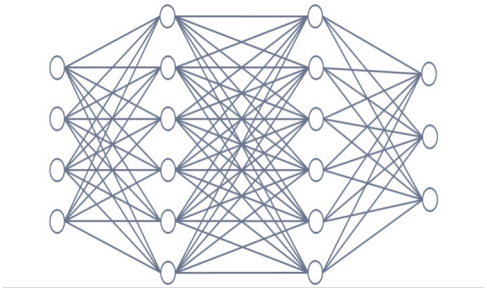
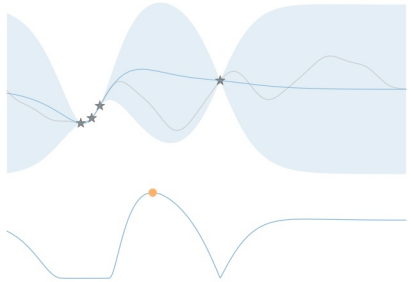
Studied problem

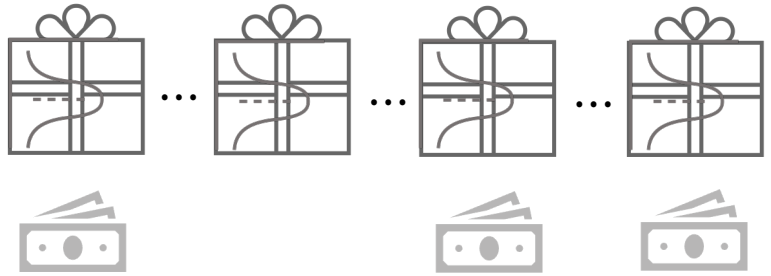




Varying evaluation costs

Adaptive stopping time

Key idea



Link to Pandora's Box problem
& Gittins index theory

Impact

Meta

BoTorch Ax

Competitive empirical performance &
interests from practitioners

"Cost-aware Bayesian Optimization via the Pandora's Box Gittins Index." NeurIPS'24.

Ongoing work

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LLM-driven black-box optimization

"Cost-aware Stopping for Bayesian Optimization." Under review.

Recap: Bayesian Optimization

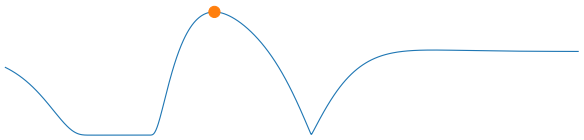
x

$f(x)$

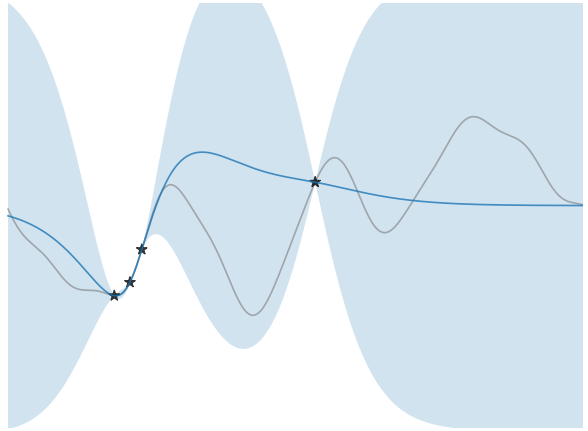
Black-box function

Acquire next input
(gradient-based optimization)

Update belief
(Bayes' rule)

