Chat Bots: A Nobel Approach for Human Computer Interaction using AI

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Abstract— Learning and interaction are viewed as two related but distinct topics in developmental robotics. Many studies focus solely on either building a machine or robot that can acquire new knowledge and learn to perform new tasks, or designing smooth human-machine interactions with pre-acquired knowledge and skills. These focuses on linking language learning with human-machine interaction, showing how better human-machine interaction can lead to better language learning by machine or robot. Toward this goal, we developed a real-time human-machine interaction paradigm in which a machine learner acquired lexical knowledge from a human teacher through free-flowing interaction.

Key words: Artificial Intelligence, Machine Learning, Bots, Supervised Learning, Natural Language Processing

I. Introduction

Language is a central component of human intelligence which is fundamental and essential for human-human everyday communication. A basic function of language is to provide linguistic labels of objects and activities which people to refer to them in speech and share experiences in everyday communication. Therefore, learning, understanding and using human languages by humanoid robot is critical for seamless human-machine interaction.

AI has always been on the pioneering end of computer science. Advanced-level computer languages, as well as computer interfaces and word-processors owe their existence to the research into artificial intelligence. The theory and insights brought about by AI research will set the trend in the future of computing. The products available today are only bits and pieces of what are soon to follow, but they are a movement towards the future of artificial intelligence. The advancements in the quest for artificial intelligence have, and will continue to affect our jobs, our education, and our lives.

Learning and interaction are viewed as two related but distinct topics in developmental robotics. Many studies focus solely on either building an Artificial Intelligence that can acquire new knowledge and learn to perform new tasks, or designing smooth human-artificial intelligence interactions with pre-acquired knowledge and skills. The present project focuses on linking language learning with human-machine interaction, showing how better human-artificial intelligence interaction can lead to better language learning by machine. We aim to build a real-time human-machine interaction paradigm in which a robot learner acquired lexical knowledge from a human teacher through free-flowing interaction.

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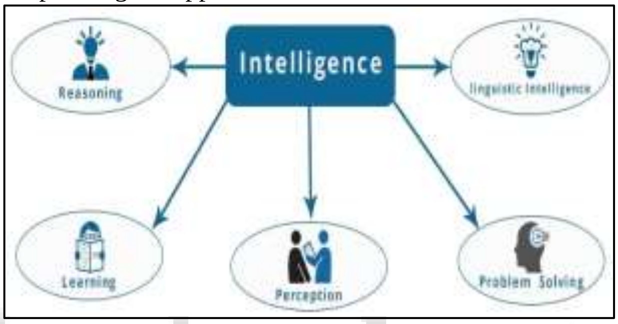

Fig. 1: Components of Intelligence

A. Reasoning

It is the set of processes that enables us to provide basis for judgement, making decisions, and prediction.

B. Learning

It is the activity of gaining knowledge or skill by studying, practicing, being taught, or experiencing something. Learning enhances the awareness of the subjects of the study. The ability of learning is possessed by humans, some animals, and AI-enabled systems.

C. Problem Solving

It is the process in which one perceives and tries to arrive at a desired solution from a present situation by taking some path, which is blocked by known or unknown hurdles. Problem solving also includes decision making, which is the process of selecting the best suitable alternative out of multiple alternatives to reach the desired goal are available.

D. Perception

It is the process of acquiring, interpreting, selecting, and organizing sensory information. Perception presumes sensing. In humans, perception is aided by sensory organs. In the domain of AI, perception mechanism puts the data acquired by the sensors together in a meaningful manner.

E. Linguistic Intelligence

It is one’s ability to use, comprehend, speak, and write the verbal and written language. It is important in interpersonal communication.

II. PROBLEM DEFINITION

Artificial general intelligence is the intelligence of a (hypothetical) machine that could successfully perform any intellectual task that a human being can. It is a primary goal of artificial intelligence research and an important topic for science fiction writers and futurists. Artificial general intelligence is also referred to as strong AI, full AI or as the ability of a machine to perform general intelligent action.

Some references emphasize a distinction between strong AI and applied AI the use of software to study or accomplish specific problem solving or reasoning tasks. Weak AI, in contrast to strong AI, does not attempt to perform the full range of human cognitive abilities.

