Introduction to Hugging Face smolagents

AI AGENTS WITH HUGGING FACE SMOLAGENTS

Adel Nehme
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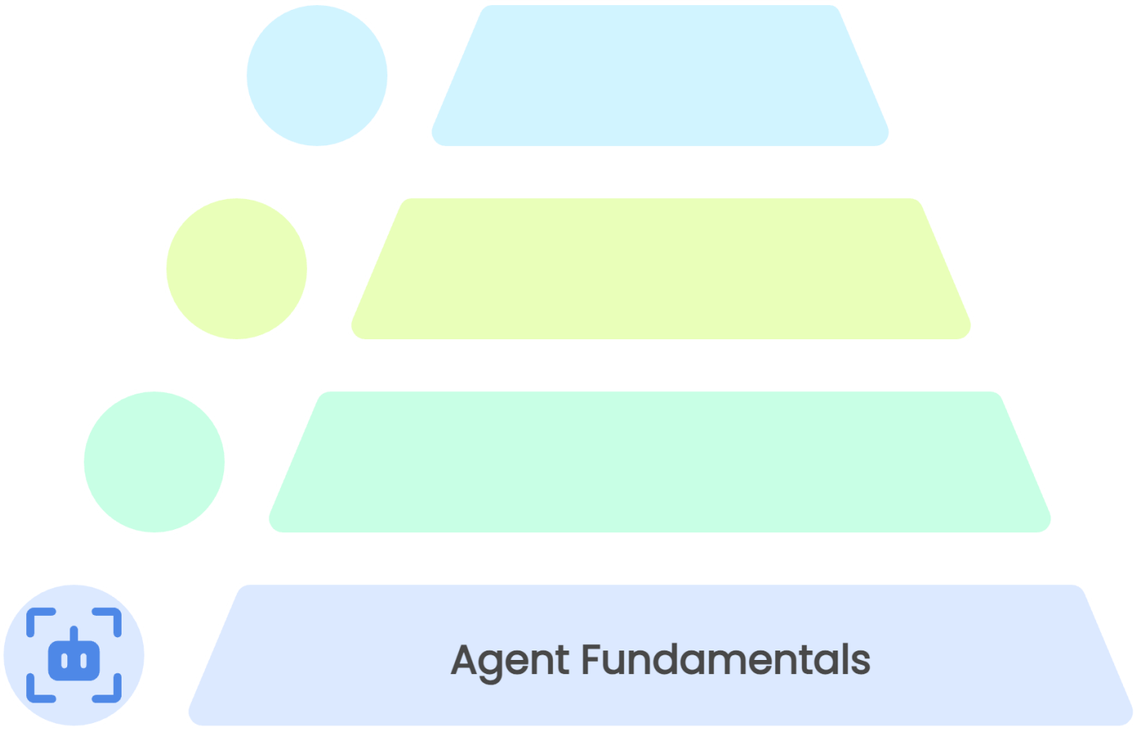
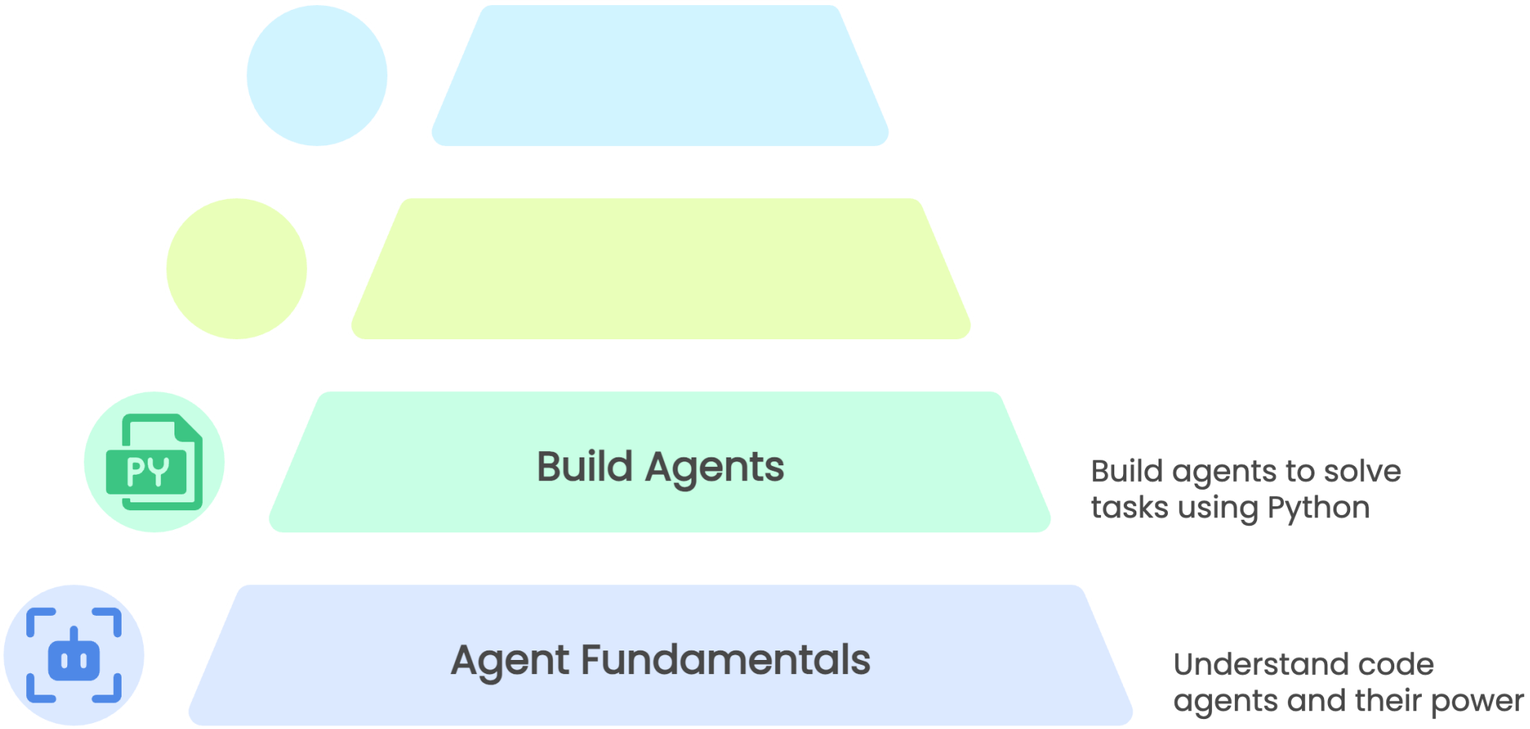
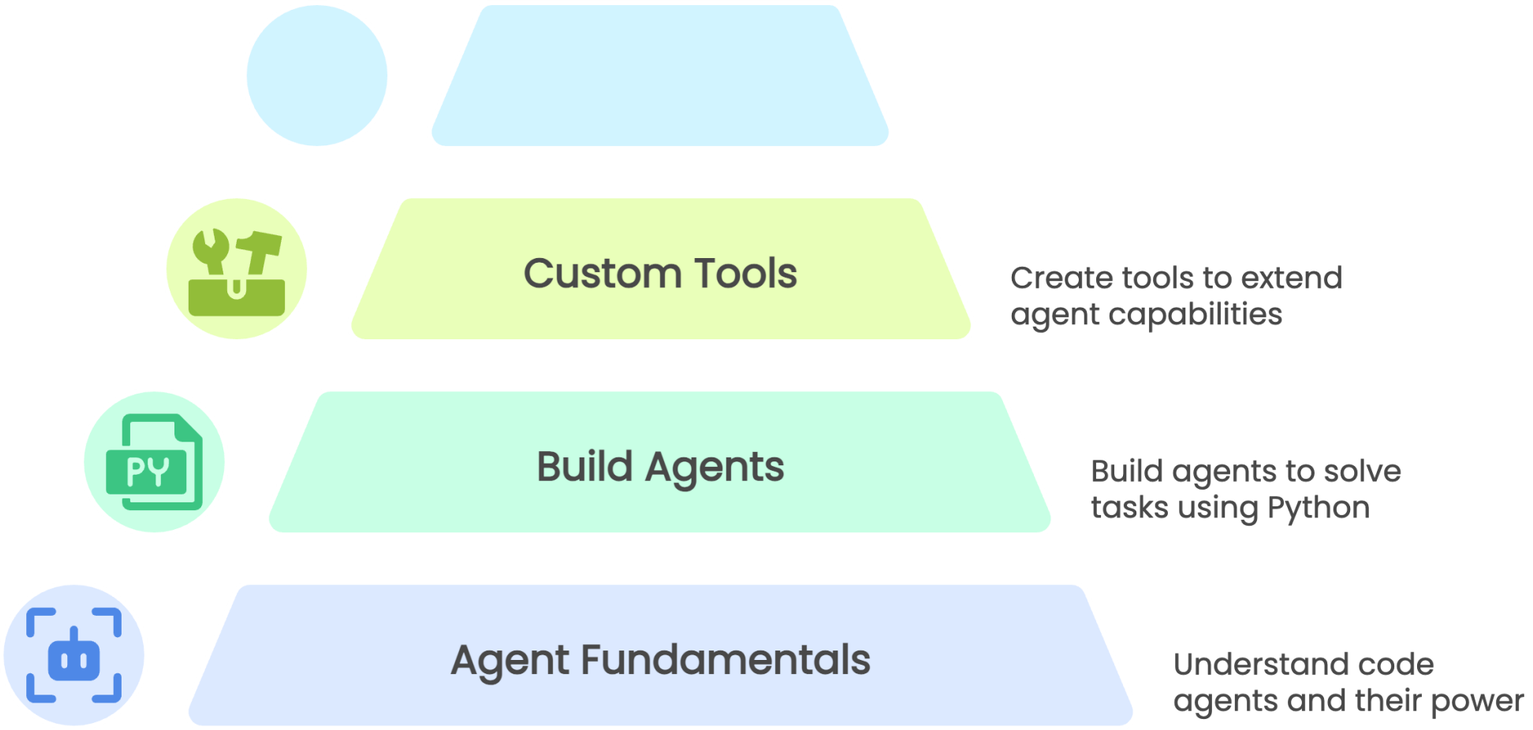


