Panel: Block Abstractions for Artificial Intelligence

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Abstract

Block-based programming languages, such as Scratch and MIT App Inventor, make computational concepts accessible to those as young as primary school students. As technology advances, so do the abilities of such block-based programming languages. This panel will discuss the state-of-the-art in artificial intelligence (AI) abstractions in block-based languages. Specifically, it will address block-based AI challenges, pedagogical value, and applications.

Keywords artificial intelligence, blocks languages, cognitive computing

1 Introduction

Artificial intelligence (AI) and machine learning (ML) are cutting edge topics in Computer Science. We posit that, in Papert's vision [1], the ability of blocks languages to increase access to technology by individuals of all ages is transferable to ML. We propose a panel at BLOCKS+ to discuss the challenges and implications of introducing ML to youth via blocks languages. Panelists consist of individuals working on different aspects of ML and blocks by building on popular languages such as Scratch and MIT App Inventor.

2 Proposed Panel Members

Evan W. Patton (Lead Software Engineer, MIT App Inventor)
The MIT App Inventor team is pursuing a number of parallel threads on machine learning on the App Inventor platform. A particular focus is on incorporating machine learning models compatible with Google's Tensorflow.js library.[1] Because these models are scaled to run in a browser context, they can be packaged into App Inventor extensions and evaluated even if network connectivity is absent. Current extensions enable classification of images from files or frames of video streams, allowing students to build apps for Android that classify real-world objects on their mobile devices.

Evan is the lead software engineer for MIT App Inventor. He oversees general development of the platform and sets technical directions. Presently he leads the development of an iOS version of App Inventor and is exploring techniques to provide real-time project editing capabilities for App Inventor projects. He holds a Ph.D. in Computer Science from Rensselaer Polytechnic Institute for training ensemble models to predict energy efficient algorithms for mobile computing environments.

Stefania Druga (Founder, Hackidemia & Research Associate, MIT Media Lab)
Stefania is innately curious and passionate about creating and testing new ways for children to learn with and about Artificial Intelligence and is currently a research associate at MIT Media Lab, Personal Robots Group. She is also a former Googler and graduated from an international Erasmus Mundus master of Media Engineering for Education (France, Spain, Portugal). In the summer of 2012 she was the Education Teaching Fellow at Singularity University where she advised and coached 80 students from 36 countries. Her initiatives and projects in education include: HacKIDemia organization (mobile lab for maker Education present in 40 countries), Afrimakers (community of Maker projects in 10 Africa countries) and MakerCamp (global camps for learning how to build and run makerspaces). As part of her thesis at Media Lab Stefania developed an open source platform for AI coding and training called Cognimates. The platform builds on top of Scratch 3.0 Blocks and provides 18 extensions targeted for teaching kids how to use different cognitive services like IBM Watson, Clarify, AFFIN for Vision and text classification or sentiment detection. Children can also train their own models in the "Teach AI" section and after use them in their coding projects (Figure 1). The platform also has a coach feature ("Cognimate", as in learning mate) where the computer can guide you in programming different challenges like teaching a robot your name (missions). Demo video from workshops with children is available here http://bit.ly/shaddy_cognimates/ and the cognimates platform is live here http:cognimates.me/.

Jessica Van Brummelen (Ph.D. Student, MIT App Inventor)
Jessica is working with the MIT App Inventor team to develop a framework for students to create their own conversational AI applications. Specifically, these applications will interface with Amazon Alexa. For example, a student may develop a story-book application in which Alexa, a conversational AI bot, can discuss the story's protagonist with the user. Using the App Inventor interface, the student may program the app to include on-screen animal characters, and Alexa to be able to talk about these characters when asked.

[1] https://js.tensorflow.org

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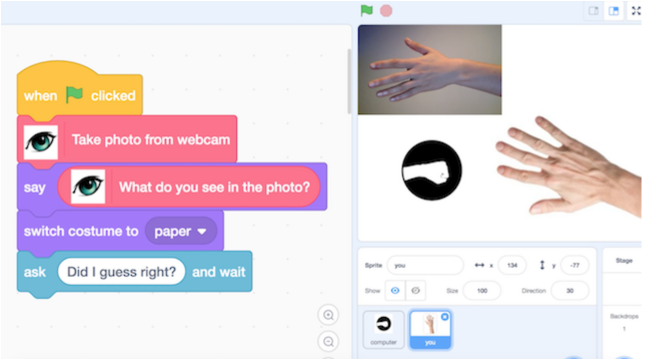
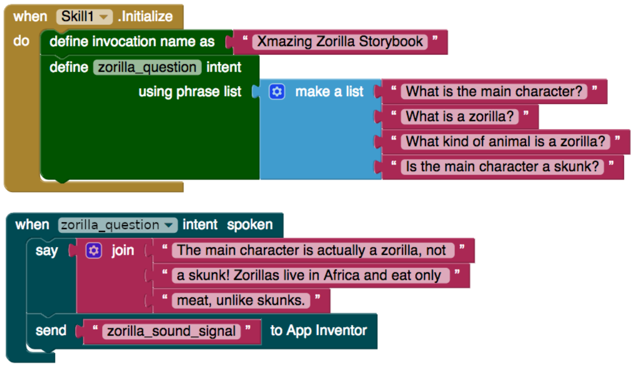


```
when 🏁 clicked
Take photo from webcam
say What do you see in the photo?
switch costume to paper
ask Did I guess right? and wait
```

