Object Detection within a Robotic Application

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Introduction

Our idea was to teach a Braccio Robotic Arm to play the child's game pairs. It should detect the playing cards laying on the table, their position and the motif of a card and find the second one. The robot picks one playing card up, places it on the stack and searches for the second one within the remaining cards. For object detection YOLOv2-Real-Time-Object detection is used for transfer learning with datasets containing images of our playing cards. We trained our network with Google Cloud Service.

Dataset

Datasets for the project could be devided into two parts. Darknet had pre-trained on the Pascal VOC 2007+2012, and we had trained 30 images for each of the 10 classes of the playing cards.

Fig. 1: Images of 20 classes from Pasca VOC2012, which is :

aeroplane, bicycle, bird, boat, bottle, bus, car, cat, chair, cow, diningtable, dog, horse, motorbike, person, pottedplant, sheep, sofa, train and tvmonitor.

Fig. 2: Training data of the playing cards. Ten classes of the cards are:

Boat, Girl, Boy, Horse, EuropeanBird, PacificBird, Flower, BlueCard, Tree, Pineapple

Images

network from tiny yolo
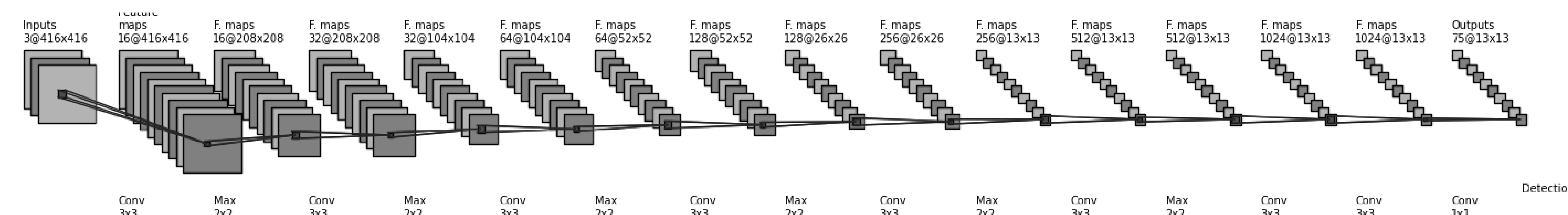10 cards + classes
architecture

Fig. 3: Network architecture.

Filters from results
Camera input with detection labels

Related Work

For the object detection, we used Yolo9000 with transfer learning to detect the motifs of the playing cards in real time. *Add table? Add link?*
The communication between the Braccio Robotic Arm and the computer is enabled with ROS. *Also with the Arduino?*
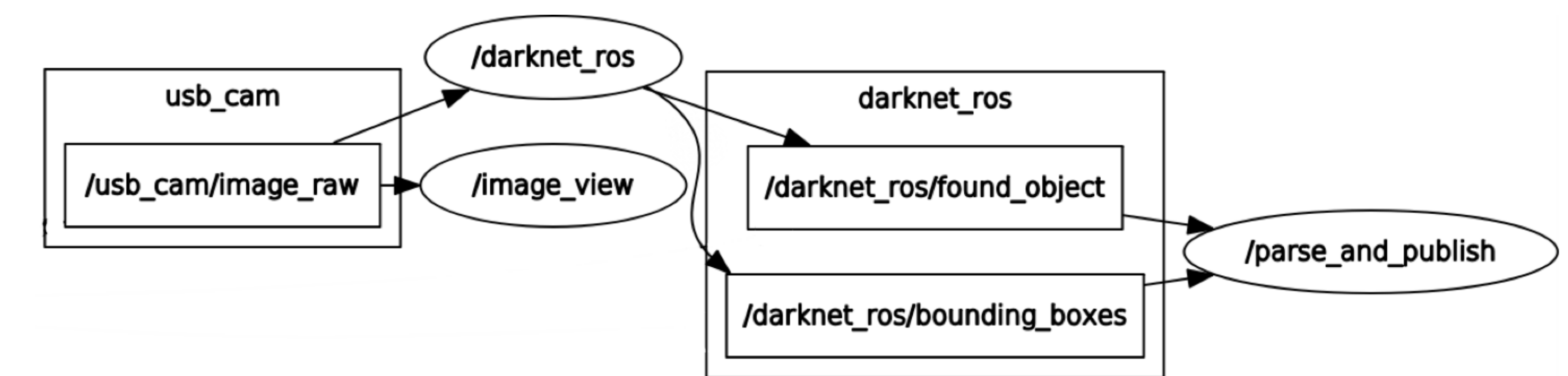

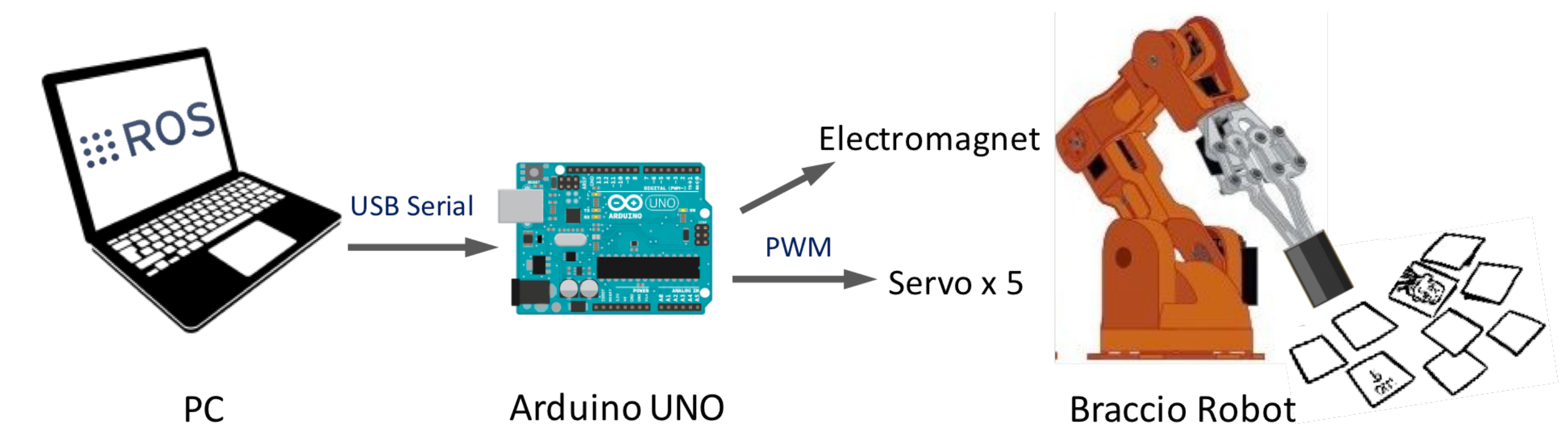Fig. 4: System structure under ROS (Robot Operating System)

Fig. 5: Hardware setup

Data and Statistics

Content in your block.

Methodology

- Input stream from camera
- Send stream to computer
- Pre-trained Yolo detects motifs of playing cards
- If card is detected, command is sent to robot to pick it up with help of a magnet and a metal strip attached on the back of the card
- Card is put on stack
- Robot searches for card with the same motif
- If detected, it picks it up and places it on the stack
- Robot starts looking for a new pair of playing cards

Description of network architecture? How well did our model perform during training?