Understand code
agents and their power


Build Agents
Build agents to solve tasks using Python
Agent Fundamentals
Understand code agents and their power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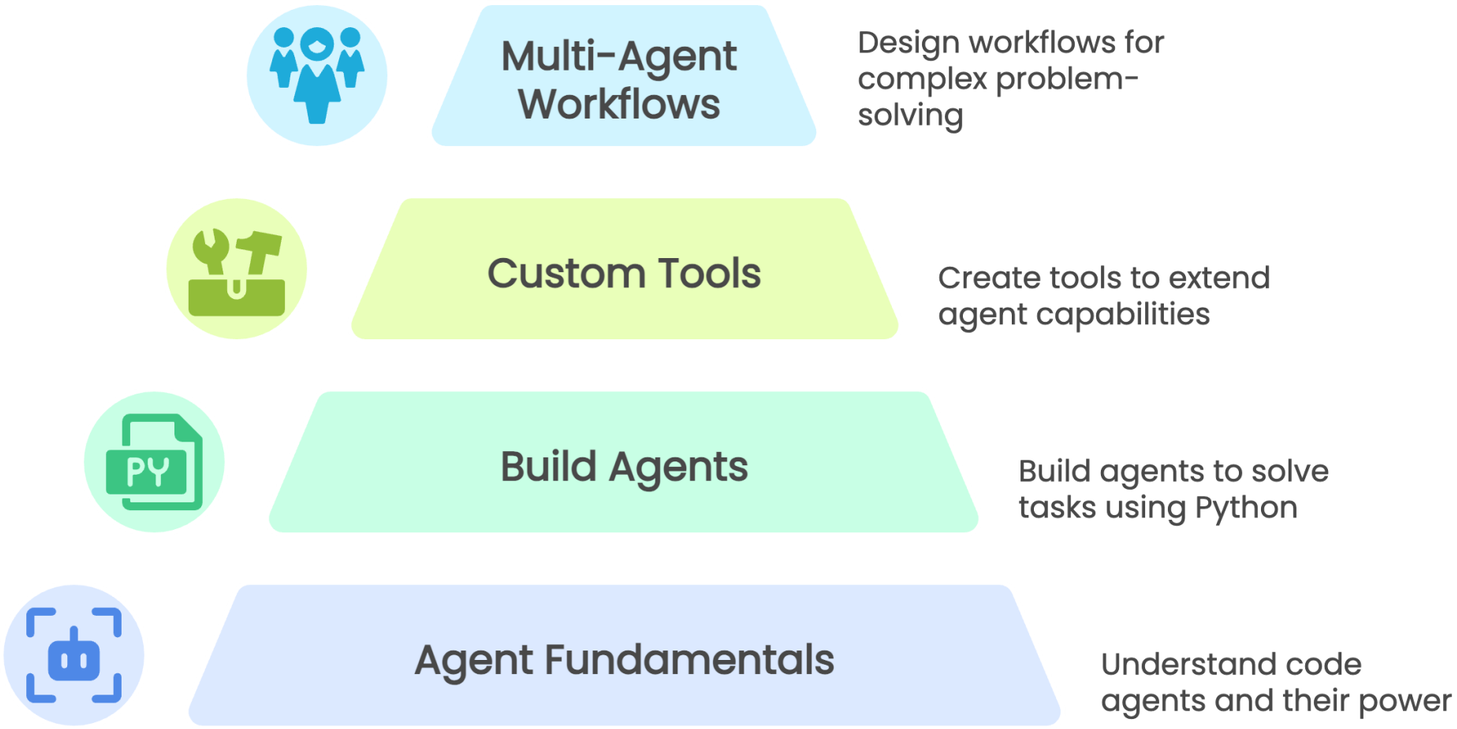
Multi-Agent Workflows
Design workflows for complex problem-solving
Custom Tools
Create tools to extend agent capabilities
PY
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Build agents to solve tasks using Python
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What is an AI agent?

An AI agent is a system that uses an LLM to interact with its environment to achieve a user-defined objective.

