Environments and Baselines for Multi-task RL

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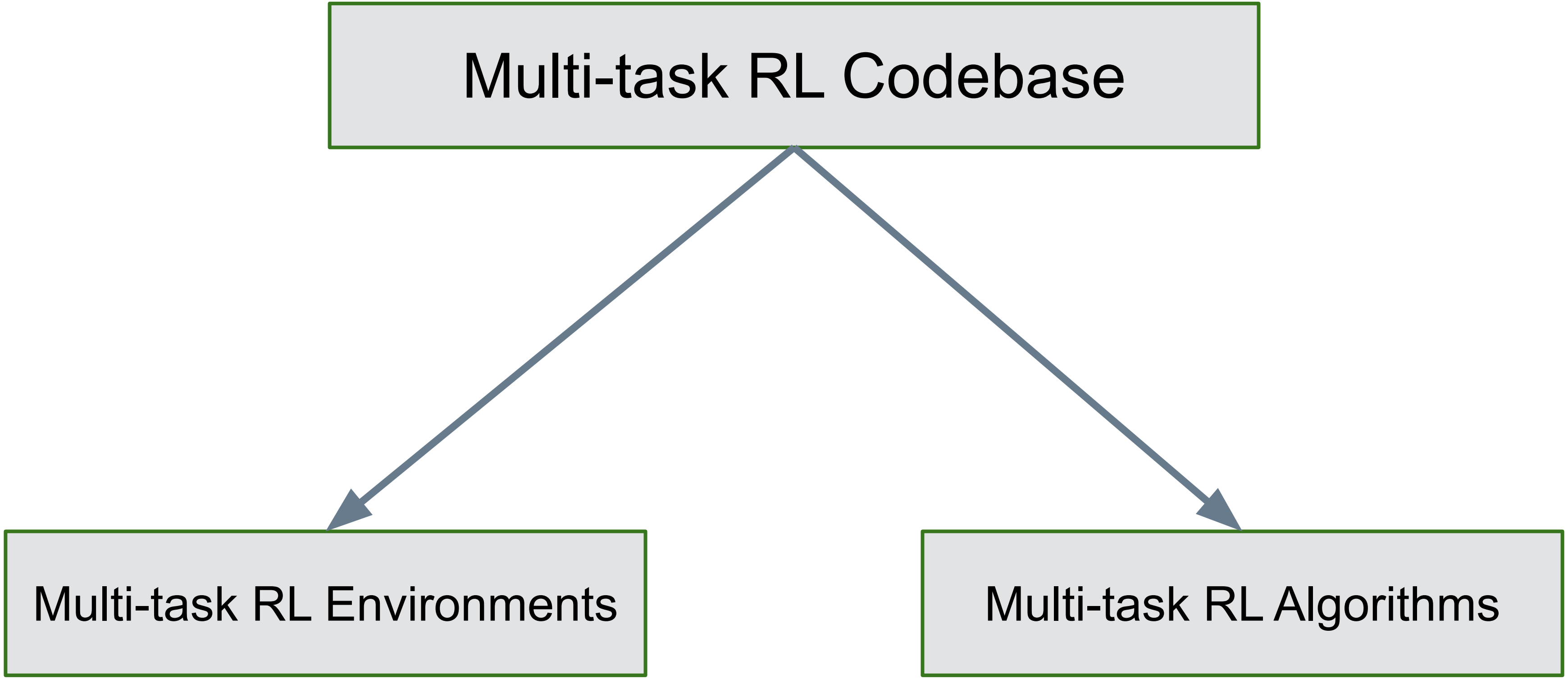
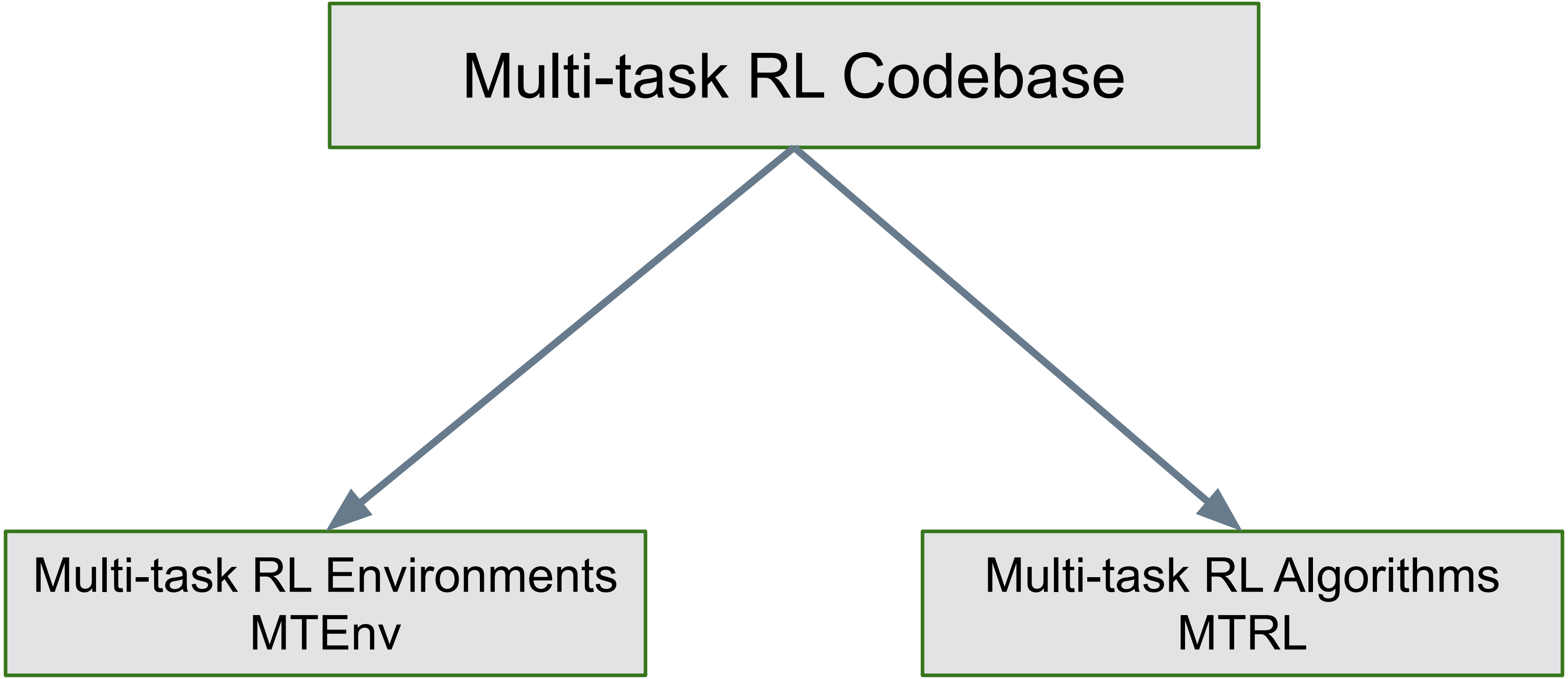
FACEBOOK AI


