**Overview**

A codebase for a speed-following reinforcement learning (RL) model has been provided to you. This model is designed to learn to follow a reference speed profile by training on a dataset that is split into episodes (chunks) of a given length. The code includes implementations of data chunking, environment definition for training (using variable episode lengths), and testing on the entire dataset.

## Objective

Your task is to extend and modify the provided code in several ways:

* Modify the RL model and experiment with different hyperparameters.
* Adjust the episode length (chunk size) used during training to determine its impact on the model's performance.
* Alter the reward structure to observe how different formulations influence the learning outcome.
* Define and implement quantitative metrics to evaluate the performance of your model. Where possible, include visualizations (e.g., plots comparing the reference speed to the predicted speed, convergence curves, error metrics over time, etc.) that demonstrate the quality of performance.

## Tasks

### 1. Model and Hyperparameter Modifications:

* Experiment with various RL algorithms (e.g., SAC, PPO, TD3, DDPG) and adjust their hyperparameters (learning rate, batch size, buffer size, , , entropy coefficient, etc.).

### 2. Episode Length Variations:

* The provided code generates a 1200-step speed dataset and splits it into episodes of a fixed length (e.g., 100 steps by default). Modify the code so that the episode length (chunk size) is a variable parameter. Test different episode lengths (e.g., 50, 100, 200) to determine the optimal training configuration.

### 3. Reward Structure Adjustments:

* Modify the reward function (for example, changing how the absolute error between the current and reference speeds is penalized) and study the effect on training performance.

### 4. Performance Metrics and Visualization:

* Define quantitative metrics (such as mean absolute error, mean squared error, convergence rate, etc.) to evaluate the performance of your model.
* Provide visualizations that compare the reference speed profile to the predicted speed profile during testing on the full dataset (all 1200 steps). Include plots and any additional visual metrics in your report.

### 5. Report Preparation:

Prepare a comprehensive PDF report that documents your modifications, experiments, and results. Your report should include:

* A description of the changes you made to the model, hyperparameters, episode length, and reward function.
* An explanation of the performance metrics you defined and why you chose them.
* Visualizations of your results, along with an analysis of how each modification affected the performance of the model.
* A discussion of your understanding of the impact of these parameters and design choices on the overall learning process.

## Submission Requirements

* A modified version of the provided code, along with any additional files used.
* A PDF report detailing your experimental setup, modifications, metrics, visualizations, and conclusions.

## Evaluation Criteria

Your assignment will be evaluated based on:

* The correctness and efficiency of your code modifications.
* The thoroughness of your experimental analysis.
* The clarity, quality, and depth of your report, including how well you explain the impact of changes to the model.
* The quality of your visualizations and performance metrics.

## Deadline

Please submit your assignment by the deadline indicated on Webcourses.

## Additional Notes

* Collaboration for discussion purposes is permitted; however, all submitted work (code and report) must be your own.
* Refer to relevant literature and include any additional references in your report.