CultureBot: A Culturally Relevant Humanoid Robotic Dialogue Agent

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ABSTRACT

The use of robots as technologically-based educational tools have been shown to be an effective means of attracting students to science and technology-related academic fields. By developing relatable robotic programs, an increase in interest in the field of technology will occur. For this work, researchers focus on the social interaction capabilities of a humanoid social robot, Pepper. The research leverages the Pepper robot platform using the Softbank NAOqi framework along with the Google Cloud Speech platform to further develop speech and gesture patterns that will afford for a culturally rich engagement interactive experience. By training culturally relevant vocabulary and gestures into the system, the robot will be able to identify verbal cues that will afford decisions on which language will best serve a particular engagement activity (i.e. Social vs. formal, AAVE vs. Standard English). Lab studies will be utilized to test the functionality of the robot's skills and styles, with the expectation of a fully functioning, culturally aware Pepper robot.

CCS CONCEPTS

• Information systems → Interaction Design → Interaction Design Process and Methods→ Activity Centered Design

KEYWORDS

Computer Science Education, Human Robotic Interaction, Culturally Relevant Technology

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1 INTRODUCTION

1.1 Computing Education Gap

In the African-American community that situates our campus, there are only three high-schools that currently offer computing courses. Among many communities in the U.S., there are efforts in place to mitigate the largely under-represented status of minority groups in the field of computing. As a result, our lab seeks to develop robotic technologies that not only engage and educate youth on the various aspects of computing, but also study interaction styles that center African-American students in order to increase comfortability and self-actualization for these often-marginalized groups.

1.2 Culturally Relevant Engagement Styles

Through the use of culturally relevant technological engagement, outreach efforts have centered on the expression of music and dance forms as a means of cultural interaction that seeks to normalize technology and culture as relevant artifacts for African American youth. This, however, leaves out an important artifact that people use every day, speech. We interact with each other by speaking and comprehending words and their meanings before we move on to understanding different interfacing forms such as music and dance.

The issue lies in the inability to recognize dialect as a cultural form and how its origins shape one's identity. Students are often berated when they struggle to write creatively in a Standard English style, when in reality, to write their voices in such a manner would be an inaccurate depiction and diminish the breadth of their cultural identity [1]. True multicultural education is based on the ideals of social justice and educational equity in an environment of respect that values diversity in experience, culture and language.

1.3 Educational Technologies for Diverse Groups

When considering the use of educational technology and its place in the classroom, along with the practice of having robots as educational tools has shown to be an effective means of attracting students to science and technology related academic fields [2]. While the use of robots in a classroom is proven to be beneficial, the environment that they create and the interactions that take place may not be culturally inclusive for every student.

When building technology for the purpose of educating students we have to make sure that when integrating them into the classroom students can learn from them and actually feel comfortable connecting with them on a one-to-one level. The robots must be able to relate to the students or else the message will be lost in translation. Trainings and methods should be given to aid teachers in the process of providing nonthreatening spaces for negotiating and applying nonstandard and standard English. They have to realize that that home language is directly linked to a student's identity. To have an inclusive and welcoming environment for all students the technology that is introduced as well as the teacher supervising the classroom, must be trained with all students, whether they speak Standard English or some other dialect.

There is much work to be done for the professional world to recognize and accept the differing dialect as language, as proper language as it relates to a person's cultural identity. It is with this work that we hope to advance the process for that recognition.

2 BACKGROUND

2.1 African American Vernacular English

African American Vernacular English (AAVE) can be differentiated from other dialects of English [1]. Because it can be derived from the Standard English language, its systematic grammatical and phonological features define AAVE as a variety of the English language, as it is defined and rule-governed [1]. Through observation by J.R. Rickford, African American students most commonly speak AAVE [3]. It is a language claimed to be spoken by working class people in urban areas [3]. However, many speakers of AAVE do not employ its features all the time, nor do all African Americans speak AAVE. AAVE speakers are typically made to feel that they are the only ones who speak a deviation from Standard English [1]. To better support these populations of students, teachers and developers can see to further educate themselves on the function of natural languages and their use in educational settings. AAVE, an example dialect, is not slang, improper grammar, or broken English [3]. The child who speaks in a vernacular dialect is not making language errors; instead, she or he is speaking correctly in the language of the home discourse community [3].

It is important to recognize the place of home language when building technology, as it is not correct to make assumptions as to whom the robot will be interacting with upon the use of the different dialect and as it is not correct to assume that AAVE is the only derived dialect of the Standard English language that the robot will need to be trained to speak.

