full thesis

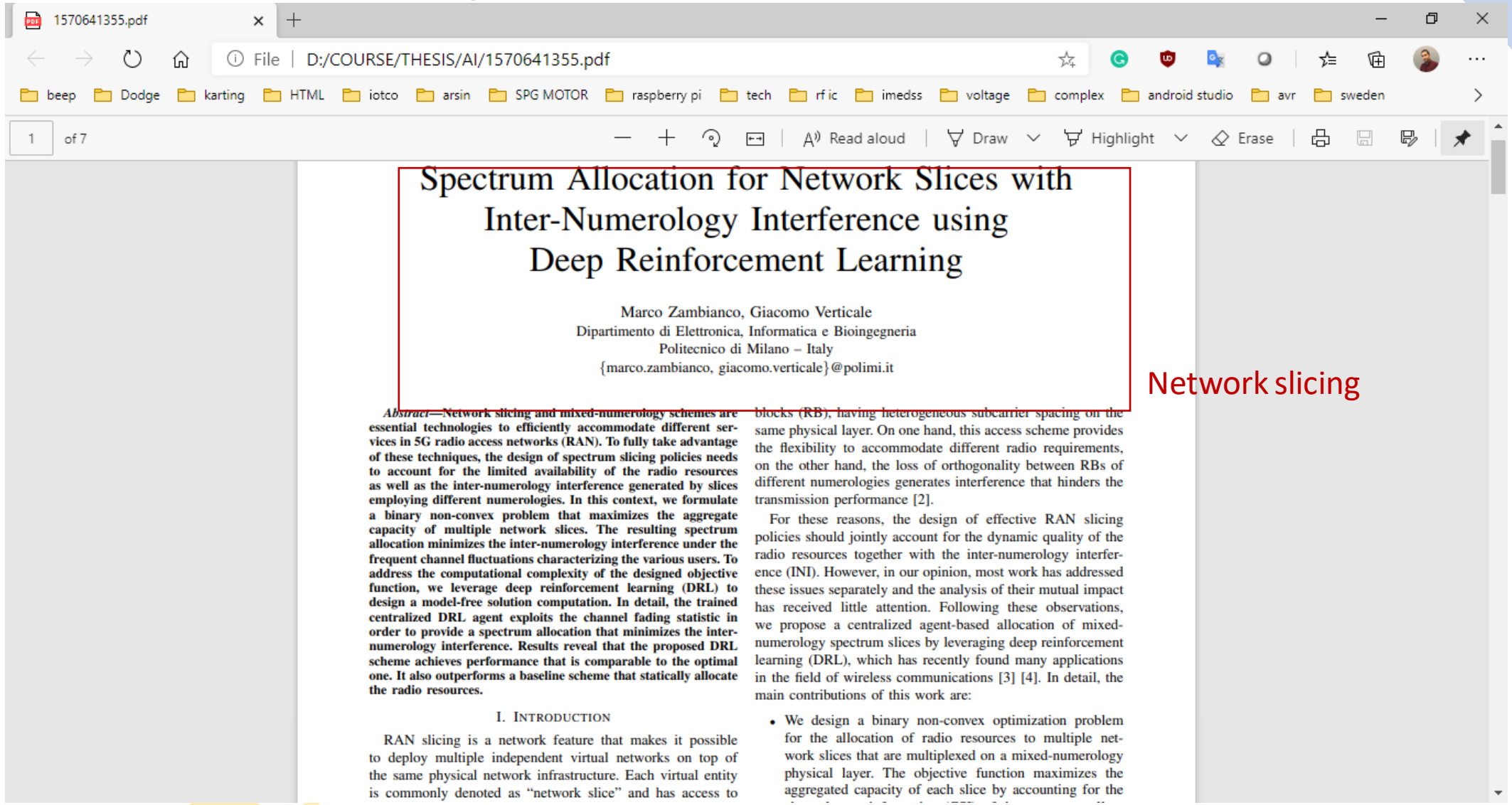
Artificial intelligence in the air

25/09/2020 (sep)

- Introduce the network slicing in 5g and 6g also neural methods
- Introduce the nokia wireless suite

Meeting **one**

Considering INI



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1 of 7 Read aloud Draw Highlight Erase

Spectrum Allocation for Network Slices with Inter-Numerology Interference using Deep Reinforcement Learning

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***Abstract*—Network slicing and mixed-numerology schemes are essential technologies to efficiently accommodate different services in 5G radio access networks (RAN). To fully take advantage of these techniques, the design of spectrum slicing policies needs to account for the limited availability of the radio resources as well as the inter-numerology interference generated by slices employing different numerologies. In this context, we formulate a binary non-convex problem that maximizes the aggregate capacity of multiple network slices. The resulting spectrum allocation minimizes the inter-numerology interference under the frequent channel fluctuations characterizing the various users. To address the computational complexity of the designed objective function, we leverage deep reinforcement learning (DRL) to design a model-free solution computation. In detail, the trained centralized DRL agent exploits the channel fading statistic in order to provide a spectrum allocation that minimizes the inter-numerology interference. Results reveal that the proposed DRL scheme achieves performance that is comparable to the optimal one. It also outperforms a baseline scheme that statically allocate the radio resources.**

I. Introduction

RAN slicing is a network feature that makes it possible to deploy multiple independent virtual networks on top of the same physical network infrastructure. Each virtual entity is commonly denoted as "network slice" and has access to blocks (RB), having heterogeneous subcarrier spacing on the same physical layer. On one hand, this access scheme provides the flexibility to accommodate different radio requirements, on the other hand, the loss of orthogonality between RBs of different numerologies generates interference that hinders the transmission performance [2].

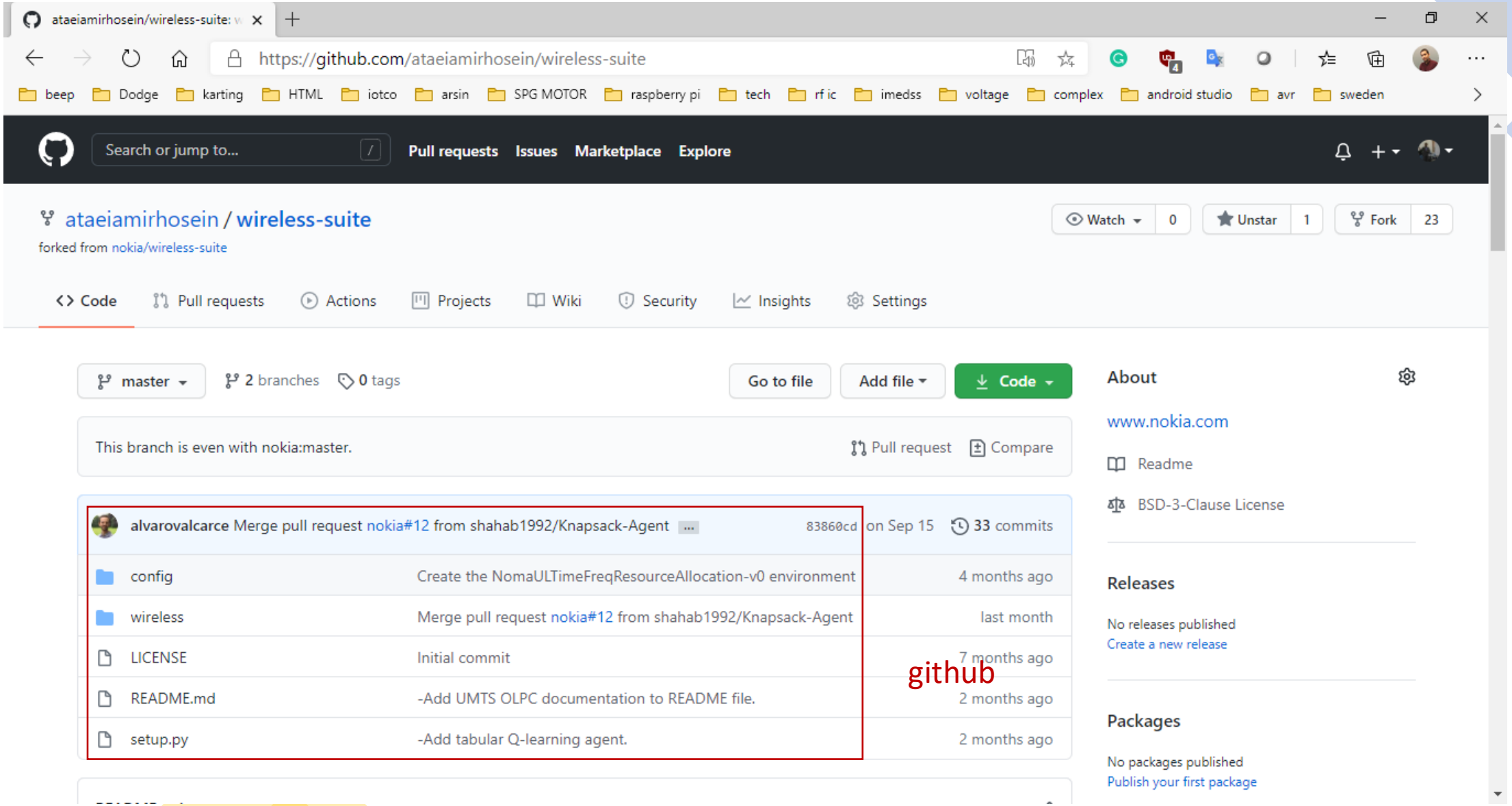
For these reasons, the design of effective RAN slicing policies should jointly account for the dynamic quality of the radio resources together with the inter-numerology interference (INI). However, in our opinion, most work has addressed these issues separately and the analysis of their mutual impact has received little attention. Following these observations, we propose a centralized agent-based allocation of mixed-numerology spectrum slices by leveraging deep reinforcement learning (DRL), which has recently found many applications in the field of wireless communications [3] [4]. In detail, the main contributions of this work are:

- We design a binary non-convex optimization problem for the allocation of radio resources to multiple network slices that are multiplexed on a mixed-numerology physical layer. The objective function maximizes the aggregated capacity of each slice by accounting for the

