Interdisciplinary Project - 17 WS 2021/22

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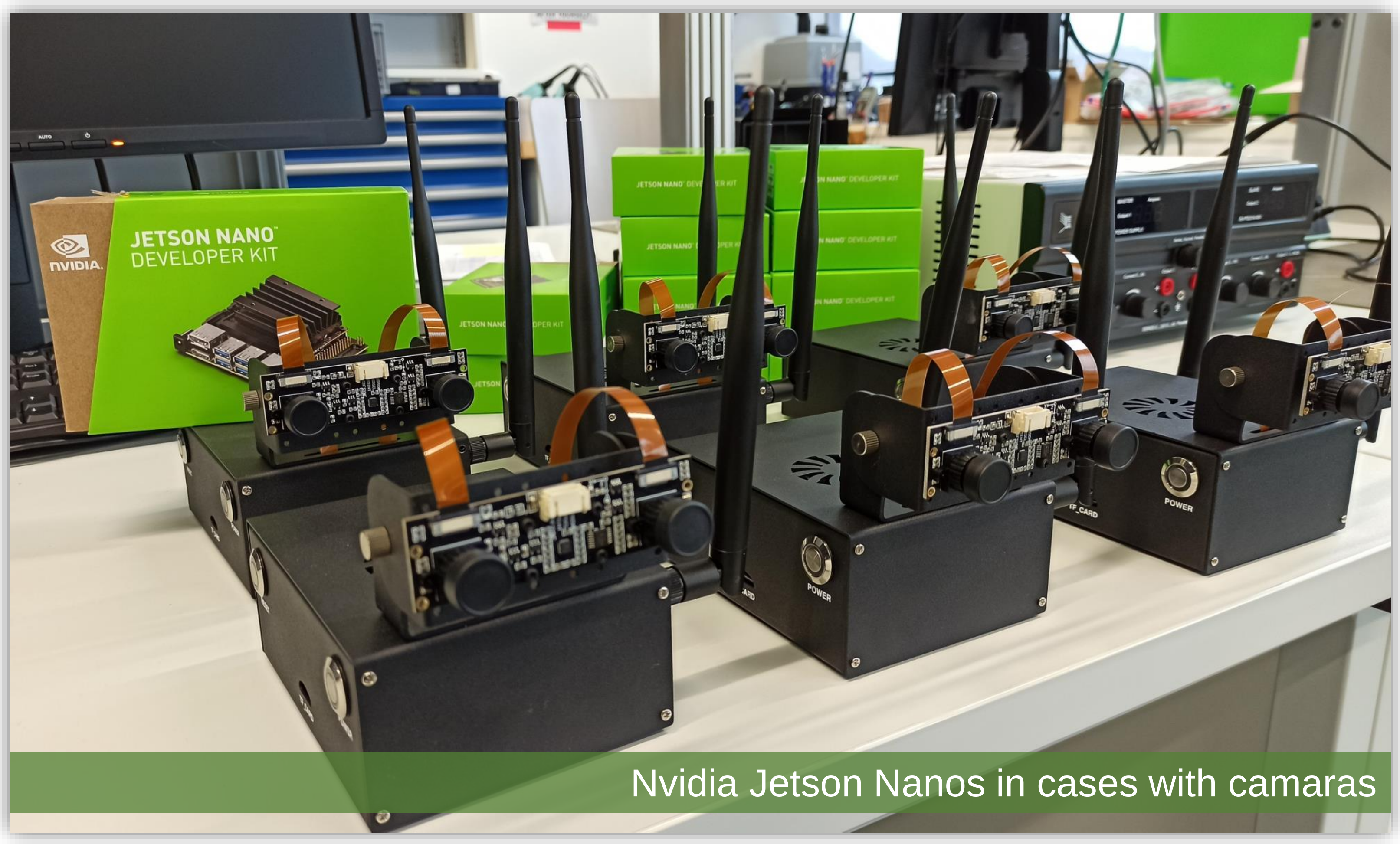
Let's plAIy

Let‘s Plaiy!

