

ID2209 HT23 Distributed Artificial Intelligence and Intelligent Agents

Final Project - Report

Group 25 - Dominika Drela, Eugen Lucchiari Hartz

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Introduction

This project aims to replicate a festival scenario featuring diverse guests, exploring their interactions and behaviors influenced by individual traits and personality values. The inquiry centers around anticipating outcomes when various agents engage under such circumstances. Our foundation for this project is grounded in the knowledge and code snippets acquired from previous weekly assignments.

Beyond individual attributes, we recognize that the meeting location plays a pivotal role in shaping agent behavior. Using concepts assimilated during our learning journey, we have employed source codes from past assignments as the groundwork. Adhering to prescribed guidelines, we closely monitored the simulation results to draw meaningful conclusions.

To fulfill the minimum requirements for project completion, we have successfully incorporated solutions, ensuring adherence to specified criteria. In addition to addressing fundamental inquiries, our project delves into the Challenge, simulating Belief, Desire, and Intention (BDI) behavior. This takes us deeper into the formalization of an agent's intention, enriching our exploration of intricate agent dynamics.

Festival Personalities - The Agents

The basic requirements necessitate the inclusion of at least 5 types of Festival Guests. We've chosen the following characters, each represented by a distinct color:

- The Normal (Green): Relaxed and unassuming, the typical festival-goer seeks a hassle-free experience and is present to enjoy the event. This agent serves as the baseline for other agents' behaviors, being neutral and open to interactions based on suitable attribute values.

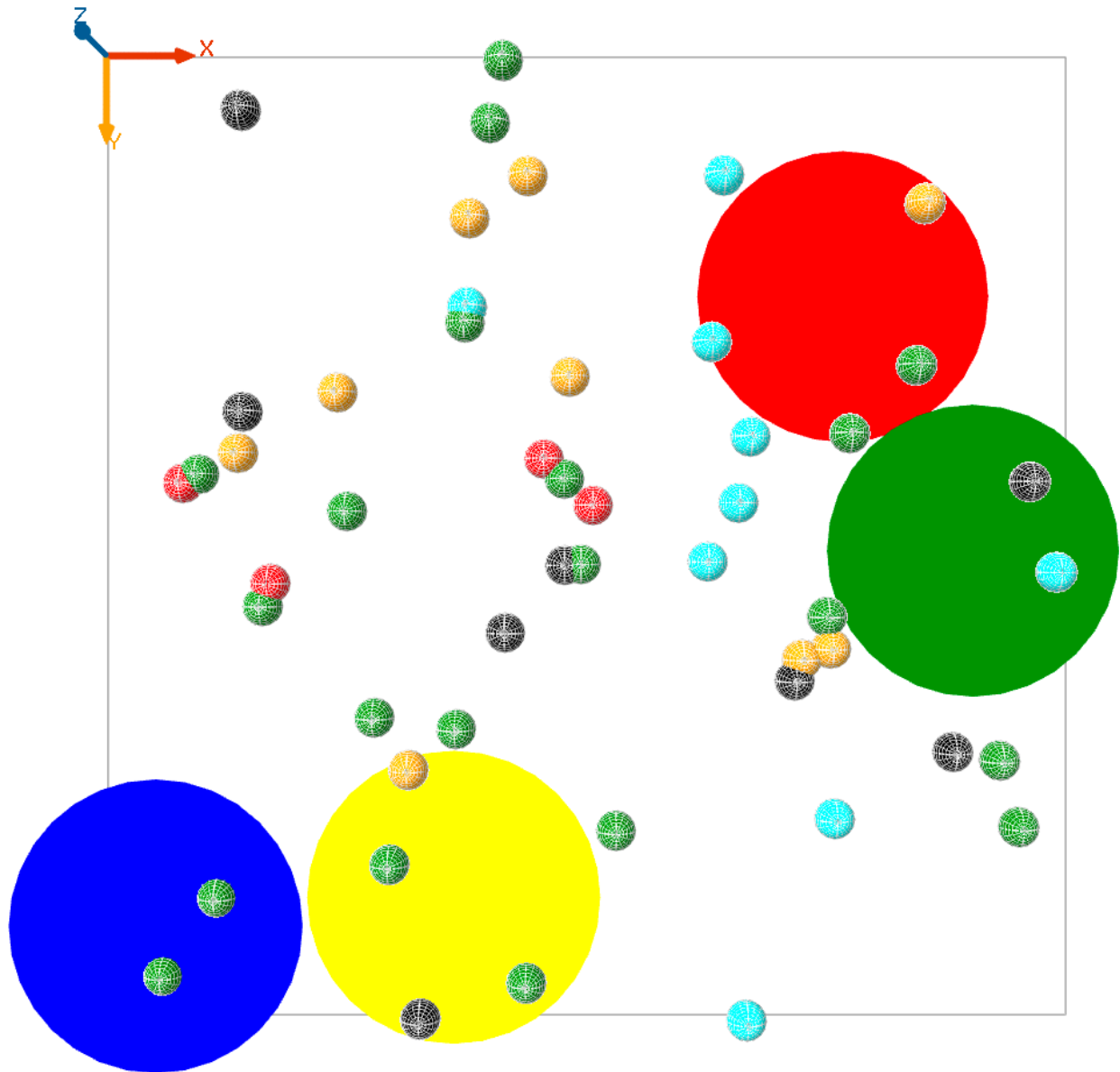
- The Party Enthusiast (Aqua): Energetic and lively, these wild revelers add a vibrant touch to every festival. They crave an electrifying time at the party venues and watering holes, making it hard to ignore their exuberance.
- The Chill People (Orange): Exhibiting just the right level of coolness, these guests attend the festival for the music and a serene experience. You'll find them in various zones, excluding party areas, as they prefer a more laid-back evening. They are unlikely to engage in arguments or conflicts with other agent types.
- Gambler (Black): Driven by the thrill of making a quick profit or risking their savings, gamblers are drawn to the designated gambling area. Their focus remains within this space, with occasional ventures for essential needs like food.
- Weirdos (Red): True to their name, weirdos exhibit unpredictable behavior. Immersed in their unique experience of events, interactions with them are inherently uncertain. We've attempted to simulate this inherent randomness as authentically as possible.