Network slicing

https://ieeexplore.ieee.org/abstract/document/8476595

Nokia


ataeiamirhosein/wireless-suite
https://github.com/ataeiamirhosein/wireless-suite
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forked from nokia/wireless-suite
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Code Pull requests Actions Projects Wiki Security Insights Settings
master 2 branches 0 tags
Go to file Add file Code
This branch is even with nokia:master.
Pull request Compare
alvarovalcarce Merge pull request nokia#12 from shahab1992/Knapsack-Agent ... 83860cd on Sep 15 33 commits
config Create the NomaULTimeFreqResourceAllocation-v0 environment 4 months ago
wireless Merge pull request nokia#12 from shahab1992/Knapsack-Agent last month
LICENSE Initial commit 7 months ago
README.md -Add UMTS OLPC documentation to README file. 2 months ago
setup.py -Add tabular Q-learning agent. 2 months ago
github
About
www.nokia.com
Readme
BSD-3-Clause License
Releases
No releases published
Create a new release
Packages
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Publish your first package

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Artificial intelligence in the air

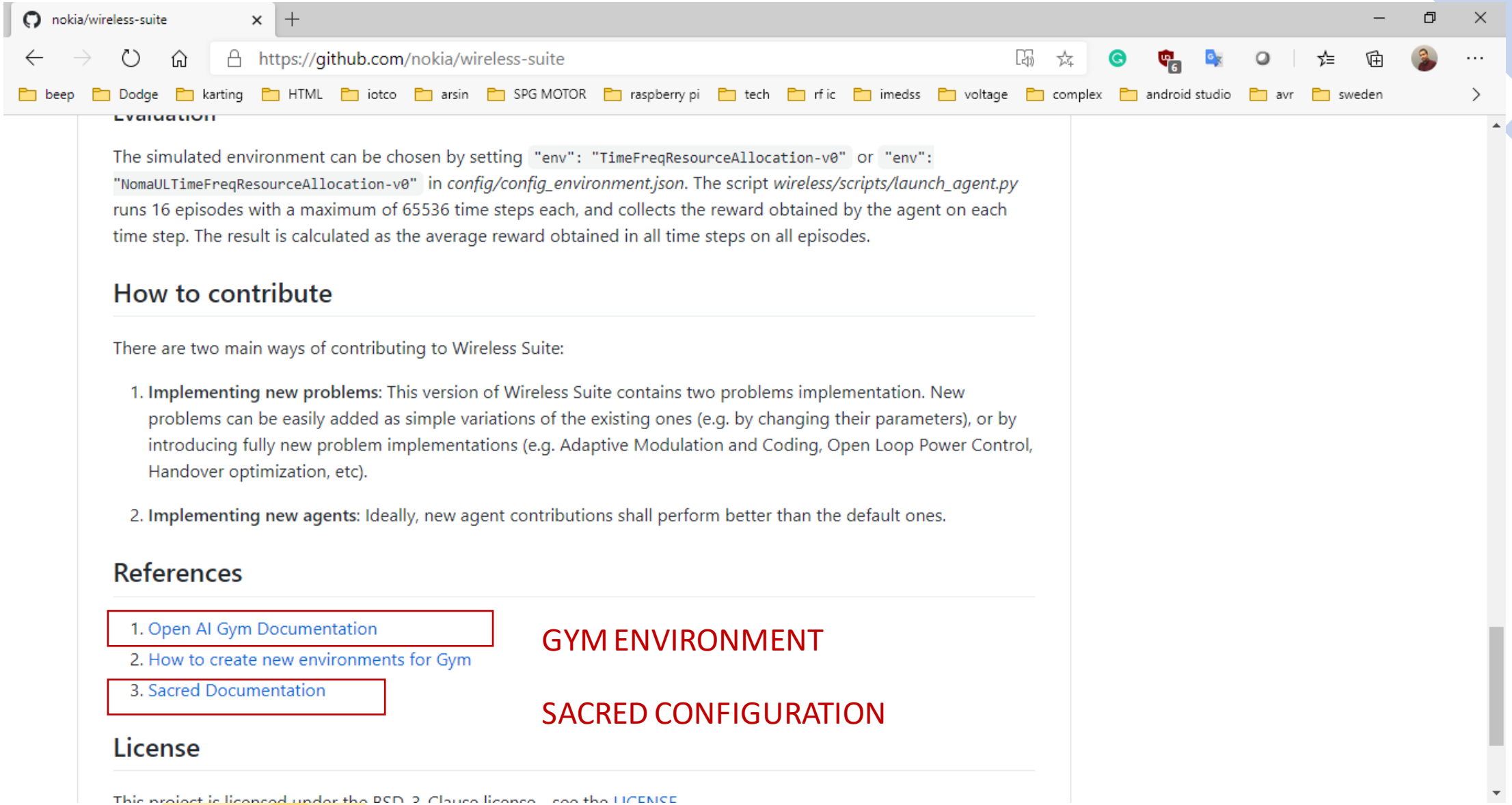
09/19/2020 (oct)

