Effective learning with intelligent personal assistant

Bhagyashri Sudhakar Wankhade
bswankhade23@gmail.com
Prof. Ram Meghe Institute of Technology and Research, Amravati, Maharashtra

Dr. V. M. Deshmukh
ymdeshmukh@mitra.ac.in
Prof. Ram Meghe Institute of Technology and Research, Amravati, Maharashtra

Gaurav J. Sawale
gjsawale@mitra.ac.in
Prof. Ram Meghe Institute of Technology and Research, Amravati, Maharashtra

ABSTRACT

In a technology dominated world, useful and timely information can be accessed quickly via Intelligent Personal Assistants (IPAs). By the use of these assistants built into mobile operating systems, daily electronic tasks of a user can be accomplished 24/7. Such tasks like taking dictation, getting turn-by-turn directions, vocalizing email messages, reminding daily appointments, setting reminders, responding any factual questions and invoking apps can be completed by IPAs such as Apple’s Siri, Google Now and Microsoft Cortana. The mentioned assistants programmed within Artificial Intelligence (AI) do create an interaction between human and computer through a natural language used in digital communication. In this regard, the overall purpose of this study is to examine the potential use of IPAs that use advanced cognitive computing technologies and Natural Language Processing (NLP) for learning. To achieve this purpose, the working system of IPAs is reviewed briefly within the scope of AI that has recently become smarter to predict, comprehend and carry out multi-step and complex requests of users.

Keywords: Artificial intelligence, Natural language processing, Intelligent personal assistants.

1. INTRODUCTION

Software systems are growing ever more complex, both vertically and horizontally, while the ability and willingness of users to put up with complexity are steadily decreasing. This dilemma affects all products in all markets. An elegant solution is to empower products with built-in advisors that address user problems at the interface: User Assistants, a.k.a. Associates, or Intelligent Agents. They provide a system adaptive behavior, which is a key differentiator. Adaptation can occur in a task, or in the interface. The User Assistant is an adaptive interface technology: the more a user interacts with and through it, the more it can discover and conform to that user’s habits, abilities, preferences, and goals, ever more accurately anticipating the user’s intentions. Software agents [1] are a new class of software that act on behalf of the user to find and filter information, negotiate for services, easily automate complex tasks, or collaborate with other software agents to solve complex problems. An intelligent agent should be endowed with an initial (built-in) knowledge and with the capability of learning. The learning capability ensures the agent's autonomy - the capability of deducing its behavior from its own experience. In fact, the learning capability gives the intelligence of an agent. By learning, it becomes able to adapt itself to its dynamic environment. Application of autonomous agents in the field of human-computer interaction gave birth to personal assistant agents. Two of the most important issues that personal assistant agents have to deal with are learning and adapting to the user's references [2]. In order to solve in an intelligent manner the problem of users assistance, the assistant agent has to continuously improve its behavior based on the experience of the actions taken by users that successfully achieved a specific task. In this direction, the agent has to be endowed with the learning capability, thus becoming able to adapt itself to its dynamic environment.

2. LITERATURE REVIEW

Two main challenges in the area of human-computer interaction are: first, how to know the user, and second, how to assist the user [8]. Most of the previous work has contributed to the first challenge by improving the interaction between users and PA agents, learning users preferences and goals, providing help at the right time and so on. As Chen and Barth’es mention [8], only knowing the user is not enough for solving all problems, as a good PA agent is supposed to have some knowledge related to the tasks to be done. Problems can be solved in an intelligent way by reasoning, making inferences and learning [9]. As far as we know, there is not much literature along this approach. There are some approaches in the literature that address the problem of predicting user behavior. The following works approach the issue of user action prediction, but without using intelligent agents and AOP. Zheu et
al proposed in [10] a probabilistic approach to predicting the next user click when searching the web using queries. The prediction is made based on a statistical relationship between queries and documents. Myers et al describe in [11] an intelligent personal agent developed to aid knowledge workers in scheduling their task. The agent learns, based on active and passive learning, user preferences and it is capable of decision making. Little details are presented regarding the learning mechanism and no evaluation results are presented. Chen and Barth’s present in [12] an approach for improving the intelligence of a personal agent by enhancing it with a case memory mechanism. The goal is to store previous experience that will help the agent in future similar situations. The learning capability hasn’t been implemented yet. Approaches in determining future users actions, but with different goals (assisting elder people or persons with cognitive diseases) are presented in [13]. The reasoning process is modeled using Bayesian networks (in order to identify user needs or intentions) and constraint-satisfaction processing engines. A comparison between our approach and the previously presented approaches cannot be provided, as there is no publicly available case study used by these approaches. Sr̆rban et al propose in [14] an agent based approach in predicting users behavior, using a probabilistic model. An intelligent interface agent that uses a supervised learning technique in order to achieve the desired goal is proposed.

