Assistant Fine-Tuning Performance Analysis

This document summarizes the results of fine-tuning experiments for generating formal postconditions for smart contracts using different GPT models. The analysis is based on 100 total runs.

Overall Performance Analysis

This section presents the overall success rates of each model across all tasks. Success is defined as generating postconditions that pass verification.

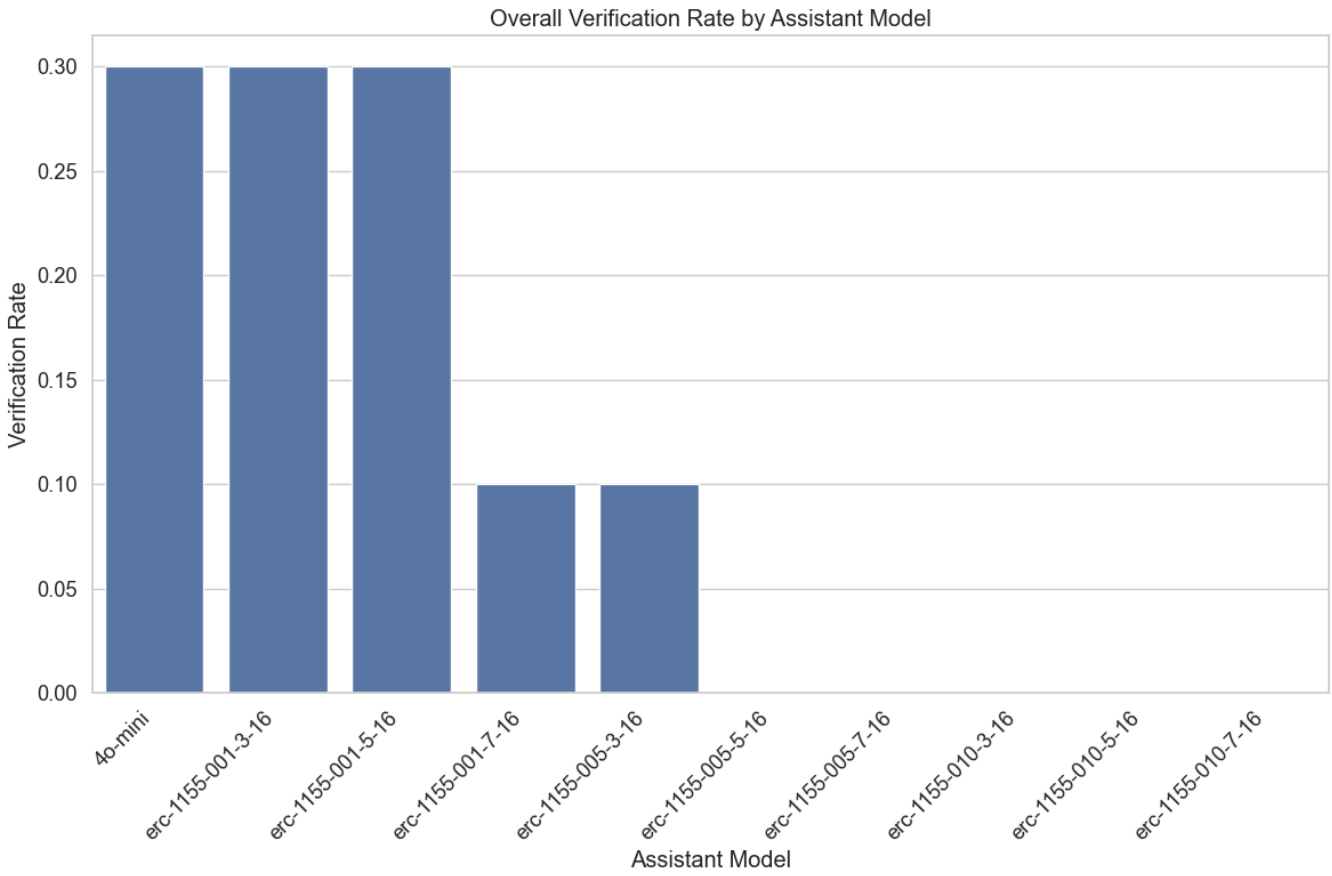
Total Runs Analyzed: 100

Overall Success Rates:

model	verification_rate	verified_count	total_runs
4o-mini	30.00	3	10
erc-1155-001-3-16	30.00	3	10
erc-1155-001-5-16	30.00	3	10
erc-1155-001-7-16	10.00	1	10
erc-1155-005-3-16	10.00	1	10
erc-1155-005-5-16	0.00	0	10
erc-1155-005-7-16	0.00	0	10
erc-1155-010-3-16	0.00	0	10
erc-1155-010-5-16	0.00	0	10
erc-1155-010-7-16	0.00	0	10

Key Observations:

- The '4o-mini' model achieved the highest overall success rate at 30.00%.
- The average verification rate across all models was 11.00%.
- The 'erc-1155-010-7-16' model had the lowest success rate at 0.00%.



