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 90 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.

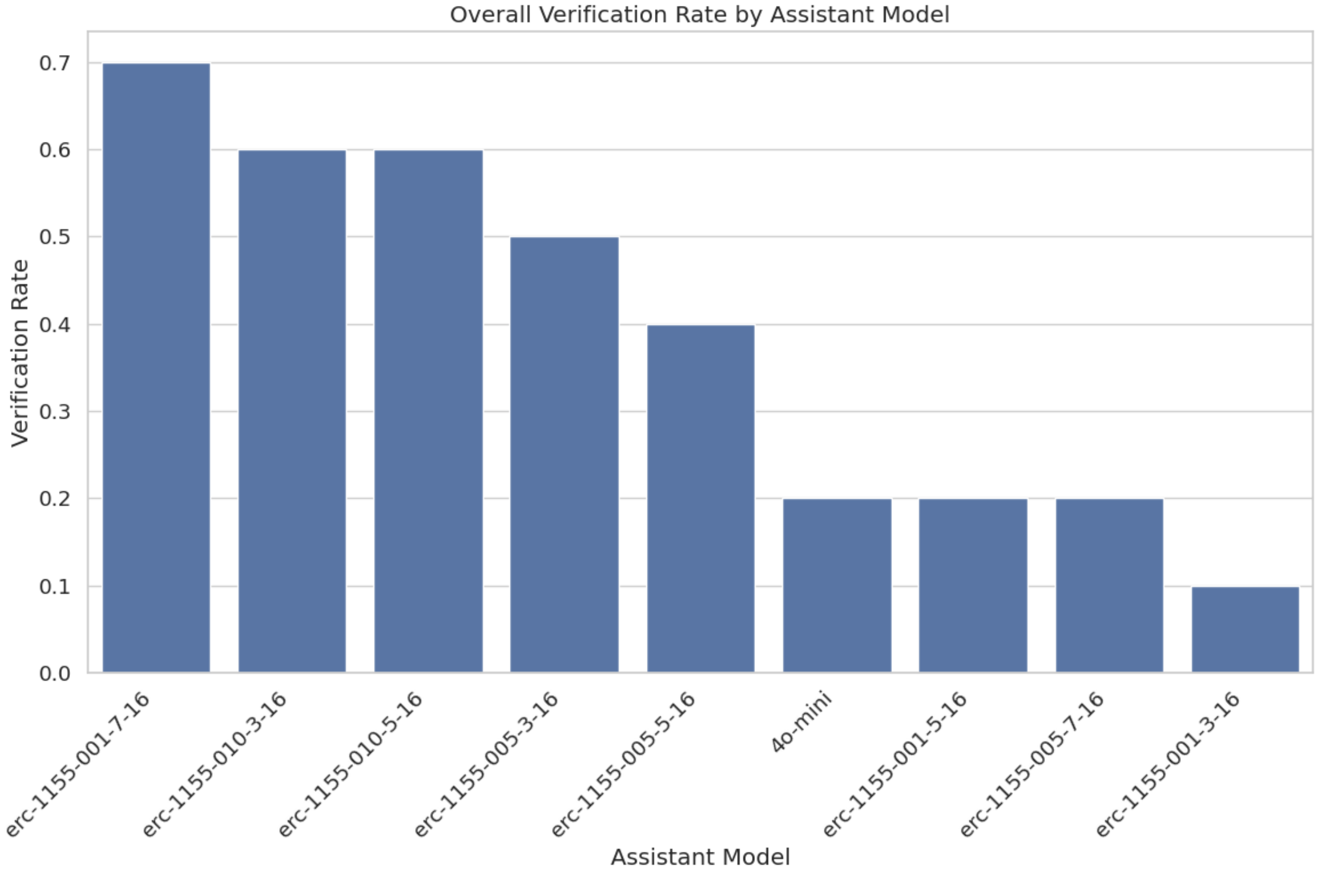
Total Runs Analyzed: 90

Overall Success Rates:

model	verification_rate	verified_count	total_runs
erc-1155-001-7-16	70.00	7	10
erc-1155-010-3-16	60.00	6	10
erc-1155-010-5-16	60.00	6	10
erc-1155-005-3-16	50.00	5	10
erc-1155-005-5-16	40.00	4	10
4o-mini	20.00	2	10
erc-1155-001-5-16	20.00	2	10
erc-1155-005-7-16	20.00	2	10
erc-1155-001-3-16	10.00	1	10

