**Primary School**

1. Computing

Maze solver challenge / Exercise

In a maze of geometries, you will need to combine the order of our hero's actions to help it reach the finish spot from the start. Our hero, snowman, has a total of five kinds of action including move forward & backward, turn left & right, and place mark on the box. Under certain conditions, it may keep executing a certain action repeatedly. With levels of difficulty escalating, you will learn how to apply and combine simple instructions to accomplish a complex task.

1. Learning

Robi’s Room / Exercise

Tamagotchi like environment. The robot will move around and do random things, like play, learn, eat, charge, wash/maintenance. Through punishment and reward the child can teach him what he should do, so that certain goals are fulfilled. Basically, teaching first how punishment and reward works, and prepare them for the idea that basically the reward comes automatically, it´s something that you can tell the system to look for – like in the food example. AKA Robi

1. Machine Learning

Mushroom Playground / Exercise

A neruon playground about mushroom. To predict whether the mushroom is poisonous or not depends on its features, like colors and textures.

1. Computer Vision

Airport security check / Exercise

Intro: The students will train an algorithm to identify objects from xray images. For that, they start by gathering images, including also automating this image gathering, and then feed them to the algorithm. After training they can check how the algorithm performs now and can either improve it or by getting more images, or moving on when good enough.

1. Movement

Movement Simulator

In this exercise, students learn how mutational algorithms can be used to create virtual creatures capable of movement. Students design their own “creatures”, specifying parameters like body shape, number of limbs, wings, etc. Then they proceed to customizing the desired movement by selecting mutational algorithms and setting parameters. The training progress is then visualized to strengthen the understanding.

1. Speech

Chatbot

Show that he can understand meaning/intent in sentences, not just respond to keywords. (like different greetings will always be understood as a greeting. )

1. Generative AI / creative AI

Interactive Music AI Application – AI Jam

The students will learn how music translates into data that different Algorithms can understand. Music in form of waves, or in form of midi data, and the possibility of even encoding it in an image. They will then choose different input and algorithm and see how this generates music.

1. Intelligent Agents

Agent Games / Exercise

Students program smart robot-like agents using visual programming interface. The robot is then put though various situations and arenas, trying to avoid/battle enemies, gathering energy and finding exits.

1. Game

Flappy Bird

Train an ai to play a simple game and play against it. Watch it get better with the iterations. Like flappy bird.

1. Robot

Robot Simulator

This exercise shows how AI and Robots come together and what kinds of systems are necessary to bring a robot to life for different tasks, such as basic "coded" interaction,autonomous tasks and human robot interaction. Students construct using components of a robot, and then program them to achieve various tasks like vaccuming a room.

**Middle School**

1. Computing / Algorithm intro

Maze solver / Exercise

In a maze of geometries, you will need to combine the order of our hero's actions to help it reach the finish spot from the start. Our hero, snowman, has a total of five kinds of action including move forward & backward, turn left & right, and place mark on the box. Under certain conditions, it may keep executing a certain action repeatedly. With levels of difficulty escalating, you will learn how to apply and combine simple instructions to accomplish a complex task.

1. Intelligent Agent

Agent Games / Exercise

Students contruct robots using visual programming interface. The robot is then put though various situations and arenas, trying to avoid/battle enemies, gathering energy and finding exits.

1. Learning

Robi’s Room / Exercise

Still the Tamagotchi like environment, 3 kinds of game modes for supervised/ unsupervised/ reinforcement learning (the unsupervised mode is more like clustering). Feeding the robot data, letting it analyze and cluster options, training it with reinforcement learning. Also AKA Robi.

1. Machine Learning

mushroom playground / Exercise

A neruon playground about mushroom. To predict whether the mushroom is poisonous or not depends on its features, like colors and textures.

1. Vision

Wekinator with kinect / Exercise

The students will be provided with a camera like Kinect that has different features like infrared & ordinary images. Based on that input, they can train the wekinator AI to respond to that. Based on their input, they will be able to make the wekinator output a range of sounds.