Festival Areas

Alongside these agents, we've established designated areas for their encounters and interactions:

1. Party Place (Red): This lively zone is dedicated to music, dancing, and overall revelry, creating an atmosphere of celebration.
2. Drinks & Chill Place (Green): A laid-back spot featuring a pub for socializing, drinking, and casual lounging - a perfect setting for unwinding and relaxation.
3. Food Court (Yellow): This area caters to the gastronomic needs of festival-goers, offering a variety of food options to satisfy their culinary preferences.
4. Gambling Area (Blue): A specialized space with a casino ambiance, providing guests with the opportunity to indulge in gambling activities if they choose.

We've assigned traits to quantify attributes such as generosity, wealth, and talkativeness exhibited by the agents. The nature of the agents' interactions will vary based on a combination of utility values associated with these traits and the specific location where the interactions occur. The agents will employ FIPA protocols for communication with each other.



Picture: Arrangement of the festival with the agents and the designated areas for interactions

Interactions

In the following, we outline the interactions among our various agents, considering the location, attributes of the interacting agents, and their overall agent type.

The Normal

Party Area - A regular guest is open to partying when approached by an agent with a generosity level exceeding 5, excluding weird guests. If the approaching guest is another regular one, the interaction brings maximum happiness with a level of 9. For any other type of guest, the regular agent maintains a moderate level of

happiness. If the approaching guest is of the weird type, the regular agent declines the invitation.

Chill Area - A normal guest is open to relaxing if the approaching guest is not excessively wealthy and does not exhibit weird behavior. The wealth rating should be below 5 for them to be willing to unwind.