Multi-task RL Codebase
Multi-task RL Environments
Multi-task RL Algorithms


Multi-task RL Codebase
Multi-task RL Environments
MTEnv
Multi-task RL Algorithms
MTRL

MTEnv

MTEnv: Goals

1. Standardize Multitask RL Environments

2. Provide Better Benchmarks

MTEnv: Standardize Multitask RL Environments

1. OpenAI Gym [1] provides the most popular interface for RL environments.

[1]: https://gym.openai.com/

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3. It is very easy to swap the agent, without changing the environment.

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3. This adds overhead for using other people environments.

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2. Make it easy to port existing environments to MTEnv.

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1. Task Information is a first class citizen.
    a. Separate seed, observation space, etc
    b. Easy to control task

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1. Task Information is a first class citizen.
    a. Separate seed, observation space, etc
    b. Easy to control task
2. Easy to port existing environments to MTEnv
    a. Provide several wrappers to help with that.

MTEnv: Supported Environments

1. Acrobot
2. Cartpole
3. DeepMind Control Suite
4. Meta-World
5. Multi-armed Bandit
6. Tabular MDP
7. Two-Goal Maze

MTEnv: Future Steps

1. Add new envs
2. Release new benchmark
3. Extending the library
    a. Dealing with variable action and observation spaces changes

MTEnv: How to play with it

1. PyPI: mtenv

2. GitHub: https://github.com/facebookresearch/mtenv

MTRL

MTRL: Components

MTRL has two components

1. Base Policy

2. **Plug and play components** to make the policy work on multi-task setup

MTRL: Base Policy

1. Actor
2. Critic
3. Encoder
4. Decoder
5. Transition model
6. Reward model

MTRL: Base Policy

1. SAC
2. SAC-AE
3. DeepMDP

MTRL: Components for Multi-task RL

1. Task/Context Encoder

2. Gradient Manipulation Algorithms

3. Task specific components and selection mechanism - eg Multi-headed policies

4. Centralized policy - Distral

MTRL: Plug and play

Base Components

Actor
Critic
Encoder
Decoder

Multitask RL Components

Multi-head policy

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Multitask RL Components

Multi-head policy

PYTHONPATH=. python3 -u main.py

*setup=metaworld env=metaworld-mt10 *

*agent=state_sac *

agent.multitask.should_use_multi_head_policy=True

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Use Mixture-of-encoders

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Multitask RL Components

Use Mixture-of-encoders

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Multitask RL Components

Use Mixture-of-encoders (4 encoders)

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*agent.encoder.type_to_select=moe *

agent.encoder.moe.num_experts=4

Multitask RL Components

Use Mixture-of-encoders (4 encoders)

MTRL: Plug and play

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Multitask RL Components

Use Mixture-of-encoders

PYTHONPATH=. python3 -u main.py

*setup=metaworld env=metaworld-mt50 *

*agent=state_sac *

agent.encoder.type_to_select=moe

MTRL: How to play with it

1. GitHub: https://github.com/facebookresearch/mtrl

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MTRL: Future Steps

1. Add more base policies and components
    a. PPO, IMPALA etc
    b. Context Aware Dynamics Model
    c. HyperNetworks
    d. Trajectory based context encoders

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MTRL: Future Steps

1. Scaling and Ease of Use
    a. Memory-efficient replay buffers
    b. Scaling policy components
    c. Add examples of complex training pipelines
    d. Pre-trained models and weights

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Thank You

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