- Read the gym and sacred documentation also deep learning

- Run the nokia wireless suite with observer

Meeting **two**

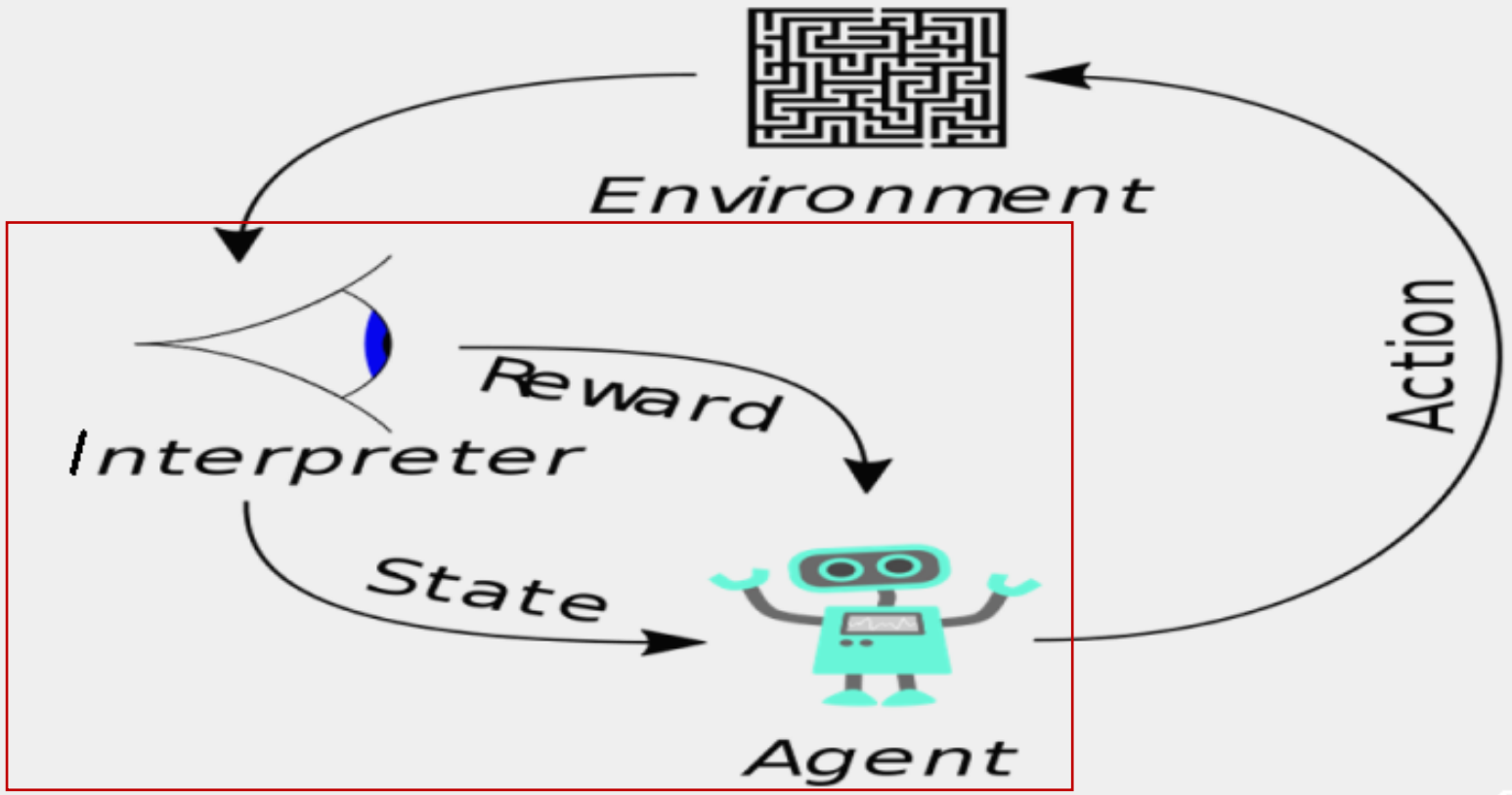
Wireless-suite develop



GYM ENVIRONMENT

SACRED CONFIGURATION

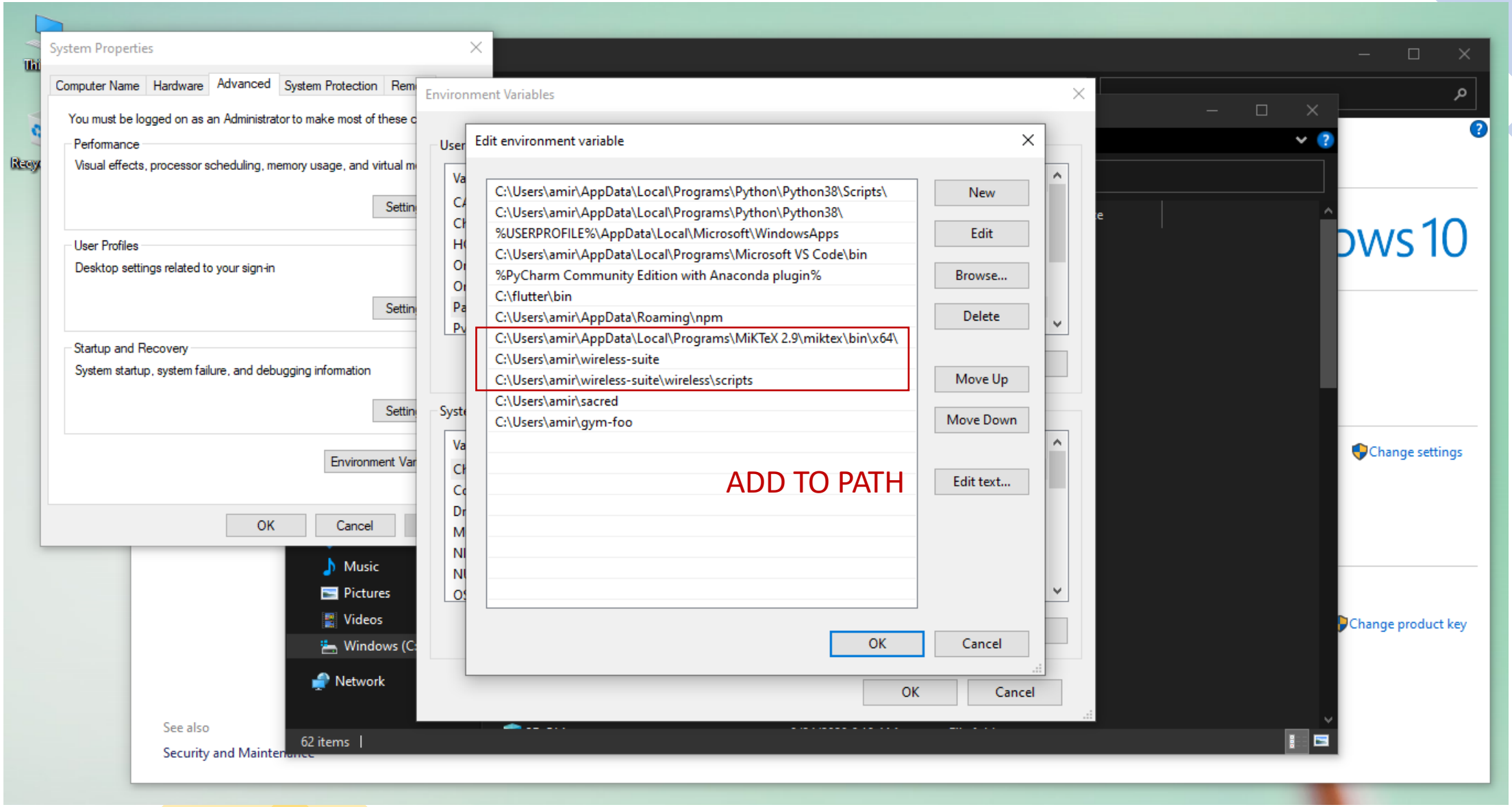
Machine learning



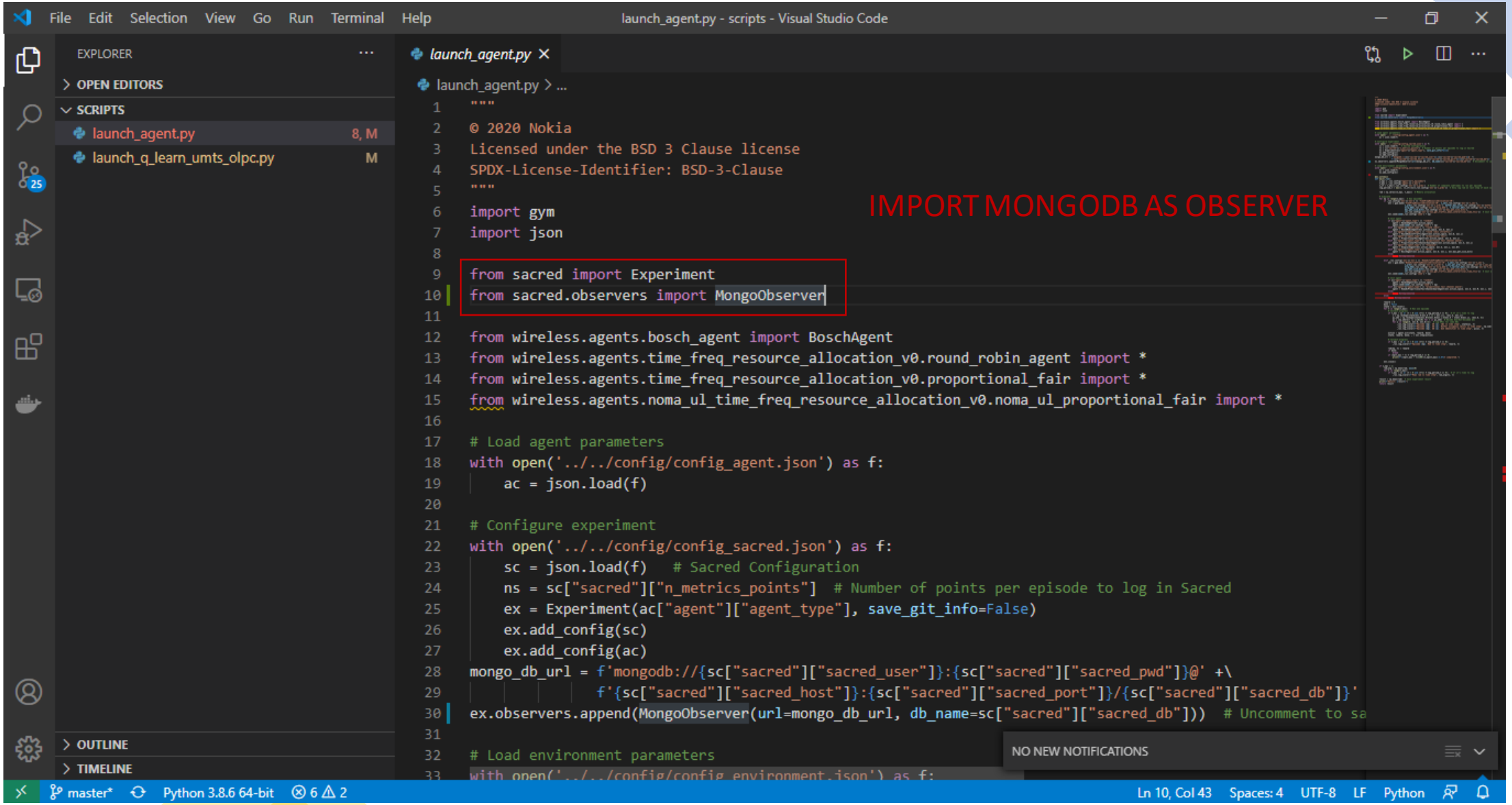
REINFORCEMENT LEARNING

https://youtu.be/kopoLzvh5jY

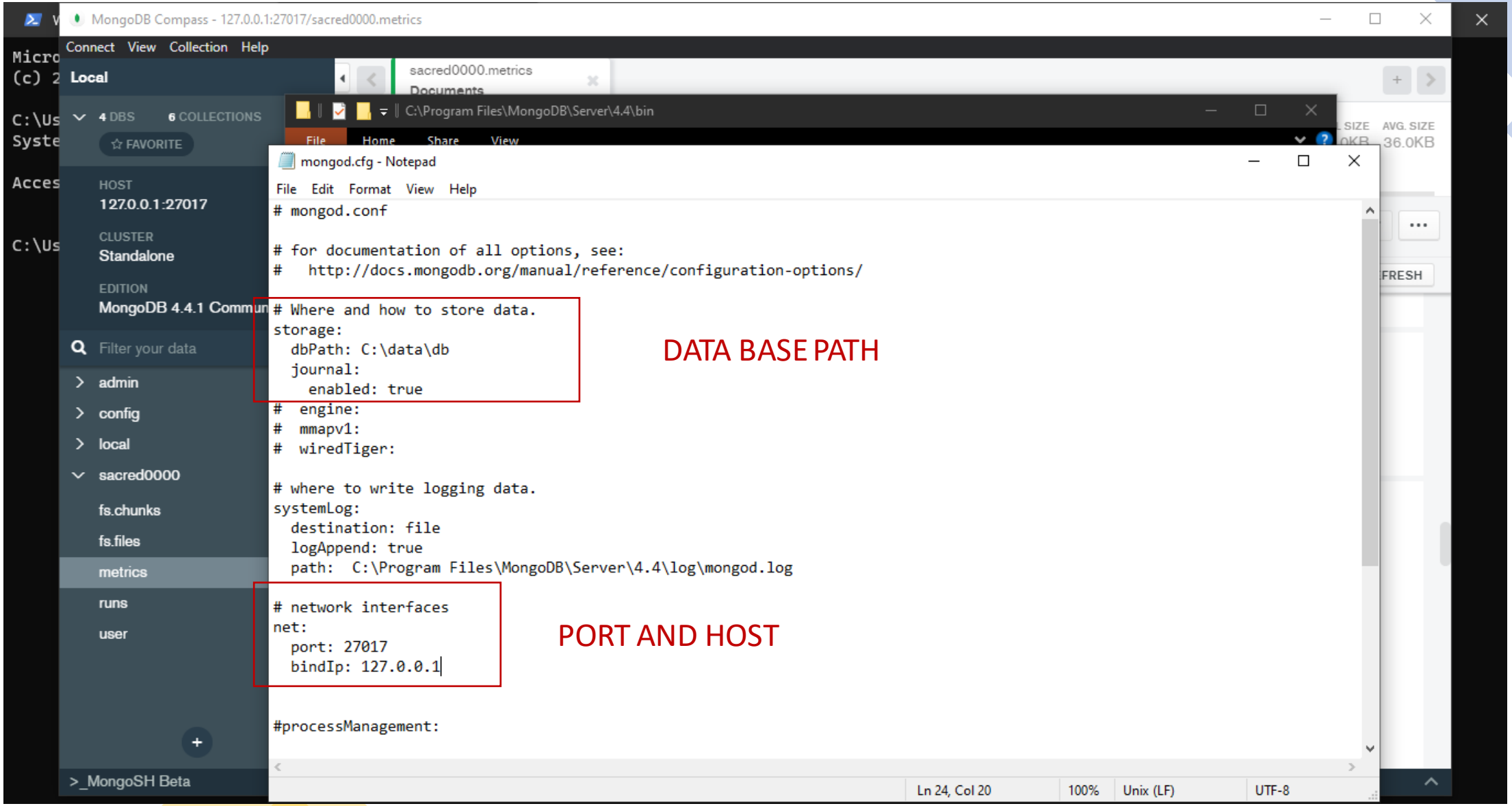
Package should be add to path list



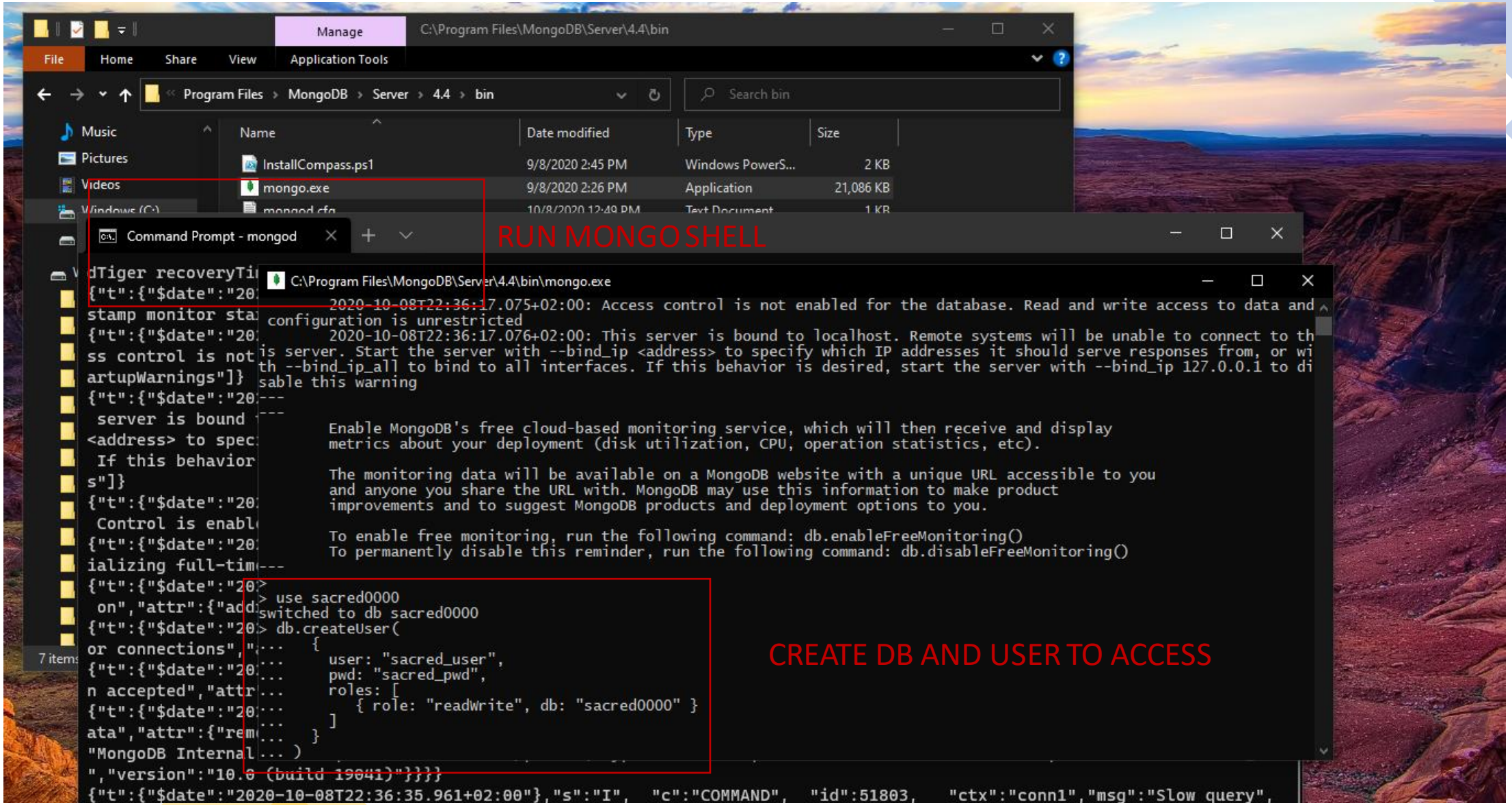