1. Speech

Chatbot / Exercise

Show that he can understand meaning/intent in sentences, not just respond to keywords. (like different greetings will always be understood as a greeting.

1. Movement

Movement Simulator / Exercise

In this exercise, students learn how mutational algorithms can be used to create virtual creatures capable of movement. Students design their own “creatures”, specifying parameters like body shape, number of limbs, wings, etc. Then they proceed to customizing the desired movement by selecting mutational algorithms and setting parameters. The training progress is then visualized to strengthen the understanding.

1. Emotion & Sentiment

Expression sensitive Bot / Exercise

The students will have the goal to use the IBM WATSON API for emotion/sentiment analyses. They will be tasked to use the API to analyze text they will be given. Can be deployed in different scenarios. – similar to chatbot for customer service, or others. Based on the emotion analyzes, they will configure how Robi, or something else, reacts.

1. Creation

Interactive Music AI Application / Exercise

The students will learn how music translates into data that different Algorithms can understand. Music in form of waves, or in form of midi data, and the possibility of even encoding it in an image. They will then choose different input and algorithm and see how this generates music.

1. Game

Flappy Bird / Exercise

Train an ai to play a simple game and play against it. Watch it get better with the iterations. Like flappy bird.

1. Robot

Robot Simulator / Exercise

This exercise shows how AI and Robots come together and what kinds of systems are necessary to bring a robot to life for different tasks, such as basic "coded" interaction,autonomous tasks and human robot interaction. Students construct using components of a robot, and then program them to achieve various tasks like vaccuming a room.

1. Plants

Plants Robot Platform / Exercise

In this project, students learn about the application of AI in manufacturing plants like robotic arms and smart control systems. They get a hand-on experience by testing out controlling a miniature robotic arm to complete various tasks using visual programming language.

1. Autonomous Car

2D/3D Autonomous Car Simulator / Exercise

1. A scratch project making an autonomous car. Car could produce some raycaster to detect its way, and then move forward.

2. Self-Driving Car Simulator. You could train the car by driving it. And even build your own racing track using Prefabs.

**High School**

1. Computing

Maze solver / Exercise

In a maze of geometries, you will need to combine the order of our hero's actions to help it reach the finish spot from the start. Our hero, snowman, has a total of five kinds of action including move forward & backward, turn left & right, and place mark on the box. Under certain conditions, it may keep executing a certain action repeatedly. With levels of difficulty escalating, you will learn how to apply and combine simple instructions to accomplish a complex task.

1. Intelligent Agent

Agent Games / Exercise

Students contruct robots using visual programming interface. The robot is then put though various situations and arenas, trying to avoid/battle enemies, gathering energy and finding exits.

1. Programming

Shop-Clerk Game / Exercise

Shop clerk exercise – customer comes, asks about the location of products. Implement the logic to loop through a dictionary of product-locations, etc, and find the appropriate response. Then reply.

1. Data

Music-image-music generation / Exercise

The students will learn how music translates into data that different Algorithms can understand. Music in form of waves, or in form of midi data, and the possibility of even encoding it in an image. They will then choose different input and algorithm and see how this generates music.

1. Machine Learning - Intro

Advanced Robi / Exercise

There are three types of Robi:

1. Supervised: Teaching robi to learn about taking care of itself.

2. Unsupervised: Teaching robi to learn about clustering mushroom.

3. Reinforcement: Teaching robi to learn about the principles of cooking.

1. Machine Learning Algorithms

Retail / Exercise

Intro: —

1. Deep learning / Neural Network

Hand-written digit recognition / Project

Intro:

This project allows students to exploit the application of deep learning in image processing and multi-objective classification problems.

