RESEARCH PROJECT 2021-2022

Department/Area

Mechanical, Materials, Electronics/Control, Telematics/CompSc

Title/Name

Improving robot grasping dexterity for an industrial application

Abstract/Description

Nowadays, human labor is in charge of some repetitive and low-added-value operations in industrial environments. In this project, we are working in the design of a robotic system able to fill bins with heterogenous parts of a real car manufacturing process.

We design from the classical and deep-learning artificial vision algorithms required for the robot to properly interpret its surroundings to the mechanical design of its end effector, in order to perform robust grasping with minimum control effort.

Prerequisites

Required	Willingness to learn and good attitude.
Recommended	Good programming skills if interested in the artificial vision part. Python. Good command of CAD environments (e.g. Solid Edge) if interested in the design part.

Supervisor/Tutor

Name	Alvaro Lopez
Email	Please do not contact Supervisor directly

Structure

Format	Semester (extensive, 15 weeks), Summer (intensive, preferably 8 weeks), Both are available
Workload	100 hours (4 ECTS) / 200 hours (8 ECTS)
Students	4

RESEARCH PROJECT 2021-2022

Department/Area

Electronics/Control, Telematics/CompSc

Title/Name

Sim-to-Real: Optimizing the use of transfer learning and the trasnference of synthetic experience to reality in robots

Abstract/Description

In this project, we have developed models in MuJoCo of several robotic arms. Using these models, we can now design efficient deep-reinforcement-learning (DRL) agents for certain tasks.

Currently, our works in this project can be framed into two research streams:

- Driving the real robot with the DRL agents designed in the virtual environment. To do so, we are using a specific and very promising neural architecture called progressive network.
- Analysing whether we can use pre-trained vision modules (CNN based) in the DRL phase to reduce the number of parameters to be trained, thus focusing them on representing the optimum behaviour policy we are looking for.

Prerequisites

Required	Willingness to learn and good attitude.
Recommended	Good programming skills. Python.

Supervisor/Tutor

Name	Alvaro Lopez
Email	Please do not contact Supervisor directly

Structure

Format	Semester (extensive, 15 weeks), Summer (intensive, preferably 8 weeks), Both are available
Workload	100 hours (4 ECTS) / 200 hours (8 ECTS)
Students	4

RESEARCH PROJECT 2021-2022

Department/Area

Electrical, Electronics/Control, Telematics/CompSc.

Title/Name

Design and Evaluation of a Communication Architecture to Control Robot Behavior based on Mood Detection through Brain Activity Monitoring.

Abstract/Description

The main goal of the research project is to develop and validate a communication architecture that let control the movements of a robot through brain activity. The brain activity will be monotired by an easy-to-use wearable device, such as the headband from Muse (https://choosemuse.com/). Meanwhile, the robot to be used is an autonomous mobile robot. The objective of this implementation is to represent in real time the mood of the user by the movements of the vehicle. That mood will be generated by listening different music themes and sound effects that produce states of calm or stress, among others. The robot will behave differently depending on the mood identified. The impact of the project is twofold: on the one hand, it is related to personalised home-based cognitive rehabilitation purposes since a proper communication between brain activity and an external device, such as a mobile robot, will show the posibility to interact with patients with brain desorders at home by using domestic robots, or other similar devices, that would assist them in case of, for example, epileptic attacks. On the other hand, the fact that a robotic device can behave, and change its movement/behavior, based on brain activity means that a telemanipulated robot can stop functioning if the system detects that the operator is getting nervous or stressed during the performance of the task; this is of high relevance when considering surgery robots.

Prerequisites

Required	Education related to Electronics, Automation and Control Engineering. Real Time Matlab/Simulink programming.
Recommended	C++/C#/Python programming.

Supervisor/Tutor

Name	José María Cogollor Delgado and Romano Giannetti.
Email	Please do not contact Supervisor directly

Structure

Format	Semester (extensive, 15 weeks), Summer (intensive, preferably 8 weeks), Both are available.
Workload	200 hours (8 ECTS).
Students	4 (2+2).

Department/Area

Electrical Engineering

Title/Name

Setting and testing power system protections

Abstract/Description

Protections are the silent centinels of the power system. Protections detect faults in the power system components (generators, lines, tranformers) and clear them by sending command actions to circuit breakers. Working in the proposed project, students will lean how to determine the settings of a state of the art protection device. Moreover, students will test the proper operation of the protection device in the laboratory.

Prerequisites

Required	Circuit theory and analysis
Recommended	AC circuit analysis

Supervisor(s)/Tutor(s)

Name(s)	Luir Rouco
Email(s)	Please do not contact Supervisor directly

Structure

Format	Semester (extensive, 15 weeks), Summer (intensive, preferably 8 weeks), Both are available *Both*
Workload	100 hours (4 ECTS) / 200 hours (8 ECTS) *Both*
Students	1, 2, 3, 4, 5 *3*

Department/Area

Mechanical

Title/Name

Mechanical losses study ans simulation for ICE.

Abstract/Description

State of the art review of empirical correlations for mechanical losses in internal combustion engines. Simulation model to predict engine performance in steady state together with combustion and volumetric efficiency. Confirmation with real data extrated from technical papers and magazines.

