Práctica 1
Instalación de Herramientas de Software
Laboratorio de Bio-Robótica
Robots Móviles

Duración 2 semanas

## Objetivos

- Familiarizar al alumno con el uso del sistema operativo Linux, distribución Ubuntu versión 20.04
- Aprender los conceptos básicos del sistema de simulación de robots móviles PUMASIMBOT

## Desarrollo

**Instalación de Ubuntu 20.04**

Instale Ubuntu 20.04, para ello, descargue la imagen de la siguiente dirección:
https://ubuntu.com/download/desktop (Asegúrese de descargar la versión correcta, de 32 o 64 bits)

Sino se puede instalar Linux en una partición en su computadora para no quitar el sistema operativo de ésta, se recomienda instalar el sistema operativo de manera nativa en un disco duro externo y no en una máquina virtual.

Para instalar Ubuntu desde Windows, para tener Linux en un disco duro externo, se pueden seguir las instrucciones de la siguiente página:
http://www.ubuntu.com/download/desktop/create-a-usb-stick-on-windows

## 2. Instalación del simulador de robots PUMASSIMBOT

Una vez instalado Ubuntu, descargue de la página:
https://biorobotics.fi-p.unam.mx/courses/robots-moviles/
en la pestaña de Material de apoyo los archivos PUMASIMBOT.zip, PUMASIMBOT.pdf y Data_PUMASIMBOT.zip

Descomprimir los archivos en /home/<usuario>
Siga las instrucciones del apendice A para la instalación y ejecución del software.
Nota, en el archivo PUMASIMBOT.pdf también contiene estas instrucciones.

## Evaluación

La práctica se considerará entregada mostrando al instrucctor la ejecución del simulador en su computadora.

# Apendice A

# PUMASIMBOT

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# PUMASIMBOT

PUMASIMBOT is a simulator system to test simple mobile robots behaviors developed by students in an introductory mobile robots course.

To use it follow the next instructions:

1. Using an Ubuntu-Linux operating system, unpack pumasimbot.zip in the user's directory.
2. Unpack data_pumasimbot in the user's directory.
3. Open an X terminal and go to the directory where the programs are, with the following command:

    cd pumasimbot

Change the permitions of the file pumasimbot_make with the following command:

    chmod 777 pumasimbot_make

Compile the source files with the following command:

    ./pumasimbot_make

# PUMASIMBOT

During compilation is possible that some warnings will appear.

4. GUI usage

If there were no critical compilation errors, go to directory gui and type the following command to see the system usage:

python3 pumasimbot.py

```
savage@pumas-Latitude-5320:~/pumasimbot/gui$ python3 pumasimbot.py

*********************************************************************************************

                                    P U M A S I M B O T

Usage: python3 pumasimbot.py num_behavior
Where num_behavior:
1 = Avoid obstacles and search for light source reactive behavior without memory
2 = Avoid obstacles behavior using a FSM
3 = Search for a light behavior using a FSM
4 = Search for a light source and avoid obstacles bahavior using a FSM
5 = Student behavior 1
6 = Student behavior 2
7 = First Search / Dijkstra Algorithms combined with a search for a light source and avoid obstacles ba
8 = Other Algorithms
```

# PUMASIMBOT

If there is an error because tkinter Python library is not installed in your computer do the following steps:

a) sudo apt-get update
b) sudo apt-get install python3-tk

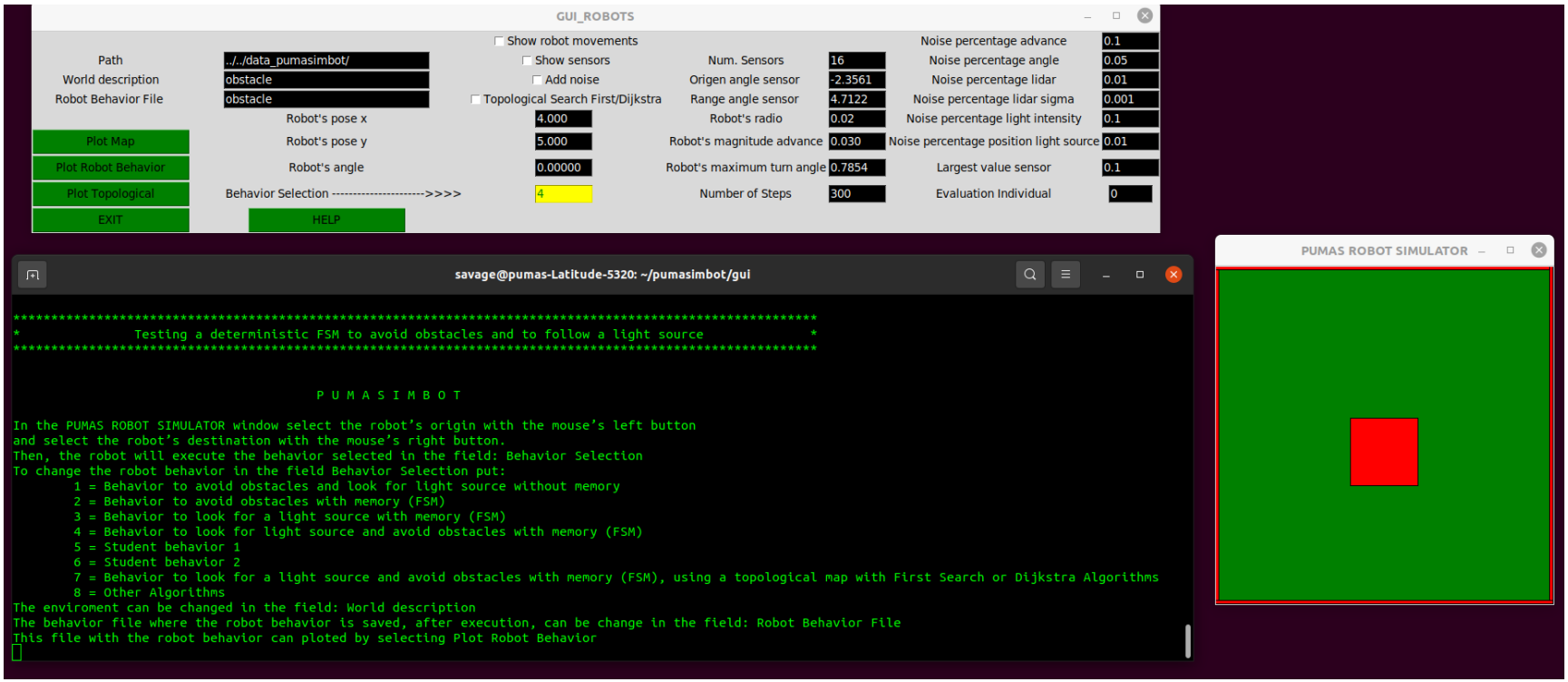
There is a possibility that other Python3 libraries where not installed in your computer, thus repeat the previous procedure with the missing libraries. If the problem persist, consult with the course instructor how to solve the problem or try to find a solution in the WEB.

# PUMASIMBOT

5. Select the type of behavior to be tested after the command python3 pumasimbot.py

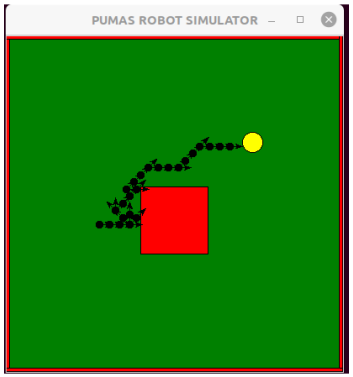
For example to test "Search for a light source and avoid obstacles bahavior using a FSM", type the following command:

python3 pumasimbot.py 4



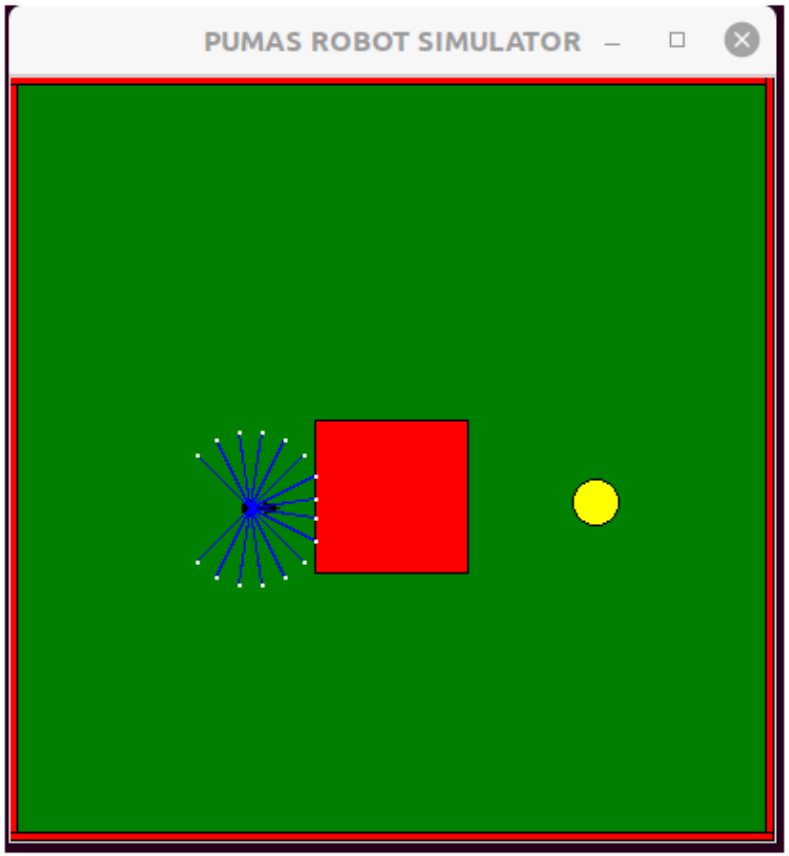
# PUMASIMBOT

In the PUMAS ROBOT SIMULATOR window select the robot's origin with the mouse's left button, and select the robot's destination with the mouse's right button. Then the execution of the behavior it is shown in PUMAS ROBOT SIMULATOR window, as it is shown in the following figure:



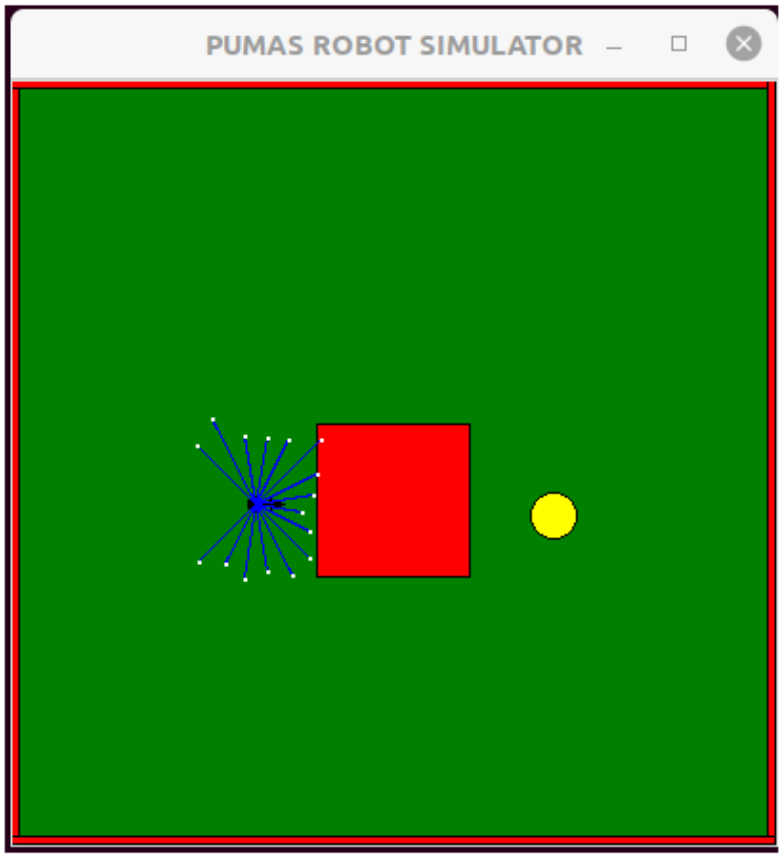
# PUMASIMBOT

To display the robot sensors select the check button Show sensors in the GUI_ROBOTS window. In the following figure it is shown the sensors with the movement of the robot of one step, by setting in Number of Steps to 1.