Model Specificity Analysis

This section examines how well each model performs when requested to generate postconditions for a particular contract standard.

Success Rate (%) for each Model on each Requested Type:

model	erc721
erc-1155-010-7-16	0.00
erc-1155-010-5-16	0.00
erc-1155-010-3-16	0.00
erc-1155-005-7-16	0.00
erc-1155-005-5-16	0.00
erc-1155-005-3-16	10.00
erc-1155-001-7-16	10.00
erc-1155-001-5-16	30.00
erc-1155-001-3-16	30.00
4o-mini	30.00

Successful Runs / Total Runs for each Model on each Requested Type:

model	erc721
erc-1155-010-7-16	0 / 10

model	erc721
erc-1155-010-5-16	0 / 10
erc-1155-010-3-16	0 / 10
erc-1155-005-7-16	0 / 10
erc-1155-005-5-16	0 / 10
erc-1155-005-3-16	1 / 10
erc-1155-001-7-16	1 / 10
erc-1155-001-5-16	3 / 10
erc-1155-001-3-16	3 / 10
4o-mini	3 / 10

Efficiency Analysis

This section evaluates the efficiency of the models in terms of the number of iterations and time taken to reach a successful verification or exhaust attempts.

Average Iterations and Time per Model:

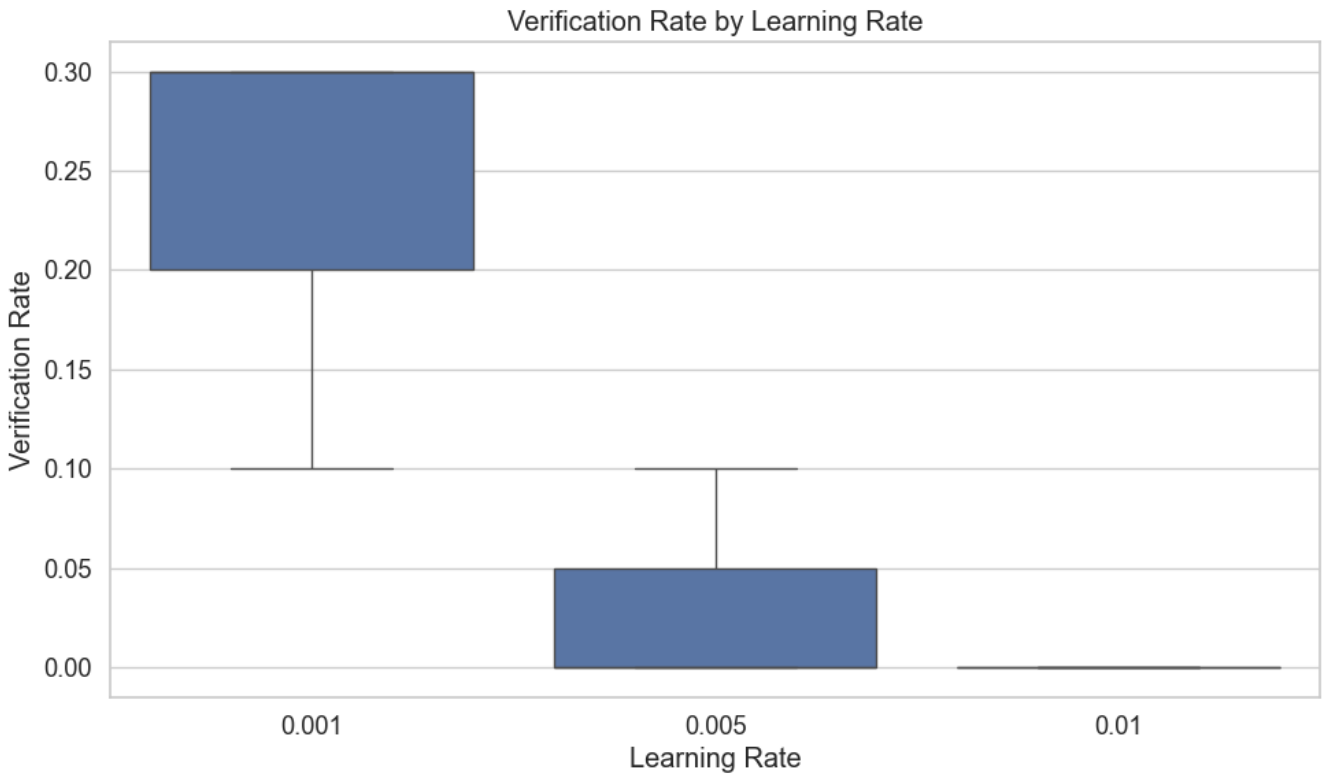
model	avg_fail_iterations	avg_success_iterations	avg_fail_time	avg_success_time	fail_rate
erc-1155-005-5-16	10.0	0.0	253.00987043380738	0.0	100.00
erc-1155-005-7-16	8.3	0.0	218.18202004432678	0.0	100.00
erc-1155-010-3-16	9.0	0.0	244.21443984508514	0.0	100.00
erc-1155-010-5-16	10.0	0.0	271.88993949890136	0.0	100.00
erc-1155-010-7-16	10.0	0.0	262.6734430074692	0.0	100.00
erc-1155-001-7-16	10.0	5.0	395.784632285436	203.3598747253418	90.00

