Injection Stage

Text Input (~880K samples)

Planning: Transform the natural language description of the scene into PDDL. The scene is [SCENE].

Table Query: Given schema, transform the query into SQL. The schema is [SCHEMA]. The Query is [QUERY].

KG/DB Query: Given KG or DB, transform the query into s-Expression or SPARQL query...

AMR Parsing: Transform the natural language sentence into AMR form...

KG Construction: Given the following ontology, extract triples from the sentence...

API Call: Given candidate api calls, output the TOP form for the request...

Action Command: Transform the natural language command into action sequence...

Code Generation: Transform the natural language question into [Python/Java/Go] code...

FOL Extraction: Transform the natural language sentence into first-order logic (FOL) form.

Visual Reasoning: Parse the question sentence with the given form...

Math Reasoning: Write a Python code to describe and solve the given problem...

AI4Science: Generate SMILES form for the natural language description of the molecular...

Infusion Stage

Random Sampling

Symbolic ~260K samples

General
-Flan
-CodeAlpaca
-WizardEvol
~310K samples

Symbol-LLM (Base) → *Params Initialize* → Symbol-LLM (Instruct)

MLE Loss

Symbolic Output

PDDL:
(define (problem BW-3)
(:domain blocksworld)
(:objects b1 b2 b3)
...

SQL:
SELECT COUNT(*) FROM singer

s-Expression / SPARQL:
PREFIX ns: <http://xxxxx>
SELECT DISTINCT x?
WHERE {
...

AMR:
(w / wish-01
:ARG0 (i / i)
:ARG1 (b / bear-02
...

KG Triples:
ethnicGroup (US, Asian Americans) | language (US, English_language)

TOP (API calls):
[IN: GET_WEATHER [SL: WEATHER_ATTRIBUTE tornados] [SL:DATE_TIME this week]]

Command:
I_TURN_LEFT I_WALK I_LOOK I_JUMP I_JUMP I_TURN_RIGHT

Bash/RX/Java/Go/...:
public Integer getInteger(xx {
Number number = xxx;
if (number==null) {

FOL:
∀ x ((Efficient(x) Reliable (x)) → HighQuality(x))

Parsed Language:
query_color(unique(filter_s hape(cylinder,same_size(un ique(filter_color(cyan,scene ()))))))

Python Code:
def Solution():
result_list = []
for i in range(10):
result_list.append(i**2)

SMILES:
CN(C(=0)N)N=0

MLE Loss

Symbolic Output | NL Output

(a) Tuning Stage

Test Tasks (In-domain + OOD)

Symbol-LLM ❄

Text-to-Symbol
NL2SQL | API
Ontology | CHEBI
Command

NL2SQL | PDDL
Function Symbols | FOL
NL2Code

General Tasks
MMLU | BigBench-Hard
......
Hellaswag | ARC | TrivialQA

Symbolic Solver (Delegations)
FastDownward | Python Interpreter
FOL Solver | SQL Excu | API Calls

Downstream Tasks

Robotic Planning: Blocksworld Termes ...

Symbolic Reasoning: Colored Object Last Letter

Table Question Answering: WikiSQL WikiTableQuestions

Visual Reasoning: Geometry3k

Math Reasoning: GSM8k SVAMP AQUA

Logical Reasoning: FOLIO ProofWriter

(b) Test Stage