ID2209 – Distributed Artificial Intelligence and Intelligent Agents

Final Project – Behavior of Different Agents

Group 25

Yunfan Yang

Pei Lun Hsu

18.12.2019

I. Basic Part

1. Introduction

In this final project, we were asked to implement a festival simulation that shows how the interactions between different types of guests are affected by their different personalities, as well as how the behaviors of individual agent affected by the personalities/attributes. The purpose of this project is not only to help us review the Gama skills that we have learned through previous assignments, but also help us get more insights into the interactions between multi-agents by implementing a more comprehensive simulation.

1.1 Requirements

• Create at least 5 different types of agents. Use at least 50 agents in scenario.

• The agents have at least 1 different set of rules on how they interact with other types.

• The agents have at least 3 personal traits that affect these rules.

• Have at least 2 different types of places where agents can meet.

• Make the simulation continuously running.

• Agent communicate with FIPA for long distance messaging.

2. Apporach

We created an alcohol festival where different types of bars serve guests with different tastes. Guests can buy drinks and interact with other guests in the bar. However, there is always only one kind of alcohol is at discount in each bar. Three personal traits of each guests: friendliness, hostility and alcohol taste will decide how one guest interacts with other guests in the same bar. Besides, there are also three attributes, money, drunkenness and alcohol tolerance, will decide whether a guest's behavior is withdrawing money, going to the toilet or going to the next bar. We also monitor the happiness and money of each guest, which are mainly affected by the interactions between guests, and check how do the global values evolve as the simulation running. The detailed descriptions about personal traits, behavior rules and actions of each agent species are as below.

2.1 Agent species

- Bar:
    a. number: 4

    b. type: wine bar/beer bar/ whiskey bar/ cocktail bar
- ATM
    a. number: 2
    b. actions: use FIPA propose to provide the locations of atms to guests while receiving any request from guests through cfp messages.
- Toilet:
    a. number: 2
    b. actions: use FIPA propose to provide the locations of toilets to guests while receiving any request from guests through cfp messages.
- Wine lover:
    a. number: 25
    b. personal traits related to interactions: friendliness(random[0 ~ 1]), hostility(random[0 ~ 1]), taste([Wine, Beer, Whisky, Cocktail])
    c. other attributes related to behaviors: money(initial: 1.0), happiness(initial: 0.5), alcohol tolerance(random [0.5 ~ 1])
    d. behaviors rules:
        i. if the drunkenness of the guest is less than its alcohol tolerance, it will ask the location of toilets from toilet agents through FIPA. As the location is known, it will go to the toilet to vomit, and reset the drunkenness to 0, i.e., sober.
        ii. if the money of the guest is less than 40% of the initial amount, it will ask the location of atms from atm agents through FIPA. As the location is known, it will go to the ATM to withdraw money, and reset the money to 1, i.e., full.
        iii. if neither drunk nor poor, the guest will randomly choose a bar to go and interact with other types of guests in the bar.
    e. interaction rules:
        i. Enter the bar, check what type of alcohol is at a discount in the bar. If the discount alcohol is same as its taste, the guest will increase the probability to buy another guest a drink.
        ii. Wait for someone to start an interaction proactively.
        iii. If no one starts an interaction, search for the nearest guest and start an interaction with the nearest guest actively.
        iv. If the nearest guest shares the same alcohol taste as the guest:

1. If both guests are friendly: the guest will buy the nearest guest some drinks and both guests' happiness largely increase.
2. if the sum of both agents' friendliness is not high enough: they will have a pleasant chat with the nearest guest, but does not buy any drink. The happiness of both guests slightly increases.

v. If the nearest guest has a different alcohol taste from the guest:

1. If both guests are hostile: They will have a fight. The happiness of both guests will largely decrease.
2. If both guests are not hostile, and both of them are very friendly (sum of friendliness is high): They will buy each other a drink. The happiness of both guests will slightly increase.
3. If both guests are not hostile, but also not friendly: They will have an unpleasant talk but do not buy any drink. Each guest's happiness will become the average of two guests'.

- beer/ whisky/cocktail lovers [3 species]:
    a. number: 25/ species
    b. all traits, attributes and rules are similar to species 'wine lover'.

3. Experiments and Results

As the experiment running, we can see the festival structure map shown in figure 1.