3. ARTIFICIAL INTELLIGENT

Being used in many areas such as computer science, cognitive and learning sciences, game design, psychology, sociology, philosophy, mathematics, neuroscience, linguistics, defense industry, medicine, and education. Artificial Intelligence (AI) has lately been propelled into the mainstream of learning. Aiming to use the techniques of search and pattern matching for providing solutions for the demanded answers, AI uses logical series of steps called algorithms and advanced cognitive computing technologies. AI, as an interdisciplinary field, is used for diagnosis of illnesses, criminal identification, and artificial instructions and has a different scope of data in terms of the developments in the above-mentioned fields as it includes the ability to reason while processing a natural language to develop communication between human and computer (Vernor, 2015). Similar to modern day, in the past, AI was still an aspiration rather than an achievement and should be applied with considerable caution in real learning situations (Last, 1990, p.243; Schwind, 1990).

3.1 Definitions of Artificial Intelligence

• “The exciting new effort to make computers think . . . machines with minds, in the full and literal sense. (Haugeland, 1985)”

• “The study of how to make computers do things at which, at the moment, people are better.” (Rich and Knight, 1991)

• “[The automation of] activities that we associate with human thinking, activities such as decision-making, problem-solving, learning...” (Bellman, 1978)

4. NATURAL LANGUAGE PROCESSING (NLP)

Artificial Intelligence (AI) as a subfield of computer science and human-computer interaction may be provided via Natural Language Processing (NLP) in order to combine human learning and machine reasoning. As expressed by Verspoor and Cohen (2013, p.1495), NLP is the analysis of linguistic data, most commonly in the form of textual data such as documents or publications, using computational methods. To the researchers, the main aim of the process is to build a representation of a text by including structural adding and insights from linguistics. NLP seems to be the most crucial element for creating computer software that provides the human-computer interaction for storing initial information, solving specific problems, and doing repetitive tasks demanded by the user. Nabiïyev (2005, 475) collates the functions of the natural language analysis as below:

• to verify the sentences used in natural language

• to correct the spelling errors

• to form a syntactic structure of the sentences

• to provide a semantic relation

• to combine the syntactic structure of the sentences and semantic relation for appropriate responding

By using NLP, demanded questions on a specific topic or subject consisting of sentences, phrases and words can be computerized appropriately and be responded via PDAs and IPAs programmed within the scope of AI.

5. PERSONAL DIGITAL ASSISTANTS (PDAs)

With the most recent attempts taken in computer science, information can be reached and released in seconds today. Designed within the frame of Natural Language Processing and AI, the search engines become able to find and bring information from big data stack easily (Kayabaşı, 2010). In parallel technological developments within the computer science, devices have evolved over time. PDAs, also known as handheld PCs or personal data assistants (Viken, 2009), were first released in the middle of 1980s in order to ease the users’ daily lives and enable the mentioned data access. Likewise, search engines, diverse types of PDAs were regarded as crucial handheld devices that have been used by multiple disciplines since their introduction in the mid-1990s (Ranson, Boothby, Mazmanian, Alvanzo, 2007). In the following steps of these developments, PDAs started to be used for daily scheduling, set up appointments as portable devices designed with touch screen technology that frees the user to record telephone numbers, addresses, appointments and to-do lists (Lenox, Terri, Woratschek & Charles, 2002). However, PDAs have eventually become obsolete due to
rapid technological changes in the world of mobile devices (Beal, 2015). Based upon this alteration, PDAs today may be considered as ancestry devices of recent mobile innovations including smart phones and tablets.