2.2 Code-Switching

Traditionally teachers regard Standard English (SE) as correct, while any deviations and non-standard features are deemed incorrect [1]. This ideal leads to a negative notion of code-switching. Code switching calls for employing students' home language to facilitate appropriate nonstandard conversations and the employing of Standard English to facilitate customary contexts for writing and speaking. An example of when code switching or even forced code switching may occur is when students from a non-affluent community are sent to school in a more affluent community to receive a "better education". Students then are forced to assimilate or are assumed to have language difficulties and minimal skills and abilities. In reality, even with a plethora of training, teachers could still be ill-prepared to provide help in nonthreatening ways because they have not been thoroughly trained in the languages of every child.

This issue would be solved with the culturally relevant education based chatbot, such as the CultureBot. The idea behind Pepper the CultureBot is to provide a piece of educational technology that helps a student to learn in a comfortable manner. Ideally when interfacing with a robot that understands ones in your natural tongue, one is ready to receive the valuable information that is being shared with them.

3 METHODS

3.1 Development Platform

To create the culturally inclined chatbot program, Softbank Choregraphe application development platform, and the NAO humanoid robotic hardware was needed. With this software and the robot "Pepper", the researcher was able to create a program that could interact in the dialect used by the user and document the most used language type, AAVE or Standard English.

Figure 1: Pepper the Robot. A Humanoid Robot used in this Research

3.2 Corpus Development

The broader merits of this bot seek to increase awareness and education of computing, college life and robotics to underrepresented largely African-American student populations who will engage with it during various outreach activities. Five topics that related to researchers and the field of computer science were chosen to populate the chatbot. In choosing the AAVE variants for various scrips we crowd-sourced the responses through social media scraping. An example of the dialogue engine is presented in Figure 2.

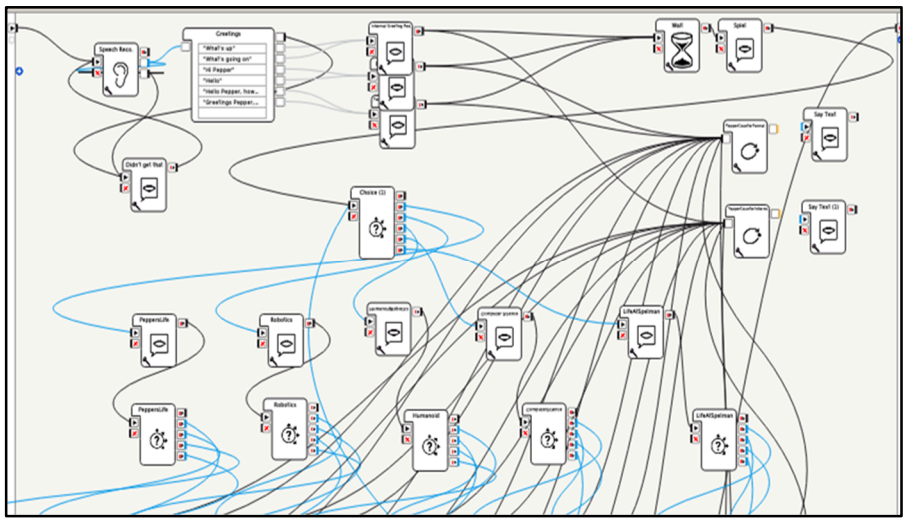

Figure 2: Choregraphe Display Featuring Conversation Pathways

The topics covered in the dialogue engine were structured into four areas of dialogue used to promote engagement on computing careers and robotic interests for the use group. The topics include:

1. Pepper's Life
2. Computer Science
3. Robotics
4. Humanoid Robotics
5. Life at Spelman College

In developing the AAVE for the script, it is important to note that much of the non-SE dialogue could not be recognized using traditional dialogue libraries in the system. AAVE is a primarily spoken language with many regional variants in both content and tonal quality. It was necessary to both develop the responses and phonetically articulate the responses within this system to meet the needs of this research study.

4 DATA

During the course of an interaction session, the bot will keep track of the user responses and the number of variants in dialogue between each dialogue type (AAVE and SE). Table 1 represents a subset of SE and AAVE interaction scripts for the robot.

Initially the robot will randomize the initial greeting. Once the user responds then the system will aggregate the count of each response type (where x: SE, y: AAVE and i is response at current point in script) and decide on a future interaction style. This code-switch dialogue generator is listed in Table 2.