AI at Schools

Introduction

Artificial intelligence is a prevalent technology that entails both, opportunities and risks to society and the environment. It is crucial for students to acquire these competences in school, enabling them to master this technology at an early age. This allows them to avoid being dominated by AI, to demystify AI, and to develop the ability for critical reflection in assessing the opportunities, applicability, and limits of AI for problem solving. The usability of many AI toolkits is continuously improving. They require less and less expert knowledge to utilize them effectively. This simplification can be taken further. Our ambition is to hide the complexity of AI in the background and provide easy-to-use programming and user interfaces as frontends.

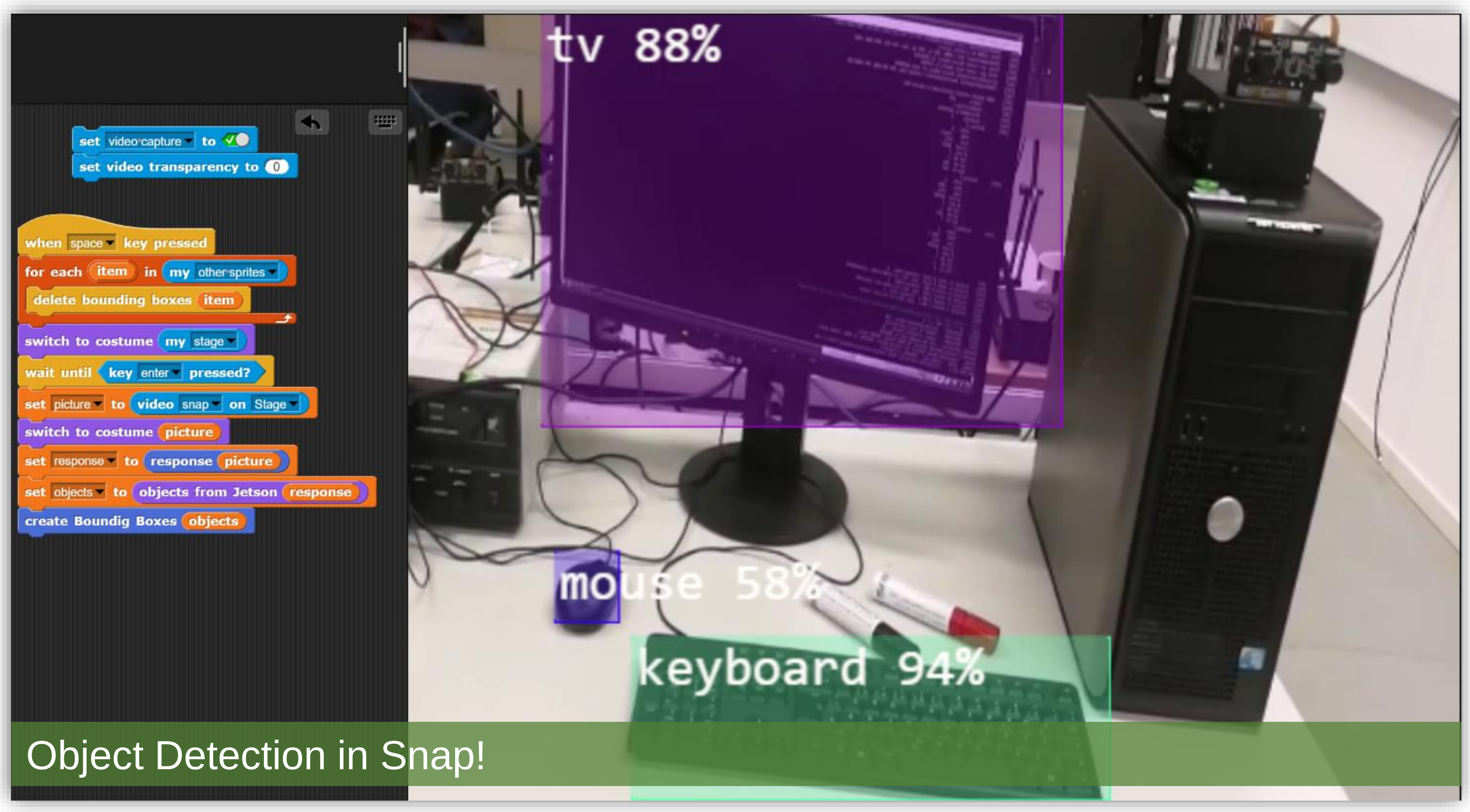

Nvidia Jetson Nanos in cases with camaras

Goal

The ambition is to develop a course curriculum and course material (brain ware), as well as hardware and software for AI-enabled computers called Jetson Nano, to be used in education. The intention is to design and implement course materials (brainware, hardware, software) for teaching AI in schools.

Prerequisites

The Jetson Nanos, as indicated above, are small but powerful computers that allow us to run many neural networks in parallel for applications such as image classification, object identification, segmentation, and speech processing. All of this is contained within a user-friendly platform that uses only 5 watts of power. In terms of software, we chose to work with "Snap!“, an educational graphical programming language that allows users to concentrate on the principles of programming without having to learn any commands or syntax. "Snap!" has a wide range of blocks that are used to emulate various programming languages. A Wiki, a GitHub repository, and a Moodle page are used to collect the brainware or documentation of the developed materials.


```
set video capture to ✓
set video transparency to 0

when space key pressed
for each item in my other sprites
    delete bounding boxes item
switch to costume my stage
wait until key enter pressed?
set picture to video snap on Stage
switch to costume picture
set response to response picture
set objects to objects from Jetson response
create Boundig Boxes objects
```

Object Detection in Snap!

Implementation