6. INTELLIGENT PERSONAL ASSISTANTS (IPAS)

With close ties to the above-mentioned parts described, Intelligent Personal Assistants (IPAs) are speech-enabled technologies in mobile platforms which have become one of the fundamental devices of learning online. As illustrated by Hauswald et al. (2015, p.223), an IPA is an application that uses inputs such as the user’s voice, vision (images), and contextual information to provide assistance by answering questions in natural language, making recommendations, and performing actions. The widespread applications of IPAs are designed to perform the required tasks of the users via using online sources available on the Internet. As connoted by Garrido et al. (2010, p.3) the most common application has been filtering information in the Web through software agents specialized in tasks such as improving the information retrieval process, or supporting users through recommender systems. IPAs, on the other hand, are personalized applications on which users may have preferences over a wide range of functions within the system, including how tasks are performed, how and when meetings are scheduled, and how the system interacts with the user (Myers et al., 2007). Combining advanced technologies with AI, IPAs namely Amazon Echo, BlackBerry’s ‘BlackBerry Assistant’, Braina, Google’s ‘Google Now’, HTC’s ‘Hidi’, Maluuba Inc’s ‘Maluuba’, Microsoft’s ‘Cortana’, Motorola’s Mya (unreleased), Samsung’s ‘S Voice’, Cognitive Code’s ‘SILVIA’, Apple’s ‘Siri’, Nuance’s ‘Vlingo’, LG’s ‘Voice Mate’, IBM’s ‘Watson’, Facebook’s ‘M (Moneypeny)’ and applications like Dragon, Indigo, Skyvi, Voice Actions, Voice Search, EVA Intern, Iris, IBM Watson, Maluuba, Evi, Jeannie, Speaktot, Alvc and Wolfram Alpha, Dahi, Duolingo, Ata, Jeannie, Andy X, ACO or Assistant B, Anki, Memrise, Pimsleur and Livemocha etc. may help learning online. Among these enumerated software agents, some already perform basic tasks of the user commands including chitchatting, text messaging, emailing, alarm setting and some for second language learning. As posted by Matney (2015), Apple, Google, Microsoft, Amazon, and Facebook have been five robust tech titans that provide their own IPAs such as Siri, Now, Cortana, Alexa and M with which instant communication and interaction have been provided through AI in recent years. As stated by Stephen Hawking (2014), an English theoretical physicist, cosmologist, author, Siri, Google Now and Cortana are the unprecedented investments and greatest products of human intelligence created in human history. Despite its cons, their potential usage for learning might still worth searching. In this study, the most commonly well-known tech giants which have their own voice assistant like Siri, Now, Cortana will be analyzed in general.

7. DISCUSSION

7.1 LEARNING WITH PDAS AND IPAS

Developed on a spoken dialogue system that uses a natural spoken language and semantic understanding techniques in an attempt to help the users obtain desired information (Chen, 2015), IPAs could be used for self-learning purposes. As also indicated in Horizon Report by Johnson, Becker, Estrada, and Freeman (2014), the virtual assistants encourage convenience and productivity, making them particularly compelling for their potential applications in academic settings, though they are four to five years away from being widely used in higher education (p. 46). IPAs in this regard could be estimated as devices to improve listening and speaking skills of the learners. As underlined by Miangah and Nezarat (2012), embedded pronunciation activities in mobile devices such as PDAs could be used through downloadable online dictionaries with sound functions in order to teach a correct phonetic form of words. To the same researchers, the speech aspect of mobile learning is as significant as a textual aspect of it, since it enables learners to comfortably speak with a system recording their voice and allowing them to listen back to themselves (p. 314). In this connection, the speech/language enabled IPAs may enhance learners’ listening and speaking skills without being bound up with native-speaker humans. As pointed out by Markowitz (2013), the smart assistants, as devices perform at human levels with facial expressions, linguistic prowess, and cognition, IPAs can assist the learners for language learning with no constraints of time and space.

