

Optimized Kalman Filter

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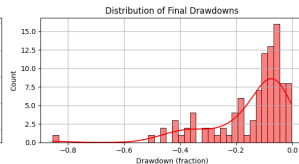
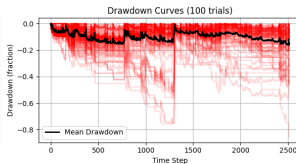
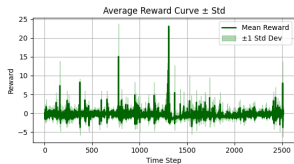
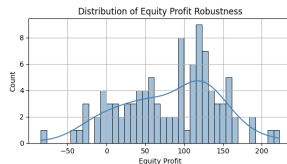
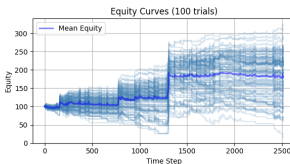
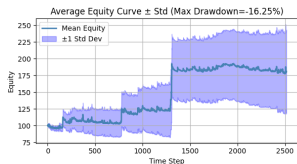


Finding the best reward for VIX

Portfolio Difference Reward

$$\mathcal{R} = x_{portfolio}[t] - x_{portfolio}[t - 1]$$

databases/VIX/results ^VIX 2015 2025 on reward portfolio diff value

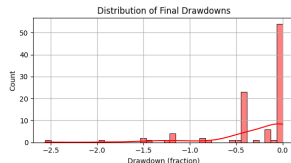
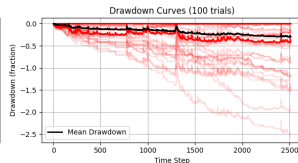
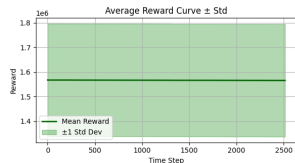
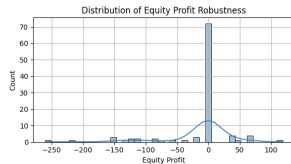
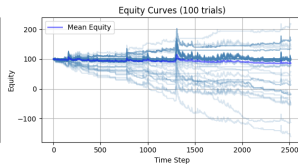
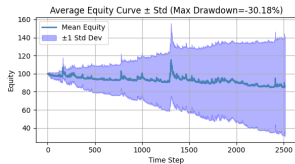


Finding the best reward for VIX

Portfolio Value and Direct Slope Reward

$$\mathcal{R} = \frac{\delta}{\delta t} (x_{portfolio}[t_{\text{last action}}] - x_{portfolio}[t]) * x_{portfolio}[t]$$

databases/VIX/results ^VIX 2015 2025 on reward slope additive

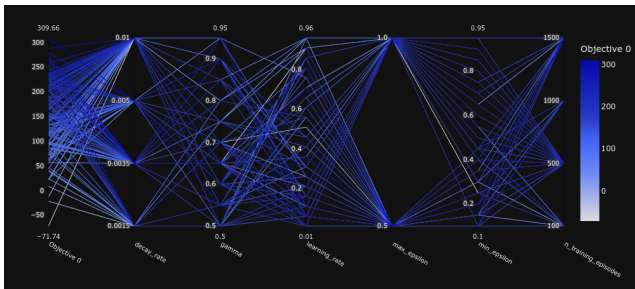
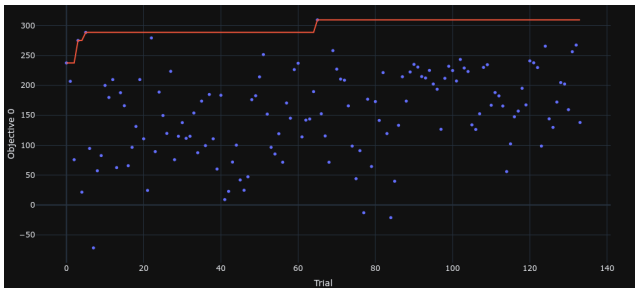


Finding the best reward for VIX

	Diff Reward	Slope Reward
<i>Mean MMD</i>	-36.25%	-30.18%
<i>MMD Distribution</i>	$\sim -9\%$	$\sim -3\%$
<hr/>		
<i>Best agent Profit</i>	284%	218%
<i>Profit Distribution</i>	$\sim 120\%$	$\sim 10\%$