From Chatbots to Agents

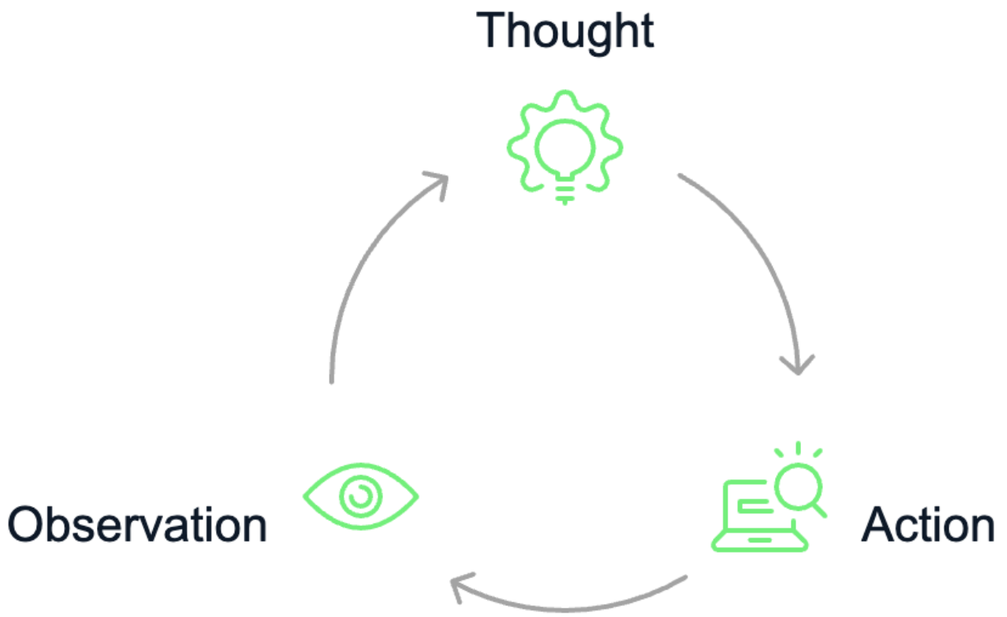
Chatbots:

- Respond with natural language
- Passive and reactive

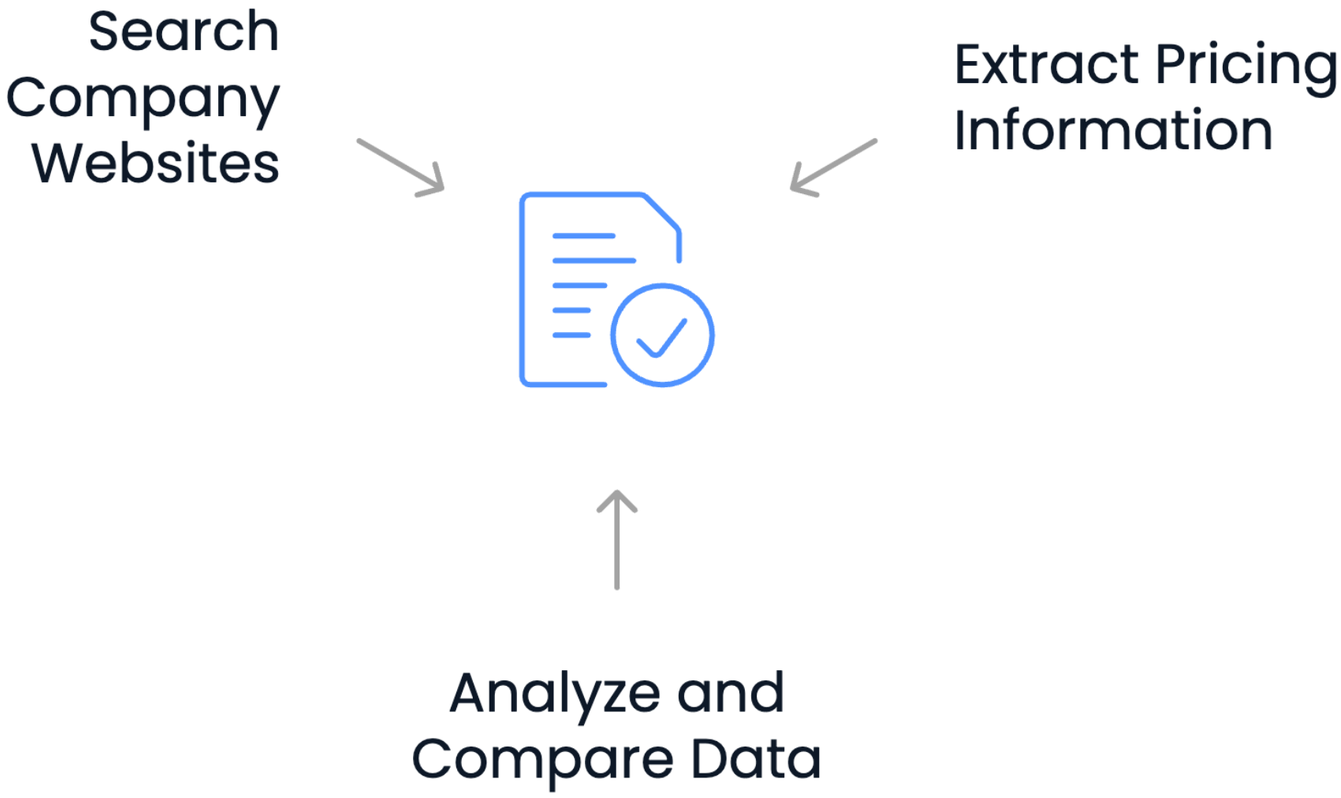
Agents:

- Can take actions (web search, read files, analyze data, etc.)
- Actively reason toward a goal

Agents follow a cycle:



Example: Competitor Pricing Research



All from a single prompt!

