

The Influential Role of Robot in Second Language Classes Based on Artificial Intelligence

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Abstract—In the fast development of technology, robot has played many vital roles in different fields of life. Robot is also used in education as a teaching assistant in arts, science and language course. In Viet Nam, the secondary schools or high schools spend a lot of money on hiring native speakers for teaching English classes. Currently, in most Asian countries where English is taught as a foreign language, therefore many various instructional methods are being used for teaching English at school as well as English Language Centers. As a result of this paper approach to English teaching robots, the use of robots like as foreign language instructors has been referred to as a robotic revolution in Industrial Revolution 4.0. In this study, we will describe applications of several robots have been conducting the English teaching instructors tutoring some extra-class's programs in Viet Nam. The results shown the potentials of individualized interaction in language education are substantial. These performances give the positively contributions to improve of motivations of children studying English as well as other languages. This paper will show the effective tools for language education of robot. From experiments in reality, using robot being an instructor in English class has proven to enhance the language teaching for children effectively. The children, who learn English with an instructor like as robot have shown better learning results in speaking, as well as more confidence and much motivation in studying.

Index Terms—teaching robot, robot classroom, artificial intelligence, fuzzy

I. INTRODUCTION

Robots can apply many different roles interacting with children in language learning. These are many researches in around the world in this field. Robots have been used as an instructor for children especially in early school education. The service robot can play and train basic knowledge. The children working along robot can gain more experience and interactive which help them more enthusiasm and energetic that why they can get more vocabularies comparing without robot. Nowadays, more and more robots will be available on market, of course, robots will change the our life to make it more and more modern and flexible. The service robot applied to teaching activities usually use for robot-assisted language learning (RALL). Many references focusing on RALL have proven robot assisted teaching to be effective tools

for language education especially for children [1]. In this paper, the service robot like as an instructor teaching the children in class for sustaining long-term interaction uses an intelligent controller implemented by Artificial Intelligence (AI).

II. ADVANTAGE OF APPLYING ROBOT IN TEACHING

Early years education is an important stage to prepare fundamental of learning a second language. Besides, comprehending the primary language skills will form hobbies of lifelong learning in foreign language. To emphasized two valuable things of mote. To emphasize the importance of influencing learners' language acquisition, the teaching method must be a driving force to promote learner-centered orientation and avoid language misconceptions. In this case, we tried to explore the integration of traditional teaching method, computer in study new language and applying robot into create a different and exciting English learning method. Combine robot and learning materials is able to improve abilities of language learners. Gesture based on content of the lesson and interactive emotions as well as display visual images and actions illustrate performed by robot enhance in processing advance language skills, children easily encourage to dance, sing along and interact with the lesson by the most memorable and interesting way, this language teaching approach using robot is implemented and the feasibility of the learning system was evaluated. To develop and carry on this idea, a new teaching method by robot by on artificial intelligent was designed to collect all of the data for reserved instance analysis. The suggested that this system did enrich students' learning experience and enhance their motivation and engagement [2]. More and more research works studying of service robots using in teaching and learning tasks.

Robot-Assistant Learning (RAL) prefers to instruct children during primarily period of learning second language especially English [3]. These days, in almost developing countries, high-tech devices such as smart phone, computer, tablet,... are used to learn in app cloud platforms, or using these devices to connect with native speaker in order to directly correct pronunciation by oral or online records. Directly interacting with a native speaker has been confirmed to be the most efficient way of learning a new language. Using a digital device based application has its own limit. The most effective and the fast technology to play the role of a native speaker is a

robot. Robots assist and reinforce the material by repetition continuously. An intelligent RALL (Robot Assisted Learning Language) system with voice recognition and vision ability can supply a suitable and feasible environment for a real discussion like with native speaker.

