

λ -Tune: Harnessing Large Language Models for Automated Database System Tuning

Victor Giannakouris, Immanuel Trummer
Cornell University



Overview

Tuning database systems is hard

- The performance of a database system depends on various tuning knobs
- Combinations of settings of tuning knobs create a large search space

Why use LLMs for database system tuning?

- LLMs understand text that contains useful information about database system tuning
- Information gained from the text narrows down the search space

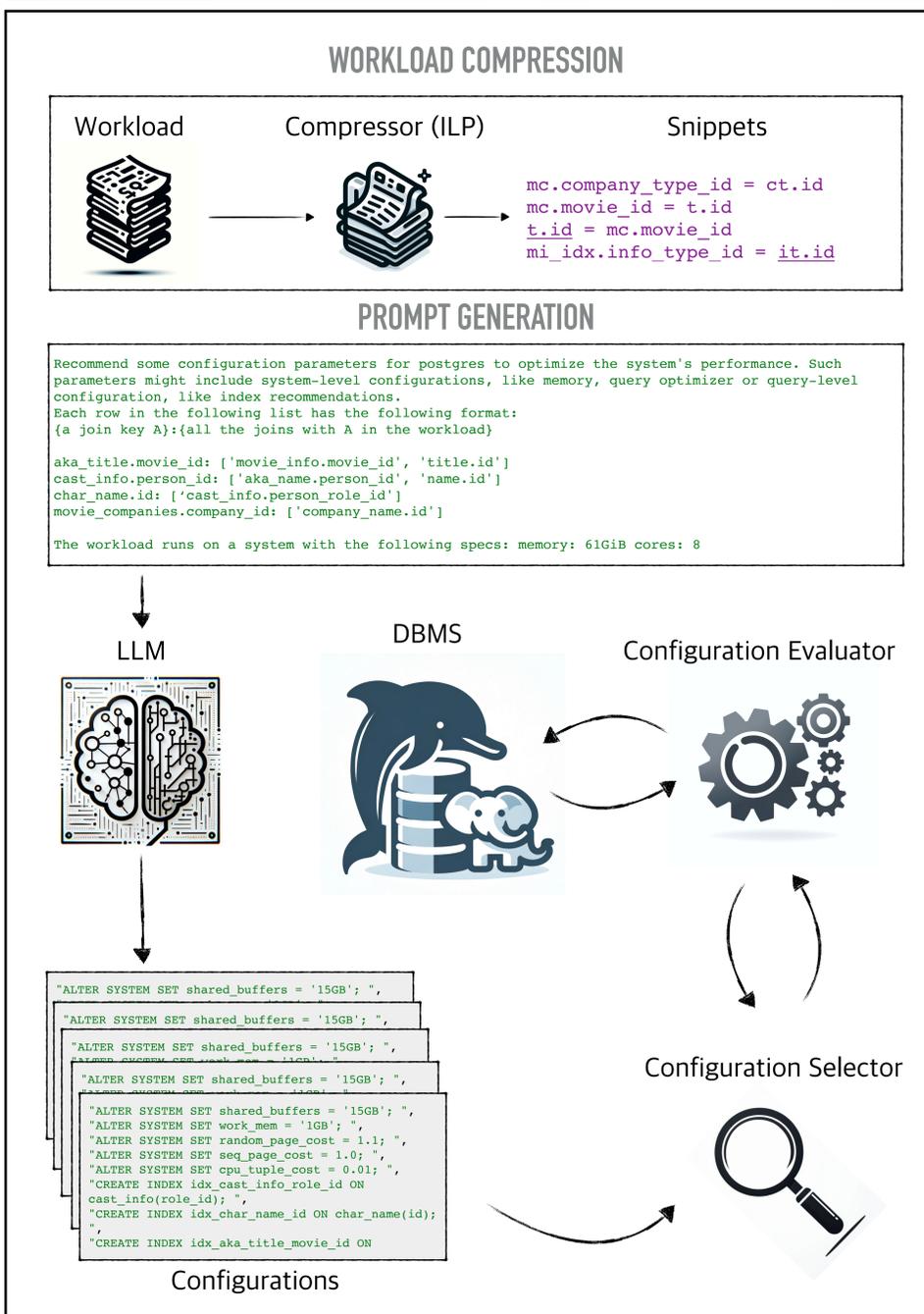
λ -Tune

- Feeds LLM with diverse information on tuning scenario
- Exploits LLM to generate full database configurations
- Bounds overheads when evaluating configurations of varying quality

Comparison with the Baselines

Aspect	DB-BERT	GPTuner	λ -Tune
LLM	BERT	GPT	GPT
LLM Input	Tuning Hints	Tuning Hints	Data, Workload, System
LLM Output	Individual Hints	Individual Hints	Full Configurations
LLM Usage	Extract Hints	Extract Hints	Generate Configurations
Search Space	Hint Combinations	Hint Combinations	Complete Configurations
Search Method	Reinforcement Learning	Bayesian Optimization	Partial Evaluations
Tuning Scope	System Parameters	System Parameters	Parameters + Physical Design

λ -Tune Architecture



Experiments

COST OF THE BEST CONFIGURATION FOUND BY EACH APPROACH, SCALED TO THE

Benchmark	DBMS	Initial Indexes	λ -Tune	UDO	DB-Bert	GPTuner	LlamaTune	ParamTree
TPC-H 1GB	PG	Yes	1.07	1.96	1.13	1	2.08	3.23
TPC-H 1GB	MS	Yes	1.06	1	1.02	1.73	1.39	3.24
TPC-H 10GB	PG	Yes	1.03	1	1.05	1.04	2.38	3.18
TPC-H 10GB	MS	Yes	4.98	1	5.16	5.84	2.86	15.2
JOB	PG	Yes	1	1.32	1.05	1.1	3.48	3.48
JOB	MS	Yes	1	1.07	3.69	3.69	3.22	3.22
TPC-H 1GB	PG	No	1.05	3.76	1	1.06	1.43	4.24
TPC-H 1GB	MS	No	1.2	2.83	1.02	1	1.61	3.64
TPC-H 10GB	PG	No	1.65	1.54	2.45	2.52	1	1.54
TPC-H 10GB	MS	No	1.04	3.2	1.09	1	1.88	3.2
JOB	PG	No	1	1.69	1.08	1.13	3.09	3.26
JOB	MS	No	1	3.07	3.07	3.07	3.07	3.07
TPC-DS	PG	No	1	1.37	1.67	1.66	3.33	3.33
TPC-DS	MS	No	1.79	3.25	1	1.03	1.05	3.25
Average			1.41	2	1.82	1.91	2.27	4.07

ABLATION STUDY