What Is smolagents?

- Lightweight Python framework
- Developed by Hugging Face

Supports two types of agents:

- `ToolCallingAgent` : Uses structured function calls
- `CodeAgent` : Writes and runs Python code

How Function-Calling Works


```
Action 1: {"tool": "search_company", "company": "Competitor A"}
Action 2: {"tool": "get_pricing", "company": "Competitor A", "plan": "Basic"}
Action 3: {"tool": "get_pricing", "company": "Competitor A", "plan": "Pro"}
Action 4: {"tool": "search_company", "company": "Competitor B"}
Action 5: {"tool": "get_pricing", "company": "Competitor B", "plan": "Basic"}
```

How Code Agents Work

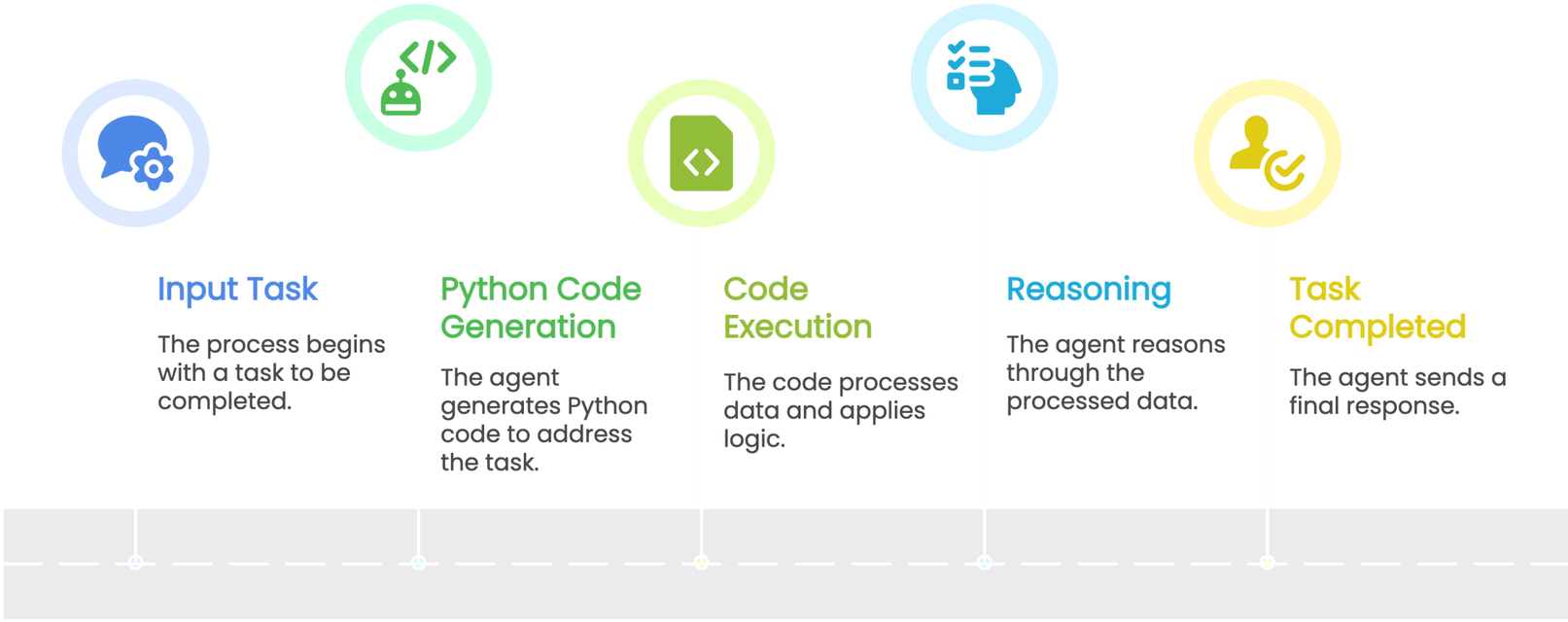
```
competitors = ["Competitor A", "Competitor B", "Competitor C"]
pricing_data = {}

for company in competitors:
    company_info = search_company(company)
    plans = extract_pricing_plans(company_info)
    pricing_data[company] = plans

most_affordable_option = min(pricing_data,
                             key=lambda x: pricing_data[x]['basic_plan'])
```

The Code Agent Flow

Research shows ~20% higher success rate than function-calling methods.



[1] https://huggingface.co/papers/2402.01030

Let's practice!