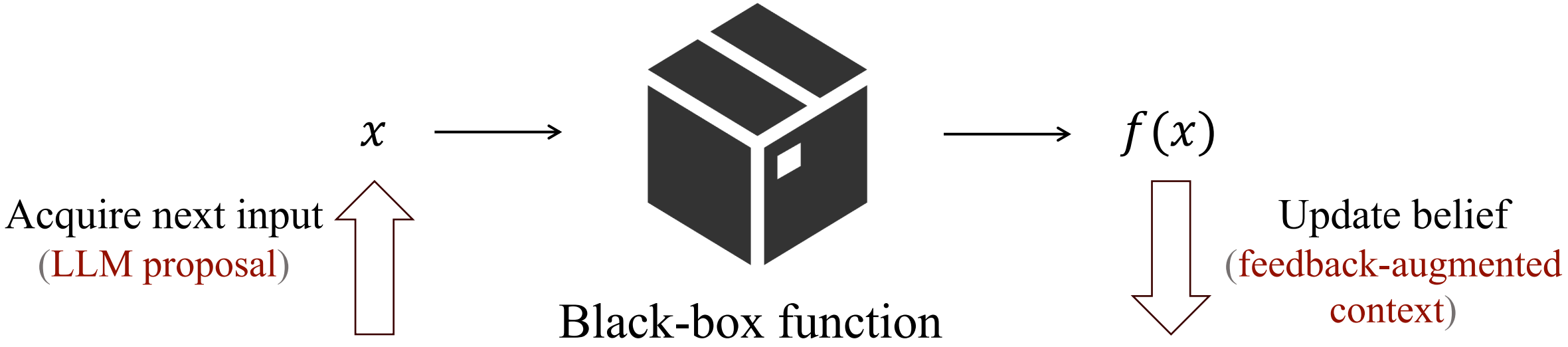


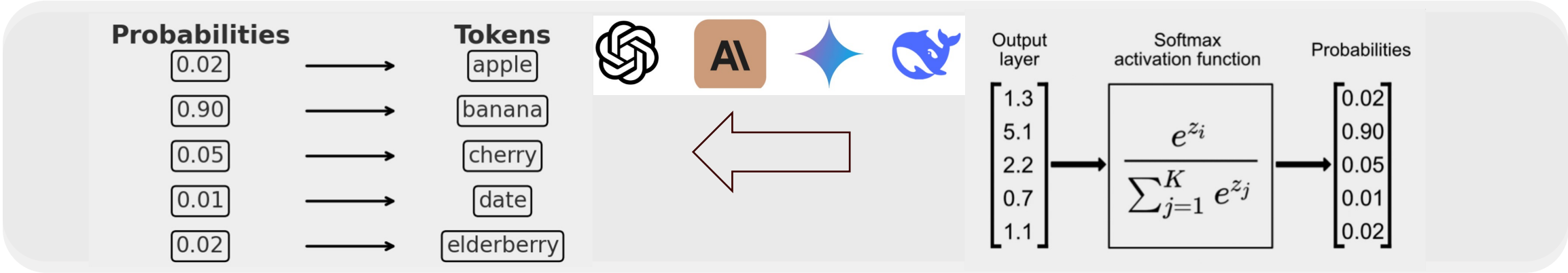
Acquisition function
(e.g., EI, UCB, TS)



Probabilistic model
(e.g., Gaussian process)

Ongoing: LLM-Driven Black-Box Optimization

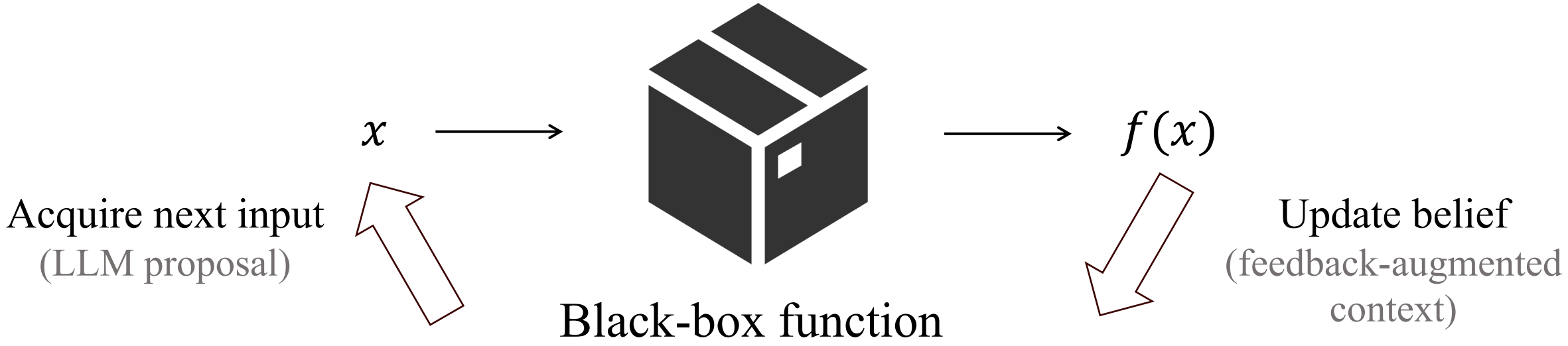




Acquisition function
(e.g., Softmax sampling)

Probabilistic model
(e.g., autoregressive model)