III. LITERATURE SURVEY

Sr. No.	Paper Title	Author	Remark
1	People modify their tutoring behavior in machine-directed interaction for action learning	Vollmer, Lohan, Fischer, Nagai, Pitsch, Fritsch	In this paper, they present results concerning the acceptance of a robotic agent in a social learning scenario obtained via comparison to adults and 8-11 months old infants in equal conditions. These results constitute an important empirical basis for making use of tutoring behavior in social robotics.
2	Active robot learning with human tutelage	Greeff, Delaunay, and Belpaeme	In this paper we describe how a robot may benefit from active learning in a human-robot tutelage setting. Rather than passively absorbing conceptual knowledge, the robot learner actively tries to influence the human teacher in order to improve its learning experience.
3	Learning to Interact and Interacting to Learn: Active Statistical Learning in Human-Machine Interaction	Chen Yu, Tian Xu, YiwenZhong, Seth Foster and Hui Zhang	This chapter provides a condensed summary of literature reviews on key topics related to interactive AI and the comparison between the present project and the related topics of the existing information will also be discussed.

Table 1:

IV. PROPOSED SYSTEM

Syntax is a form of grammar. It is concerned primarily with word order in a sentence and with the agreement of words when they are used together. So it is, in a sense, acting as a kind of 'police officer' for the way in which sentences are constructed. English is a language that has a structure known as SVO.

"The cat (subject) washes (verb) its paw (object)."

This is the correct word order and also there is agreement between the words. If there were no agreement within the sentence, it could read, "The cat washes their paw." This does not make sense. The cat may have four paws, but it is only washing one paw. For there to be agreement, the possessive 'it' has to be correct. Thus "The cats (plural) wash their (plural) paws (plural)." This is the correct use of the plural possessive (their).

At first, syntax can seem daunting and it is always difficult initially to understand what a subject, verb or object actually is. It can also be difficult to understand whether agreement between the subject, verb or object is right or wrong. There are lots of tools such as grammar checkers, programmers or worksheets to help you get to grips with syntax and to make sure that you have the right word order and that within the sentence there is always agreement between the words, tenses and so on. It is true that syntax can take some time to master, but, once you understand its principles and can apply it without too much effort, then it really is worth the effort, since it will greatly improve your written English.

The proposed system contains the following modules:

1) Face recognition
2) Language Processing and Storage

A. Eigenface Face Recognition

Eigenfaces is the name given to a set of eigenvectors when they are used in the computer vision problem of human face recognition. The approach of using eigenfaces for recognition was developed by Sirovich and Kirby (1987) and used by Matthew Turk and Alex Pentland in face classification. The eigenvectors are derived from the covariance matrix of the probability distribution over the high-dimensional vector space of face images. The eigenfaces themselves form a basis set of all images used to construct the covariance matrix. This produces dimension reduction by allowing the smaller set of basis images to represent the original training images. Classification can be achieved by comparing how faces are represented by the basis set.

A set of eigenfaces can be generated by performing a mathematical process called principal component analysis (PCA) on a large set of images depicting different human faces. Informally, eigenfaces can be considered a set of "standardized face ingredients", derived from statistical analysis of many pictures of faces. Any human face can be considered to be a combination of these standard faces. For example, one's face might be composed of the average face plus 10% from eigenface 1, 55% from eigenface 2, and even -3% from eigenface 3. Remarkably, it does not take many eigenfaces combined together to achieve a fair approximation of most faces. Also, because a person's face is not recorded by a digital photograph, but instead as just a list of values (one value for each eigenface in the database used) much less space is taken for each person's face.

The eigenfaces that are created will appear as light and dark areas that are arranged in a specific pattern. This pattern is how different features of a face are singled out to be evaluated and scored. There will be a pattern to evaluate symmetry, if there is any style of facial hair, where the hairline is, or evaluate the size of the nose or mouth. Other eigenfaces have patterns that are less simple to identify, and the image of the eigenface may look very little like a face.

The technique used in creating eigenfaces and using them for recognition is also used outside of facial recognition. This technique is also used for handwriting analysis, lip reading, voice recognition, sign language/hand gestures interpretation and medical imaging analysis. Therefore, some do not use the term eigenface, but prefer to use 'eigenimage'.

We start with face recognition process and after that we start with speech to text conversion .Then we analyse the sentence to figure out that it is descriptive or interrogative type of sentence. To analyze what is being said in the sentence we study the English grammar rules.

