



TITLE: Creating with PoseNet

LEARNING SCENARIO

<i>School:</i>	<i>Duration (minutes):</i>	90
<i>Teacher:</i>	<i>Students age:</i>	10

Essential Idea:

Let's create an AI project with Scratch!

Topics:

- designing, creating and writing in a visual programming language: ideas, stories and solutions to problems of varied complexity
- experimenting with AI
- civilization related implications of AI

Aims:

- design and create simple programs
- understand the concept of variable, define and use variable it in their programs
- test models related to recognition

Outcomes:

- creating and testing simple program that use Body Sensing blocks

Work forms:

- individual work, work in pairs, group work

Methods:

- presentation, talk, discussion, interactive exercise

ARTICULATION

The course of action (duration, minutes)

INTRODUCTION



The interaction between humans and AI is a two-way street: we respond to the outputs and behaviors of AI systems in robots and computers and AI responds to various forms of human behavior.

What do we as humans use motion for on a day-to-day basis?

We move to get places! Whether it's by walking, driving, riding a bike, swimming, wheeling, or other, we put in the effort to get ourselves from one place to another.

We also move a whole lot when we're playing sports.

Let's not forget the role of motion and movement in the creative arts! Let's think about the ways we move when we're making art, making music, or performing theater.

Creative processes take many forms: some involve movement and others don't. Pieces of art that do use movement are quite powerful: think of a moving art piece like a hanging mobile swinging in the wind, or the synchrony of an orchestra or ballet troupe moving flawlessly to the melody of an opera.

Sometimes we express ourselves visually without even thinking about it. We also constantly use our facial expressions as markers for how we're feeling and others can read those expressions and understand our emotions or intentions.

Motion and movement are really powerful means of communication and a way in which people signal one to another. They help deliver messages and carry an idea across from one person to another or even hundreds of people. In this way, movement is one key medium through which people interact with one another and understand one another.

It looks like AI entities can move if they are programmed to do so. But can AI understand human movements? What do you think?

AI doesn't "understand" motion as you or I do, but it can be trained to extract specific patterns of movement and respond to them. The images and poses that we used on Teachable Machines are cues that a computer uses to extract meaning from movement, they represent the visual components of a movement or the position of your body during a movement, but they don't actually encode motion itself.

Announcement of the goal of the lesson:

We will look at AI systems that understand human movement, facial expressions, and other motion-based interactions.

MAIN PART

Scratch is a tool used for creating. We can use Scratch to make stories, games, animations, art, music, and interactive AI systems. We'll be using a special version of Scratch that adds special AI features as extensions. We learned about the difference between Teachable Machine models trained with image and pose data. Image models were trained on the entire images from the camera, while pose models looked only at the dots and lines that they recognized as a body pose.

To translate images to poses, Teachable Machine uses a pre-trained model known as "PoseNet", which is a machine learning model that has been trained on many many examples of images and their corresponding pose skeletons.

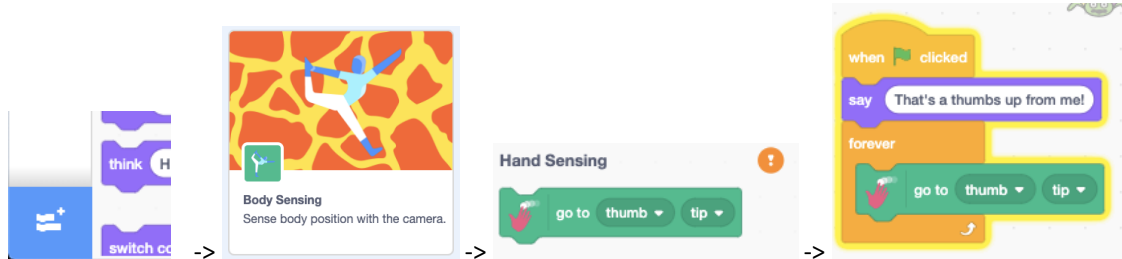
PoseNet takes the camera image and converts it to blue dots and lines. These dots are known as "key points". While we used these key points as input to our Teachable Machine models, we can use these same key points as parts of our Scratch projects!