Following references, using robot like as instructor has ten features that could bring the advantage of learning second language these: Repeatability; Flexibility; Digitization; Humanoid Appearance; Body Movement/Motion; Interaction; Anthropomorphism; Sensing Capability, Intelligence and Automatic Speech Recognition; Language Understanding and Dialogue Management; Emotional Expression [4]. Robots are used in guidance of English instructor that would bring more difference comparing with apps in smart devices because robot has its appearance with movements of head, arms and posture as well as gestures and emotion.

III. STRUCTURE OF TEACHING ROBOT

Currently, one of the cutting-edge technologies in education likely to be used is robotics. These robots not only have a graphics user interface but are also able to carry on autonomous movement, visual recognition, voice recognition through a camera, a microphone, and physical interaction based on many different sensors. However, robots now can perform many nonverbal communication namely facial expressions, gestures and actions. Robots can be used in some classrooms to increase and collect level of attention of student. The main objective of the current research was the service robot named MiABot for use in the English learning classes. MiABot was pre-programmed based on AI for each teaching session to be teacher in teaching a particular syllabus and was operated autonomously during the teaching sessions. In the class, students and robot have participate in class activities together without any teacher. Robot with the appropriate design can perform many tasks in class in order to support for teacher (Fig. 1).

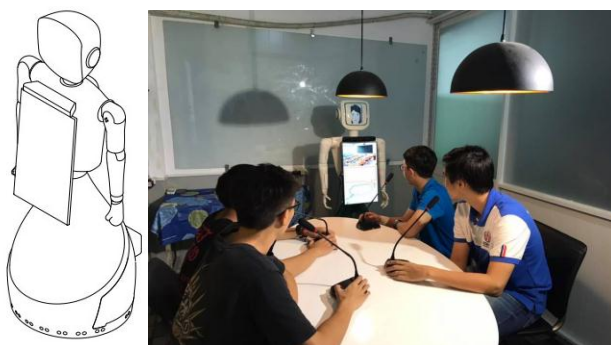


Figure 1. General design of teaching robot.

The contents of English lessons were considered as beginning English learners. Accordingly, several lessons plan was selected and 10 teaching scenarios were written based on it. Content of the lesson were constructed base on the level and language ability of participants.

Accordingly the standard of English system, specific Cambridge Textbooks is considered to embedded in robot with songs and games also included in the scenarios. Otherwise, the songs were uploaded in MiABot and she was programmed to dance to them.

Moreover, presentation slides were shown by using projector to explain the meaning of vocabulary or 3D technology is going to go viral in the near future. Only one laptop was also applied with 2 tasks: one to operate MiABot and the other connected to the projector.

IV. IMPROVING LESSON QUALITY USING FUZZY LOGIC AND NEURAL NETWORK

It is based on the observation that people make decisions based on imprecise and non-numerical information namely age, level, class size. These models have can recognize, represent, manipulate, interpret, and utilize data and information. Specifically, robot will use models to decide two values: lesson and level of activity (many, medium or few). For example, robot will choose an easy lesson and many activities for low-level, young-student and medium-size class. Because fuzzy logic comes from human logic, we start with three input values: age, level, class size and two output values: lesson, activity. After determining input and output values, we start to set values for every input and output. Then, we start to makes rules based on human mind. Human beings make decisions based on rules. All the decisions human make are all based on computer like if-then statements in programming language. Rules are related to ideas and one event to another. Fuzzy machines tend to copy the behavior of human which work as the same method. However, the decisions are replaced by fuzzy sets and the rules are replaced by fuzzy rules. Fuzzy rules are used fuzzy logic systems to conclude an output based on input variables. We made twenty-seven rules to make decisions on lesson and activity of classroom. (Fig. 2)

In order to make classroom more exciting and interactive, robot has to have ability to talk, ask and answer questions of students. We focus on the ability to response many sentences (statement, question, negative sentence) in many topics and situations. Natural language processing (NLP) and machine learning are used to solve this problem. It is an important technique helping robot to understand human language in order to take actions namely: translating, analyzing information, recognizing voice and so on. Generally, NLP has three basic steps namely preparing data, preprocessing and choosing machine learning algorithm (Fig. 3).