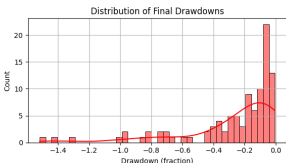
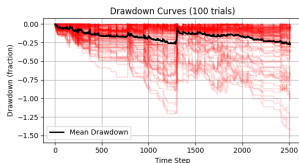
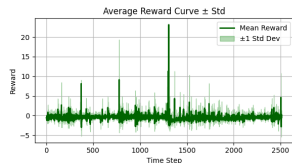
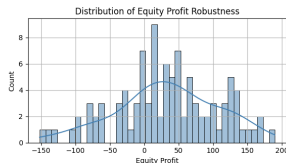
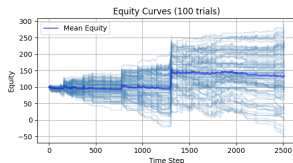
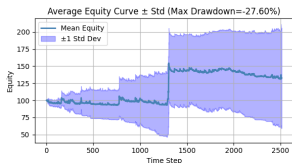


Optuna Hyperparameterization



Optuna Hyperparameterization

results ^VIX 2015 2025 on reward portfolio diff value optimized parameters



Mean MMD

-27.60%

MMD Distribution

$\sim -5\%$

Best agent Profit

290%

Profit Distribution

$\sim 40\%$



Optuna Hyperparameterization

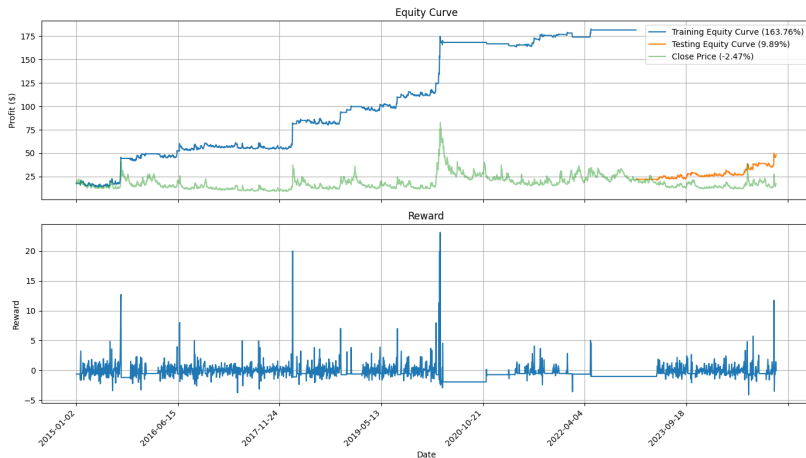


Figure 3: Best performing agent from the 100 training trials



Reward and Parameterization test on DeepQLearning

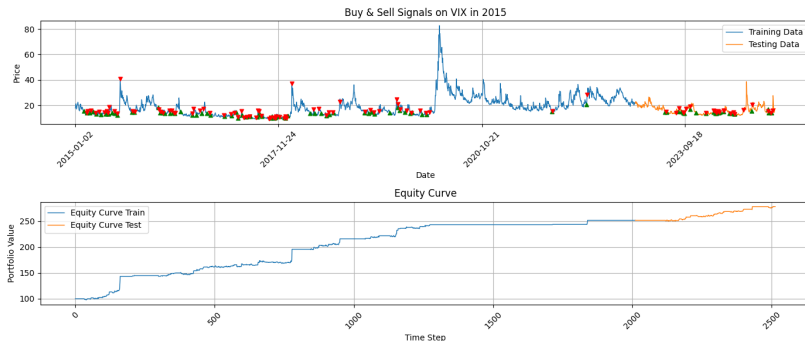


Figure 4: Deep Q-Learning Agent



Agent comparison for VIX

	Q-Learning	Deep Q-Learning (not optimized)
<i>Agent Training Profit</i>	163%	151%
<i>Agent Testing Profit</i>	10%	24%
<hr/>		
<i>Global Profit</i>	173%	175%



Thank You