Food Area - Concerning food, the ordinary guests tend to prefer dining with individuals of their own type and are not inclined to share a meal with other agents, irrespective of their attribute values.

Gambling Area - In the gambling area, the normal guests are willing to participate in gambling activities if both their own wealth attributes and those of the interacting guest are greater than 5.

The Party Enthusiast

Party Area - The party enthusiast is ready to engage in party activities with all types of agents, but there are specific conditions. They prefer interactions with agents who have high generosity and talkative traits. If these conditions are not met, they would prefer to enjoy the party on their own.

Chill Area - The party enthusiast is open to chilling and having a drink with individuals who exhibit high generosity, as long as they are not classified as weirdos or gamblers.

Food Area - Similar to the normal crowd, party enthusiasts prefer to share a meal with those of their own kind. In this scenario, they only agree if the other agent is also a party person.

Gambling Area - Gambling Area - The party guest will engage in gambling activities only if both they and the requesting guest have a wealth attribute greater than 5.

The Chill Person

Party Area - The chill person prefers to keep things mellow and is not interested in partying. Consequently, they will avoid entering the party area with any other agent.

Chill Area - In their designated zone, the chill person is open to relaxing and having a drink with any agents, regardless of their type or attributes.

Food Area - Chill agents will share a meal only with other chill agents, maintaining the consistent pattern observed in this area for all agent types.

Gambling Area - Chill agents are willing to engage in gambling activities with agents who are moderately wealthy, but not excessively so. However, they themselves need to possess significant wealth (wealth > 6) to entertain the idea.

The Gambler

Party Area - The gambler is inclined to participate in the party scene if the approaching agent exhibits high generosity and is not classified as a weirdo.

Chill Area - In line with their preferences, gamblers are open to chilling only when the approaching agent's wealthy trait is high and they are not classified as weirdos. Additionally, the gambler themselves should have a wealth rating of 0 to accept the invitation to chill.

Food Area - Gamblers will participate in the food area interactions exclusively with other gamblers.

Gambling Area - For gambling interactions, both the gambler and the approaching agent should have comparable wealth ratings to capture the gambler's interest. Regardless of the agent type, the gambler is ready to engage in play if this condition is met.

The Weird

Party Area - Weird individuals express happiness at the idea of being invited to a party, and they willingly accept party invitations from any agent, irrespective of their type or attribute values.

Chill Area - Similar to their approach to partying, the weird crowd is consistently open to chilling with any agent, disregarding their type or attribute values.

Food Area - Weird guests limit their food interactions to only other weird guests, excluding any other agent, regardless of their trait values.

Gambling Area - In the domain of gambling, weird individuals exhibit some discernment. They decline to engage in gambling unless the other agent is wealthy, irrespective of the agent's type.

Some examples from the log that describe the interactions

```
#####happiness_Level_mapmap(['visitor0':147,'visitor1':42,'visitor2':147])
visitor27is anormaldoesnt want to gamble with normalwhose type is normal
#####happiness_Level_mapmap(['visitor0':147,'visitor1':42,'visitor2':147])
#####happiness_Level_mapmap(['visitor0':147,'visitor1':42,'visitor2':147])
#####happiness_Level_mapmap(['visitor0':147,'visitor1':42,'visitor2':147])
#####happiness_Level_mapmap(['visitor0':147,'visitor1':42,'visitor2':147])
visitor32 is a gambler doesnt want to gamble with gambler who is not wealthy enough
#####happiness_Level_mapmap(['visitor0':147,'visitor1':42,'visitor2':147])
#####happiness_Level_mapmap(['visitor0':150,'visitor1':42,'visitor2':150])
visitor16 is a weird having food with weird whose type is weird
#####happiness_Level_mapmap(['visitor0':150,'visitor1':42,'visitor2':150])
visitor37is a partyEnthusiastdoesnt want to have food with normalwhose type is normal
#####happiness_Level_mapmap(['visitor0':156,'visitor1':42,'visitor2':156])
#####happiness_Level_mapmap(['visitor0':156,'visitor1':42,'visitor2':156])
#####happiness_Level_mapmap(['visitor0':156,'visitor1':42,'visitor2':156])
#####happiness_Level_mapmap(['visitor0':156,'visitor1':42,'visitor2':156])
visitor46is a partyEnthusiastdoesnt want to have food with weirdwhose type is weird
#####happiness_Level_mapmap(['visitor0':156,'visitor1':42,'visitor2':156])
#####happiness_Level_mapmap(['visitor0':156,'visitor1':41,'visitor2':156])
visitor21is anormalhaving food with normalwhose type is normal
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#####happiness_Level_mapmap(['visitor0':156,'visitor1':41,'visitor2':156])
visitor27is anormaldoesnt want to gamble with gamblerwhose type is gambler
#####happiness_Level_mapmap(['visitor0':156,'visitor1':41,'visitor2':156])
#####happiness_Level_mapmap(['visitor0':156,'visitor1':41,'visitor2':156])
#####happiness_Level_mapmap(['visitor0':156,'visitor1':41,'visitor2':156])
visitor31 is a gambler doesnt want to have food with normal whose type is normal
#####happiness_Level_mapmap(['visitor0':156,'visitor1':41,'visitor2':156])
```