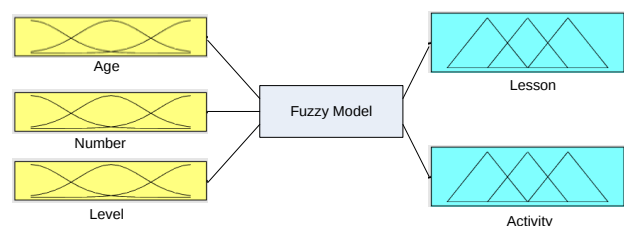


Figure 2. General fuzzy system for deciding lesson and activity.

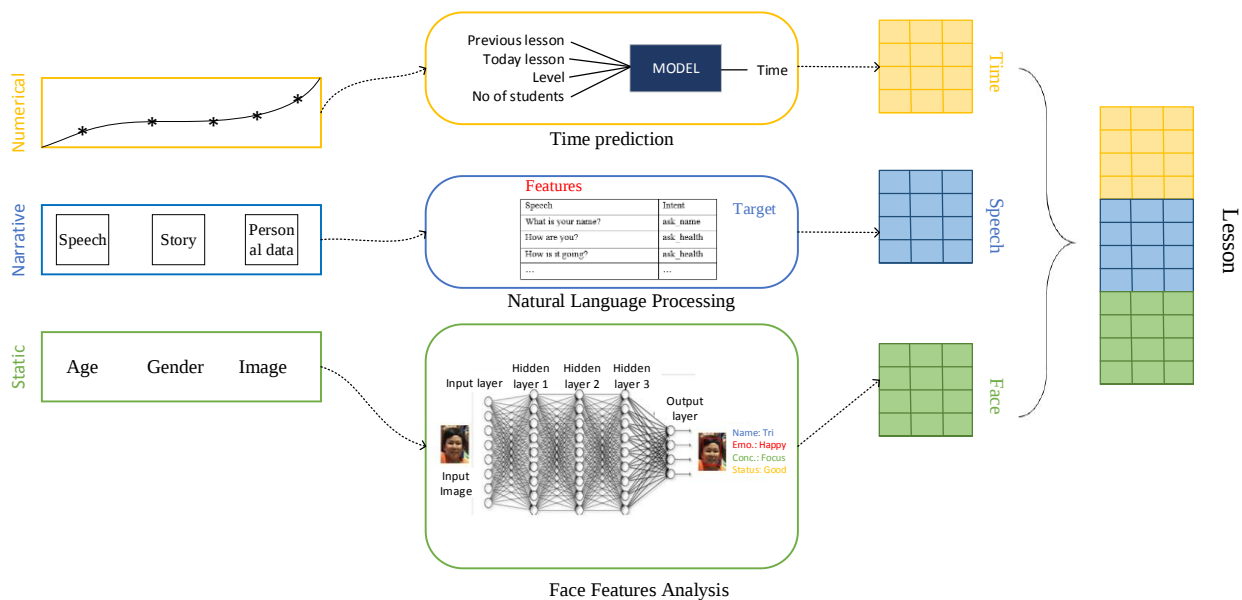


Figure 3. Applying artificial intelligence in classroom

We will pick the airport topic which is one of trained topics of robot to demonstrate clearly NLP's steps. In a full model, there are many trained topics about many aspects of life to help robot to have a correct and flexible responses in different situations. Preparing data relating to the topic that we choose, it means a thousand of sentences, speech and common question in the airport should be added into robot as the dataset. Besides, we also have to consider all of the conversations which usually take place at the airport such as security check, check-in counter, luggage checking and so on. After we have a thousand of the airport sentences, we start to do some preprocessing steps. Word tokenizer is the first thing which should be done in NLP preprocessing. This step splits a sentence into many words to be processed easily in the next steps. Synonym is a common thing in every language. All of the synonyms in dataset should be managed. Then, we should extract entities like name of people, name of place, city and so on. Besides, stop words should be eliminated, too. Stop words are commonly used words (such as "the", "a", "an", "in", "on", "by") that a search engine has been programmed to ignore, both when indexing entries for searching and when achieve them as the result. Finally, we start choosing the suitable machine learning algorithm. Because the sentences for one topic are not really big so Nayve Bayes is considered to use. But if it is the model for the whole robot, Support Vector Machine which is commonly used for big data is highly recommended. SVM is usually used for binary classification with linearly separable and non-linear separable classes which is appropriate for classification intents in natural language processing.