Should be import mongo observer



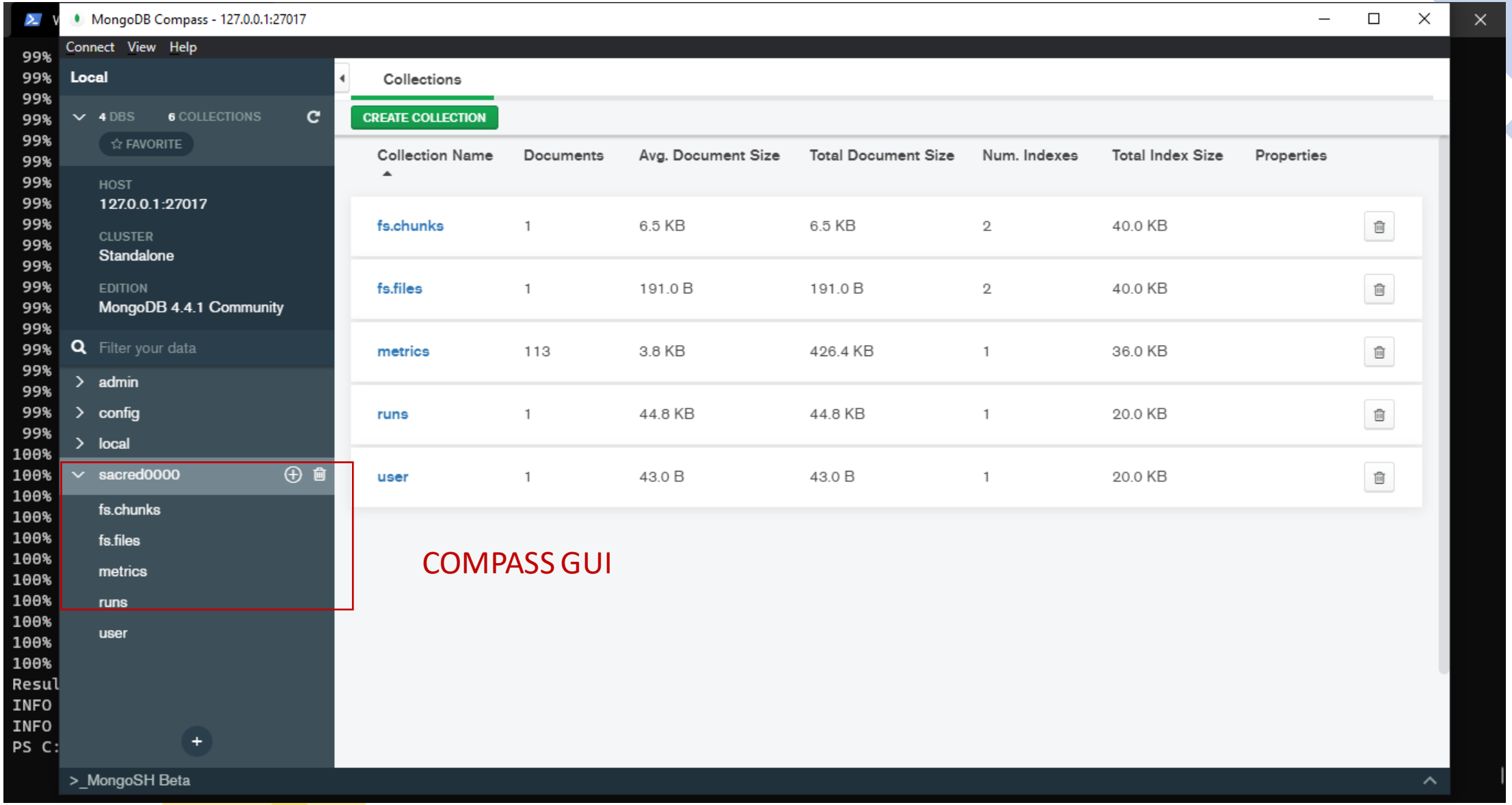
Configuration of mongodb



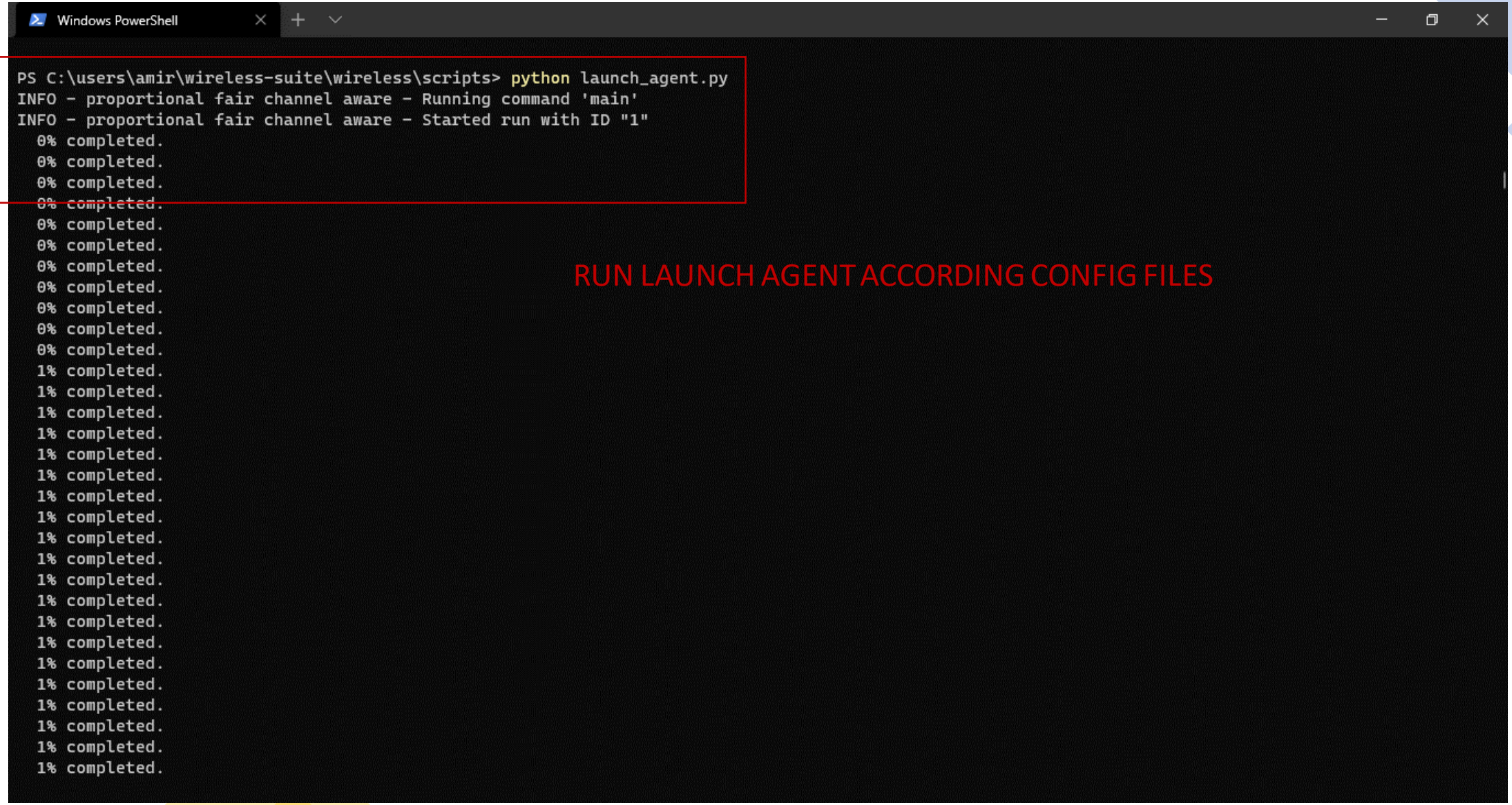
Running mongodb and it’s shell



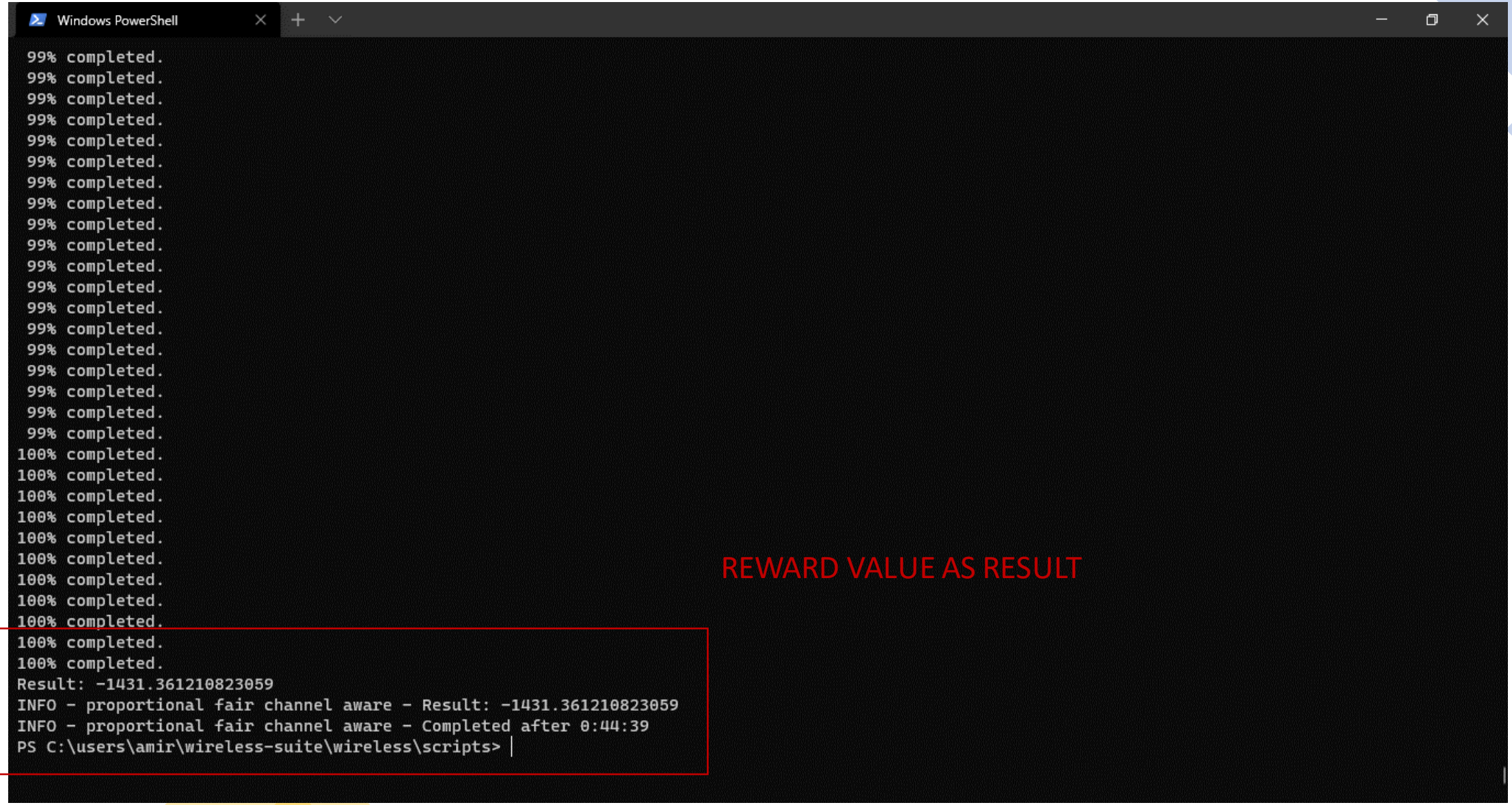
See the data in GUI mongodb compass



Run the simulation

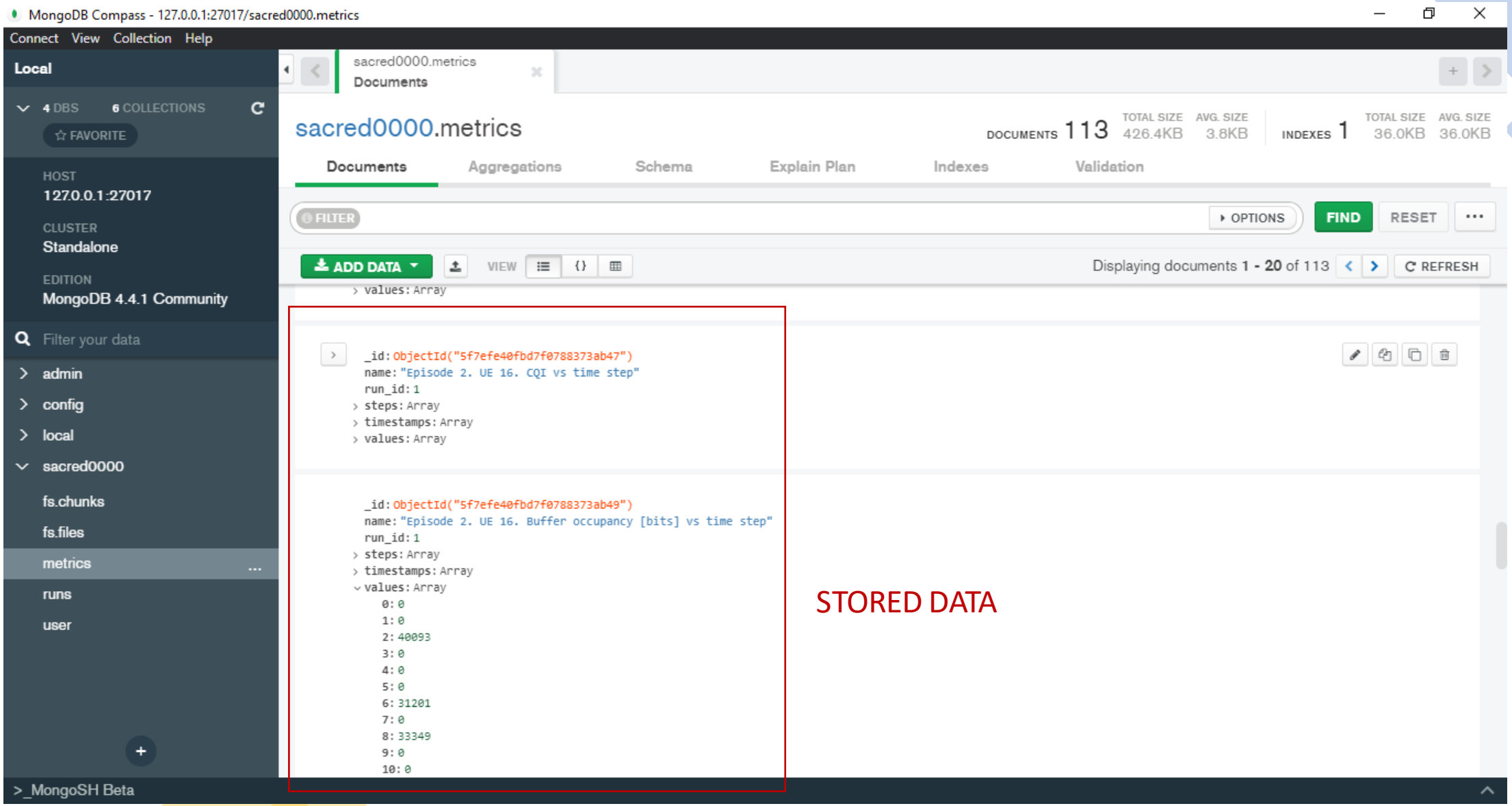


Get the reward number



REWARD VALUE AS RESULT

Evaluate all the datas that are saved



STORED DATA

Gym environment

gym/creating-environments.md

https://github.com/openai/gym/blob/master/docs/creating-environments.md

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- Create a new repo called gym-foo, which should also be a PIP package.
- A good example is https://github.com/openai/gym-soccer.
- It should have at least the following files:

```
gym-foo/
  README.md
  setup.py
  gym_foo/
    __init__.py
    envs/
      __init__.py
      foo_env.py
      foo_extrahard_env.py
```

- `gym-foo/setup.py` should have:

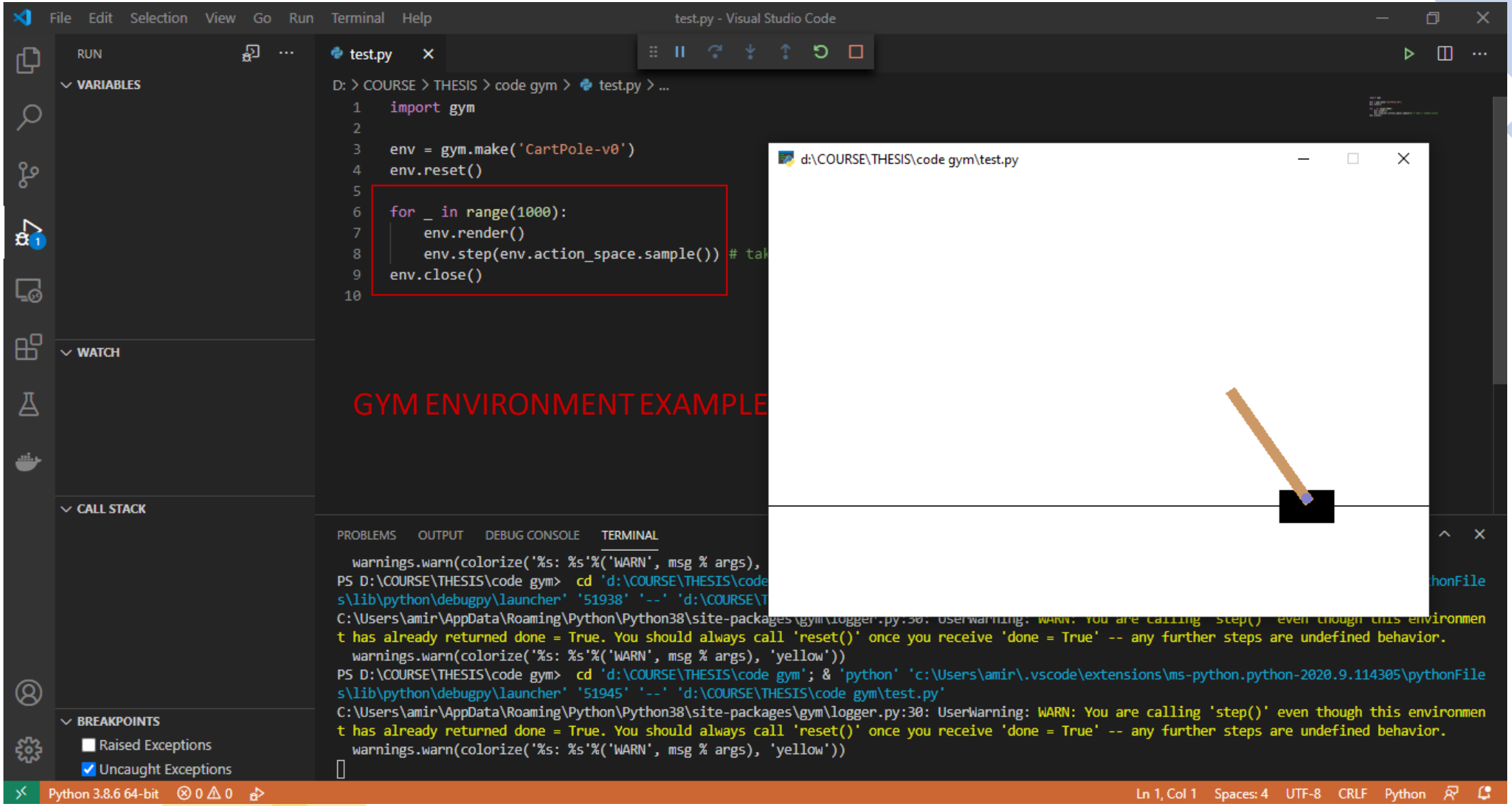
```
from setuptools import setup

setup(name='gym_foo',
      version='0.0.1',
      install_requires=['gym']  # And any other dependencies foo needs
)
```

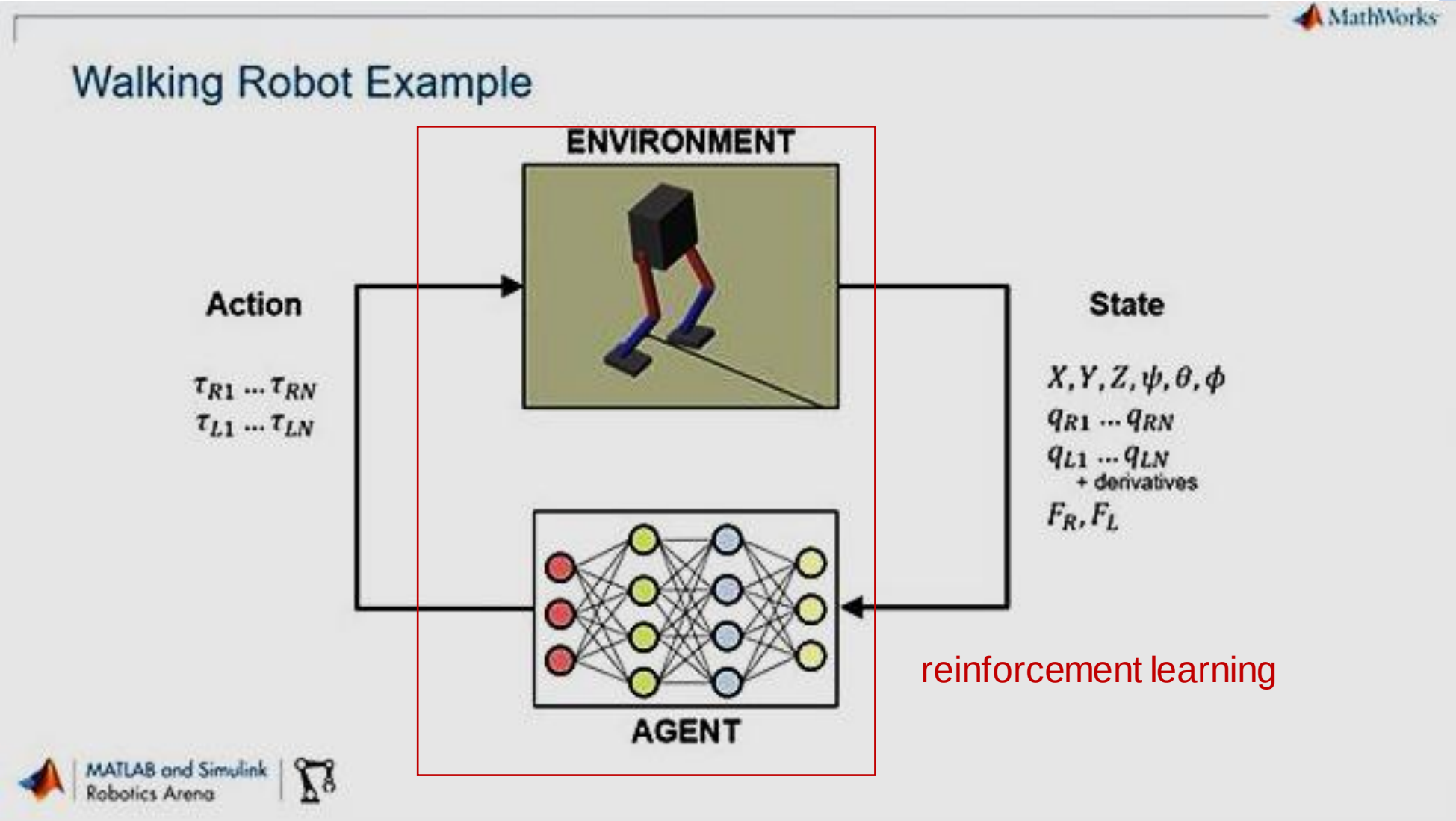
MAKE ENVIRONMENT

- `gym-foo/gym_foo/__init__.py` should have:

Test open ai gym



Matlab



https://it.mathworks.com/products/reinforcement-learning.html

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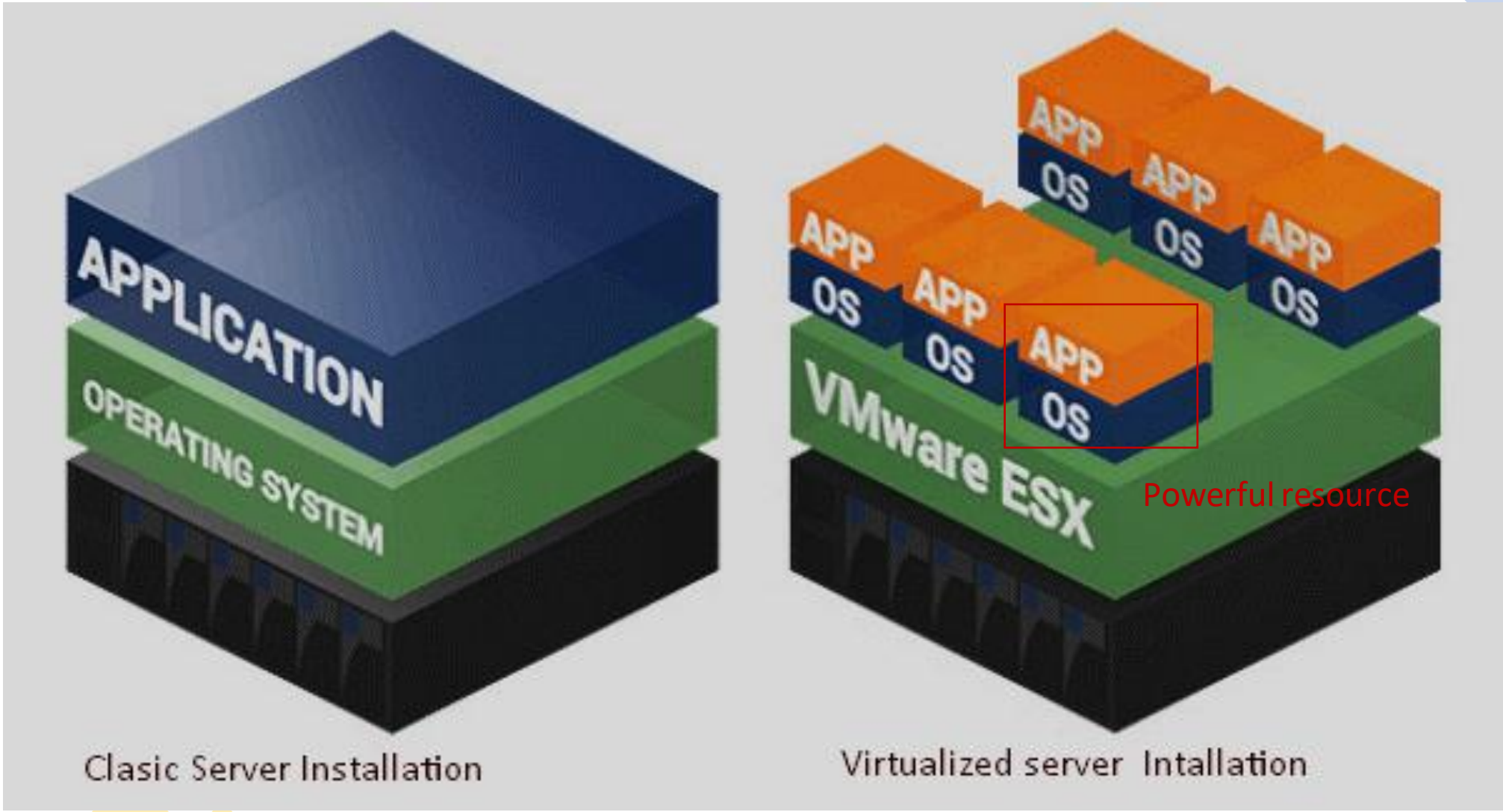
Artificial intelligence in the air