To accomplish our goal, we needed to create a python flask-server on the Jetson and connect it to the "Snap!"-Environment. We also added custom blocks to "Snap!" to mask the connection's complexity, because we do not want consumers to be concerned about the connection but rather with the AI. We want to teach them the fundamentals of "Snap!" to get things started with the learning material. As a result, we designed a tutorial that explains the core user interface and gives users assignments to practice with the language. Simultaneously, we developed teaching materials for object detection fundamentals to guarantee that students are aware of our system's capabilities and limits. Our algorithm can distinguish roughly 80 different objects thanks to the COCO dataset. Other objects that are not part of the dataset will not be recognized correctly. We also explain how such a model can be trained, but that it will take a lot of time and effort to get good results.
After teaching both object detection and "Snap!" to the students, it is time to put everything they have learned together and construct a program in "Snap!" that allows them to transfer camera input from their PC to the jetson and evaluate the results. The students can use the "Snap!" blocks to have the program output what it recognizes in the camera input via text to speech.

Evaluation/Discussion

We explored various methods for teaching students at the young age of 9 to 11 how to program while keeping it engaging and non-intimidating. It was eye-opening to learn how different cultures approach programming and how gamification could benefit us. Some concepts for the Jetson Nanos, such as wheels and arms to add a touch of robotics, had to be cut short during the process, since time was moving faster than the concepts. Overall, we were successful in achieving our goal of generating teaching materials. We have not been able to test the material yet due to hardware limitations and a lack of time, but we are confident in what we have created.

Outlook

The future possibilities are practically limitless. Students may, for example, add their own datasets and train them to make the program more "intelligent" in certain areas. Furthermore, we may use gamification to boost the already awakened interest, allowing us to delve even further into the topic of AI. We could also translate the materials as a multilingual team to increase the range of people who can use the educational resources.

Resources

https://snap.berkeley.edu/
https://wiki.eolab.de/doku.php?id=ip:ws2021:lets_plaiy:start
Picture with children created by **Max Fischer** on **Pexels**

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