



Replicating MRKL

This walkthrough demonstrates how to replicate the [MRKL](#) system using agents.

This uses the example Chinook database. To set it up follow the instructions on <https://database.guide/2-sample-databases-sqlite/>, placing the `.db` file in a notebooks folder at the root of this repository.

```
from langchain import LLMChain, OpenAI, SerpAPIWrapper,
SQLDatabase, SQLDatabaseChain
from langchain.agents import initialize_agent, Tool
from langchain.agents import AgentType
```

```
llm = OpenAI(temperature=0)
search = SerpAPIWrapper()
llm_math_chain = LLMChain(llm=llm, verbose=True)
db =
SQLDatabase.from_uri("sqlite:///../../../../../../../../notebooks/Chinook.db")
db_chain = SQLDatabaseChain.from_llm(llm, db, verbose=True)
tools = [
    Tool(
        name = "Search",
        func=search.run,
        description="useful for when you need to answer questions about
current events. You should ask targeted questions"
    ),
    Tool(
        name="Calculator",
        func=llm_math_chain.run,
        description="useful for when you need to answer questions about
math"
    ),
    Tool(
        name="FooBar DB",
        func=db_chain.run,
        description="useful for when you need to answer questions about
FooBar. Input should be in the form of a question containing full
context"
    )
]
```



```
mrkl = initialize_agent(tools, llm,
agent=AgentType.ZERO_SHOT_REACT_DESCRIPTION, verbose=True)
```

```
mrkl.run("Who is Leo DiCaprio's girlfriend? What is her current age
raised to the 0.43 power?")
```

```
> Entering new AgentExecutor chain...
```

```
I need to find out who Leo DiCaprio's girlfriend is and then
calculate her age raised to the 0.43 power.
```

```
Action: Search
```

```
Action Input: "Who is Leo DiCaprio's girlfriend?"
```

```
Observation: DiCaprio met actor Camila Morrone in December 2017,
when she was 20 and he was 43. They were spotted at Coachella and went
on multiple vacations together. Some reports suggested that DiCaprio
was ready to ask Morrone to marry him. The couple made their red carpet
debut at the 2020 Academy Awards.
```

```
Thought: I need to calculate Camila Morrone's age raised to the
0.43 power.
```

```
Action: Calculator
```

```
Action Input: 21^0.43
```

```
> Entering new LLMMathChain chain...
```

```
21^0.43
```

```
```text
```

```
21**0.43
```

```
```
```

```
...numexpr.evaluate("21**0.43")...
```

```
Answer: 3.7030049853137306
```

```
> Finished chain.
```

```
Observation: Answer: 3.7030049853137306
```

```
Thought: I now know the final answer.
```

```
Final Answer: Camila Morrone is Leo DiCaprio's girlfriend and her
current age raised to the 0.43 power is 3.7030049853137306.
```

```
> Finished chain.
```

```
"Camila Morrone is Leo DiCaprio's girlfriend and her current age
raised to the 0.43 power is 3.7030049853137306."
```

```
mrkl.run("What is the full name of the artist who recently released an album called 'The Storm Before the Calm' and are they in the FooBar database? If so, what albums of theirs are in the FooBar database?")
```

```
> Entering new AgentExecutor chain...
```

I need to find out the artist's full name and then search the FooBar database for their albums.

Action: Search

Action Input: "The Storm Before the Calm" artist

Observation: The Storm Before the Calm (stylized in all lowercase) is the tenth (and eighth international) studio album by Canadian-American singer-songwriter Alanis Morissette, released June 17, 2022, via Epiphany Music and Thirty Tigers, as well as by RCA Records in Europe.

Thought: I now need to search the FooBar database for Alanis Morissette's albums.

Action: FooBar DB

Action Input: What albums by Alanis Morissette are in the FooBar database?

```
> Entering new SQLiteDatabaseChain chain...
```

What albums by Alanis Morissette are in the FooBar database?

SQLQuery:

```
/Users/harrisonchase/workplace/langchain/langchain/sql_database.py:191:
SAWarning: Dialect sqlite+pysqlite does *not* support Decimal objects natively, and SQLAlchemy must convert from floating point - rounding errors and other issues may occur. Please consider storing Decimal numbers as strings or integers on this platform for lossless storage.
```

```
sample_rows = connection.execute(command)
```

```
SELECT "Title" FROM "Album" INNER JOIN "Artist" ON
"Album"."ArtistId" = "Artist"."ArtistId" WHERE "Name" = 'Alanis
Morissette' LIMIT 5;
```

```
SQLResult: [('Jagged Little Pill',)]
```

Answer: The albums by Alanis Morissette in the FooBar database are Jagged Little Pill.

```
> Finished chain.
```

Observation: The albums by Alanis Morissette in the FooBar database are Jagged Little Pill.

Thought: I now know the final answer.

