Implementing Anki Cozmo with Monte Carlo Localization to Solve the Kidnapped Robot Problem

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CS371: Introduction to Artificial Intelligence

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Table of Content:

Cozmo and AI: An Introduction to Using Cozmo With Artificial Intelligence

Using AI with Anki Cozmo

Goals:

- Learn how to program with Cozmo
- Find a possible solution to the robot kidnap problem and implement it in Cozmo

Main steps:

1. Take images
    a. Rotate and take images
    b. Save images to particular folder
2. Stitch images together
    a. Stitch the images for a panorama view
    b. Downsample image to low resolution
3. Have Cozmo “get lost”
    a. Have Cozmo randomly turn at an angle
4. Have Cozmo find out where it is
    a. Using Monte Carlo Localization Cozmo will know where it is

Setup:

Materials needed:

- Laptop and compatible smartphone
    - Meaning: Apple computer with apple phone, PC computer with android phone
- Anki Cozmo
- Pick an IDE (we chose PyCharm a free editor you can download)
- Access to the internet
- Github account

The following setup steps are also explained in their online tutorial:
https://developer.anki.com/blog/learn/tutorial/getting-started-with-the-cozmo-sdk/

For windows:

1. Go to the developer website: https://developer.anki.com/
    a. Click the "Get Started" page
    b. Go to "Installation-Windows"
2. Download latest version of Python from Python.org
    a. During installation, tick the "Add Python to Path" checkbox on setup screen on the first screen of the installer window
    b. "Install"
3. Download the Cozmo SDK files
    a. In the Python installation on the windows install page
    b. Open up the command prompt
    c. (optional) pin the command prompt to your taskbar for quick/easy access to SDK
    d. Enter the command: "pip3 install --user cozmo[camera]"
4. Download OpenCV
    a. To install OpenCV use the following: pip install openCV-python

Mobile device setup for Android

While on your computer setup (not on your smartphone)

1. On the Cozmo SDK website, click "Android Debug Bridge" page
2. Click "link" to download "platform-tools-latest-windows.zip"
3. Click "open folder"
4. Open a new files explorer window

5. Go to your user folder
6. Create new folder “Android”
7. Go inside “Android” folder
8. Move over the downloaded “platform-tools-latest-windows.zip” into the “Android” folder and extract all in that folder
9. Go into the folder "platform-tools-latest-windows" and go into the "platform-tools" folder
10. Right click start menu and navigate: “system” > “Advanced system settings” > “Advanced” > “environment variables” > “User variables for user” > “Path” > “edit”
11. In the “edit environment variable” window click “new” > “add path to adb”
    a. The path name should be along the lines of: “"C:\Users\name\Android\platform-tools-latest-windows\platform-tools"
12. Click “ok” on everything to close out the windows
13. To double check your installation
    a. Open command prompt
    b. Enter “adb”
    c. If everything was installed properly, then the console will display information about the “adb”

Final Installation step for Mobile Setup

1. Enable USB debugging on android device
    a. Instructions for specific devices are online. Lookup how to for your own device.
2. connect phone to computer
3. command prompt > "adb devices"
4. with cozmo app running, connect phone to robot
5. In app on phone, go to main menu > "settings" > "Cozmo SDK" > "Enable SDK"

Run Some Example Programs

1. on computer developer site > go to "Downloads" page > "Windows SDK Examples"
2. in command line > navigate to the folder you have the examples in (look for "Cosmo SDK examples" folder)
3. Extract the files (remember where you extracted to)
4. in command line, navigate to where you have "Cozmo SDK examples" and go to their tutorials

Run a code

1. go to the program you want to run: ""cd 01_basics""
    a. run "Hello World" program
2. in command prompt: “py 01_hello_world.py” (could also use tab completion”

Code Outline:

1. Have Cozmo take panorama picture
    a. Get Cozmo to take a picture and save it to a particular folder
    b. Get Cozmo to turn 360 degrees and take pictures that have some overlap
    c. Stitch the images together for a panoramic view
2. Have Cozmo randomly turn
3. Have Cozmo recognize where it is

Sources:

- https://www.youtube.com/watch?v=9TJeK_AEFYo
- https://web.archive.org/web/20171218032016/http://www.mobileway.net/2015/02/14/install-opencv-for-python-on-mac-os-x/
- https://blogs.sap.com/2018/07/30/cozmo-read-to-me/
- https://www.pyimagesearch.com/2018/12/17/image-stitching-with-opencv-and-python/