**Project Notes**

Literature

Hierarchical reinforcement learning for self‐driving decision‐making without reliance on labelled driving data

* Independent Manoeuvre Selection and Motion Control
* APRL – Asynchronous Parallel RL – Each learner has own policy network, average is taken at each iteration, learners synchronise form shared network before making new decisions

Hands-On Reinforcement Learning with Python

* Reinforcement Learning Basics – Policy Function, Value Function, Agent-Environment Interface, Q Function, MDP, Bellman Equation, Monte Carlo Methods
* Policy Optimisation
* Feature exploitation vs Feature exploration

Deep Learning, Reinforcement Learning and World Models

* Generalised Policy Updates
* World Models

Lightweight 3D hand pose estimation by cascading CNNs with reinforcement learning

* CNN and feature extraction
* Feature exploitation vs Feature exploration

## Installing Mario-env

Was using python 3.12, needed Descartes package -> Pillow -> zlib.

Zlib not recognised by pip, tried .exe install, that didn’t work.

Found .whl archived package at <https://www.lfd.uci.edu/~gohlke/pythonlibs/#pillow>

Only compiled versions were python version <=3.11

Uninstalled python 3.12 and installed 3.11,

Installed pillow package on 3.11

## Changes to Mario Env

As I will be using a different approach so these trajectories are not as necessary

Removed all references to trajectories in state-handler

Removed Pangolin visualiser

## Key Memory Locations

|  |  |  |
| --- | --- | --- |
| Location | Offset | Description |
| 0x809BD70C | 0x61 | Moving Direction  (1: forward, 2: backward) |
| 0x809BD70C | 0x3C | Steering Direction  (0: left, 7: straight, 14: right) |
| 0x809BD730 | 0xF8 | Current Lap Completion  (float 0-3) |
| 0x809BD730 | 0x1B9 | Minutes |
| 0x809BD730 | 0x1BA | Seconds |
| 0x809BD730 | 0x1BC | Third-Seconds |
| 0x809C2EF8 | 0x40 + 0x0 | X Position (float) |
| 0x809C2EF8 | 0x40 + 0x4 | Y Position (float) |
| 0x809C2EF8 | 0x40 + 0x8 | Z Position (float) |

Source - <https://github.com/JackWBoynton/mariokart-rl/README.md>

Dolphin Config : GFX.ini -> Added `DumpFramesAsImages = True` in `[Settings]`

: Added hotkeys for frame advancing, learning can run independent of game framerate. Can be done not in real time

Installed Tesseract OCR Engine <https://github.com/tesseract-ocr/tesseract>

Funky Flame Runner: MT = 113 ,Wheelie = 97 ,Normal = 84

If I choose to advance the emulator frame by frame to allow more time for processing, then I will need to take into account the fact that dolphin only recognises inputs during a frame change. So the input would need to be held, frame advanced, then released. This approach could be very interesting to show the process of what happens each frame.

Charged MT = 270

## Gecko Codes

To display relevant in-game information, a gecko code is used. This is a type of cheat code that is often used by people performing TASs (Tool-Assisted Speedruns) when they need to know the exact state of the game, which will also be very useful for me. These codes are supported by the emulator and can be activated/disactivated using the GUI.

To process the information displayed by the ‘TAS Debug Panel’ created by [Melg, stebler, Seeky, SwareJonge, kierio04, Gaberboo] I need to extract the text from each frame. To do this, I decided to make a dictionary containing pictures of all possible characters and their values. I then use OpenCV to find any matches, and return the corresponding character value from the dictionary

Pixel co-ords of Various Features

* XZ Vel:
  + L=89
  + T=177
  + R=133
  + B=191
* Race%:
  + L=98
  + T=251
  + R=159
  + B=264
* MT:
  + L=149
  + T=269
  + R=160
  + B=284

Single character is 11x15

## Dolphin wrapper

* Init
  + Open dolphin
  + Assert config options – framedumps, input recording
  + Load default savestate
  + Pause emulation
* Step
  + Read frame
  + Calculate estimated reward for each input
  + Update Q function?
  + Return input with highest reward
* Reset
  + Load default savestate
  + Reset controller
* Terminate
  + Return sum of rewards
  + Stop emulation
  + Reset controller
  + Wipe framedumps folder

## Controller

* Reset
* Press button
  + Button name
* Angle stick
  + Stick
  + Anlge (0-14)

## Frame Reader

* Open file
* Greyscale
* Downsample
* Return information