Artificial intelligence is starting to become a part of our daily lives. Be it personal assistants like Siri or intelligent sensors that allow us to take perfect pictures or automatic parking features in cars, we are surrounded by artificial intelligence. However, one area where the presence of Artificial Intelligence still needs to be felt is education. The education industry is still functioning a lot on traditional methods with little change over the years. Artificial Intelligence can bring about wonderful changes to the current education system benefiting both the institutions as well as the students.

![Fig.1 Typical architecture of intelligent assistant personal used for educational purpose](image-url)
Here are 5 ways in which AI can make radical changes to the education experience.

1) AI can help automate basic activities

From school to graduation to higher graduation, Indian education system works on a grading system. This is definitely a tedious job for teachers to prepare a grading sheet time and again for each student and fill in for various sub-sections. Well, artificial intelligence can help to do away with it. AI can help to automate the grading for all types of multiple choice questions, fill in the blanks type of questions. It not too far when AI will be able to grade another type of questions with lengthy answers. This will help teachers to focus more on in-class activities. While AI may not be able to completely replace human grading but it can get close enough to it.

2) AI can provide real-time assistance to students

Today all educational institutions keep a record of student data and also collect data from students on various parameters through feedback. All this data needs to be analyzed and the suggestions should be implemented to bring about a change. Educational Institutions today with the help of ‘learning analytics’ can understand a lot about student activity, how they are performing and what are their weak areas etc. Artificial Intelligence can help in taking this to the next level by providing real-time support to students.

AI can help in the learning process of an individual student and can offer timely interventions in real time to support the students especially when the teachers are not available as AI can be available 24*7.

3) AI can bring in global learning.

Education cannot be limited to boundaries and AI can help achieve this. It can help bring radical changes in the education industry by allowing students to learn any type of course from anywhere in the world at any time. Education programs powered by artificial intelligence can start equipping students with basic skills and as AI develops and becomes more advanced, a wider range of courses can be run with the help of AI giving students the opportunity to learn from anywhere anytime.

4) AI can become new teachers

With the development happening on the artificial intelligence front, it is not far when artificial intelligence will be able to conduct class-room teaching for various streams. Though AI cannot completely replace teachers but they can take care of the basic teaching sessions and teachers can act as facilitators to help where AI falls short. Teachers can supplement AI lessons and provide assistance to weak students thereby providing the required human interaction and hands-on experiences to students.

5) AI can reason out the weak points in a course.

Feedback is very important for improvement. In a similar way, teachers and students both need feedback about their performance in order to improve. AI can help on this front. For instance, AI can figure out which areas most students are performing good and which areas most students are performing poorly and giving wrong answers. It can alert the faculty on a real-time basis so that he/she know where more efforts are required. This will help in improving the performance of students. Also, students can get immediate feedback rather than waiting for the teacher to communicate.
8. CONCLUSION

It high time that traditional way of education is followed and that education is just taken for granted. The onus lies on the educational institution to bring changes in the education system making them more efficient, more student-friendly and preparing students for the real-world. The paths of this study regarding IPAs is intended to reveal an overview of how and to what extent these devices might be used in human-computer interaction and learning. Although there have been several works related to IPAs in education (also known and conceived as Intelligent Pedagogical Agents by Garrido et al. (2010, p.4) the potential use of IPAs for second language learning within Natural Language Processing (NLP) should be focused particularly. In this regard, it may be suggested that both devices (PDAs) and applications (IPAs) might be used as feasible tools for language learning; so more qualitative and quantitative studies may be conducted accordingly.

9. REFERENCES