After having some knowledge of the basic principles of deep learning and neural networks, students will accomplish a handwritten numeral recognition project based on Tensorflow deep learning framework and MNIST data set. They will be requested to write part of the code to complete the model, tune some hyperparameters and visualized them on Tensorboard, and ultimately obtain a classification model of a high accuracy.

**Tools**

jupyter notebook / tensorflow

1. Vision

YOLO object detection / Project

This project allows students to understand the application of deep learning in computer vision (CV) and object recognition.

Students are required to grasp some fundamental principles of CV and then finish an interesting project about recognizing Santa Claus by some simple programming. Through the webcam and a pre-trained YOLO model, students can dynamically discover whether there is a Santa Claus in the environment. Once the Santa Claus is detected by the program, it will send the signal to Arduino and lighten a Christmas tree and broadcast music.

**Tools**

jupyter notebook / tensorflow / Arduino

1. Speech

RNN on 20 books / Project

This project allows students to comprehend the application of deep learning in natural language processing and text generation.

First of all, students need to understand the basic principle of recursive neural network (RNN). Then they can implement a project of text generation and fiction rewriting based on the tensorflow deep learning framework and char-RNN-Tensorflow. Students need to write part of the code to refine the model, and visualize it on Tensorboard and tune some hyperparameters. Finally, they are to achieve a reasonable model for generating text and even continue to write a novel.

**Tools**

jupyter notebook / tensorflow

1. Movement

Athlete game / Project

This project allows students to learn the application of reinforcement learning in training intelligent AI agents.

After understanding the basic principles of Q-learning, students will implement a project about automatically controlling athletes to complete Speed Run games based on the tensorflow deep learning framework. Students need to write part of the code to refine the model, for example, how to reward or punish the virtual athlete. Finally, the virtual athlete will automatically finish the game and get a pretty good score.

**Tools**

jupyter notebook / tensorflow / javascript

1. Emotion & Sentiment

Emotional Chatbot / Project

This project allows students to learn the application of deep learning in natural language processing and sentiment analysis.

Students will use Python to write a chat robot which can deduct users’ emotion through their input text. By utilized a API on sentiment analysis, students need to write a piece of code to train a chatbot that can sense the emotions of the input language and produce different responses with respect to them.

**Tools**

jupyter notebook

1. Creation

Images to Cat / Project

This project allows students to understand the application of deep learning in image processing.

Students are required to understand the basic principles of image translation and generative adversarial network. Based on the Tensorflow deep learning framework, a project can be implemented that automatically transform the hand-drawing tracing lines into cat images. Students need to write part of the code to refine the model, and visualize it on Tensorboard and tune some hyperparameters. Ultimately, they will realize a cat generative model based on user input.

**Tools**

jupyter notebook

1. Game

Snake / Project

This project allows students to understand the application of neural networks and heuristic algorithms in game control.

After having some knowledge of the basic principles of genetic algorithms, students can write a greedy snake game in Processing. By setting a proper fitness function, the snake will be more and more intelligent in each generation. Students need to write a piece of code to train a smart snake, which can automatically get a high score in this game in the end.

**Tools**

Processing

1. Robot

2d robot simulator / Project

This project will teach students to build a 2D robot simulator. The simulator shows how AI and Robots come together and what kinds of systems are necessary to bring a robot to life for different tasks, such as basic "coded" interaction,autonomous tasks and human robot interaction. Students construct using components of a robot, and then program them to achieve various tasks like vaccuming a room.

1. Plants

Teaching a robot arm / Project

In this project, students learn about the application of AI in manufacturing plants like robotic arms and smart control systems in a more detailed way. They get a hand-on experience by testing out controlling a miniature robotic arm to complete various tasks using visual programming language.

1. Autonomous Car

2d/3d Autonomous car simulator / Project

In this project, students could build their own scratch project about making an autonomous car. Car could produce some raycaster to detect its way, and then move forward.Besides, students could train an self-driving car in a 3D environment by driving it. And even build your own racing track using Prefabs.