REINFORCE vs Actor-Critic

Both are policy gradient algorithms

**REINFORCE**

It optimizes the expected return by following the gradient of the log-policy scaled by the returns obtained from full episodes.

Algorithm summary:

-Collect full episodes using the correct policy (Monte Carlo)

-Compute return

-Update parameters with

Characteristics:

-Simple and unbiased gradient estimate

-No value function required

-High variance due to full-episode returns

-Inefficient sample usage (one update per episode)

-Convergence can be very slow

**Actor-Critic**

It combines REINFORCE and value-based methods. It uses two models:

Actor: learns the policy

Critic: learns a values function to estimate expected returns

It uses temporal-difference learning to estimate the advantage

Update rule

Characteristics:

-Lower variance due to baseline V(s)

-Online updates possible

-Faster and more stable learning

-Biased gradient estimate due to bootstrapping

-Additional model must be trained (extra complexity)

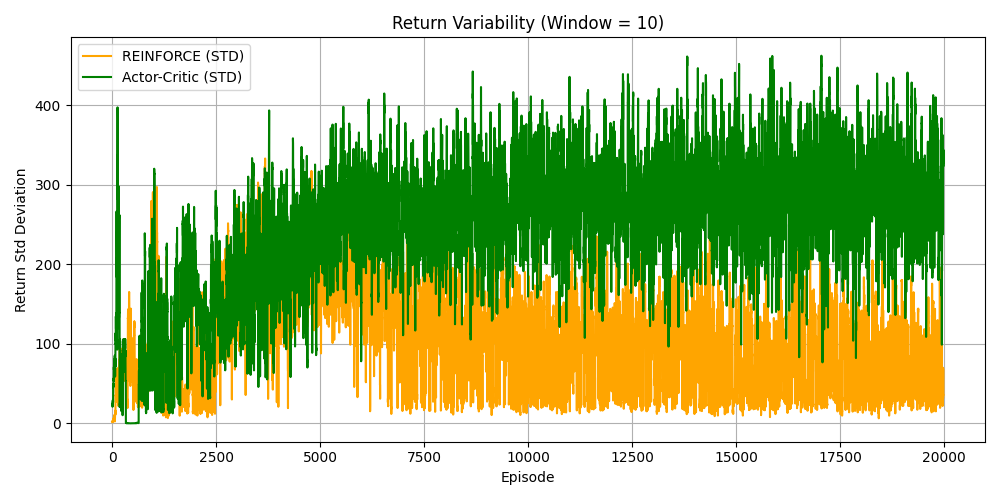
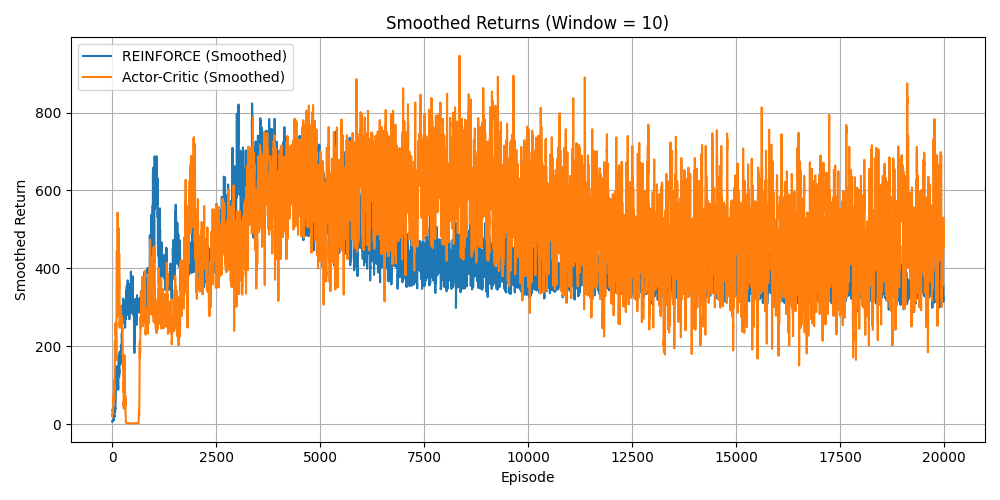
-Sensitive to the quality of the value estimate

**Environment**

Observation space: continuous state vector Box([-inf -inf -inf -inf -inf -inf -inf -inf -inf -inf -inf], [inf inf inf inf inf inf inf inf inf inf inf], (11,), float64)

Action space: continuous joint torques Box([-1. -1. -1.], [1. 1. 1.], (3,), float32)

**Results** (20k steps)



PPO

**Results** (1M steps)

No normalization (Source)

Immagine che contiene testo, Diagramma, diagramma, linea

Il contenuto generato dall'IA potrebbe non essere corretto.

With normalization (Source)

Immagine che contiene testo, Diagramma, linea, diagramma

Il contenuto generato dall'IA potrebbe non essere corretto.

With normalization (Target)

Immagine che contiene testo, Diagramma, diagramma, linea

Il contenuto generato dall'IA potrebbe non essere corretto.

Test on source env (no norm)

Immagine che contiene testo, schermata, diagramma, Diagramma

Il contenuto generato dall'IA potrebbe non essere corretto.

Test on target env (no norm)

Immagine che contiene testo, schermata, diagramma, Diagramma

Il contenuto generato dall'IA potrebbe non essere corretto.

Test on source env (with norm)

Test on target env (with norm)