Key Observations:

- The 'erc-1155-001-7-16' model achieved the highest overall success rate at 70.00%.
- The average verification rate across all models was 38.89%.
- The 'erc-1155-001-3-16' 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	erc20
erc-1155-010-5-16	60.00
erc-1155-010-3-16	60.00
erc-1155-005-7-16	20.00
erc-1155-005-5-16	40.00
erc-1155-005-3-16	50.00
erc-1155-001-7-16	70.00
erc-1155-001-5-16	20.00
erc-1155-001-3-16	10.00
4o-mini	20.00

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

model	erc20
erc-1155-010-5-16	6 / 10
erc-1155-010-3-16	6 / 10

model	erc20
erc-1155-005-7-16	2 / 10
erc-1155-005-5-16	4 / 10
erc-1155-005-3-16	5 / 10
erc-1155-001-7-16	7 / 10
erc-1155-001-5-16	2 / 10
erc-1155-001-3-16	1 / 10
4o-mini	2 / 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:

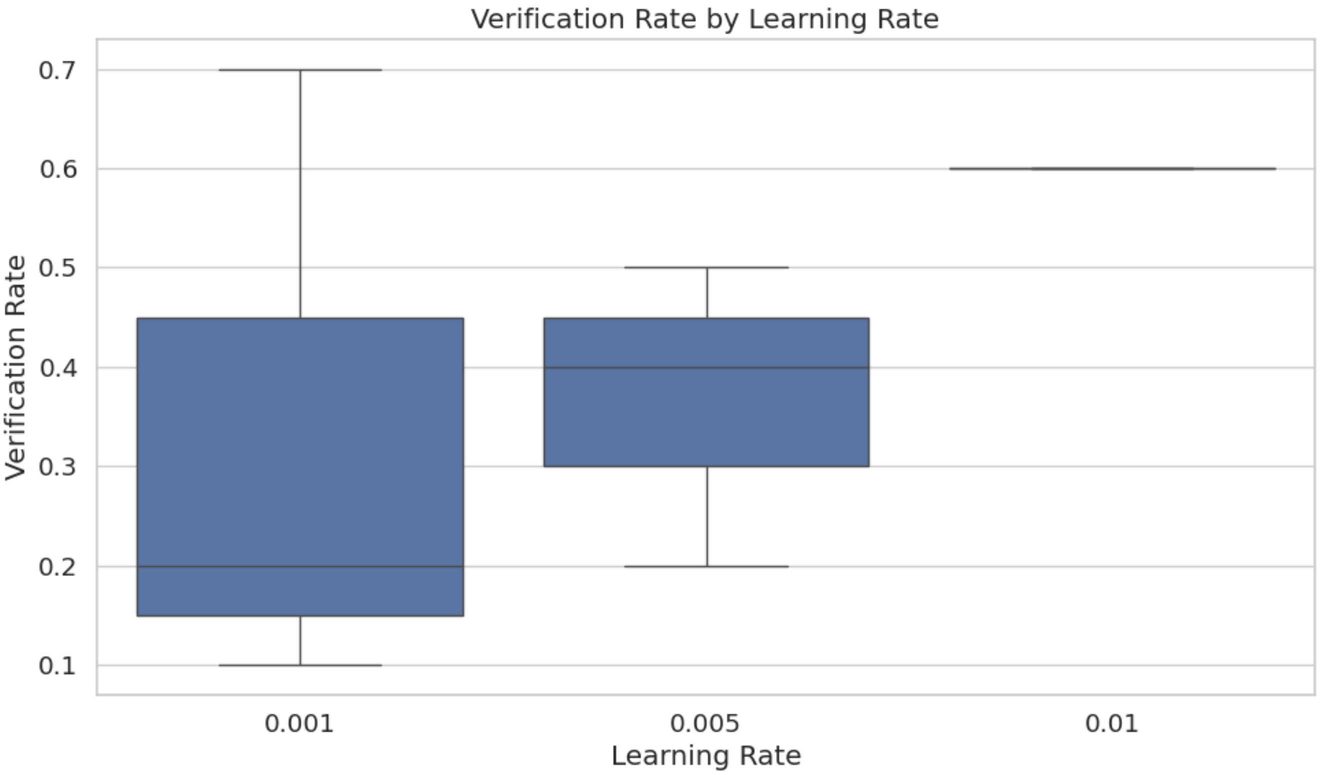
model	avg_fail_iterations	avg_success_iterations	avg_fail_time	avg_success_time	fail_rate
erc-1155-001-3-16	10.0	2.0	310.1737881766425	78.46017789840698	90.00
4o-mini	10.0	1.5	296.6070077717304	75.37543189525604	80.00
erc-1155-001-5-16	10.0	0.5	279.8856382369995	40.85800004005432	80.00
erc-1155-005-7-16	8.75	1.5	232.97990891337395	68.17317497730255	80.00
erc-1155-005-5-16	10.0	3.75	294.864764213562	126.47356379032135	60.00
erc-1155-005-3-16	10.0	2.4	302.7510801315308	116.84099688529969	50.00
erc-1155-010-3-16	10.0	4.166666666666667	330.28510987758636	147.44587333997092	40.00