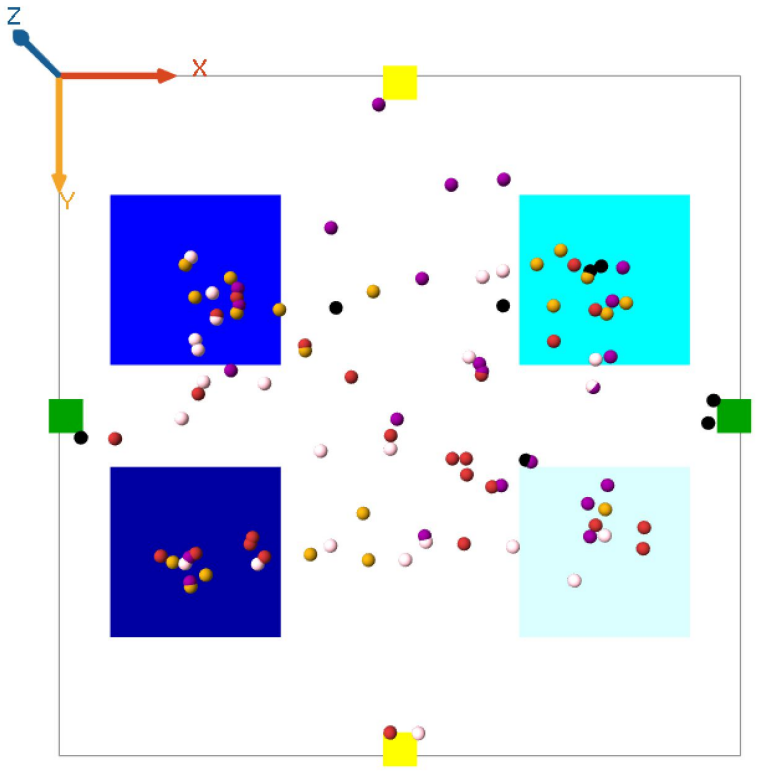


Figure 1. festival structure map

In our festival experiment, there are four different bars, i.e., big squares, on the map. The guests with different alcohol tastes, i.e., small spheres, can visit each bar and interact with other guests in the bars. There are two ATMs, i.e., small yellow squares, on the top and bottom of the map, and also two toilets, i.e., small green squares, on the left and right of the map.

Log messages below shows the different interactions between guests in the bars:

(Time 464.0): whiskey_lover16 and wine_lover15 buy each other a drink, both are happy ~

(Time 465.0): whiskey_lover18 has a short chat with whiskey_lover23, both are happy~

(Time 465.0): cocktail_lover0 has a fight with wine_lover19, both are not happy :(

(Time 469.0): cocktail_lover20 and whiskey_lover22 buy each other a drink, both are happy ~

(Time 475.0): cocktail_lover10 has an akward conversation with whiskey_lover13, both are neither happy nor unhappy.

As well as the interactions between guests and toilet and ATM agents:

(Time 476.0): cocktail_lover23 is drunk, but does not know where is the toilet.

cocktail_lover23 ask toilet agent for the location via cfp message

(Time 477.0): toilet0 provide the toilet location to guests who need to vomit.

(Time 477.0): toilet1 provide the toilet location to guests who need to vomit.

(Time 477.0): cocktail_lover23 go to toilet to vomit.

(Time 486.0): cocktail_lover19 runs out money, but does not know where is the atm.

cocktail_lover19 ask atm agent for the location via cfp message

(Time 487.0): atm0 provide the atm location to guests who need to withdraw money.

(Time 487.0): atm1 provide the atm location to guests who need to withdraw money.

(Time 487.0): cocktail_lover19 go to atm to withdraw money.

We monitor two global values during the experiment running, i.e., happiness and money. The graph that shows the evolution of the global happiness and money are in Figure 2.

