Exploring Artificial Intelligence Through Image Recognition

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Abstract

This demonstration showcases the different use cases of Artificial Intelligence (AI) in education by introducing students to applications of the Scribbler robot with the Fluke board in order to cultivate an interest in programming, robotics, and AI. The targeted audience for this is students aged eight through twelve. This demonstration uses three Scribbler robots to introduce students to common tools in AI (OpenCV and Tesseract), and teach them the basics of coding in an interactive, unintimidating way; by physically describing the goals of simple shape-building algorithms and implementing them using cards with both visual and written representations of the instructions.

Introduction

Students will be given tasks to think about and construct algorithms using the Scribbler robot in one of two ways: either working one-on-one with the robot, or working as a team in a creative, problem-solving project. Two distinct but related tasks are given in order to accommodate students with various learning needs, such as their desire to learn AI through problem solving. This gives them exposure to computer vision, automatic reasoning, human robot interaction, and knowledge in computer science. The goal is to help students learn despite different comfort levels when it comes to engaging with others (Chang et al. 2010).

The core of both demonstrations relies on the functionality of the Scribbler robot. The robots visual input sensor (i.e. camera) allow students to interact with it in a physical way, as opposed to going directly to the console and coding themselves. This will introduce them to high level programming concepts and algorithms development in an engaging way. The instruction images will be parsed by OpenCV, an open source computer vision software, and Tesseract, Google's character recognition software. These demonstrate the functionality of AI in the real world using computer vision and character recognition.

One-on-One Demonstration: Making Shapes

Students will be asked to draw a shape using the robot. The set of shapes available to draw will be limited to simple polygons. There will be two instruction-sets to code the robots: a visual set, and a written set. Instructions will be given by placing index cards into a provided block, which will position the instruction in front of the robot's camera. Instructions will be given by using a restricted symbol-set and written-set. We will provide pre-written solutions to the problem in order to demonstrate the task. These pre-written solutions will take the form of a single instruction written out as the image of the desired shape (e.g. a picture of a triangle), or the name of the desired shape (e.g. the word "triangle").

Students will be asked to draw shapes with the robot using the instruction-sets. This will take the form of symbols (up arrow for forward, rounded arrow for rotate in designated direction with a given quantity, etc.) or written instructions ('forward', 'rotate clockwise 60', etc.). The intention is to have the students a) design an algorithm that constructs a goal shape and b) relate a physical instruction (as indicated by the symbol-set) to a written instruction. The instructions will be parsed using a combination of OpenCV and Tesseract, and interpreted as instructions to the robot. The roles of computer vision and character recognition will be explained to the students.

Team Demonstration: Constructing a Maze

Children will be divided into different groups of either 2 or 3. Each student will be given a different task, exposing them to all aspects of this activity. One student will be tasked to draw the maze, and the other (2) child(ren) will design the proper way to navigate the scribbler through (Figure 1). Students will be provided the basic concepts and background on how the will need to design the maze and algorithm, such as sequential structure, conditional structure, etc., to create steps for the Scribbler. For example, they will be given cards in which the Scribbler

will interpret the images, either it be left, right, forward, backward, stop, or play sounds, then encode to specific actions. OpenCV is used to process these images and transfer them to instruct the robots to move, playing sounds, or even draw pictures. The same process as the one-to-one demonstration also applies here. This allows students exposure to computer vision and AI, and problem solving through collaboration.

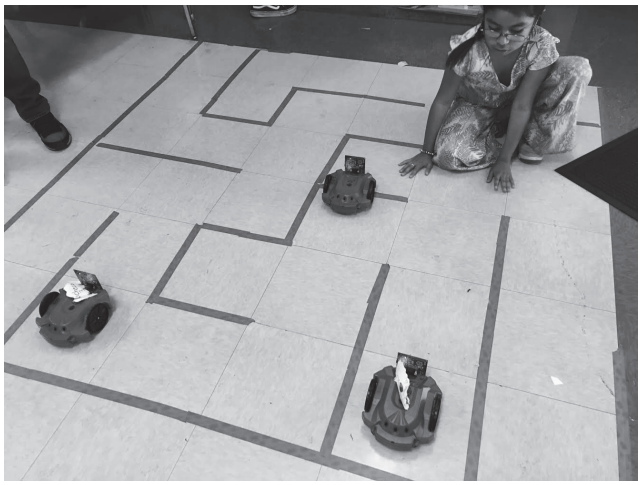

Figure 1. Maze and Scribbler robots

Individual Demonstration: Voice Synthesis - Text-to-Speech

Students will be able to interact with the robots to learn speech synthesis. A form of this is the *text-to-speech* system, which essentially converts language text into speech. Students will be tasked to write down a word that can be either random, their name, etc. They will then hold their index card in front of the robot. The robot will then capture the picture and parse the text using Tesseract. The parsed text will be synthesized using eSpeech (Kahn, Marian 1998.) and sounded out through the computer. Students could also write nonsense words to see how the computer pronounces it. Students will be prompted on how the machine figures out words, or creates specific sounds based on letter pattern, and this will introduce them into the idea of machine learning as described in the Autobots project (Tejada, et al. 2016). In addition, students will be asked to come up with several use cases for text-to-speech in application. Examples could be taking pictures of billboards that are too far away and having them read out loud, or taking pictures of text in different languages and sounding them out in English.

Conclusion

The core of this work is to utilize robots to expose students to artificial intelligence and demonstrate different use cases for it. The use of robots allows them to become teaching assistants and a fundamental function of theirs is their ability to interact with people. It is an introductory demo that educators with little knowledge on AI can show, and it can be extended to different level of schools. By this way, children will not only learn the use of AI in reality, but some basic introduction on computer science.

References

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