Challenge 1

We are incorporating BDI (Belief, Desire, Intention) in our challenge segment of the project. BDI is a highly valuable model that outlines the sequence of actions in any project, aiming to emulate human behavior in the agents. Our implementation involves a basic BDI model, encompassing different behavior structures within its architecture. We gather information about the agent's desires, and our goal is to fulfill these desires using the BDI model.

Each time an agent generates a desire, we employ the "update desire" action to add it to the system. The Perception behavior structure is utilized to build the belief base. We use "perceive" statements to store information about the locations of the party place, chilling spots, gambling areas, and food venues.

Once we have the desire and the location where the visitor wishes to go, the next step is to actualize the intention. Here, we leverage the plan behavior structure of BDI. Plans are formulated for every intention, and the following steps are executed to implement the plan structure:

- The primary goal of the plan structure is to update the target location of the visitor. It first checks if the target is nil. If true, a subintention is added to extract values of the location from the belief and set the target of the visitor to fulfill its intention, subsequently removing the intention.
- If the target is not nil initially, a command is issued to "go to target." Once the desire is satisfied, we set the target to nil, allowing the visitor to contemplate another desire.

```

visitor30has intention to go towards food location
visitor31has intention to go towards party location
visitor32has intention to go towards food location
visitor32done having food and thinking of other desire
visitor33I have a desire for gambling
visitor34has intention to go towards party location
visitor35has intention to go towards chill location
visitor36has intention to go towards party location
visitor37has intention to go towards chill location
visitor38has intention to go towards gambling location
visitor39has intention to go towards gambling location
visitor40has intention to go towards chill location
visitor41has intention to wander
visitor42has intention to wander
visitor43has intention to go towards food location
visitor44has intention to wander
visitor45has intention to go towards gambling location
visitor46has intention to wander
visitor47has intention to go towards food location
visitor48has intention to wander
visitor49has intention to wander
visitor0has intention to go towards party location
visitor1has intention to wander
visitor2has intention to wander
visitor3has intention to go towards chill location
visitor4has intention to go towards chill location
visitor5has intention to go towards food location
visitor6has intention to go towards gambling location
visitor7has intention to go towards chill location
visitor8has intention to go towards party location
visitor9has intention to go towards food location
visitor10has intention to wander
visitor11has intention to go towards party location
visitor12has a belief for chill location
visitor12has intention to go towards chill location