model	avg_fail_iterations	avg_success_iterations	avg_fail_time	avg_success_time	fail_rate
erc-1155-005-3-16	10.0	8.0	402.2135084470113	370.7291696071625	90.00
4o-mini	10.0	5.0	494.73936925615584	289.7690637111664	70.00
erc-1155-001-3-16	10.0	4.0	331.7394518852234	167.11883401870728	70.00
erc-1155-001-5-16	10.0	5.666666666666667	348.4481887817383	246.8782045841217	70.00

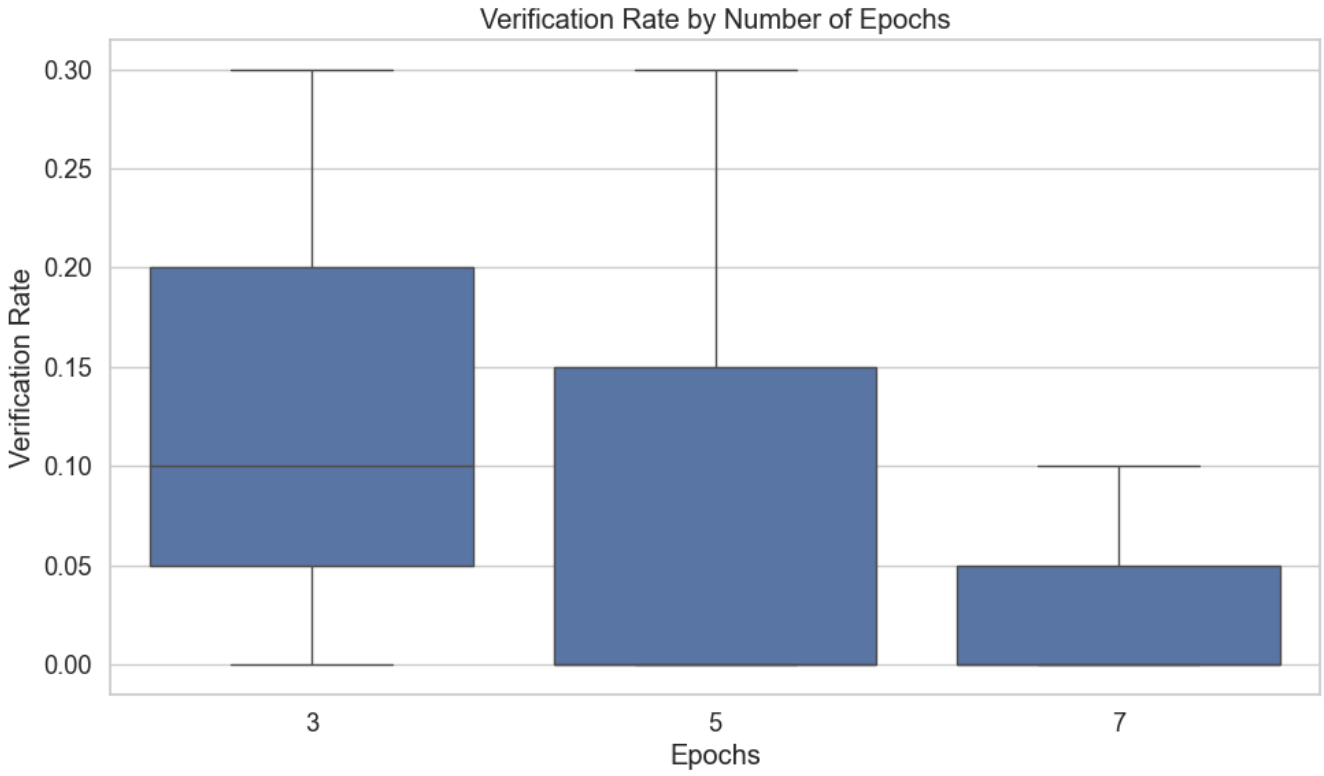
Hyperparameter Analysis

This section analyzes the impact of different hyperparameters (learning rate, epochs, batch size) on model performance.

