Assistant Fine-Tuning Performance Analysis Entire Contract

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 80 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.

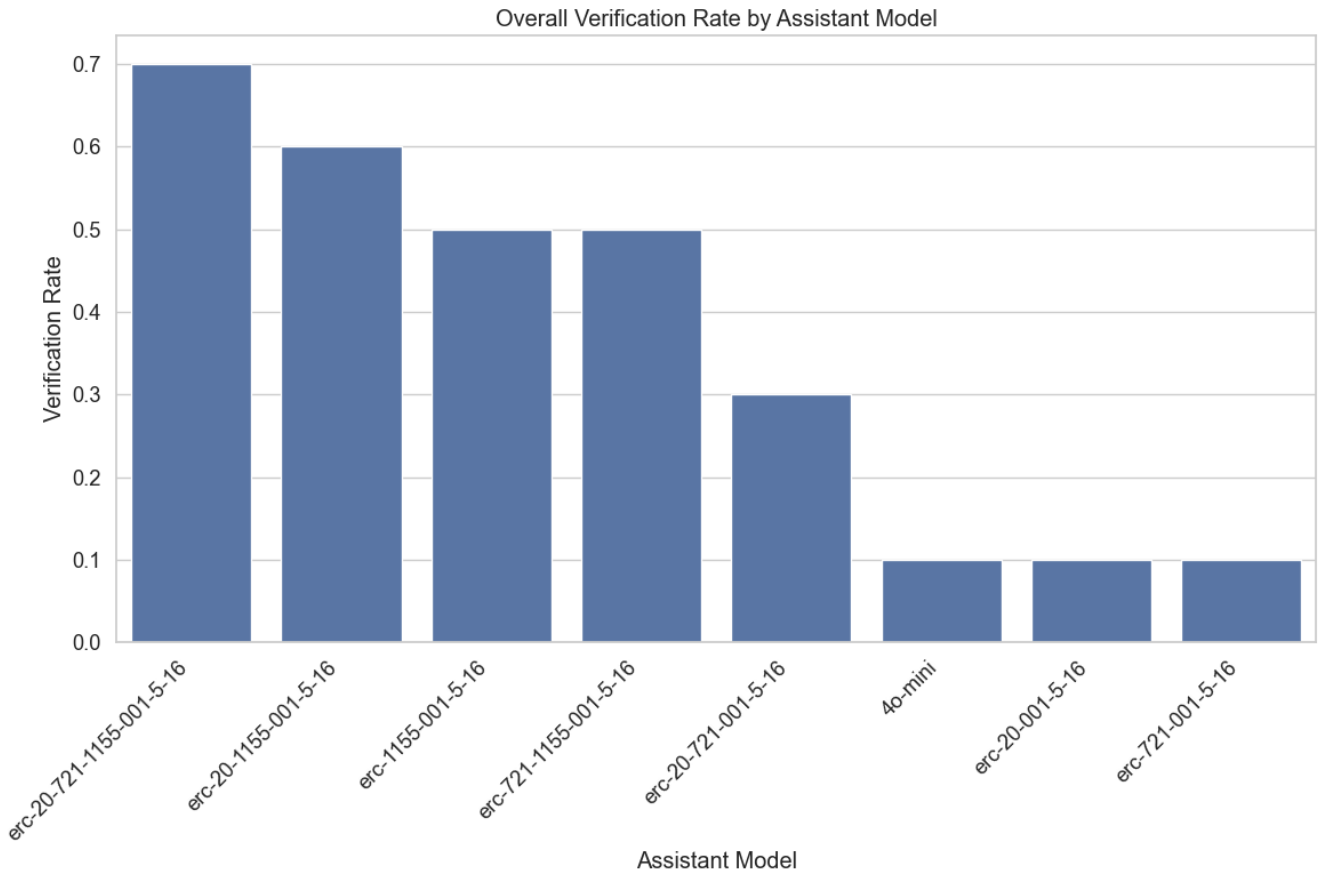
Total Runs Analyzed: 80

Overall Success Rates:

model	verification_rate	verified_count	total_runs
erc-20-721-1155-001-5-16	70.00	7	10
erc-20-1155-001-5-16	60.00	6	10
erc-1155-001-5-16	50.00	5	10
erc-721-1155-001-5-16	50.00	5	10
erc-20-721-001-5-16	30.00	3	10
4o-mini	10.00	1	10
erc-20-001-5-16	10.00	1	10
erc-721-001-5-16	10.00	1	10

Key Observations:

- The 'erc-20-721-1155-001-5-16' model achieved the highest overall success rate at 70.00%.
- The average verification rate across all models was 36.25%.
- The 'erc-721-001-5-16' model had the lowest success rate at 10.00%.