V. FACE ANALYSIS FOR IMPROVING CLASSROOM MANAGEMENT

This method is used to build a feature vector

(distance between the points, angle between them) [5]. The face recognition was processed by calculating the Euclidean distance between feature vectors of a probe and reference image (position of eyes, ears, nose,...). To get a database for a student, we take approximately 500 photos of that student. The process happens with every single image includes: preprocessing, face detection, change it into train data. In preprocessing stage, some functions of OpenCV will applied to make the image better namely Gaussian, Canny, Sharpening. That make these next stages become easier. Then the face in the image will detected by using a created database. After that, a machine learning model which is trained from multiple images is used to detect faces in other images (Fig. 4). After obtaining the image of face, the face area will be cropped out of the image. The image face only will change into 28x28 grayscale then it is continuously encoded to a matrix which will be an input for the face analysis.

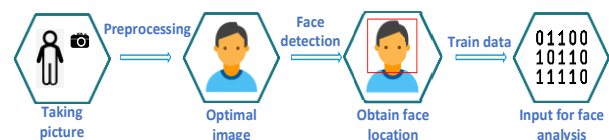


Figure 4. Steps preparing for face analysis

VI. FACE ANALYSIS BASED ON MACHINE LEARNING

A big data base is the compulsory for an accurate training model. The expected output we have will depend on the input. For example, we want to recognize the emotion of student. Specifically, there are some expressions of face emotion are put in this example namely happy, sad, focusing, angry, neutral, etc. (Fig. 5). The database includes roughly 500 photos for each expression. The important thing is that we have to group

similar photos in a group. It means all of happy photo will be in the same place and this is also applied for the rest. Every image will be processed in preparation stage, we will have matrix of every image to use as input data. The Convolutional Neural Network is considered to use for this case. We can use TensorFlow to load the dataset. The categorical data is converted into a vector of numbers. In some cases PCA is recommended to reduce the number of dimension of the input value. The dimension of training data is reshaped to feed the sample into the CNN model. Then we set the value of training iteration, learning rate and batch size.

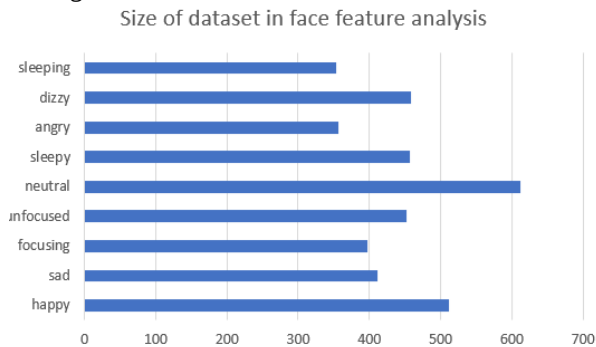


Figure 5. Dataset for training

Training iteration is the number of times training the network. Learning rate is multiplied with the weights based on which the weights get updated. That reduce the cost, loss, cross entropy. The high value can cause some memory errors. The low value can cause the poor performance. It is a considerable and noticeable value. After that, we create wrappers for simplicity. As usually, we define convolution and max-pooling functions for calling them many times in the network. Cross entropy is used as the loss function, because the cross-entropy function's value is always positive. The model will be embedded and tested on the MiA robot after every training iteration which will help to keep track of the performance of the model to get the optimal in the near future (Fig. 6).