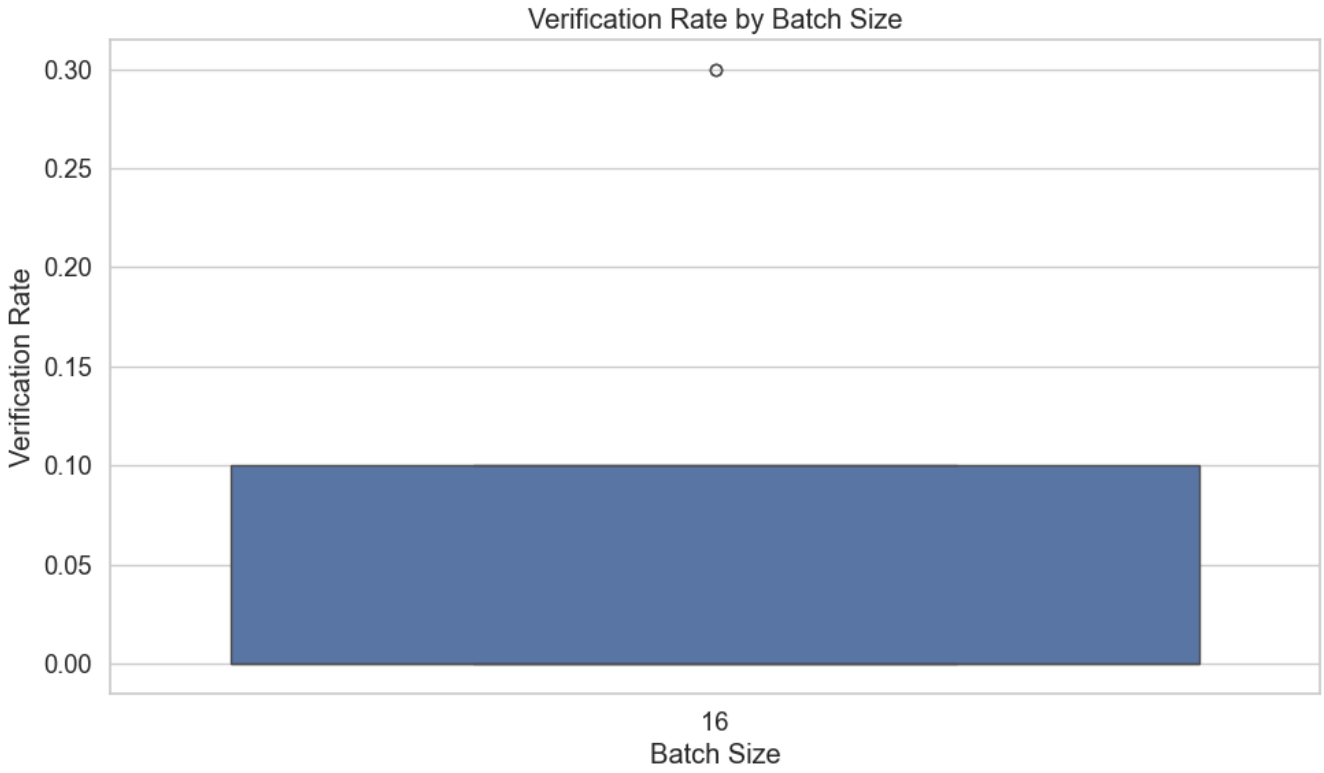
By Learning Rate



By Epochs



By Batch Size



Function-level Verification Analysis

This section examines which specific functions are most successfully verified by each model.

Function Verification Rates

Overall Conclusion

Based on the analysis, the following conclusions can be drawn:

1. The models `4o-mini`, `erc-1155-001-3-16` and `erc-1155-001-5-16` demonstrated the highest overall verification rates.
2. Fine-tuning generally improved performance compared to the baseline `4o-mini` model (verification rate: 30.00%).
3. The optimal hyperparameters appear to be a learning rate of 0.001, 3 epochs, and a batch size of 16.
4. Successful verification attempts are significantly faster than failed attempts, suggesting that early success indicators can help determine when a model is likely to produce valid postconditions.

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