# MIRO – A PET ROBOT LEARNING THROUGH INTERACTION

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## Background and Objective

Most of the currently existing pet robots are equipped with a predefined set of commands and corresponding behaviours. However to simulate the relationship between humans and pets better, teaching process could be used to help forming a bond between them.[1]

The system developed in the project will allow users to teach the robot new commands and tricks through interaction.

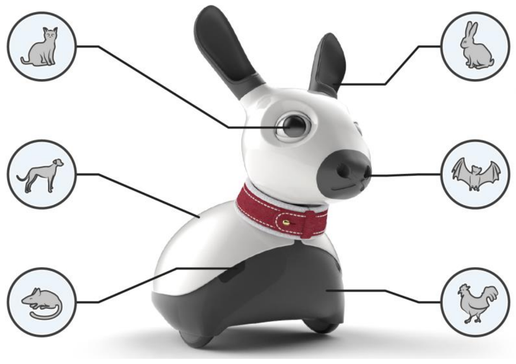

*Figure 1: MiRo – pet robot* [2]

## Techniques and tools

- **MiRo** – a social pet robot developed by Consequential Robotics.
- **ROS** – a framework used for robotics programming. Provides a middle layer between hardware and software. [3]
- **OpenCV** – computer vision and image processing library used in the project to detect visual commands given to the robot. [4]
- **Reinforcement learning** – branch of machine learning which finds solutions to problems by attempting to maximize reward accumulated over time. [5]

## Monitoring system

- Will allow to control the learning proces
- Visual representatnion of commands and corresponding actions will be displayed
- Emotion and mood changes will be shown

## Emotions and mood

- Emotion temporarily increased by rewarding the robot
- Mood defined as emotion over time, affects learning rate
- Actions associated with positive emotions performed more often

## Command Detection

Commands will be represented by shapes and colours. Two cameras in robot's eyes will recognize a shape and colour each to form a command.

1. A mask will be applied to the camera image to discard data of pixels with colours other than specified.
2. Modified image will be used to detect contours, and - based on approximate number of edges – shapes.
3. Pixels inside the contours will be checked against colour boundaries to detect colour.

*Figure 2: Shape recognition with OpenCV*

## Learning and sequence building

Each command will be associated with one or more actions. All actions will start with equal chance of being performed which can be adjusted by giving positive feedback or ignoring the robot.[6]

1. After learning command, one random action and a „stop" action will be assigned.

2. Feedback to regular action will modify the probability of robot performing it again for the same command.

3. Positive feedback to „stop" action will result in the trick being marked as finished. No feedback will allow to extend sequence by another random action.

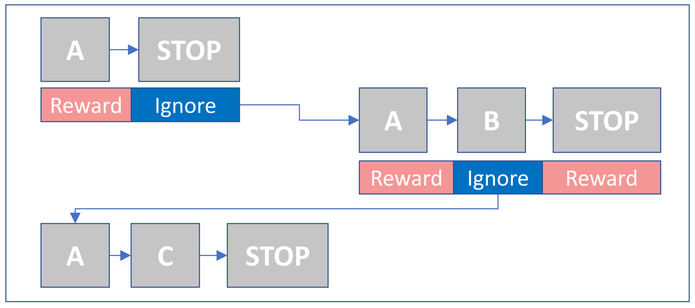


*Figure 3: Example sequence action sequence building based on user's reaction*

## Future work

- Develop more complex emotion system including preferenes
- Further enhance command detection to deal with unlimited shape types and colours
- Apply software to different types of pet robots

## References

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