Ongoing: LLM-Driven Black-Box Optimization



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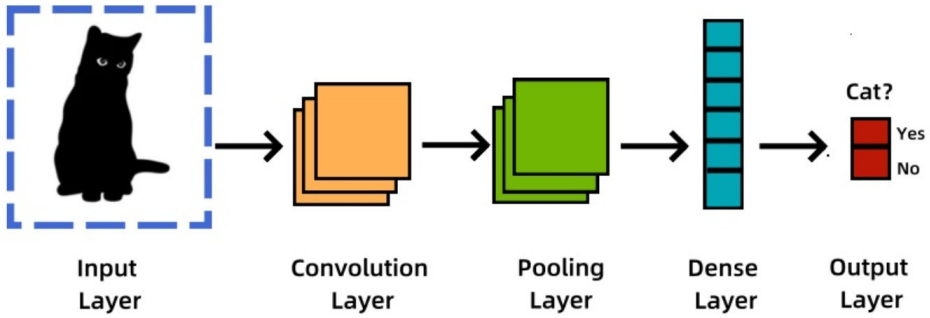
Large language model

Existing LLM-Driven Method: GENIUS

(e.g., CNN config)
Neural architecture



Validation accuracy

Acquire next input
(LLM proposal)

Update belief
(feedback-augmented context)

Black-box function

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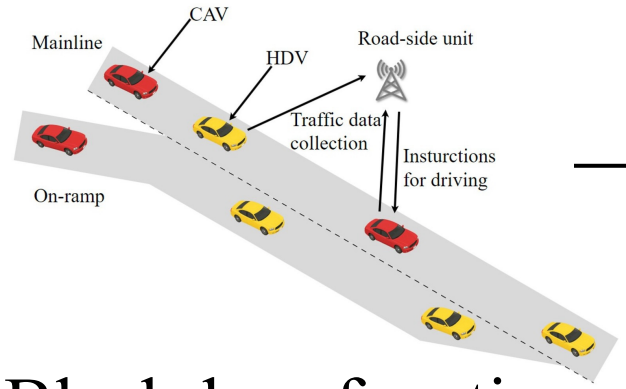
Large language model

Challenge: Diverse Data Sources in RL

Mixed-autonomy traffic control:

Neural architecture
(RL state representation)



Average speed

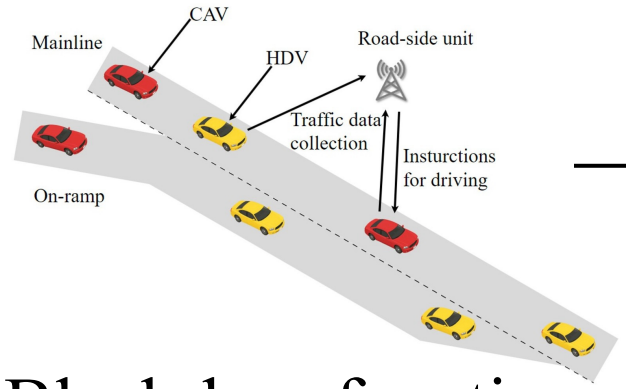
Black-box function
(RL training & evaluation)

Challenge: Diverse Data Sources in RL

Mixed-autonomy traffic control:

Composite neural architecture
(FFN & Transformer config)

for vector & time-series data



Black-box function
(RL training & evaluation)

Average speed

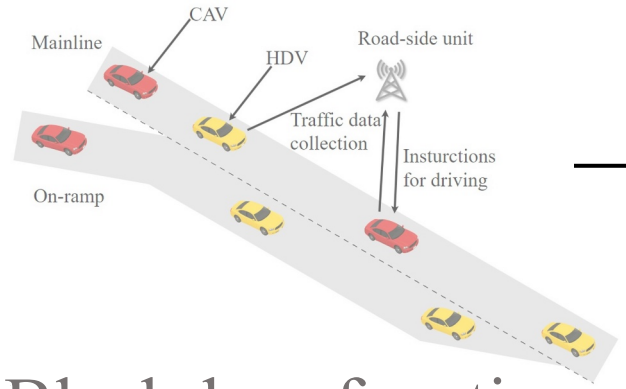
- Current traffic state — Vector
- Temporal traffic evolution — Time-series
- Vehicle sequence history — Time-series

Challenge: Diverse Data Sources in RL

Mixed-autonomy traffic control:

Composite neural architecture
(FFN & Transformer config)

for vector & time-series data



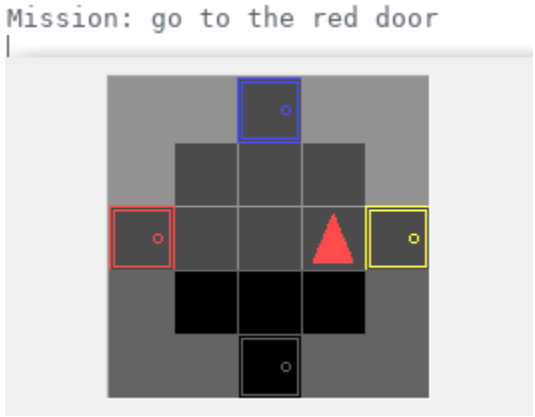
Black-box function
(RL training & evaluation)