Table 1: Robotic Dialogue Script

Type of Speech	Standard English Example (x)	AAVE Example (y)
Salutation	Hello, Hi Greetings How are you?	What's up! Hey Howya' Doin'?
Valediction	Goodbye I'll see you later	Bye Peace Out
Affirm	Yes Certainly	Yeah Sure thang
Negate	No Not at all	Nah Nope
Question Phrases	What are you going to do? How is your family?	What you tryna do? How's ya fam doin?

Table 2: Agent Decision Generation

User Response at Node i	Current Condition	Next Dialogue
x_i = Standard English'	$\Sigma x + x_i > \Sigma y$	x_{i+1}
y_i = African American Vernacular English	$\Sigma y + y_i > \Sigma y$	y_{i+1}
x_i = Standard English	$\Sigma x + x_i = \Sigma y$	x_{i+1}
y_i = African American Vernacular English	$\Sigma y + y_i = \Sigma y$	y_{i+1}

One must note that in cases where the user has more of a propensity to code switch equally between dialogues ($\Sigma x + x_i = \Sigma y$ and $\Sigma y + y_i = \Sigma y$) during an interaction, the bot will maintain

the interaction style previously demonstrated by the user. It is also useful to understand that if the user switches styles while in dialogue the bot will maintain the preferred language style.

Upon completion of an interaction script, the aggregate values for each user will be stored and maintained. Upon completion of the study, we will analyze these results for user engagements as they correlate to interaction preference for African-American students.

5 RESULTS

For this work-in-progress, we found that we were able to appropriately distinguish 5 different topics of trial dialogue between a human and Pepper the robot. Additionally, a counter was added to the program to track the number of times the dialect of the human and Pepper switched. At the end of the session, the number of informal and formal communications would be expressed letting the developer know what dialect was preferred or most used throughout the conversation.

6 FUTURE WORK

Researchers will begin with preliminary testing of the program to examine whether or not the use of AAVE in robotics is beneficial to the user experience. Users will engage with Pepper in a conversation regarding, robotics, computer science, life at our college, humanoid robotics, or life as Pepper the robot for at least 5 minutes or until they have exhausted all conversation paths, whichever comes first. By allowing the allotted length of time to pass, researches will have enough data to collect to map the preferred dialect and the number of times the language switched between Standard English and AAVE.

To advance to the program to further stages, researchers would also like to further develop the AAVE dialect within the program and possibly add more dialects to suit a larger population. As an ongoing project, and words/ phrases Pepper the robot cannot recognize or learn through machine learning, should be reported to Softbank Developers in a n effort to help build out the PepperIQ's natural language software platform.

7 CONCLUSION

The main goal of this work is to provide a tool that can engage with students in a way that increases their learning potential and makes them feel safe and comfortable through a code-switching robot where a student can engage in their most comfortable language and dialogue style without the pressure of being corrected or mis-understood. The method of employing a language involved culturally relevant robotic agent in the classroom to help students learn is assumed to be a benefit to students who use AAVE throughout their lives, in their home and community see applied computing and robotics as an accessible and obtainable career field.

This research hopes to further the innovation of education technology and education based on technological theory in order to expand the domain of knowledge associated with robotic engagement, natural language processing and computer science education for minority communities by developing innovative and robust frameworks for engaging youth in various groups.

REFERENCES

[1] K. Dara Hill. 2009. Code-Switching Pedagogies and African American Student Voices: Acceptance and Resistance. *Journal of Adolescent & Adult Literacy* 53, 2 (2009), 120–131. DOI: http://dx.doi.org/10.1598/jaal.53.2.3.

[2] S. S. Mufwene. 2001. J. R. Rickford and R. J. Rickford, Spoken Soul: The Story of Black English. John Wiley & Sons, 2000, xii 267 pp. Hb. $24.95. *Language in Society* 30, 3 (2001), 479–487. DOI: http://dx.doi.org/10.1017/s0047404501213050.

[3] J. R. Rickford. 1999. Language Diversity and Academic Achievement in the Education of African American Students: An Overview of the Issues. *Making the connection: Language and academic achievement among African American students* (1999), 1–30.

[4] L. P. E. Toh, A. Casuo, P.-W. Tzuo, I.-M. Chen, and S. H. Yeo. 2015. A Review on the Use of Robots in Education and Young Children. *Educational Technology & Society* 19, 2 (August 2015), 148–163.

[5] J. Whitney. 2005. Five Easy Pieces: Steps toward Integrating AAVE into the Classroom. *English Journal* 94, 5 (January 2005), 64. DOI: http://dx.doi.org/10.2307/30047356