B. Stanford NLP Package

“A sentence can be formed from a noun followed by a verb” Rules in this notation are phrase structure rules. They look like our earlier morphology rules. Because these rules make phrases, not words. As in our morphology unit, we can use ‘tree structures’ to illustrate the way these rules make larger structures. We start from taking out the verb then moving on to figuring out the subject of the sentence (noun) which specifies the ‘what’ ‘who’ of the sentence. Then there are descriptive words (adverb/adjective) which specify the ‘when’ ‘where’ ‘how’ of the sentence.

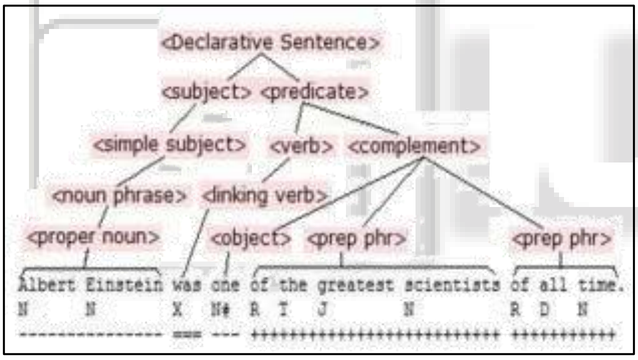

Fig. 2: Classification of a Sentence

In Language processing we make use of Stanford NLP Library available online with provides us with a set of tools to examine a sentence’s intent, its object and sentiment [10, 11]. Taking out the subject of the discussion is an important part while figuring out the conversation’s focal point. Along with that, figuring out the sentiment of the user is equally important in order to figure out the difference between, “It was a rough day today” and “It was a nice day today”. The AI must be smart enough to analyze the sentences to determine which kind of reply befitted the best, “Oh it’s sad to hear that!” or “That’s awesome!”. This is generally done by sentiment analysis provided by the NLP by distinguishing the behavior as, positive, very positive, negative, very negative and null.

The biggest advantages of chatbots include being able to reach a broad audience on messenger apps, as well as the ability to automate personalized messages. They also can improve efficiency by taking over tasks for which humans are not essential. One disadvantage is that not all bots are created equal. For example, when Facebook opened up messenger to bots, many people were disappointed in the lack of sophisticated entry level bots were able to provide. However, this will improve over time, with better bot selection..

Prior to the industrial revolution, we depended on individually trained artisans to hand-produce goods, which was a time-consuming effort with varying quality. Using machinery, factories were able to replicate redundant processes to produce 10x the output in a fraction of the time. Manufacturing advantage allowed new companies to form and disrupt old industries. We saw the same thing happen with the invention of the consumer internet and both social media and mobile phones were used as tools to revolutionize business once again.

Chatbots are the next natural evolution of the Internet for two important reasons. First, chatbots allow users to seamlessly interact with multiple apps from one location. This is important because it allows the bot to take on menial tasks from the user.

For example, instead of closing our text conversation to pull up a map and find the closest restaurant, then closing the map to pull up the website to look at the menu, then closing the browser to call and make a reservation, I can have a virtual assistant like Siri, Cortana, or Google Now accomplish all of that from a single interface. Second, with the Internet of Things projected to include over 50 billion connected devices by 2020, chatbots allow for voice navigation on wearables, smartcars, and other internet-enabled devices. Chatbots can help save time, labor, and money when used to handle easily automated tasks or low-pressure customer-facing situations.

Current bots are basically bringing the existing use cases to a new interface, the new reality that derives from there will be a total innovation, and the sooner you get yourself comfortable with it, the better you will be prepared to these changes as a professional and the more impact you can make on your circles in terms of adoption of new technologies.

C. Chatbots for Productivity

For businesses, learning to use chatbots is a vital step to remaining competitive in the next iteration of the internet. These chatbots can automate tasks traditionally performed by humans while providing a simple user interface.

For example, Slack’s chatbot (appropriately known as the Slackbot) works like an AI virtual assistant. Slackbot can schedule appointments and follow-ups, answer simple questions, file expense reports, and complete other administrative tasks, acting as an executive assistant for even solo entrepreneurs or small mom-and-pop operations.

The company also has plans to upgrade its AI to act as a knowledge bank, helping guide everyone from new hires to C-suite executives in completing their tasks, similar to Tony Stark’s J.A.R.V.I.S. AI assistant in the Iron Man and Avenger movies. It’s a move that will soon give anyone the power of a full corporate organization behind them.

Many large companies are even creating their own AI chatbots like Overstock’s Mila, which “mans” the company’s employee sick line, coordinating schedules and workloads in the backend while offering a friendly voice to the end-user.