The teacher shows, explains and guides the students in the first practical task:





To use PoseNet in our projects, we just need to bring in some extra blocks! We click on the “Add Blocks” blue button on the bottom of the screen. And then we select the “Body Sensing” extension.



Once we add this, notice that our camera has turned on on the right side of the screen. The green checkmark next to "Body Pose Sensing" means the PoseNet model has a prediction of where the key points are in the camera image! If it has an orange question mark, it may mean that there is a problem with the camera or web app, or the model does not have a confident prediction. If you try covering the camera with your hand, for example, it will blink between the checkmark and yellow indicator.

If we stop the project and we click that block, our sprite moves to where the model thinks it sees a left shoulder pose keypoint in the camera scene.

If we put that block within a forever loop as we did before, we can see that it follows our shoulder.

The hand blocks usage a different pose model that is similar to PoseNet, from Google's MediaPipe team.

This model, instead of being trained on body images, has been trained on images of hands. The red dots in these examples are the key points, just like key points we get out of the PoseNet model.

Since each model you add to your project means your computer has to run every model many times per second (known as frames per second, or framerate of the model), you might want to save any work and refresh the browser page to unload the body model first.

After importing the hand sensing model, you'll notice we have a new block:

Note that unless your hands are visible from your camera, the indicator is orange, since it only shows green when it predicts that there is a hand in the view of the camera.

Based on the previous example, students design their practical work individually and/or in pairs:

Interactive exercise 1:

- Open the Scratch.
- Create a New project.
- Add Blocks “Body Sensing”.
- Create your project.
- Test and save your project.
- Present your project to the students in the class. Discuss. Peer evaluation.
- Save your work to the class e-portfolio.

The Face model is from an emotional AI company known as Affectiva. Similar to PoseNet and MediaPipe's Hand Model, Affectiva's model gives you key points on the face (like eyebrow, mouth, nose, etc.), but it also goes a step further and gives us "expressions", like "mouth open", "eyebrows raised", "blinking", etc.

We can use the facial key points just like hand and body pose data. We can use facial expressions like “mouth open” as Events in our Scratch projects, just like how the “when Green Flag” block makes our code run.

Let's try changing costumes when we smile and furrow our eyebrows.

Since this model is more complex, and some of the output classes are more subjective, we may not expect the higher level insights about facial expressions, and especially emotions, to be as high confidence predictions as the various key points in the different models.

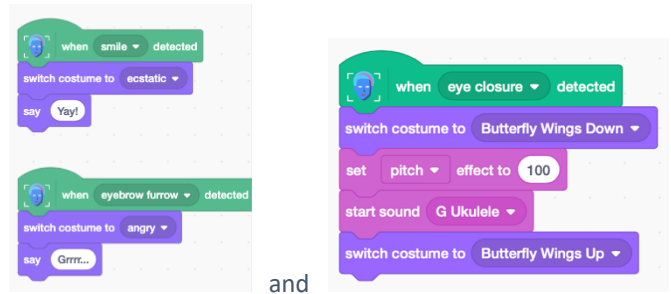




ARTIE: Artificial Intelligence in Education - challenges and opportunities of the new era:
development of a new curriculum, guide for educators and online course for students
Project co-funded by European Union under Erasmus+ Programme, 2020-1-HR01-KA201-077800

The teacher shows, explains and guides the students in the next practical task:

Examples to present and discuss:



Based on the previous examples, students design their practical work individually and/or in pairs:

Interactive exercise 2:

- Open the Scratch.
- Create a New project.
- Add Blocks "Face Sensing".
- Create your project.
- Test and save your project.
- Present your project to the students in the class. Discuss. Peer evaluation.
- Save your work to the class e-portfolio.

CONCLUSION

We can build tools that will look for particular features, like the position of your eyes or the direction in which your finger is moving. These tools are designed and used by people - people like us decide how a computer behaves in response to human motion, meaning that people are in control of what an AI system does.

Methods

presentation
talk/discussion
work on the text
graphic work
interactive exercise /simulation on the computer

Work forms

individual work
work in pairs
group work
frontal work

Material

- Scratch
- <https://mitmedialab.github.io/prg-extension-boilerplate/create/>





Literature

- <https://dancingwithai.media.mit.edu>

PERSONAL OBSERVATIONS, COMMENTS AND NOTES