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Creating an Agent With Tools

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Creating a Code Agent (No Tools)

```python
from smolagents import CodeAgent, InferenceClientModel

agent = CodeAgent(
    tools=[],
    model=InferenceClientModel()
)
agent.run("Calculate the average of the list [23, 45, 67, 89]")
```

```
Executing parsed code:
  numbers = [23, 45, 67, 89]
  average = sum(numbers) / len(numbers)
  final_answer(average)
Final answer: 56.0
[Step 1: Duration 4.14 seconds| Input tokens: 1,900 | Output tokens: 109]
56.0
```

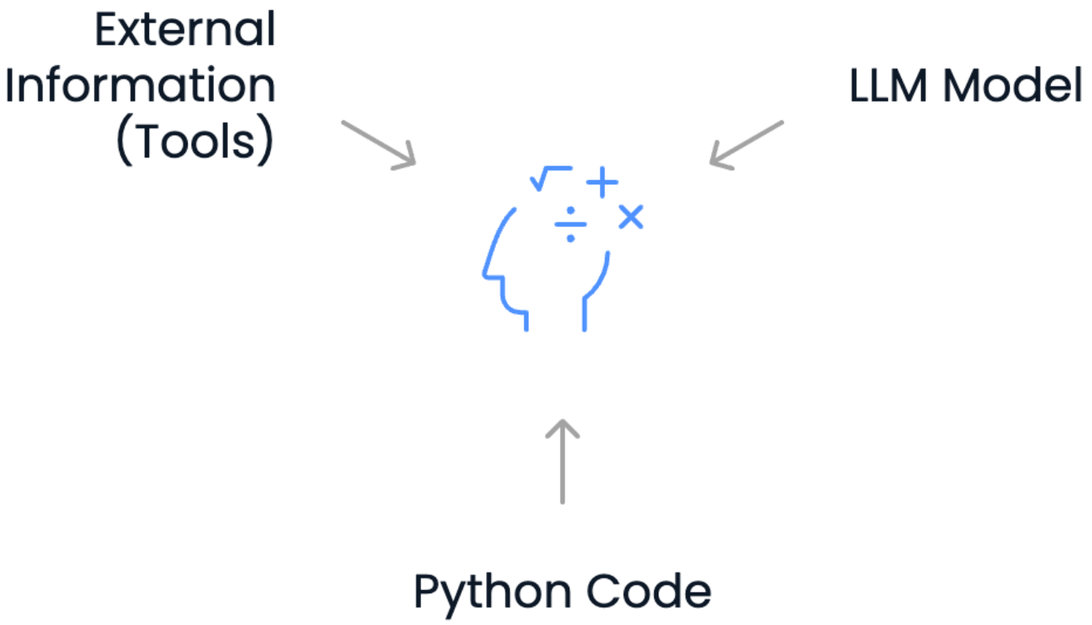
Why Use Tools with Code Agents?

The agent we defined can already solve many tasks using:

- An LLM model
- Python code

But it may also need access to external information:

- Example: live web data



That's where tools come in!

Adding a Web Search Tool

```
from smolagents import CodeAgent, InferenceClientModel, WebSearchTool


agent = CodeAgent(
    model=InferenceClientModel(),
    tools=[WebSearchTool()]
)
```

Code Agent With Web Search Tool Output

```
agent.run("What's the tallest building in the world right now?")
```