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	erc1155
erc-721-1155-001-5-16	50.00
erc-721-001-5-16	10.00
erc-20-721-1155-001-5-16	70.00
erc-20-721-001-5-16	30.00
erc-20-1155-001-5-16	60.00
erc-20-001-5-16	10.00
erc-1155-001-5-16	50.00
4o-mini	10.00

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

model	erc1155
erc-721-1155-001-5-16	5 / 10
erc-721-001-5-16	1 / 10
erc-20-721-1155-001-5-16	7 / 10

model	erc1155
erc-20-721-001-5-16	3 / 10
erc-20-1155-001-5-16	6 / 10
erc-20-001-5-16	1 / 10
erc-1155-001-5-16	5 / 10
4o-mini	1 / 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:

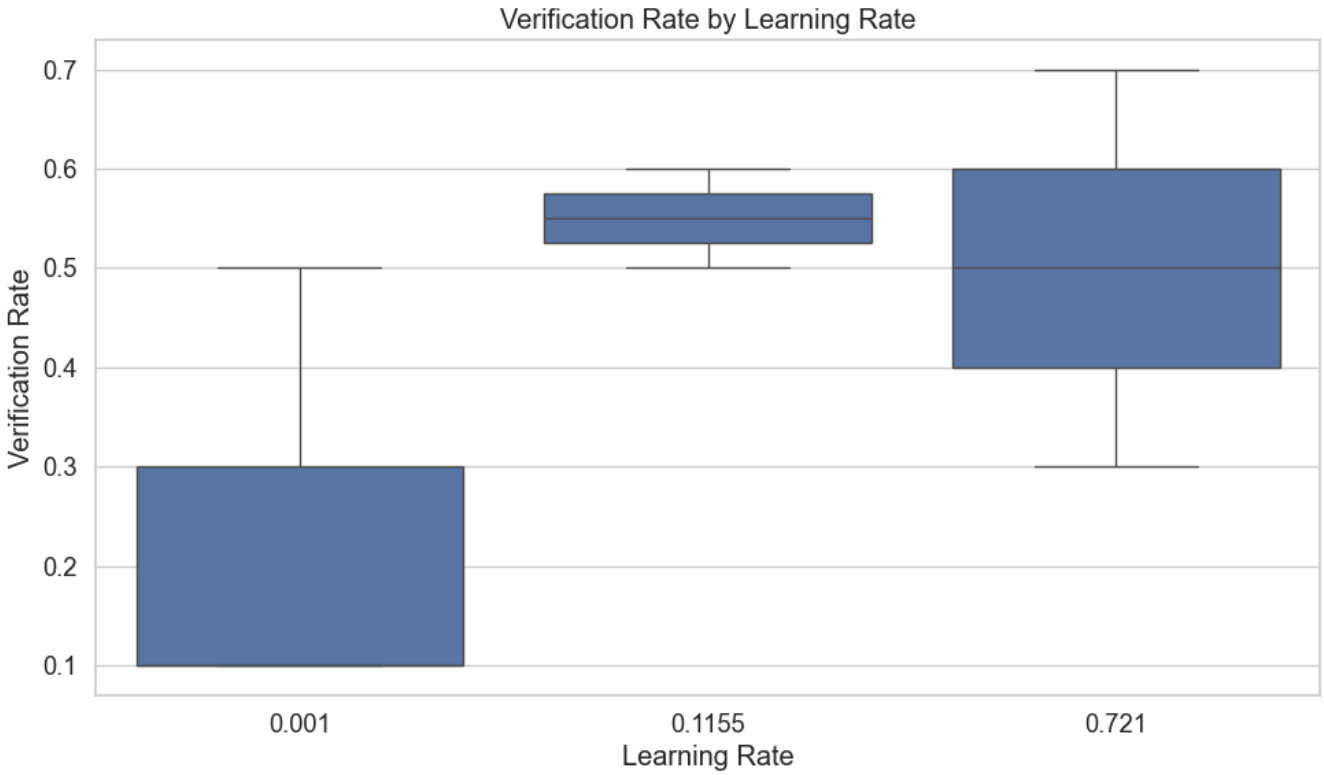
model	avg_fail_iterations	avg_success_iterations	avg_fail_time	avg_success_time	fail_rate
4o-mini	10.0	2.0	394.29024481773376	131.73115611076355	90.00
erc-20-001-5-16	10.0	6.0	506.8208063973321	337.18719458580017	90.00
erc-721-001-5-16	10.0	1.0	303.4327322906918	155.34373307228088	90.00
erc-20-721-001-5-16	10.0	1.6666666666666667	477.40826289994374	128.38063486417136	70.00
erc-1155-001-5-16	10.0	0.4	332.8495099544525	72.63426847457886	50.00
erc-721-1155-001-5-16	10.0	1.8	475.6532118320465	188.09829206466674	50.00
erc-20-1155-001-5-16	10.0	2.6666666666666665	544.839805483818	169.74025563398996	40.00

