimuli evoke and strengthen certain responses in the child. The sequence of language acquisition is determined by the most salient environmental stimuli at any point in time, and by the child's past experience with those stimuli. The learning principle of reinforcement is therefore taken to play a major role in the process of language acquisition, and is the one we believe should be used in creating artificial intelligence.

4. The Developmental Model

We maintain that a behavioristic developmental approach could yield breakthrough results in the creation of artificial intelligence. Programs can be granted the capacity to imitate, to extract implicit rules and to learn from experience, and can be instilled with a drive to constantly improve their performance. Language acquisition can be achieved through successive approximations and positive and negative feedback from the environment. Once given these capabilities, programs should be able to evolve through critical developmental language acquisition milestones in order to reach adult conversational ability. Human language acquisition milestones are both quantifiable and descriptive, and any system that aims to be conversational can be evaluated as to its analogical human chronological age. Such systems could therefore be assigned an age or a maturity level beside their binary Turing Test assessment of \intelligent" or \not intelligent".

4.1. Success in Other Fields

Developmental principles have enabled evaluation and treatment programs in fields formerly suffering from a lack of organizational and evaluative principles and have been especially useful in areas, which border on the question of intelligence. Normative developmental language data has enabled the establishment of diagnostic scales, evaluation criteria and treatment programs for developmentally delayed populations. In other areas, such as schizophrenic thought disorder, in which clinicians often found themselves unable to capture the communicative problem of patients in order to assess their intelligence level or cognitive capability, let alone to decipher medication treatment effects, the developmental approach has proven to be a powerful tool.

5. Language Modeling

We are interested in programming a computer to acquire and use language in a way analogous to the behavioristic theory of child language acquisition. In fact, we believe that fairly general information processing mechanisms may aid the acquisition of language by allowing a simple language model, such as a low {order Markov model, to bootstrap itself with higher-level structure.

5.1 Markov Modeling

Claude Shannon, the father of Information Theory, was generating quasi-English text using Markov models in the late 1940's. Such models are able to predict which words are likely to follow a given finite context of words, and this prediction is based on a statistical analysis of observed text. Using Markov models as part of a computational language acquisition system allows us to minimize the number of assumptions we make about the language itself, and to eradicate language-specific hard-wiring of rules and knowledge. Some behaviorists explain that language is processed as word-sequences, or response-chains, with the words themselves serving as stimulus for their successors. Information theoretic measures may be applied to Markov models to yield analogous behavior, and more sophisticated techniques can model the case where long-distance dependencies exist between the stimulus and the response. To date, conversation systems based on this approach have been thin on the ground, although the technique has been used extensively in related problems, such as speech recognition, text disambiguation and data compression.

5.2. Finding Higher-Level Structure

Information theoretic measures may be applied to the predictions made by a Markov model in order to find sequences of symbols and classes of symbols, which constitute higher-level structure. For example, in the complete absence of a priori knowledge of the language under investigation, a character-level Markov model inferred from English text can easily segment the text into words, while a word-level Markov model inferred from English text may be used to `discover' syntactic categories. This structure, once found, can be used to bootstrap the Markov model, allowing it to capture structure at even higher levels. A hierarchy of models is thus formed, each of which views the data at a different level of abstraction. Although each level of the hierarchy is formed in a purely bottom-up fashion from the data supplied to it by the level below, the fact that each model provides a top-down view with respect to the models below it allows a feedback process to be applied, whereby interaction between models at adjacent levels of abstraction serves to correct bad generalizations made in the bootstrapping phase. It is our belief that combining this approach with positive and negative reinforcement is a sensible way of realizing Turing's vision of a child machine.

6. Evaluation Procedure

Our proposal is to measure the performance of conversational systems via both subjective methods and objective developmental metrics.

6.1. Objective Developmental Metrics

The ability to converse is complex, continuous and incremental in nature, and thus we propose to complement our subjective impression of intelligence with objective incremental metrics. Examples of such metrics, which increase quantitatively with age, are:

Vocabulary size: The number of different words spoken.

Mean length of utterance: The mean number of word morphemes spoken per utterance.

Response types: The ability to provide an appropriate sentence form with relevant content in a given conversational context, and the variety of forms used.

Degree of syntactic complexity: For example, the ability to use embedding to make connections between sentences, and to convey ideas.

The use of pronominal and referential forms: The ability to use pronouns and referents appropriately and meaningfully. These metrics provide an evaluation of progress in conversational capability, with each capturing a specific aspect Together they enable an understanding of the nature of the critical abilities that contribute toward our desired goal: achieving a subjective judgment of intelligence. The challenge in creating maturational criteria is in combining these metrics meaningfully. One might expect discrepancies in the development of the different aspects of conversational performance. For example, some systems may utter long, syntactically complex sentences, typical of a child aged five or above, but may lag in terms of the use of pronouns expected at that age. Weighting the various developmental metrics is far from trivial.