Once you're familiar with using chatbots for productivity, you'll be experienced enough to start developing consumer chatbots.

V. Conclusion

AI is at the centre of a new enterprise to build computational models of intelligence. The main assumption is that intelligence can be represented in terms of symbol structures and symbolic operations which can be programmed in a digital computer. There is much debate as to whether such an appropriately programmed computer would be a mind, or would merely simulate one, but AI researchers need not wait for the conclusion to that debate, nor for the hypothetical computer that could model all of human intelligence. Aspects of intelligent behaviour, such as solving problems, making inferences, learning, and understanding language, have already been coded as computer programs, and within very limited domains, such as identifying diseases of soybean plants, AI programs can outperform human experts. Now the great challenge of AI is to find ways of representing the commonsense knowledge and experience that enable people to carry out everyday activities such as holding a wide-ranging conversation, or finding their way along a busy street. Conventional digital computers may be capable of running such programs, or we may need to develop new machines that can support the complexity of human thought.

One of the strongest demonstrations of linking interaction and learning is to show that even if the same learning algorithm is given without any changes to process additional feedbacks from human users, the learning system can improve its performance through social interaction. That is, social behaviours from a machine learner make a human teacher provide better and more teaching signals, and by doing so, better and more training data through social interaction lead to better statistical learning. We can view this as active learning through interaction, in which the machine learner generated behaviours to reveal its current learning states, and those behaviours gave human teachers first-hand information about what the robot or machine learner needed next for successful learning. In summary, real-time learning using on-demand information elicited through machine-human interaction can lead to successful statistical learning without complicated internal algorithms.

References

[1] H. H. Clark and M. A. Krych, "Speaking while monitoring addressees for understanding," Journal of Memory and Language, vol. 50, pp. 62-81, 2004.
[2] "Learning to Interact and Interacting to Learn: Active Statistical Learning in Human-Robot Interaction" by Chen Yu, Tian Xu, YiwenZhong, Seth Foster and Hui Zhang in 2014 International Joint Conference on Neural Networks (IJCNN) July 6-11, 2014, Beijing, China.
[3] M. Scheutz, P. Schermerhorn, and J. Kramer, "The utility of affect expression in natural language interactions in joint human-robot tasks," in Proceedings of the ACM SIGCHI conference on Human-robot interaction, 2006, pp. 226-233.
[4] A. L. Thomaz and C. Breazeal, "Teachable robots: Understanding human teaching behavior to build more effective robot learners," Artificial Intelligence, vol. 172, pp. 716-737, 2008.
[5] A.-L. Vollmer, K. S. Lohan, K. Fischer, Y. Nagai, K. Pitsch, J. Fritsch, et al., "People modify their tutoring behavior in robot-directed interaction for action learning," in IEEE International Conference on Development and Learning, 2009, pp. 1-6.
[6] Arnold M.Zwicky Robert N. Kantor, "A Survey of Syntax" Stanford University, Language Development Gramr and Semantics, Cal 1980.
[7] Literature Survey on Syntax Parser for English Language Using Grammar Rules. Shraddha Anantpure, Hinal Jain, Neha Alhat, SmitaBhor, Prof. Shanti Guru Computer Engineering, DYPCOE, Akurdi, University of Pune, India.
[8] A survey of Face Detection, Extraction and Recognition. Yongzhong Lu, Jingli Zhou, Shengsheng Yu National Storage System Laboratory School of Software Engineering Huazhong University of Science and Technology Wuhan, 430074, P. R. China
[9] A Survey Paper on Automatic Speech Recognition by Machine , Dinesh Kumar Dansena Department of Computer Science and Engineering Raipur Institute of Technology Raipur, India ,Yogesh Rathore (Assistant Professor), Department of Computer Science and Engineering Raipur Institute of Technology Raipur, India.
[10] Survey on Various Natural Language Processing Toolkits, L.B. Krithika and KalyanaVasanthAkondi School of Information Technology and Engineering, VIT University, Vellore-632014, Tamil Nadu, India.
[11] The Stanford Core NLP Natural Language Processing Toolkit Christopher D. Manning Linguistics & Computer Science Stanford University manning@stanford.edu, Mihai Surdeanu SISTA University of Arizona msurdeanu@email.arizona.edu, John Bauer Dept of Computer Science Stanford University horatio@stanford.edu.