Final Answer: The artist who released the album 'The Storm Before

the Calm' is Alanis Morissette and the albums of hers in the FooBar database are Jagged Little Pill.

> Finished chain.

"The artist who released the album 'The Storm Before the Calm' is Alanis Morissette and the albums of hers in the FooBar database are Jagged Little Pill."

With a chat model

```
from langchain.chat_models import ChatOpenAI

llm = ChatOpenAI(temperature=0)
llm1 = OpenAI(temperature=0)
search = SerpAPIWrapper()
llm_math_chain = LLMMathChain(llm=llm1, verbose=True)
db =
SQLDatabase.from_uri("sqlite:///../../../../../notebooks/Chinook.db")
db_chain = SQLDatabaseChain.from_llm(llm1, db, verbose=True)
tools = [
    Tool(
        name = "Search",
        func=search.run,
        description="useful for when you need to answer questions about
current events. You should ask targeted questions"
    ),
    Tool(
        name="Calculator",
        func=llm_math_chain.run,
        description="useful for when you need to answer questions about
math"
    ),
    Tool(
        name="FooBar DB",
        func=db_chain.run,
        description="useful for when you need to answer questions about
FooBar. Input should be in the form of a question containing full
context"
    )
]
```

```
mrkl = initialize_agent(tools, llm,
agent=AgentType.CHAT_ZERO_SHOT_REACT_DESCRIPTION, verbose=True)
```

```
mrkl.run("Who is Leo DiCaprio's girlfriend? What is her current age
raised to the 0.43 power?")
```

```
> Entering new AgentExecutor chain...
Thought: The first question requires a search, while the second
question requires a calculator.
Action:
```
{
 "action": "Search",
 "action_input": "Leo DiCaprio girlfriend"
}
```

Observation: Gigi Hadid: 2022 Leo and Gigi were first linked back
in September 2022, when a source told Us Weekly that Leo had his
"sights set" on her (alarming way to put it, but okay).
Thought: For the second question, I need to calculate the age raised
to the 0.43 power. I will use the calculator tool.
Action:
```
{
 "action": "Calculator",
 "action_input": "((2022-1995)^0.43)"
}
```

> Entering new LLMMathChain chain...
((2022-1995)^0.43)
```text
(2022-1995)**0.43
```
...numexpr.evaluate("(2022-1995)**0.43")...

Answer: 4.125593352125936
> Finished chain.

Observation: Answer: 4.125593352125936
Thought: I now know the final answer.
Final Answer: Gigi Hadid is Leo DiCaprio's girlfriend and her
```

current age raised to the 0.43 power is approximately 4.13.

> Finished chain.

"Gigi Hadid is Leo DiCaprio's girlfriend and her current age raised to the 0.43 power is approximately 4.13."

```
mrkl.run("What is the full name of the artist who recently released an
album called 'The Storm Before the Calm' and are they in the FooBar
database? If so, what albums of theirs are in the FooBar database?")
```

> Entering new AgentExecutor chain...

Question: What is the full name of the artist who recently released an album called 'The Storm Before the Calm' and are they in the FooBar database? If so, what albums of theirs are in the FooBar database?

Thought: I should use the Search tool to find the answer to the first part of the question and then use the FooBar DB tool to find the answer to the second part.

Action:

...

{

 "action": "Search",

 "action_input": "Who recently released an album called 'The Storm Before the Calm'"

}

...

Observation: Alanis Morissette

Thought: Now that I know the artist's name, I can use the FooBar DB tool to find out if they are in the database and what albums of theirs are in it.

Action:

...

{

 "action": "FooBar DB",

 "action_input": "What albums does Alanis Morissette have in the database?"

}

...

> Entering new SQLiteDatabaseChain chain...

What albums does Alanis Morissette have in the database?

SQLQuery:

/Users/harrisonchase/workplace/langchain/langchain/sql_database.py:191:
 SAWarning: Dialect sqlite+pysqlite does *not* support Decimal objects
 natively, and SQLAlchemy must convert from floating point – rounding
 errors and other issues may occur. Please consider storing Decimal
 numbers as strings or integers on this platform for lossless storage.

```
sample_rows = connection.execute(command)
```

```
SELECT "Title" FROM "Album" WHERE "ArtistId" IN (SELECT "ArtistId"  

  FROM "Artist" WHERE "Name" = 'Alanis Morissette') LIMIT 5;
```

```
SQLResult: [('Jagged Little Pill',)]
```

Answer: Alanis Morissette has the album Jagged Little Pill in the
 database.

```
> Finished chain.
```

Observation: Alanis Morissette has the album Jagged Little Pill in
 the database.

Thought: The artist Alanis Morissette is in the FooBar database and
 has the album Jagged Little Pill in it.

Final Answer: Alanis Morissette is in the FooBar database and has
 the album Jagged Little Pill in it.

```
> Finished chain.
```

'Alanis Morissette is in the FooBar database and has the album
 Jagged Little Pill in it.'