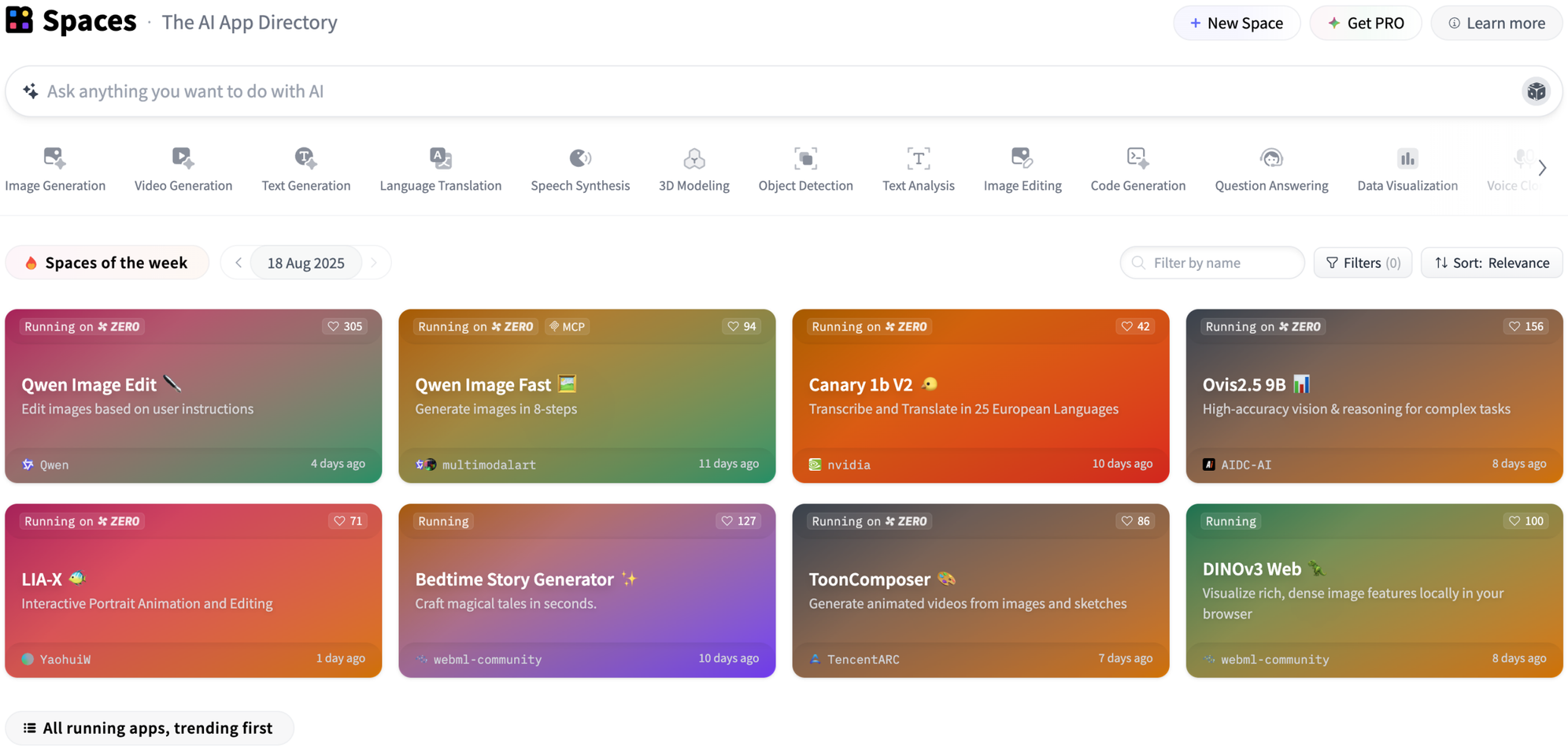
```
Executing parsed code:
  tallest_building_info = web_search("tallest building in the world 2023")
  print(tallest_building_info)

# Search results omitted for brevity...

Executing parsed code:
  final_answer("Burj Khalifa, Dubai, 828 meters")
Final answer: Burj Khalifa, Dubai, 828 meters
[Step 2: Duration 2.97 seconds| Input tokens: 5,078 | Output tokens: 153]
Burj Khalifa, Dubai, 828 meters
```

Built-in Tools (by Category)

Category	Tools
Information Retrieval	`ApiWebSearchTool`, `DuckDuckGoSearchTool`, `GoogleSearchTool`, `WebSearchTool`, `WikipediaSearchTool`
Web Interaction	`VisitWebpageTool`
Code Execution	`PythonInterpreterTool`
User Interaction	`UserInputTool`
Speech Processing	`SpeechToTextTool`
Workflow Control	`FinalAnswerTool`

[1] https://huggingface.co/docs/smolagents/main/en/reference/default_tools

Tools From the Hugging Face Hub



Using Community Tools from Hugging Face

```
from smolagents import load_tool

# Load remote tool from Hugging Face
model_downloads_tool = load_tool(
    repo_id="example-repo/hf-model-downloads",
    trust_remote_code=True
)

# Create agent with remote + built-in tools
agent = CodeAgent(
    tools=[model_downloads_tool, WebSearchTool()],
    model=InferenceClientModel()
)
agent.run("Find the most downloaded image classification model on Hugging Face")
```

```
google/vit-base-patch16-224-in21k
```

Let's practice!

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Creating an Agent With Custom Tools

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If code agents can already write and run Python and use built-in tools, why would I need to create custom tools at all?

Because custom tools give you important advantages

Benefits of Custom Tools

- **Reliability:** Write and test logic explicitly instead of relying on the agent to guess
- **Reusability:** Use tools across projects and agents
- **Consistency:** Get predictable behavior across runs (great for debugging)
- **Controlled access:** Expose only what you want (files, APIs, databases, etc.)

Scenario: You Run a Retail Store

- Inventory data is stored in a CSV file (size, color, quantity, and price)
- Code agents can write code to read CSVs
- But they don't have access to files by default
- You need to wrap file access in a custom tool

Anatomy of a Custom Tool

```python
from smolagents import tool
import pandas as pd

@tool
def check_inventory(product_name: str) -> int:
    """
    Check the available quantity of a product in the inventory CSV.

    Args:
        product_name (str): The name of the product to look up.

    Returns:
        int: The quantity in stock. Returns 0 if the product is not found.
    """
    df = pd.read_csv("store_inventory.csv")
    match = df[df["product_name"] == product_name]
    stock_quantity = int(match.iloc[0]["quantity"]) if not match.empty else 0
    return stock_quantity
```