6.2. The Subjective Component

We do not claim that objective evaluation should take precedence over subjective evaluation, just as we do not judge children on the basis of objective measures alone. Subjective judgement is an important if not determining criterion of overall evaluation. We believe that the subjective evaluation of artificial intelligence is best performed within the framework of the Turing Test. The judgement of intelligence is in the eye of the beholder. Human perception of intelligence is always influenced by the expectation level of the judge toward the person or entity under scrutiny- obviously, intelligence in monkeys, children or university professors will be judged differently. Using objective metrics to evaluate maturity level will help set up the right expectation level to enable a valid subjective judgement to be made. Accordingly, we propose that suitable developmental metrics be chosen in order to establish a common denominator among various conversational systems so that the expectation level of these systems will be realistic. Given that subjective impression is at the heart of the perception of intelligence, the constant feedback from the subjective evaluation to the objective one will eventually contribute to an optimal evaluation system for perceiving intelligence. By using the developmental model, computer programs will be evaluated to have a maturity level in relation to their conversational capability. Programs could be at the level of toddlers, children, adolescents or adults depending on their developmental assessment. This approach enables evaluation not only across programs but also within a given program.

7. Conclusion

We submit that a developmental approach is a prerequisite to the emergence of intelligent lingual behavior and to the assessment thereof. This approach will help establish standards that are in line with Turing's understanding of intelligence, and will enable evaluation across systems. We predict that the current paradigm shift in understanding the concepts of AI and natural language will result in the development of groundbreaking technologies which will pass the Turing Test within the next ten years.

8. References

[1] A.M. Turing, “Computing machinery and intelligence," in Collected works of A.M. Turing: Mechanical Intelligence, D.C. Ince, Ed., chapter 5, pp. 133{160. Elsevier Science Publishers, 1992.

[2] Stuart M. Shieber, “Lessons from a restricted Turing test," Available at the Computation and Language e-print server as cmp-lg/9404002., 1994.

[3] K. Hasida and Y. Den, “A synthetic evaluation of dialogue systems," in Machine Conversations, Yorick Wilks, Ed. Kluwer Academic Publishers, 1999.

[4] Noam Chomsky, Syntactic Structures, Mouton, 1975.

[5] B.F. Skinner, Verbal Behavior, Prentice-Hall, 1957.

[6] R.E. Owens, Language Development, Macmillan Publishing Company, 1992.

[7] G. Whitehurst and B. Zimmerman, “Structure and function: A comparison of two views of development of language and cognition," in The Functions of Language and Cognition, G. Whitehurst and B. Zimmerman, Eds. Academic Press, 1979.

[8] J.B. Gleason, The Development of Language, Charles E. Merrill Publishing Company, 1985.

[9] A. Goren, G. Tucker, and G.M. Ginsberg, “Language dysfunction in schizophrenia," European Journal of Disorders of Communication, vol. 31, no. 2, pp. 467{482, 1996.

[10] A. Goren, “The language deflicit in schizophrenia from a developmental perspective," in The Israeli Association of Speech and Hearing Clinicians, 1997.

Semantic Web

- Ms. Deepika Chaudhary, Associate Professor and Program Incharge, Department of Computer Applications, Chitkara University, Punjab

In around 1980's significant research appeared in Information Science Literature for improving the search results while developing Expert Systems. Significant research work started as a result, Hundreds of universities, start-up companies, and major corporations published research and filed patents on various algorithmic techniques for machine-aided searching over three decade. By the late 1990s and early 2000s, these technologies began to be described as semantic search components. In 2001 **Tim Berners-Lee** published an article in Scientific American proposing a **semantic web** evolving out of the expanding worldwide web.

"I have a dream ... [where computers] become capable of analyzing all the data on the web - content, links, and transactions between people and computers. A 'Semantic Web', which should make this possible, has yet to emerge, but when it does, the day-to-day mechanisms of trade, bureaucracy and our daily lives will be handled by machines talking to machines. The 'intelligent agents' people have touted for ages will finally materialize."

- Sir Tim Berners-Lee, 1999

More simply Semantic Web can be termed as "an extension of the current web in which information is given well-defined meaning, better enabling computers and people to work in co-operation". This Web of structured data would enable automated assistants (called software agents) to operate on behalf of human beings. The Semantic Web is not a new computing environment but rather an extension of the existing Web. Semantic data that provides a machine-readable "meaning" of information is layered over the information that is provided for people.

Semantic Web technologies as a whole have made tremendous strides in the last decade which include:

The Open Linked Data movement has grown massively every single year and contains far more information than any single resource anywhere on the Web.

Massive organizations—such as Merck, Johnson & Johnson, Chevron, Staples, GE, the US Department of Defense, NASA, and others—now rely on Semantic Web technologies to run critical daily operations.