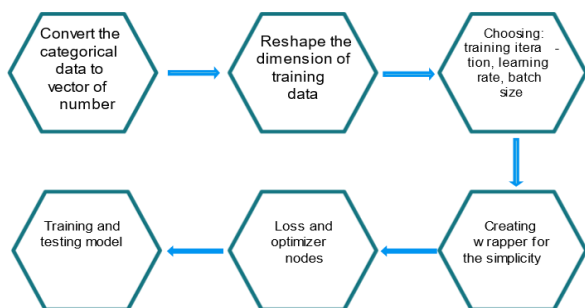


Figure 6. Diagram illustrates steps creating model for face analysis.

VII. EXPERIMENTS AND DISCUSSIONS

As we mentioned in section I, it is very difficult for teacher to have a look on every single student so there is a live camera will continuously keep tracking on every student to send the image frame to the main computer

which includes the trained model (Fig. 7). The image frame of student will be processed in trained model and the output will be the facial expression namely emotion, age, gender, name and attention rate. There are two ways of the output of trained model. The first one will go to the teachers' screens for them to adjust their behavior, focus on the students who lose attention. The second way of these data will be store in a database which can be a server. The data of the attention, emotion and behavior of student can be summarized and used for further aims such as evaluating manner, sending to parents and helping teachers to have reviews of student's attitude toward their teaching methods. Checking attendance is also the advantage of this method. The camera can get the data of all students every second so the number of students in class is also updated continuously. Moreover, the face analysis includes the face recognition. It can check attendance and update immediately for teachers can know exactly the current class size. This helps teacher reduce tasks, become more proactive and manage class more effectively. The teaching sessions were held two times a week with each session lasting 45 minutes to one hour and covering half of a chapter of the selected book. MiABot would spoke English as well as Vietnamese during the sessions. This way makes the students feel more comfortable with studying the new material. After applying teaching methods and technologies, we set up a classroom with four students to test the efficiency of this robot. Classroom is set up with a round table, chairs, speakers, microphones and a robot. Robot will work as a partner of students in group discussion, it helps student to improve speaking and listening skills and saves teacher's labor by presenting new lesson. At the beginning of the lesson, robot can recognize the students in order to access saved data to put in fuzzy system in order to choose the suitable lesson. The lesson depends on the student's level, class size and previous lessons. During the lesson, the advantages of robot are the repeatability and wide knowledge [6]. Robots regurgitate educational activities many times without complaining. This feature assists teachers and helps children to practice oral skills. Robot proves the outstanding in pronunciation which can help students much in speaking and listening skills. A teacher utilizes the same teaching activity in different classes in many terms. Repetition has many advantages for students, comprehension and familiarity with the spirit of a language. Besides, studying with robot can encourage students in raising their ideas and develop the creativity. Robot's intelligent interaction is one of the basic functions to become teaching assistant. Practicing different dialogues is important in language learning classes [7].

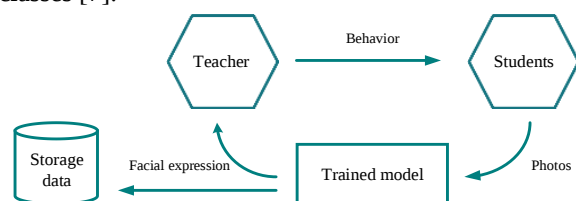


Figure 7. Trained model applied in classroom

TABLE I. THE IMPROVEMENT OF STUDENTS AFTER STUDYING WITH ROBOT

Student name	Before learning with robot		After learning with robot	
Student 1	Listening	15/20	Listening	16/20
	Speaking	42/50	Speaking	45/50
Student 2	Listening	12/20	Listening	15/20
	Speaking	40/50	Speaking	43/50
Student 3	Listening	17/20	Listening	17/20
	Speaking	45/50	Speaking	46/50
Student 4	Listening	16/20	Listening	15/20
	Speaking	43/50	Speaking	45/50