Best Practices for Custom Tools

```python
@tool
def check_inventory(product_name: str) -> int:
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```
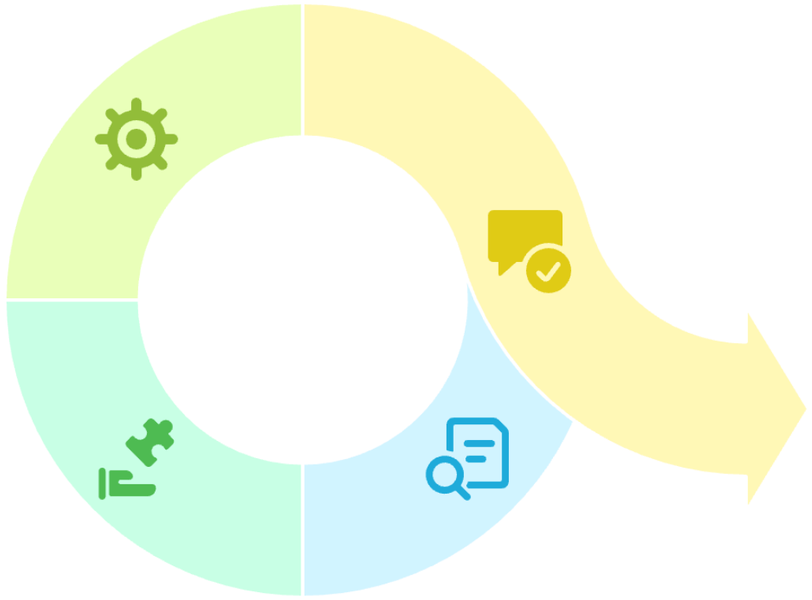

Parameter

Type hints

Docstring

Do we have any t-shirts in stock?



1

Analyze Question

The agent interprets the user's query.

2

Match to Tool

The agent identifies the appropriate tool.

3

Execute Tool

The agent runs the tool with necessary input.

4

Formulate Response

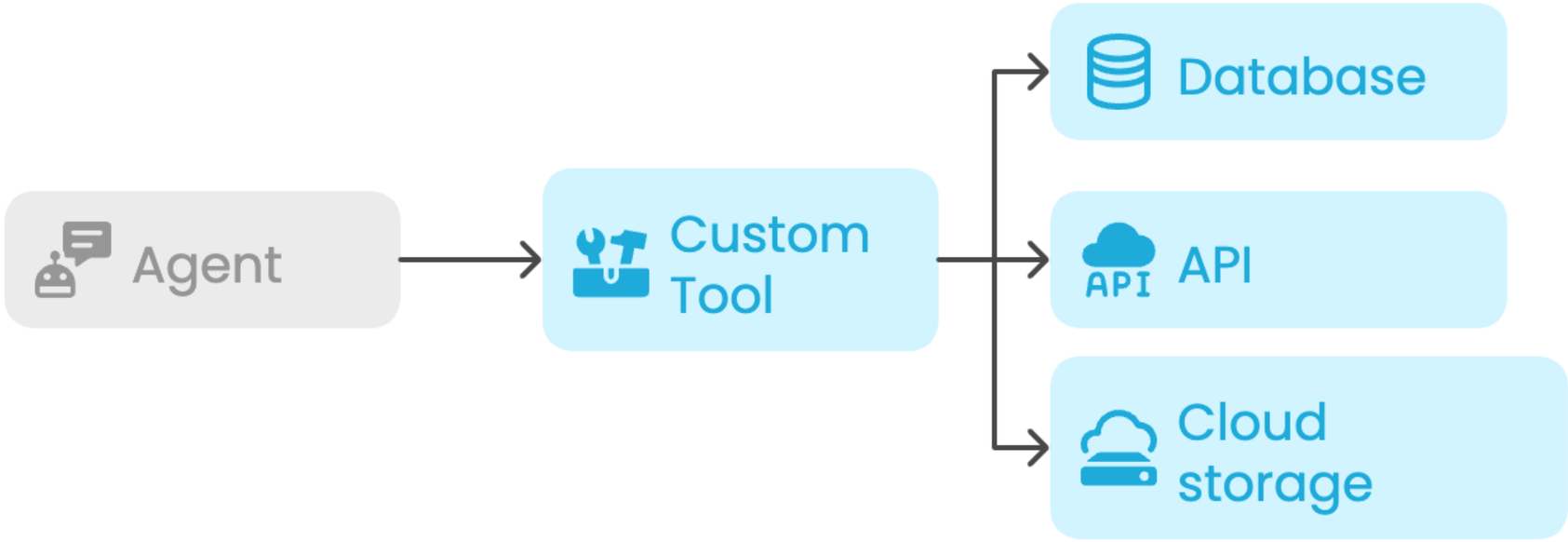
The agent crafts a helpful answer.

Registering a Custom Tool with Your Agent

```
from smolagents import CodeAgent

agent = CodeAgent(
    tools=[check_inventory], # Add custom tool
    model=InferenceClientModel(),
    additional_authorized_imports=["pandas"]  # Allow external package
)

agent.run("Do we have any large t-shirts in stock?")
```

```
Yes, we have 8 large t-shirts in stock.
```

Custom Tools in Production Projects



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