```

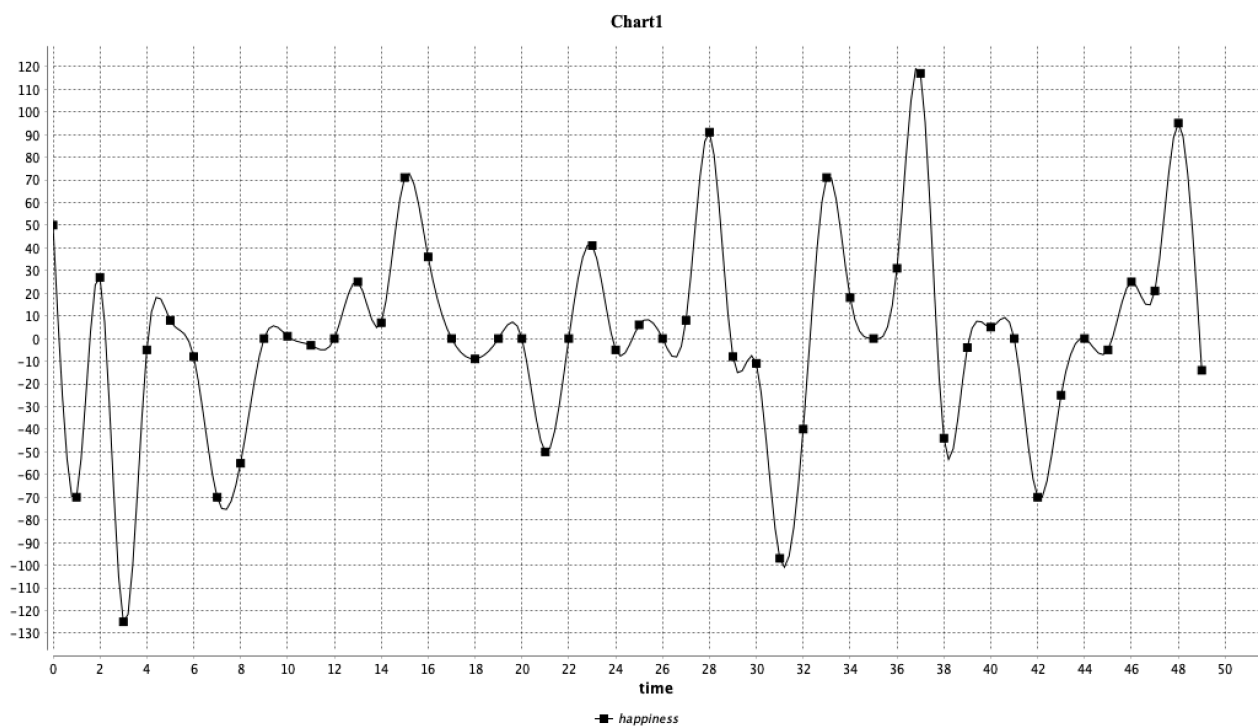
The first line in the screenshot for example indicates that Visitor30 has the intention to move towards the food location. This implies that the visitor initially acquires a belief regarding the location of the food place and subsequently sets a target to fulfill this intention.

Examining the 4th line in the screenshot, it mentions that Visitor20 has chilled and is contemplating another desire. In this scenario, the visitor has successfully fulfilled the desire to relax at the drinks and chill place, resulting in the target being set to nil. This allows the visitor to consider their next desire.

When we look at the penultimate line, we can see that it indicates that Visitor12 has a belief about the chill location. This signifies that the visitor is aware of where the chill place is located and now needs to set their target to the chill place location in order to proceed towards it.

Experiments and Results

In the foundational code, where interactions between different types of agents at the festival are captured, a notable trend emerges: overall happiness tends to peak when agents engage in activities or socialize with other agents of the same type. As outlined in the approach, there are instances where happiness increases when approached by a different type of agent. To effectively showcase this dynamic variation in happiness over time, we have generated a graphical representation, presented below.