model	avg_fail_iterations	avg_success_iterations	avg_fail_time	avg_success_time	fail_rate
erc-20-721-1155-001-5-16	10.0	2.142857142857143	421.9002103805542	144.10592917033605	30.00

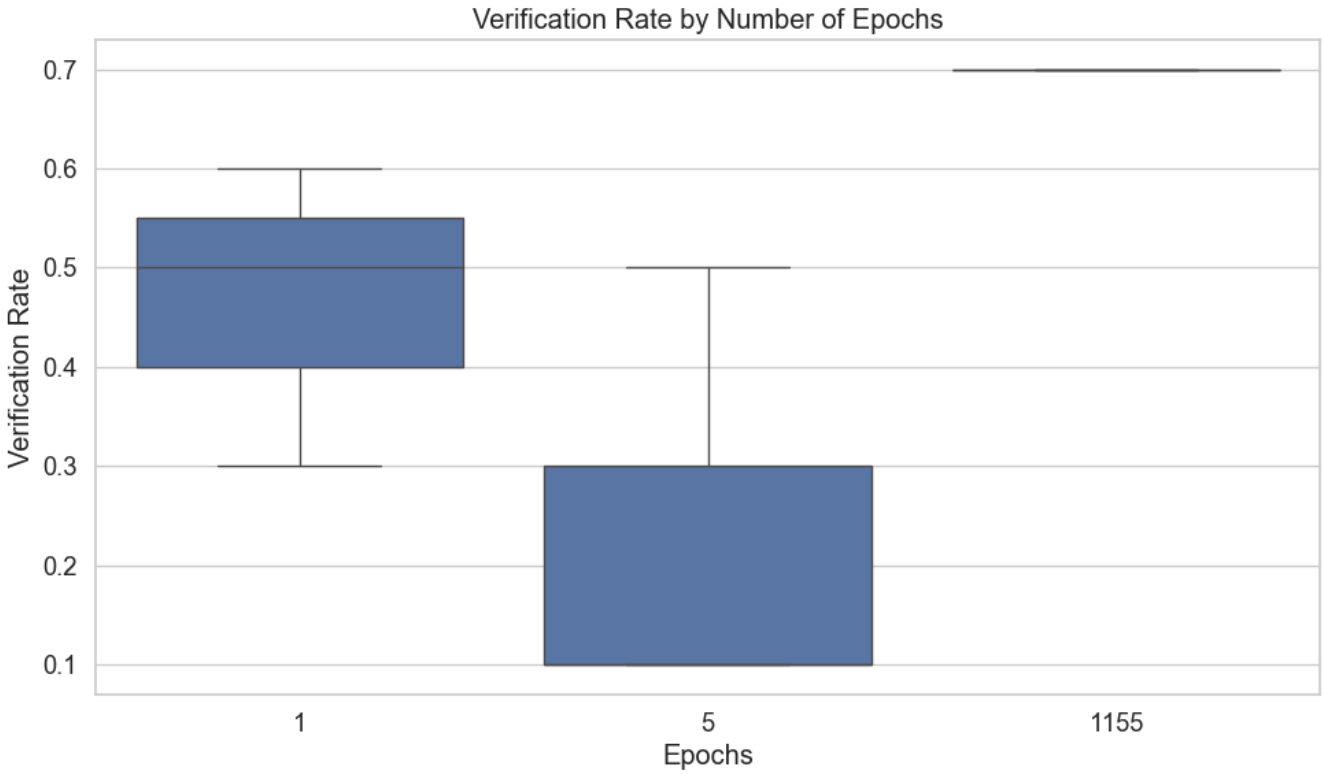
Hyperparameter Analysis

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

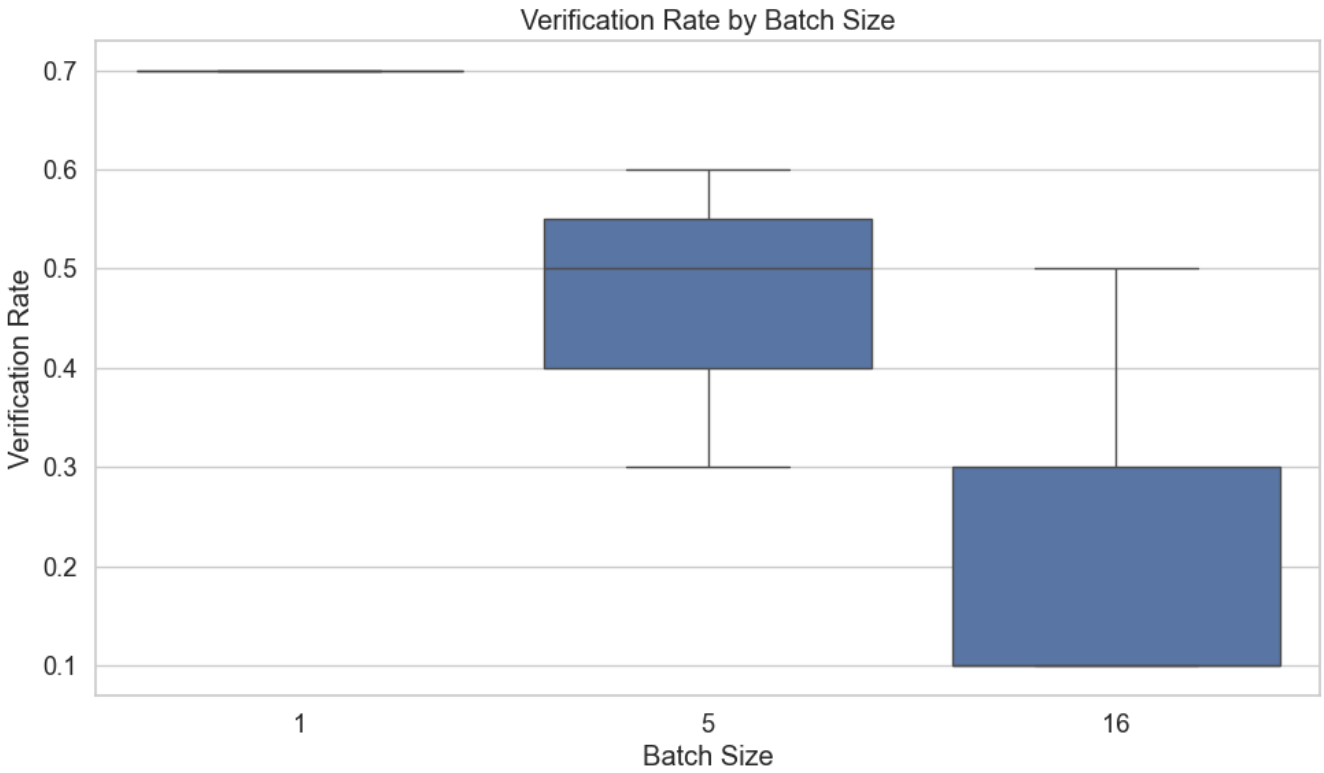
By Learning Rate



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 `erc-20-721-1155-001-5-16`, `erc-20-1155-001-5-16` 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: 10.00%).
3. The optimal hyperparameters appear to be a learning rate of 0.116, 1155 epochs, and a batch size of 1.
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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