Prerequisites

Required	Basic ICE Knowledge
Recommended	

Supervisor(s)/Tutor(s)

Name(s)	Juan de Norverto
Email(s)	Please do not contact Supervisor directly

Structure

Format	Semester (extensive, 15 weeks), Summer (intensive, preferably 8 weeks), Both are available
Workload	100 hours (4 ECTS)
Students	1, 2

Department/Area

Mechanical

Title/Name

Sustainability analysis of different types of table salts.

Abstract/Description

Table salts have experienced a boom in diversity and pricey gourmet versions can be found in high-end retail shops. However, not all these high-range salts are produced by the same methods. There is a gradation between industrial salts, obtained in highly mechanized salt making sites and hand-harvested salts from small salinas. Producers claim their salt is more sustainable than others. The aim of this project is to use a standard tool (LCA/Ecoaudit) to measure the sustainability of the production of high-range salts and debate the strengths and the flaws of this tool. Four or five different salts will be analyzed.

Prerequisites

Required	
Recommended	Basic knowledge of concepts related to environmental management and sustainability

Supervisor(s)/Tutor(s)

Name(s)	Katia Hueso Kortekaas, Marta Revuelta Aramburu
Email(s)	Please do not contact Supervisor directly

Structure

Format	Semester (extensive, 15 weeks), Summer (intensive, preferably 8 weeks), Both are available
Workload	100 hours (4 ECTS)
Students	2

Department/Area

Applied Mathematics

Title/Name

Art and science. Dance videos as a support for the teaching of mathematical concepts.

Abstract/Description

The aim of this project is the elaboration of some didactic videos with an artistical content. The student will collaborate in the realization of said videos.

Prerequisites

Required	Interest in art and Mathematics
Recommended	Good Spanish level

Supervisor(s)/Tutor(s)

Name(s)	Javier Rodrigo
Email(s)	Please do not contact Supervisor directly

Structure

Format	Summer (intensive, preferably 8 weeks)
Workload	100 hours (4 ECTS)
Students	2

RESEARCH PROJECT 2021-2022

Department/Area

IIT

[Borrar lo que no proceda]

Title/Name

Simulation of a 100% renewable electricity market: long-term versus short-term marginal costs

Abstract/Description

Two simulation models based on mathematical programming will be specified and programmed to simulate a case study 100% renewable, with solar, wind, and storage. First, the investment cost minimization for a small case study will be programmed. Results and sensitivities to main invesment parameters will be analyzed. Second, a detailed hourly model for operational cost minimization will be programmed. Results and sensitivities to operational parameters will be analyzed. Long-term and short-term marginal costs would be derived and compared from the two previous models.

Prerequisites

Required	MATLAB optimization toolbox, Python
Recommended	GAMS or other optimization languages

Supervisor(s)/Tutor(s)

Name(s)	Tomás Gómez
Email(s)	Please do not contact Supervisor directly

Structure

Format	Semester (extensive, 15 weeks), Summer (intensive, preferably 8 weeks), Both are available *[Borrar lo que no proceda. Si ambas modalidades se ofrecen, dejar tal cual]*
Workload	200 hours (8 ECTS) *[Borrar lo que no proceda. Carga total por alumno, para la asignación de ECTS por alumno]*
Students	1, 2, 3 *[Borrar lo que no proceda. Número máximo de alumnos trabajando en equipo en el proyecto]*

RESEARCH PROJECT 2021-2022

Department/Area

Electronics, IIT

Title/Name

Detection of additives in meat products using a ring resonator biosensor and machine learning

Abstract/Description

Ring resonator biosensors are a very promising technology due to their low-cost and reusability. Moreover, they can be easily integrated with antennas to develop wireless or contactless sensors. The objective of the proposed project is to test this biosensor design with meat products in order to detect chemical additives. The measurements will be analyzed with ML techniques to maximize biosensor accuracy. The results will be used to delimit the full potential of this technology for food industry application

Prerequisites

Required	Electronic measurements
Recommended	It would be nice to have some knowledge of machine learning, but it could be learned during the project.

Supervisor(s)/Tutor(s)

Name(s)	Miguel Monteagudo Honrubia, Francisco Javier Herraiz Martínez, Javier Matanza Domingo
Email(s)	Please do not contact Supervisor directly

Structure

Format	Semester (extensive, 15 weeks) \ Summer (intensive, preferably 8 weeks)
Workload	200 hours (8 ECTS)
Students	1

RESEARCH PROJECT 2021-2022

Department/Area

Electronics, IIT

Title/Name

Lactose detector for dairy products using a ring resonator biosensor and machine learning

Abstract/Description

Ring resonator biosensors are a very promising technology due to their low-cost and reusability. Moreover, they can be easily integrated with antennas to develop wireless or contactless sensors. The objective of the proposed project is to test this biosensor design with dairy products in order to detect lactose. The measurements will be analyzed with ML techniques to maximize biosensor accuracy. The results will be used to delimit the full potential of this technology for food industry application

Prerequisites

Required	Electronic measurements
Recommended	It would be nice to have some knowledge of machine learning, but it could be learned during the project.

Supervisor(s)/Tutor(s)

Name(s)	Miguel Monteagudo Honrubia, Francisco Javier Herraiz Martínez, Javier Matanza Domingo
Email(s)	Please do not contact Supervisor directly

Structure

Format	Semester (extensive, 15 weeks) / Summer (intensive, preferably 8 weeks)
Workload	200 hours (8 ECTS)
Students	1