The Semantic Web standards—RDF, SPARQL, OWL, and others—were merely drafts in 2001, but they have now been formalized and ratified.

Truly, an entire industry has been born in the past ten years, complete with multiple trade shows on several continents, a growing user community, and active standards bodies. In spite of recent huge strides on the part of Schema.org, Facebook's Open Graph, and others, the vision of an entire Web of interoperable data has still not yet been realized. The learning curve for using Semantic Web technologies is till date steep because few educational resources currently exist for users new to the concepts, and still fewer resources can be found that discuss when and how to apply the technologies to real world scenarios.

Two Amazing Inventions of 2014

- Mr. Naveen Sharma, Asstt. Professor,
  Department of Computer Applications, Chitkara University, Punjab

1. Smart RING

Ring is Wearable Input Device that lets you control anything like Gesture control, text transmission, payment, and more. Modern technology hasn't yet been able to bring us magic wands, but Ring, a new project from Logbar Inc. in 2014, is the latest step toward that goal.

Using a Bluetooth sensor and gesture-recognition technology, Ring lets you do things like send text messages and control connected home devices with just a few waves of your finger. As you walk into your house, for example, you might wave your finger to engage with your lamp and then, with another gesture, adjust its brightness or turn it off. Another couple of swipes will turn your TV off or on and allow you to switch channels.

Logbar has also developed payment software that you can use to pay participating retailers or other people just by waving your finger in the shape of checkmark and then tracing out the amount you'd like to pay. Customized gestures for other tasks can be created using your smartphone or tablet.

Ring Device

At the moment, Ring is only good for about 1,000 gestures before it needs to be recharged, so it doesn't make sense to use it for texting too often. It's also a bit cumbersome and isn't waterproof, so you may want to be selective about when you wear it. But as developers dream up novel ways of using it, Ring has the potential to give us continuous access to the "Internet of Things" without having to stare at our smart phones all the time. The device was a big hit on Kickstarter earlier this year, blowing past its funding goal of $250,000 and ultimately raising over $880,000. The first models will ship in July, with donors having ponied up between $145 and $185 to get their hands on one.

2. SCiO

Israel-based company Consumer Physics Inc. invented SCiO, a USB-sized sensor that identifies the chemical make-up of food and send it directly to a smartphone. SCiO is a handheld device which scans the molecular fingerprint of a physical matter and immediately provides information about it such as protein, nutrients and calories in any food. It can also measure how ripe a fruit is even without peeling it. The gadget might be able to transform how people eat. SCiO is capable of identifying and authenticating a medicine's molecular makeup with its vast medication database. In the future, the device might be able to analyze bodily fluids and human tissues.

SCiO can deliver real-time findings to its mobile app on a smartphone through Bluetooth with the use of near-IR spectroscopy which reads an object's molecular fingerprint. It stimulates the object's molecules and documents the reactions. The said apps will be included when the product arrives to its consumers.

The technology behind SCiO has been around for decades, particularly in sewage, oil and chemical quality control. However, SCiO is the first to bring a portable spectrometer to consumers, offering an application that's a lot more versatile. Its developers are engineers from Harvard and MIT who tested the product with high accuracy in live presentations.

SCiO Device

"The first application is for consumers interested to know the nutritional value of what they are eating," Consumer Physics CEO Dror Sharon said. "I often meet people who don't know what's in cheese, fruit and vegetables and have a hard time discerning what they should eat. I think his can be empowering if people want to change their intake, whether for medical reasons or training, and can be educational in teaching us to make better nutritional choices."

Consumer Physics started a Kickstarter project to raise funds for SCiO. The campaign was able to receive almost $500,000 in pledges from backers from different parts of the world. The company hopes to deliver SCiO by the end of 2014, focusing only on food and drugs at this time. Consumer Physics is also working on an app for plants, scanning if and how much water the plants still need.

Call for Articles

At Chitkara University, the endeavor has always been to hone the skills of the learners. Keeping in line with this tradition, the Department of Computer Applications, Chitkara University, Punjab had come up with an online magazine titled ***Wall For All***. This e-magazine was proposed to provide a platform to the budding learners where they can share their knowledge and also the general information pertaining to the computing field. The e-magazine also provides an opportunity to the faculty members to share their ideas and views on topics of general interest. ***Wall For All*** is available for free download in PDF format from department's website ca.chitkara.edu.in.

The students as well as faculty members are encouraged to contribute articles of interest for the magazine. The articles must be original in nature, and if adapted, due credit must be extended towards that source. The students may forward the articles through their respective advisors, while the faculty members may send the same directly to the editors of ***Wall For All***.

CHITKARA UNIVERSITY

Corporate Office:
Saraswati Kendra
SCO 160-161, Sector 9 C,
Chandigarh 160 009
INDIA

Phones:
+91-172-2746209, 2747057

Fax:
+91-172-2746154

www.chitkara.edu.in
ca.chitkara.edu.in