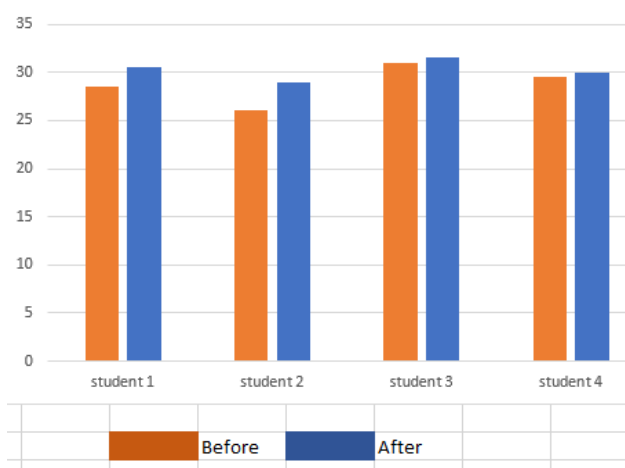


Figure 8. Overall score of students before and after studying with robot

After one month studying with robot, there are some changes in the language skills of students (Table I, Fig. 8). Students are more confident and proactive in communication. Specially, when students talk in a trained topic which practiced many times with robot, students can speak really fluently, raise many own ideas and use a lot of difficult vocabularies. Since robots must be programmed based on AI in advance and operated by a human, they may seem to be quite infeasible tools to be used in education. There also are several deficiencies: first of all is costly for learners not many learners have a change commonly to face with robot or cannot have an affordable price due to highly price purchased; secondly, there is no help available in the learner's mother tongue when miscommunications occur; finally, different native speakers may be assigned to different classes according to their schedules and this would impede learners' progress-tracking. However, robot is the next generation of technology that will be extensive in everyday life, they will inevitably find their way into education in much the similar way as computer did many years ago. There were some obstacles to the use of a robot in class. Firstly, students desired to approach to touch and interact with the robot named MiABot and touch her which attracted the others student, at times made class management a bit harder for the teaching assistant. When robot MiABot

was dancing follows the song, they would try to imitate her movements and postures. According to Total Physical Response (TPR) approach, can contribute to better language learning gains, this can be a good point, since imitation is considered as a social skill and physical engagement. This imitation, however, sometimes distracted them from paying attention to the content of the song being played by MiABot.

In attempt to receive MiABot's applause and positive feedback, the students contingently created a quite competitive, felt jealous of the ones to give the right answers. This is the main reason to push up the improvement of student grade and language skills of student which is attended in this research.

VIII. CONCLUSION

This robot can perform well in class as a teaching assistant with ability to convey knowledge via variable lessons which is designed suitably for robot. It is also successful in building an intelligent robot which applied fuzzy, neural network and many machine learning algorithms in order to improve processing abilities. Concretely, natural language processing makes robot become smarter, friendlier and easily encourage students to study and work hard in class. Students are more confident and proactive when they talk and lead the conversation with robot. Face analysis using image processing helps teacher to control the class better and more active. Teacher now can keep tracking student better and have a good summary of classroom data after class in order to understand students better. Robot gradually replaces human in many fields in order to improve the productivity and reduce human labor; the combination of traditional methods and modern technologies is inevitable. Teaching is an important field of human being, the applying robot and technology based on traditional teaching methods will enhance the quality of education which shows in the development of students. Traditional methods which still have some defects because of human weakness are expected to be more effective by the outstanding trait of robot. Developed robots for educational in generally, in this research MiA robot for language teaching purposes has proven the effective in enhancing English as the second language and Vietnamese is learner's mother tongue. Using robots as instructor or teaching assistants (TA) have shown better not only in knowledge achievements in general but also motivation and greater confidence.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Nguyen Dao Xuan Hai and Tuong Phuoc Tho contributed to the analysis and implementation of the research, to the analysis of the results and to the writing of the manuscript. All authors discussed the results and contributed to the final manuscript. Besides, Nguyen

Truong Thinh conceived the study and were in charge of overall direction and planning. Nguyen Truong Thinh is a corresponding author.

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