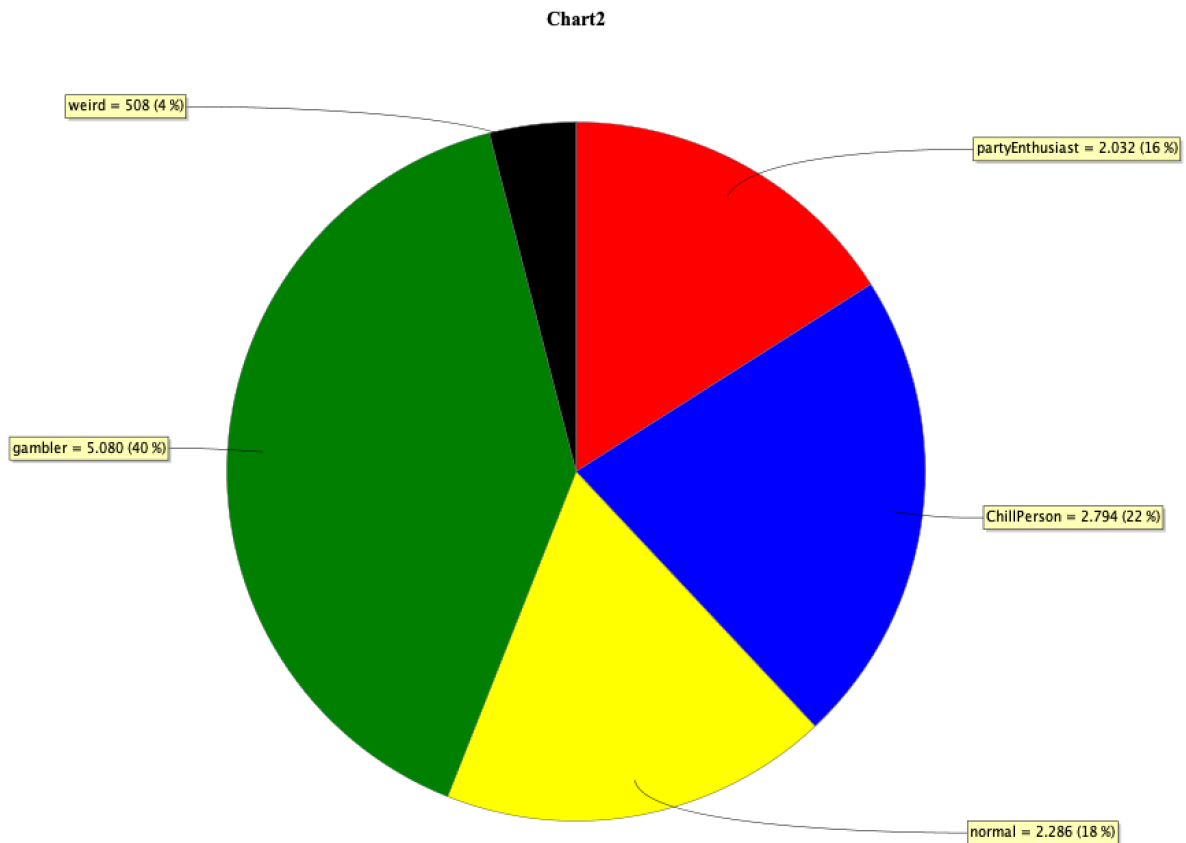


Chart displaying the distribution of the Festival Crowd

Discussions and Conclusions

The project posed significant challenges, primarily stemming from the intricate nature of visualizing and comprehending the potential pathways resulting from each interaction. It resembled the complexity seen in the implementation of AI in video games, particularly in role-playing games (RPGs).

This undertaking served as a synthesis of the various concepts accumulated throughout the assignments. Reflecting on our progress from grasping the fundamentals of GAMA using the Wiki, it is remarkable to witness how much we've advanced. The project instilled confidence in our understanding of foundational Distributed AI concepts, providing us with hands-on expertise.

Throughout the assignments and the project, we've observed that agent behavior is not always straightforward. It goes beyond a simple input-output dynamic, involving negotiations and protocols. By leveraging examples from the GAMA wiki, we successfully implemented BDI behavior in agents. This kind of behavior closely mirrors how we navigate our daily lives.

Undertaking a project of this scale and complexity for the first time, we earnestly hope that we've done justice to the task.