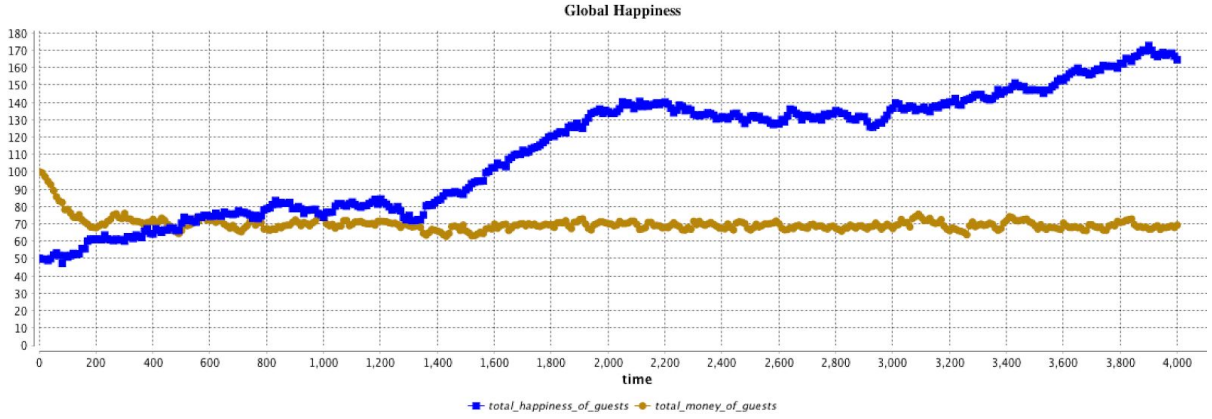


Figure 2. global happiness (blue line) and global money (dark gold line) of guests versus time

We also monitor the distribution of happiness among all beer lovers around time step 4000, which is shown in figure 3.

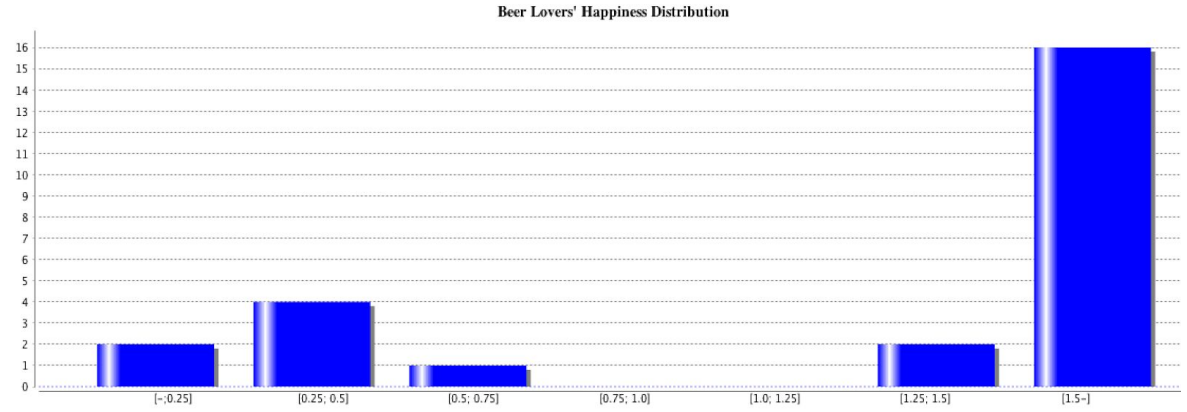


Figure 3. distribution of happiness of beer lovers at time 4000

4. Discussion and Conclusion

As we can see from figure 2, the global happiness gradually increased from the start point (happiness = 0.5 /guest, total happiness = 50 at time 0) as the experiment running. The trend is reasonable since if the distributions of the attributes, i.e., happiness and hostility, are perfectly random distribution, the probability for a guest to become happier in each interaction is 0.4375, which is slightly higher than the probability for a guest to become unhappier, i.e., 0.375. In addition, the discount of a specific alcohol in each bar also help increases the probability of the guests who like this kind of alcohol to treat other guests more drinks, which makes the probability to become happier higher. We can also see that the global money reach equilibrium around 70 after a short decreasing at the beginning of the experiment. Since the amount of money that a guest can take after going to atm is fixed, the equilibrium of the global money is also reasonable. The evaluation of the global money will be discussed more in the challenge part.

From figure 3, we can that the happiness of most of the beer lovers (18/25) is larger than 1.25 after the experiment running 4000 time steps, only a small portion of guests (2/25) with a happiness lower than 0.25. This distribution is also a reasonable result from our design of the experiment. As there are more chances for an individual guest to become happier, happiness will pile up as the alcohol festival keep running. Only a small portion of guests who have very high hostility will always pick a fight with another guest during interaction, and ends up having lower happiness.

However, it is not realistic for a person to become happier and happier without a limit as he/she drinks more and more alcohol. We all know that getting wasted is a horrible feeling, especially when we vomit. Therefore, what if we make guests lose some happiness every time they drink too much and go to vomit in the toilet? The new results of global happiness trend and the distribution of happiness after adding the new mechanism to lose happiness are shown in figure 4 and figure 5, respectively.

