CrewAI: Multi-Agent Collaboration Framework

An Overview of Agents, Tasks, Crews, and Tools in Collaborative AI

CS297

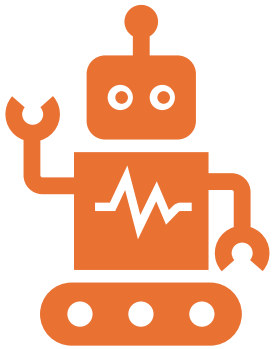
Presented To

Dr. Chris Pollett, Department of Computer Science

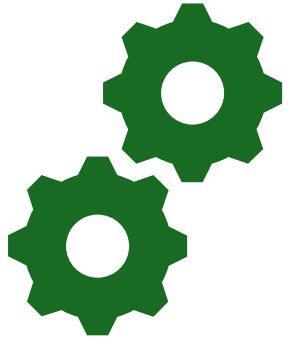
Presented By

Adithya Harish Kumar

What is CrewAI?



Multi-agent system that orchestrates various AI agents to work collaboratively on tasks, le



Combining the capabilities of specialized agents within a coordinated framework leveraging different tools and resources

Agents

- Autonomous AI entities designed to perform specific tasks
- **Autonomous:** Operates independently within the system
- **Specialized:** Tailored for particular domains or tasks
- **Collaborative:** Capable of interacting with other agents for multi-step processes

```
writer = Agent(
    role="Content Writer",
    goal="Write insightful and factually accurate "
         "opinion piece about the topic: {topic}",
    backstory="You're working on a writing "
              "a new opinion piece about the topic: {topic}. "
              "You base your writing on the work of "
              "the Content Planner, who provides an outline "
              "and relevant context about the topic. "
              "You follow the main objectives and "
              "direction of the outline, "
              "as provide by the Content Planner. "
              "You also provide objective and impartial insights "
              "and back them up with information "
              "provide by the Content Planner. "
              "You acknowledge in your opinion piece "
              "when your statements are opinions "
              "as opposed to objective statements.",
    allow_delegation=False,
    verbose=True
)
```

Tasks

- **Definition:** Tasks are units of work assigned to agents, which can range from simple instructions to complex processes.
- **Types of Tasks:**
  - **Atomic Tasks:** Simple, single-step tasks that can be completed by one agent.
  - **Compound Tasks:** Multi-step processes requiring collaboration among several agents.
- **Task Assignment:** CrewAI dynamically assigns tasks based on the agent's specialization and current workload.

```
write = Task(
    description=(
        "1. Use the content plan to craft a compelling "
            "blog post on {topic}.\n"
        "2. Incorporate SEO keywords naturally.\n"
        "3. Sections/Subtitles are properly named "
            "in an engaging manner.\n"
        "4. Ensure the post is structured with an "
            "engaging introduction, insightful body, "
            "and a summarizing conclusion.\n"
        "5. Proofread for grammatical errors and "
            "alignment with the brand's voice.\n"
    ),
    expected_output="A well-written blog post "
        "in markdown format, ready for publication, "
        "each section should have 2 or 3 paragraphs.",
    agent=writer,
)
```

Crew

- A team of agents assembled to work on a complex task.
- Composed of diverse agents with different skills, collaborating to achieve a common goal.
- **Key Characteristics:**
- **Flexibility:** Crews are formed dynamically based on the task's complexity and requirements.
- **Scalability:** Crew size can vary depending on the task load and the agents' abilities.

```
crew = Crew(
    agents=[planner, writer, editor],
    tasks=[plan, write, edit],
    verbose=2
)
result = crew.kickoff(inputs={"topic": "Artificial Intelligence"})
```

Tools

- Tools are external or internal utilities that agents use to perform specific tasks or enhance their functionality within the CrewAI system
- Some Tools:
  - **CSVSearchTool** – For searching within CSV files
  - **FileReadTool** – Reads individual files
  - **ScrapeWebsiteTool** – For general web scraping purposes
  - **RagTool** – A tool for performing retrieval-augmented generation (RAG)

```
from crewai_tools import DirectoryReadTool, \
                         FileReadTool, \
                         SerperDevTool
```

Multi-Agent Collaboration

- **Collaboration Dynamics:**
  - Agents work together by sharing task progress, results, and updates.
  - Each agent performs part of a task or a step in the process chain.
  - Sequential and Hierarchical
- **Key Benefits:**
  - **Efficiency:** Agents can work in parallel, reducing overall time.
  - **Specialization:** Each agent handles the tasks they're best suited for, enhancing overall performance.

Memory

Memory refers to the system's capability to store and retrieve past actions, decisions, and task outcomes.

- **Short-Term Memory (STM):** Stores temporary, task-relevant information for immediate use.
- **Long-Term Memory (LTM):** Retains knowledge, patterns, and task outcomes for future use.
- **Entity Memory:** Entity memory is the information retained by agents about specific entities (e.g., users, stocks, clients, or documents) that they interact with over time.