model	avg_fail_iterations	avg_success_iterations	avg_fail_time	avg_success_time	fail_rate
erc-1155-010-5-16	10.0	3.8333333333333335	285.0248826146126	159.38762096563974	40.00
erc-1155-001-7-16	10.0	3.2857142857142856	311.7308252652486	119.78038280350822	30.00

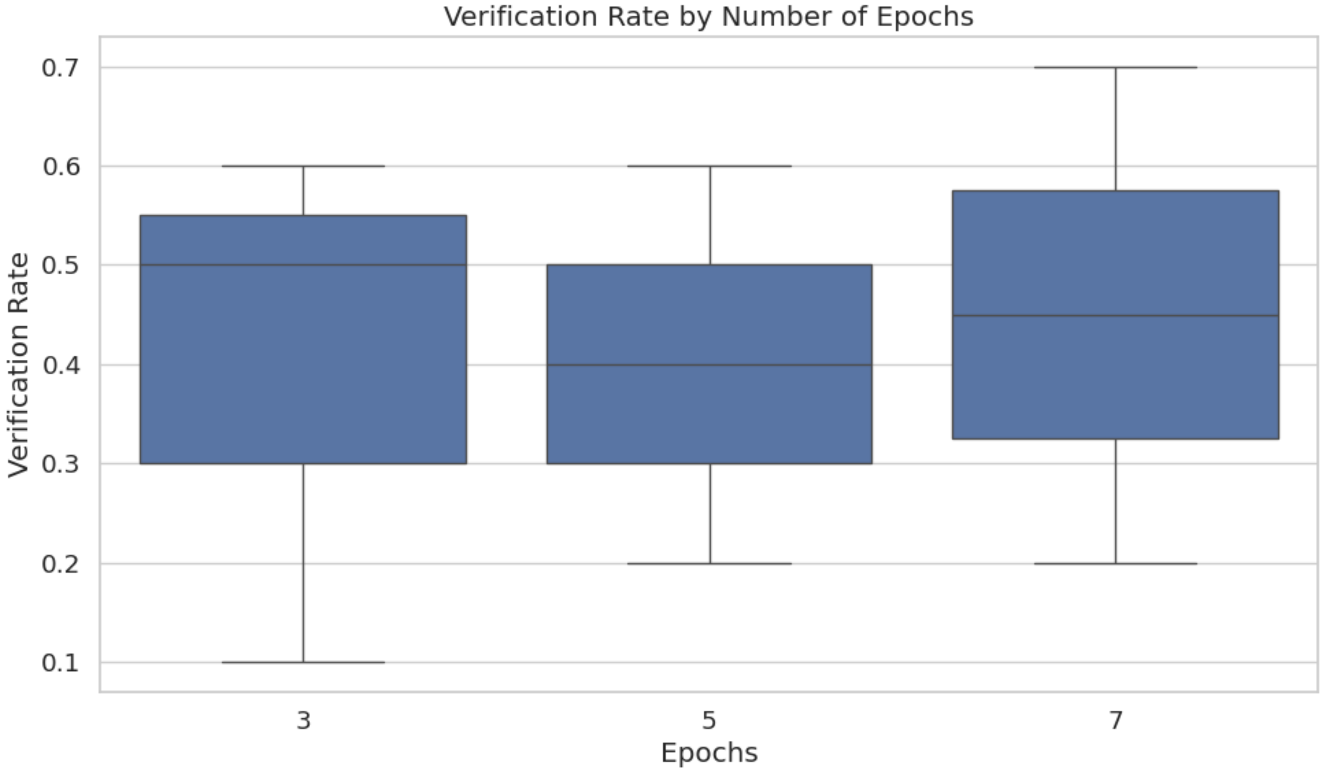
Hyperparameter Analysis

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

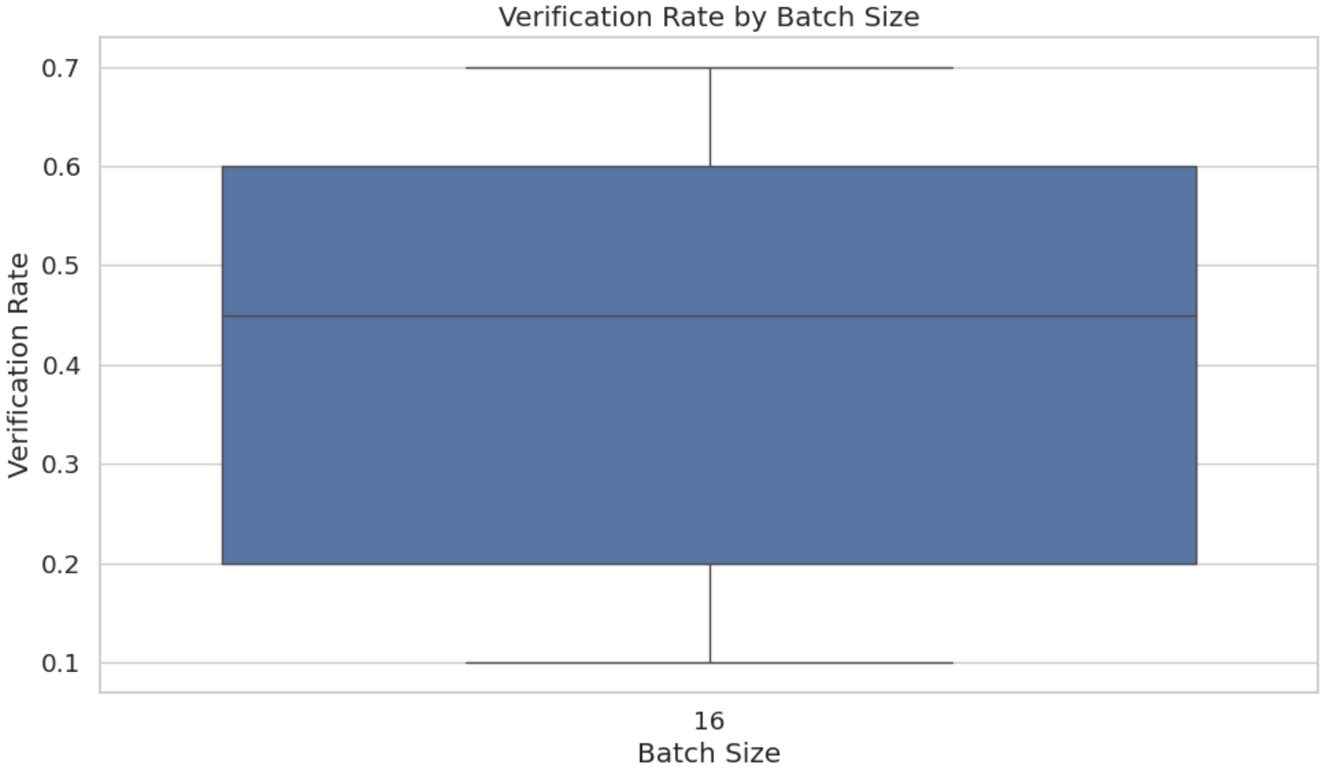
By Learning Rate



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-1155-001-7-16`, `erc-1155-010-3-16` and `erc-1155-010-5-16` demonstrated the highest overall verification rates.
2. Fine-tuning generally improved performance compared to the baseline `4o-mini` model (verification rate: 20.00%).
3. The optimal hyperparameters appear to be a learning rate of 0.010, 7 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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