Figure 1. Example of Cognimates blocks for programing the computer to play Rock, Paper, Scissors with you based on a model children trained with pictures of their hands



```
when Skill1 .Initialize
do  define invocation name as " Xmazing Zorilla Storybook "
    define zorilla_question intent
        using phrase list  make a list  " What is the main character? "
                                        " What is a zorilla? "
                                        " What kind of animal is a zorilla? "
                                        " Is the main character a skunk? "

when zorilla_question intent spoken
    say  join  " The main character is actually a zorilla, not "
               " a skunk! Zorillas live in Africa and eat only "
               " meat, unlike skunks. "
    send " zorilla_sound_signal " to App Inventor
```

Figure 2. The blocks in this MIT App Inventor program define an Amazon Alexa skill that allows users to ask about the main character in a storybook app.

To illustrate, a block program for Alexa is shown in Figure 2. Other research includes building an extension for App Inventor to implement a machine learning model for conversation generation.

Jessica is an Electrical Engineering and Computer Science Ph.D. student at MIT working with MIT App Inventor and Amazon to pursue conversational AI and education research. With this research, she aims to empower students with tools to develop conversational AI applications, equip students with a greater understanding of AI, and spark discussion about conversational AI implications, capabilities, and ethics. Jessica holds a B.ASc. in mechanical engineering, in which she developed mechatronics tools to improve safety. Now she aims to equip others with technological skills to solve further real-world problems.

Joe Mazzone (Teacher at Davies Career and Technical High School)
Joe Mazzone has been looking for a fun and engaging way to introduce machine learning to his introductory CS class. Machine Learning for Kids is a tool created by IBM employee Dale Lane to introduce machine learning to children by providing them with hands-on experiences for training simple machine learning models and building things with them. The tool leverages IBM Watson services web APIs and was originally designed to work with Scratch. Machine Learning for Kids is expanding its programming options and Joe Mazzone has created an App Inventor extension that allows young developers to easily train machine learning models and use them in their mobile apps.

Joe Mazzone is a Pre-Engineering Technology program Career and Technical Education instructor at Davies Career and Technical High School in Lincoln, RI. Joe serves as Secretary of the Computer Science Teachers Association of Rhode Island and Technovation Rhode IslandâĂŹs Regional Ambassador. He also supports the RI Department of education as a PrepareRI Ambassador, ensuring all RI students have access to CTE programs aligned to industry-recognized skills. Joe is an MIT Master Trainer in Educational Mobile Computing and a Raspberry Pi Certified Educator.

Xavier Puig Fernandez (Ph.D. Candidate, MIT CSAIL)
Xavier is a Ph.D. student at MIT, working in computer vision under the supervision of professor Antonio Torralba. His research focuses on understanding complex human activities, such as chores through video demonstrations and language. While these are common activities, it is challenging to find demonstrations of them with which to train computer vision systems. To address that, he proposed VirtualHome, a simulator that takes these activities represented as programs and simulates them in a virtual home. Xavier uses blocks to crowd-source such activities, allowing people with no coding experience to write programs representing chores they would typically do at home.

3 Summary

Given the recent growth in public visibility of ML technologies, it is important for the visual programming language community to think about how to approach these technologies pedagogically. Possible questions that the panel may discuss, in addition to audience questions, include: a) What are the technical, presentation, and pedagogical challenges of ML that can be addressed with blocks languages? b) How can we make ML tools and concepts approachable to young people? c) What types of problems can people solve today with the effort that has been made and what do we think we will be able to do in the near future? d) How do we teach young people about ML bias and ethics using visual programming languages? Answers to these questions and other will greatly inform future development work at the intersection of ML and blocks languages.

References

[1] Seymour Papert. 1980. *Mindstorms: Children, computers, and powerful ideas.* Basic Books, Inc.