Assignment 5 (Paper)

The goal of this assignment is to implement ***one*** of model-based algorithms using PyTorch, train ***one*** MBRL agents on ***one*** of Atari environments, and use advanced NN architectures such as CNN, Auto Encoders, and RNN.

Summary

1. Install needed Python libraries:
    - Python, Gymnasium, PyTorch, Wandb, huggingface_hub, ale-py
2. Implement **ONE** of the model-based algorithms
    - World Models
    - Model-Based with Model-Free Fine-Tuning (MBMF)
    - Model-Based Policy Optimization (MBPO)
    - Model-Based Value Expansion (MBVE)
3. Setup needed hyperparameter tuning & Wandb
4. Train the RL model in **ONE** of the following Atari environments
    - TetrisNoFrameskip-v4
    - BreakoutNoFrameskip-v4
    - SpaceInvadersNoFrameskip-v4
5. Use "RecordVideo" Wrapper to record the RL agent in-action
6. Publish your model and results to Hugging Face leaderboard
7. **Bonus**: Compare your results with model-free models (DDQN, SAC, PPO) **[2pt for 2 free-models]**

8. Write a research **paper** with the model architecture, hyperparameters, and results

Deliverables

Use can use this paper template or any other template from overleaf (https://www.overleaf.com/read/wbsmvbgzkytx#c67e8b)

Deliver only the paper named with your_team_number.pdf

Add the following to the paper:

1. [link] GitHub repository with Python codes (Gym Environment, models)
2. [link] The recorded video of the trained agent in action

    Tip: add the videos to Wandb as media and share them in a "wandb report"

3. The Important charts in the Experiments chapter. For more sharing you can add an extra WandB report link.

Helping Materials

- World Models: https://worldmodels.github.io/
- MBMF: https://sites.google.com/view/mbmf

- MBPO: https://jannerm.github.io/mbpo-www/
- MVE: https://github.com/danielpalenicek/value_expansion
- https://ale.farama.org/
- https://ale.farama.org/gymnasium-interface/
- https://ale.farama.org/visualization/

Clarifications:

1. Bonus is for (7) only, you need to run the free-models on the Atari environment you choose. The required comparison is not theoretical but experimental.
2. Paper writing tips:
    a. Paper shouldn't exceed 5 pages (excluding title and reference pages)
    b. Introduction: 4 sentences [introduce the topic. why is it important. what is the problem/gap/focus at hand. what are we offering/ what is our aim.]
    c. Lit review: how did we get here with referencing every claim, example:
    اخترع الباحث فلان عجلة مستديرة سنة كذا[مرجع]. ثم أتى باحث آخر فصنع عربة وركبها على العجلة [مرجع]. ثم اقترح آخرون [مرجع] تحسين الاختراع بإضافة أعمدة دعم للعجلة [مرجع]، بينما اقترح أخر رصف الطرق لتقليل المقاومة وبالتالي تسهيل حركة العجلات على الطريق[مرجع]. والآن لدينا ما لدينا من عربات وطرق.