Average speed

Goal-oriented tasks:

Composite neural architecture
(CNN & GRU config)

for image & text data



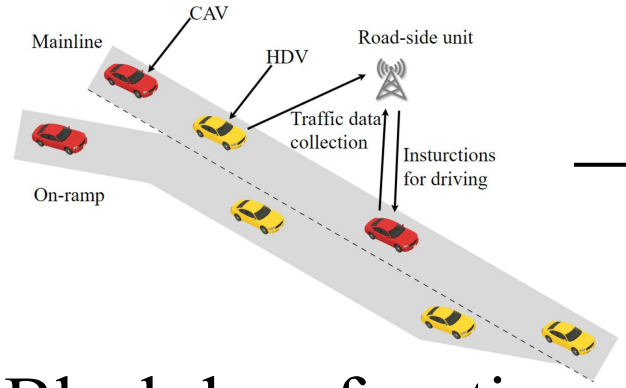
- Image observation
- Textual instruction

Average reward

Composite Neural Architecture Search

Mixed-autonomy traffic control:

Composite neural architecture



Average speed

Update belief
(feedback-augmented context)

Can side info help?

Acquire next input
(LLM proposal)

Black-box function
(RL training & evaluation)

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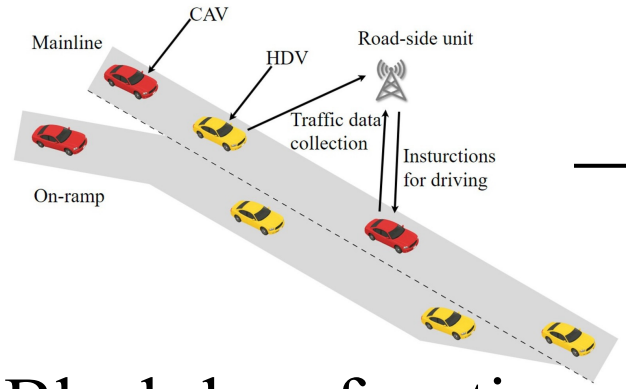
Side Info: Representation Quality

Mixed-autonomy traffic control:

Joint work with Yu Yu and Li Jin (SJTU)

Composite neural architecture
(FFN & Transformer config)



Average speed

representation quality?

Black-box function
(RL training & evaluation)

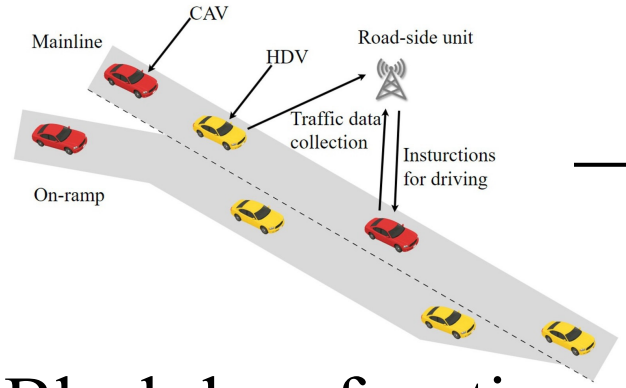
- Current traffic state — Vector
- Temporal traffic evolution — Time-series
- Vehicle sequence history — Time-series

Our LLM-Driven Method: Incorporate Side Info

Mixed-autonomy traffic control:

Joint work with Yu Yu and Li Jin (SJTU)

RL state representation →



→ Average speed

Acquire next input
(LLM proposal)

Update belief
(feedback-augmented context)

Black-box function
(RL training & evaluation)

performance metric + representation quality

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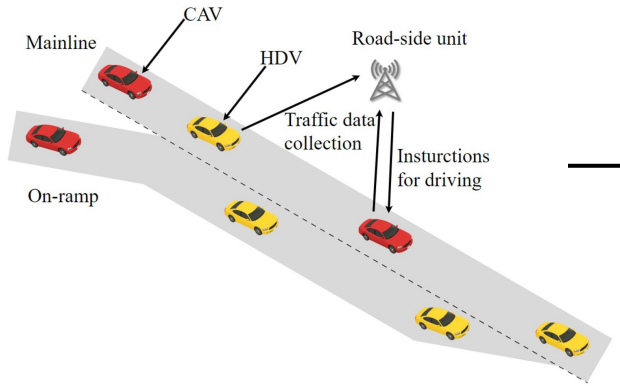
Our LLM-Driven Method (LACER) vs Baselines

Mixed-autonomy traffic control:

Joint work with Yu Yu and Li Jin (SJTU)

RL state representation → 

→ Average speed