



Departamento de Engenharia de Eletrónica e Telecomunicações e de Computadores
Licenciatura em Engenharia Informática e de Computadores

Third Practical Project

Artificial Intelligence course

2022/2023 Summer Semester

Version 1.00

Teacher: Nuno Leite

ISEL, 22 May 2023

Learning objectives

At the end of the **Third practical project**, students should be able to:

- ☐ Understand algorithms of Automatic Planning: Total order and partial order planners;
- ☐ Apply partial order planner to solve a given problem;
- ☐ Understand how Neural Networks work;
- ☐ Apply Neural Networks to a classification problem.

First exercise

Consider the existence of the scene illustrated in Figure 1, where the *Pos i* box contains parts of *type i* and where all robots are capable of transport and mount any part in the mounting position (*Pos montagem*) but only robot R3 has capabilities to transport the assembly to the output.

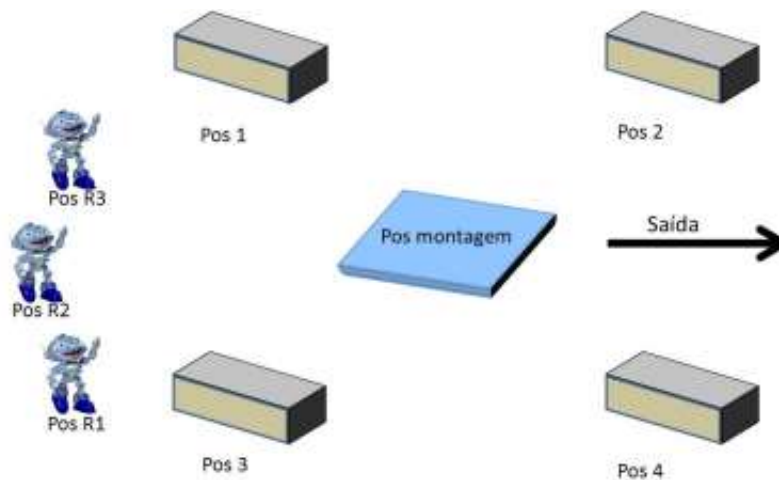


Figure 1: Application scenario.

The parts that make up the product to be assembled are drawn in Figure 2. The finished product is drawn in Figure 3.

Using the algorithms studied in class (Goal regression with and without best-first, and POP), create the most appropriate plan for the assembly of this product, and respective transportation by robot R3 to the output point.

The developed program must be written in the Prolog language. The input/output is text-based.

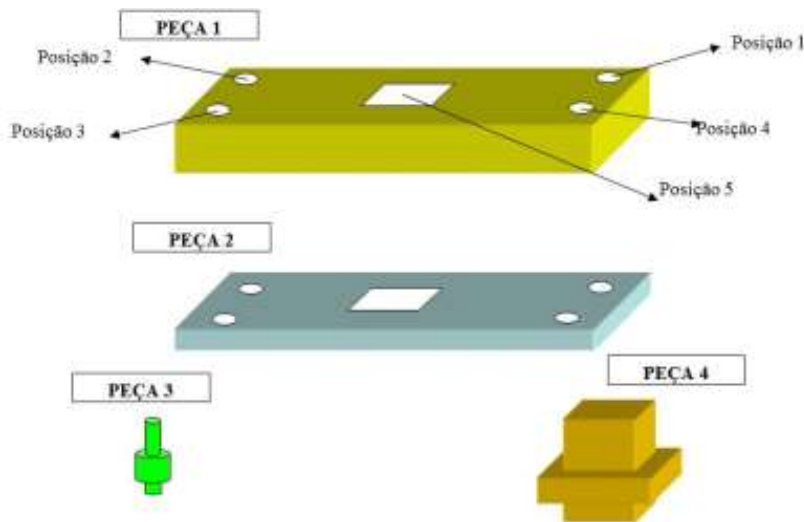


Figure 2: Parts that make up the product to be assembled.

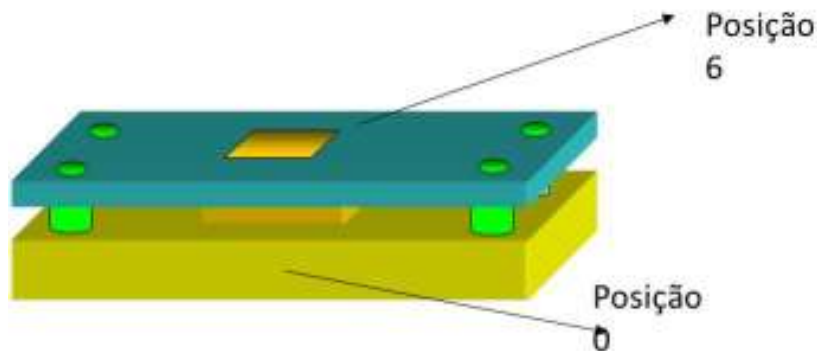


Figure 3: Finished product.

Second exercise

In this exercise, the objective is to study and test a Neural Network for classification of handwritten digits from a public database.

You should study the code from the book “Make your own Neural Network”, by Tariq Rashid. The complete code in Python is located in https://github.com/makeyourownneuralnetwork/makeyourownneuralnetwork/blob/master/part2_neural_network.ipynb.

The MNIST Dataset of Handwritten Numbers

The format of the MNIST database (available from the researcher Yann LeCun’s website <http://yann.lecun.com/exdb/mnist/>) isn’t the easiest to work with, so others have helpfully created data files of a simpler format, such as this one <http://pjreddie.com/projects/mnist-in-csv/>. These files are called CSV files (comma separated values).

This website provides two CSV files:

- A training set http://www.pjreddie.com/media/files/mnist_train.csv
- A test set http://www.pjreddie.com/media/files/mnist_test.csv

See section about this subject in the book.

Your task is to adapt the given Python code in order to test the trained neural network with files given by the user. You should generate your own files of handwritten digits and test the accuracy of the model. The application should be as simple as possible (console based).

Due date: 8 July 2023 until 23:59.

The delivery of the work must present the report and all developed code, delivered in the Moodle system. The report must be concise and justify all decisions taken. It must indicate the student group composition and the curricular unit info.