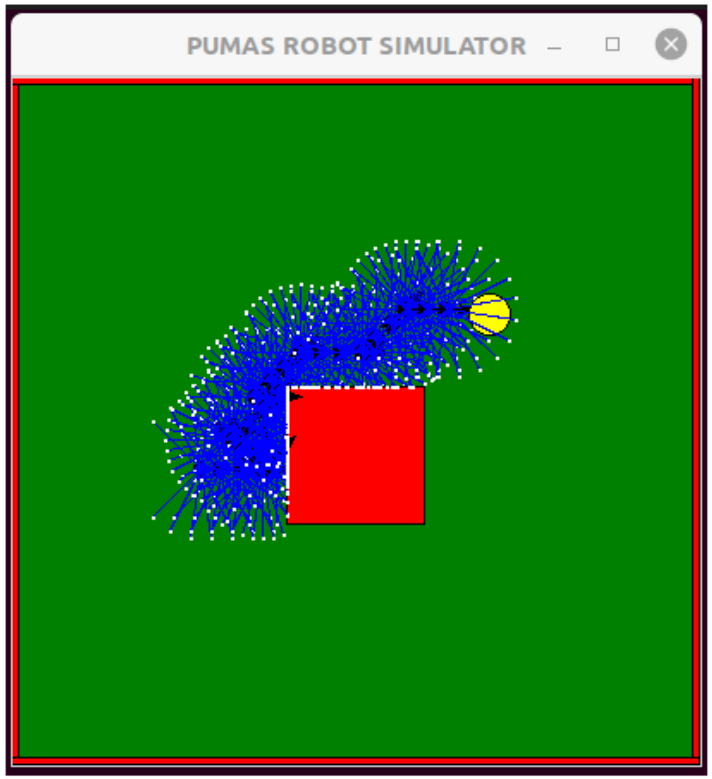
# PUMASIMBOT

To add noise to the sensors and to the movement select the check button Add Noise. In the following figure is shown the effect of adding noise:



# PUMASIMBOT

To display the movement of the robot step by step, select the check button Show robot movements.



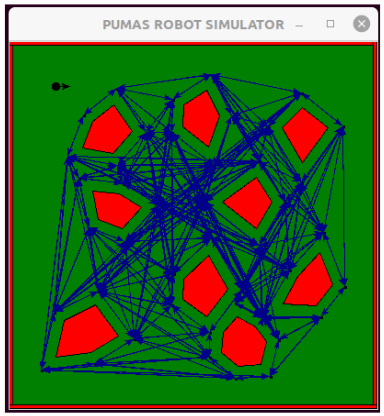

To plot again the previous behavior of the robot, select the Plot Robot Behavior.

# PUMASIMBOT

Different behaviors can be selected in the Behavior Selection option.
These behaviors are related to the C/C++ code in the directory pumasimbot/state_machines in the files *.h
The behaviors in these files are called in the file pumasimbot/motion_planner/GoTo_State_Machine.cpp that is executed any time a destination is selected in the PUMAS ROBOT SIMULATOR window.
When a behavior is modified or a new one is created it is necesary to compile again with pumasimbot/motion_planner/compile_motion_planner

# PUMASIMBOT

In the field World description can be selected the environment where the simulated robot operates, there are 15 environments: obstacle, random_1, random_2,..., random_14. When a new environment is selected push the Plot Map button to display it. A topological map of the environment can be plot pushing the Plot Topological button.




Selecting behavior 7, that looks for a light source and avoids obstacles with memory (FSM), using a topological map with First Search or Dijkstra Algorithms, these are selected in the check button Topological Search First/Dijkstra