26/10/2020 (oct)

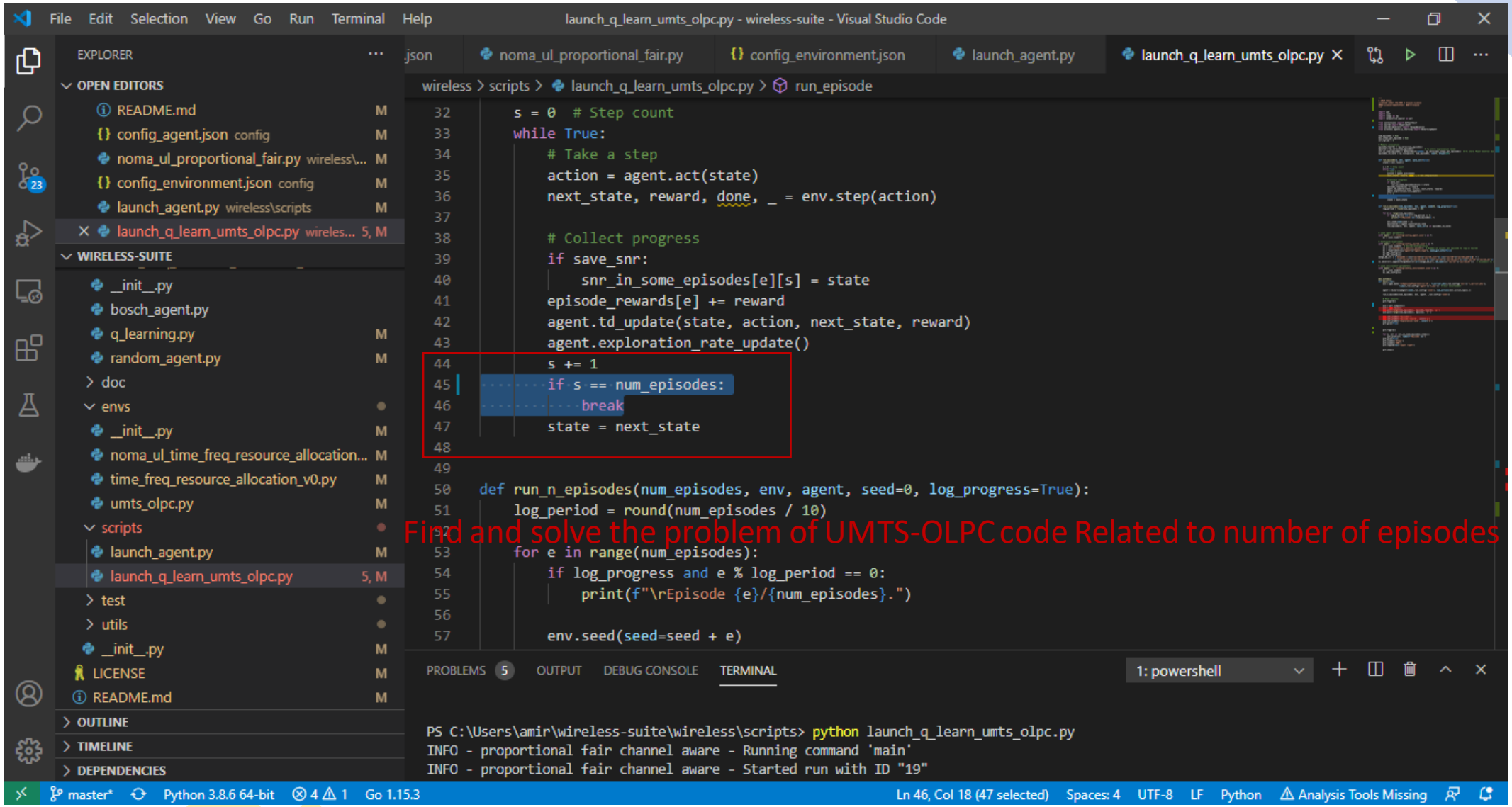
- Exploit all the specification of q-learning python program
- improve the time efficiency

