Project assignment:

1 student
Holze

❖ Fusion of polarized images

In this project, students will use polarized videos (i.e. video recordings where frames were recorded with different orientation of a polarizing filter) to merge the frames carrying most relevant information. The role of the students is to find a suitable quality evaluation metric(s) to select the frame to be merged in an existing fusion algorithm.

Project main area	Additional knowledge	Hardware	Work @ Lab[1]	Tutor
Robotics & Computer vision	• Quality evaluation metrics • Matlab Image Toolbox (or OpenCV libraries)	• No additional hardware required	One session for work assignment, then optional	Marcello Calisti m.calisti@sssup.it

[1] **Research centre on sea technologies and marine robotics, Livorno**

Project assignment:

2-3 students

❖ Grasping objects in the Neurorobotics Platform (NRP)

In this project, students will use a simulated humanoid robot in the Neurorobotics Platform to perform basic grasping tasks . The role of the students is to extend the current model of the iCub robot including hands and use an inverse kinematic model to control the arm and hand.

Project main area	Additional knowledge	Hardware	Work @ Lab[1]	Tutor
Robotics	• Inverse Kinematics model • NRP	• No additional hardware required	• One session for NRP installation • One session for embedding the iCub model • One session for embedding the inverse kinematic controller	Egidio Falotico e.falotico@santannapisa.it Alessandro Ambrosano a.ambrosano@santannapisa.it

Project assignment:

2-3 students
Alderighi
Lisi

❖ **Prey-predator behavior in the Neurorobotics Platform (NRP)**

In this project, students will use simulated mobile robots in the Neurorobotics Platform to perform basic prey-predator behaviors. The role of the students is to extend the NRP in order to support multiple robots and define prey and predator behaviors

Project main area	Additional knowledge	Hardware	Work @ Lab[1]	Tutor
Robotics	• NRP	• No additional hardware required	• One session for NRP installation • One session for extension of the NRP for multiple robots simulation support • One session to define and implement pray and predator behaviors	Egidio Falotico e.falotico@santannapisa.it Alessandro Ambrosano a.ambrosano@santannapisa.it

Project assignment:

1/2 students
De Socio

❖ **Development and implementation of a *predictive* model for catching moving objects**

The objective of this work is to catch a tossed ball with the robot hand. The trajectory must be predicted with a neural network in order for the robot to catch it. The robot will use simple computer vision mechanisms. The model will be implemented and tested in simulated environment.

Project main area	Additional knowledge	Hardware	Work @ Lab[1]	Tutor
Artificial Intelligence Robotics	• Neural Networks • Robotic Simulator • Computer Vision	None	One/two meetings to define the model	Egidio Falotico e.falotico@santannapisa.it Hari Teja Kalidindi h.kalidindi@santannapisa.it

Project assignment:

1 student
Nardo

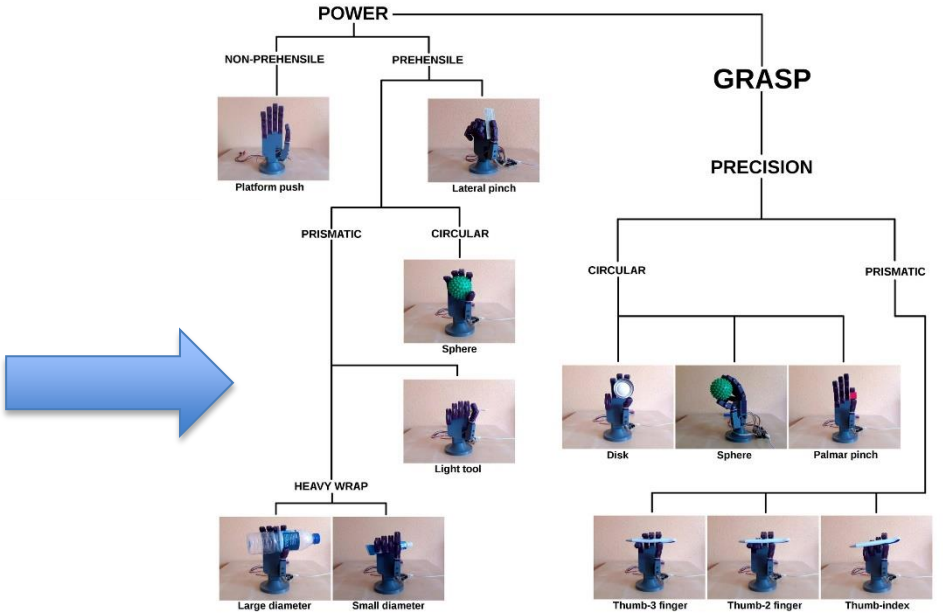
❖ **Design/implement a classification algorithm for grasping type**

This project involves processing images in the given datasets and develop a classification algorithm in order to predict grasping types for an anthropomorphic robotic hand. The proposed classification problem will be analyzed in three different parts in consecutive order.

i) The offline image classification and grasping type prediction algorithm will be developed during the 1st and 2nd part of the project.
ii) Then, as 3rd part requires, this know-how should be transferred into a robotic simulator (e.g. the Neurorobotics Platform) to test whether similar results can be achieved on a virtual robot.

Project main area	Additional knowledge	Hardware	Work @ Lab[1]	Tutor
Robotics & Algorithm Design	• Machine learning • Robotic Simulator	• None	Bi-weekly project progress meeting	E.Falotico & M.Kirtay

Appendix -I



Desired Skills/Backgrounds:

- Ability to code in any programming language except Matlab (e.g. C++, Python)
- Hands on experience with basic image processing algorithms and standard computer vision/machine learning/data analysis libraries (e.g. SciKit, Keras, OpenCV)
- Sound knowledge on state-of-art machine learning algorithms