Meeting **three**

Virtualy run on top of powerful HW

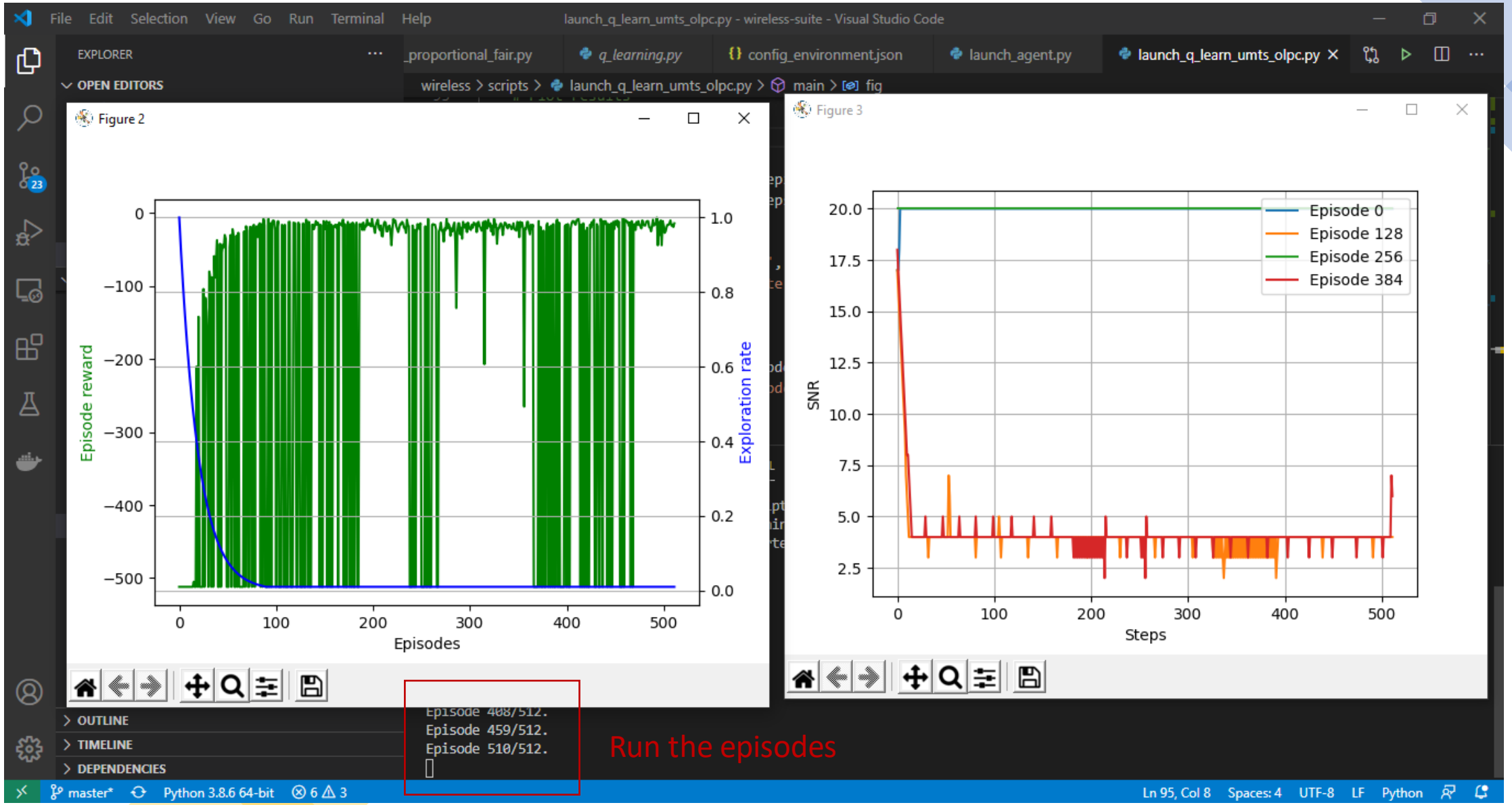


Q-learn



https://www.youtube.com/watch?v=e3L4VocZnnQ

Output plots



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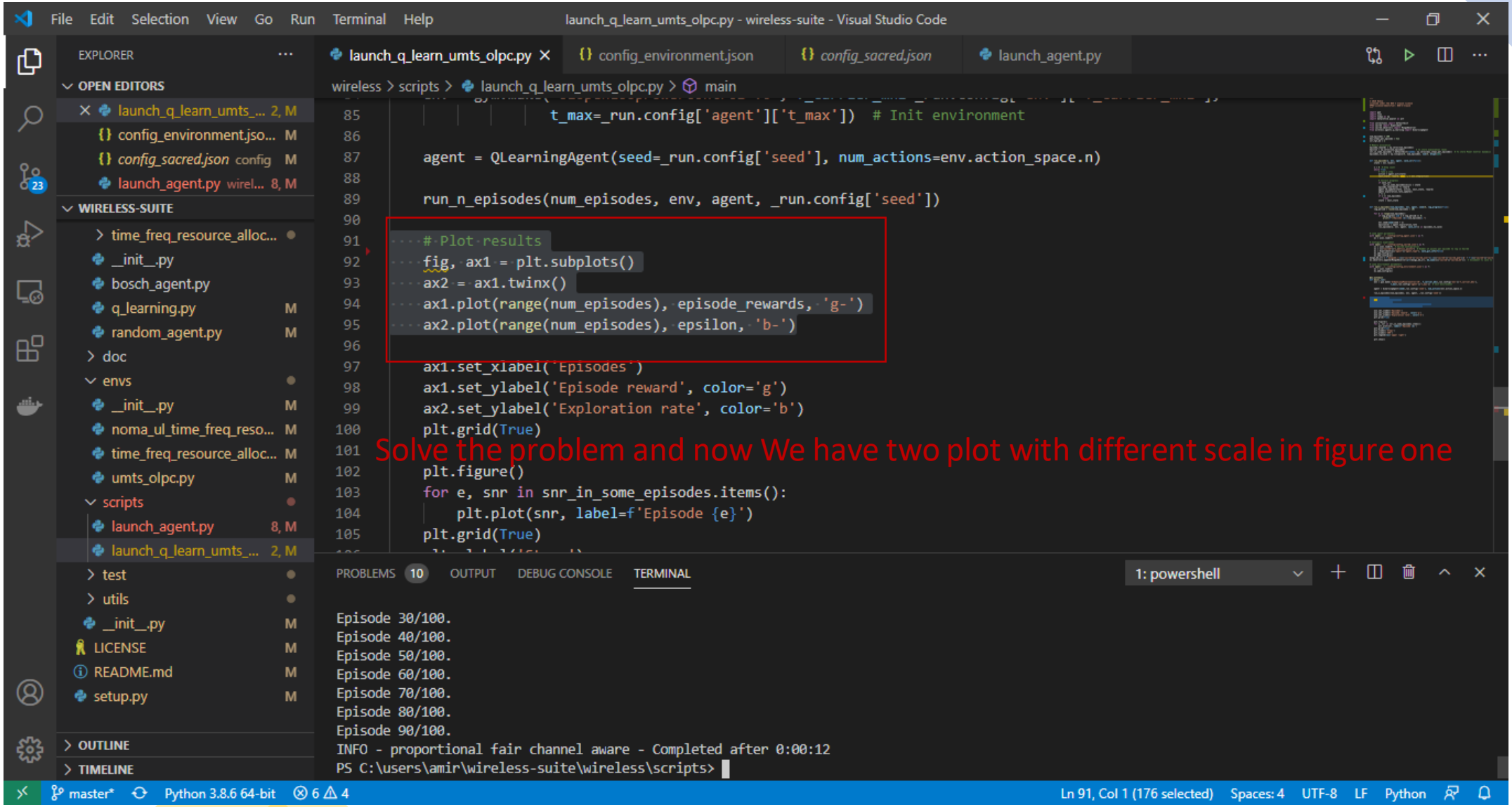
Artificial intelligence in the air

10/11/2020 (nov)

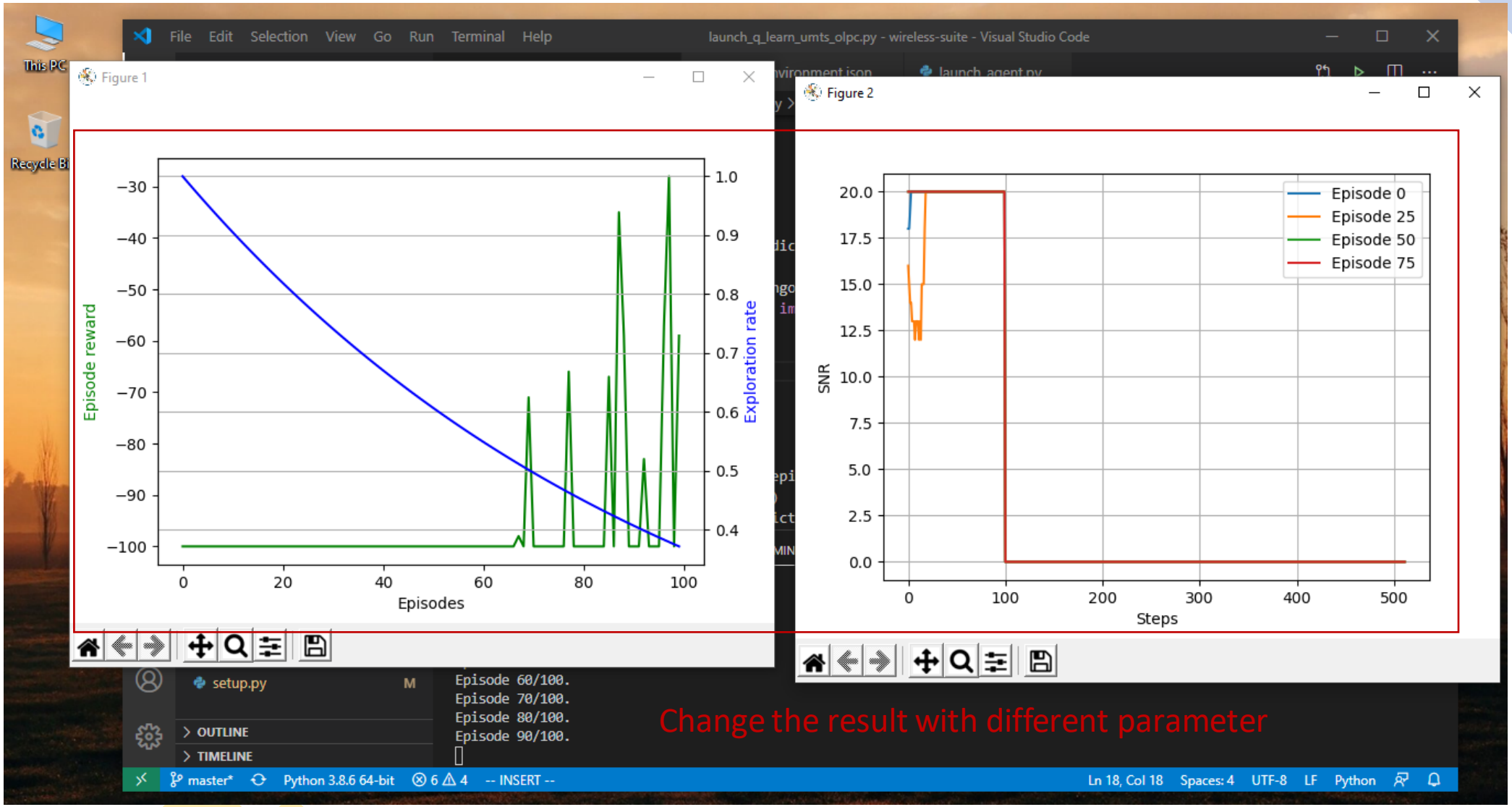
- Solve the problems of q-learning python program
- change the configuration and compare result

Meeting **four**

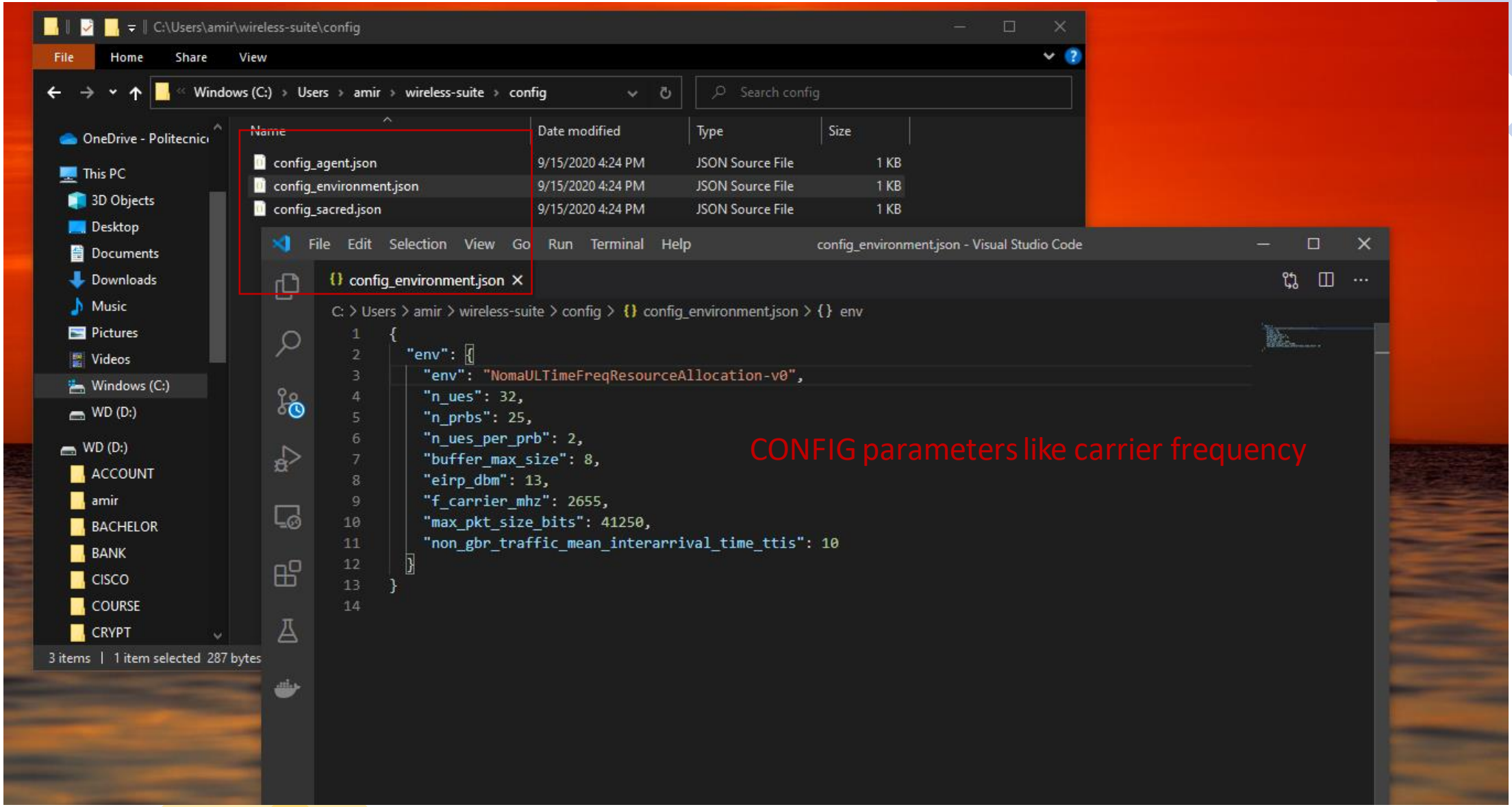
Fix the problem of plots



Comparing results with change config file



Parameters that we can change



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Artificial intelligence in the air

01/12/2020 (dec)

- find split in time frequency file
- implement qlearn in time frequency program

Meeting **five**

Frequency resource allocation