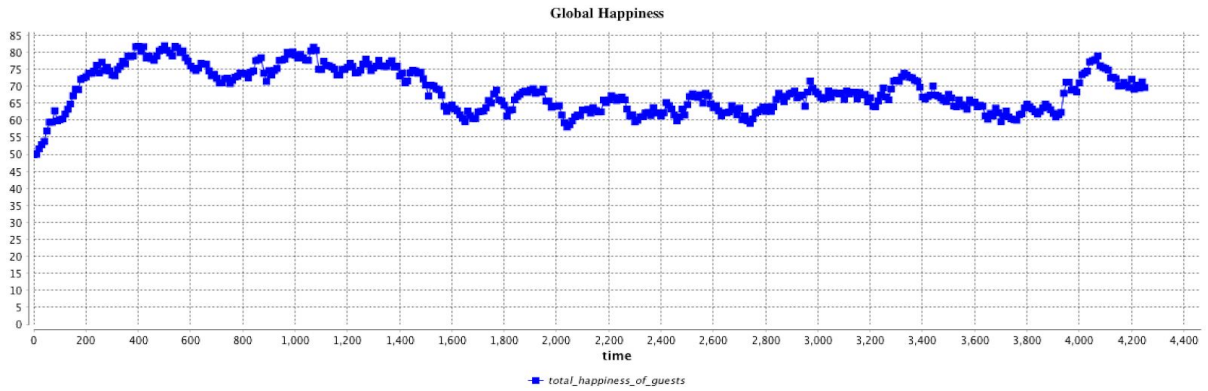


Figure 4. global happiness of guests versus time after adding vomit penalty

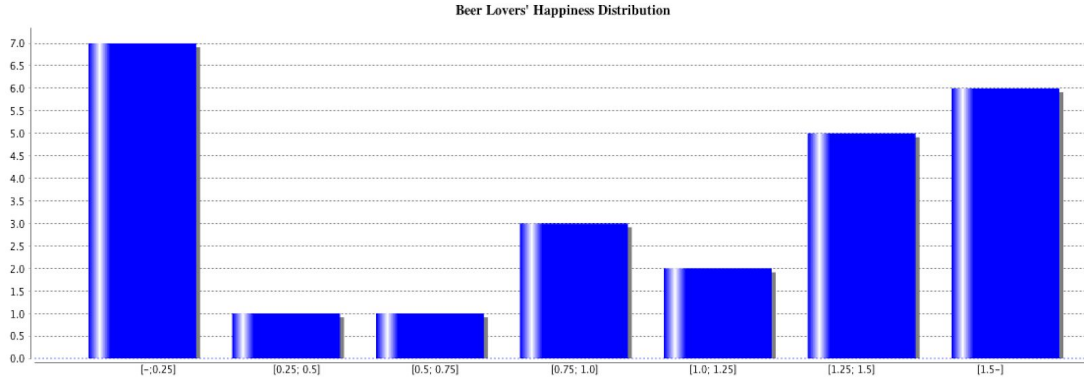


Figure 5. distribution of happiness after adding vomit penalty at time 4200

From figure 4, we can see that after adding the vomit penalty, the global happiness increases for a while after the experiment began, and stops increasing as some drunk guests start to vomit. After that, the global happiness oscillates between 50 and 100, it would not directly goes up as the global happiness did before the change. The distribution of happiness of beer lovers is also more scattered after the change as we can see from figure 5. For those guests who easily get drunk and become too happy, the vomit penalty now prevents their happiness from piling up without a limit. The individual happiness is now forced to scatter more evenly between 0.25 and 1.5, and the happiness of this festival seems to be closer to the real case in a festival.

In conclusion, we built an alcohol festival experiment to simulate interactions between guests with different alcohol tastes at bars that providing discounts on different alcohols. There are several personalities and attributes that affect the behaviours and interactions of the guests. We monitored the global happiness as the experiment running, as well as the distribution of happiness among one kind of guests, i.e., beer lovers. We find that this variable, i.e.,

happiness, is largely affected by adding new behavior of guest in the experiment, e.g., vomit penalty on happiness.

II. Challenge Part: BDI

• Introduction

for the challenge part of the project, our team finished the first challenge - BDI. differed from the basic part, in order to implement BDI properly, we changed some rules and add a new species “thief” to the program.

• Approach

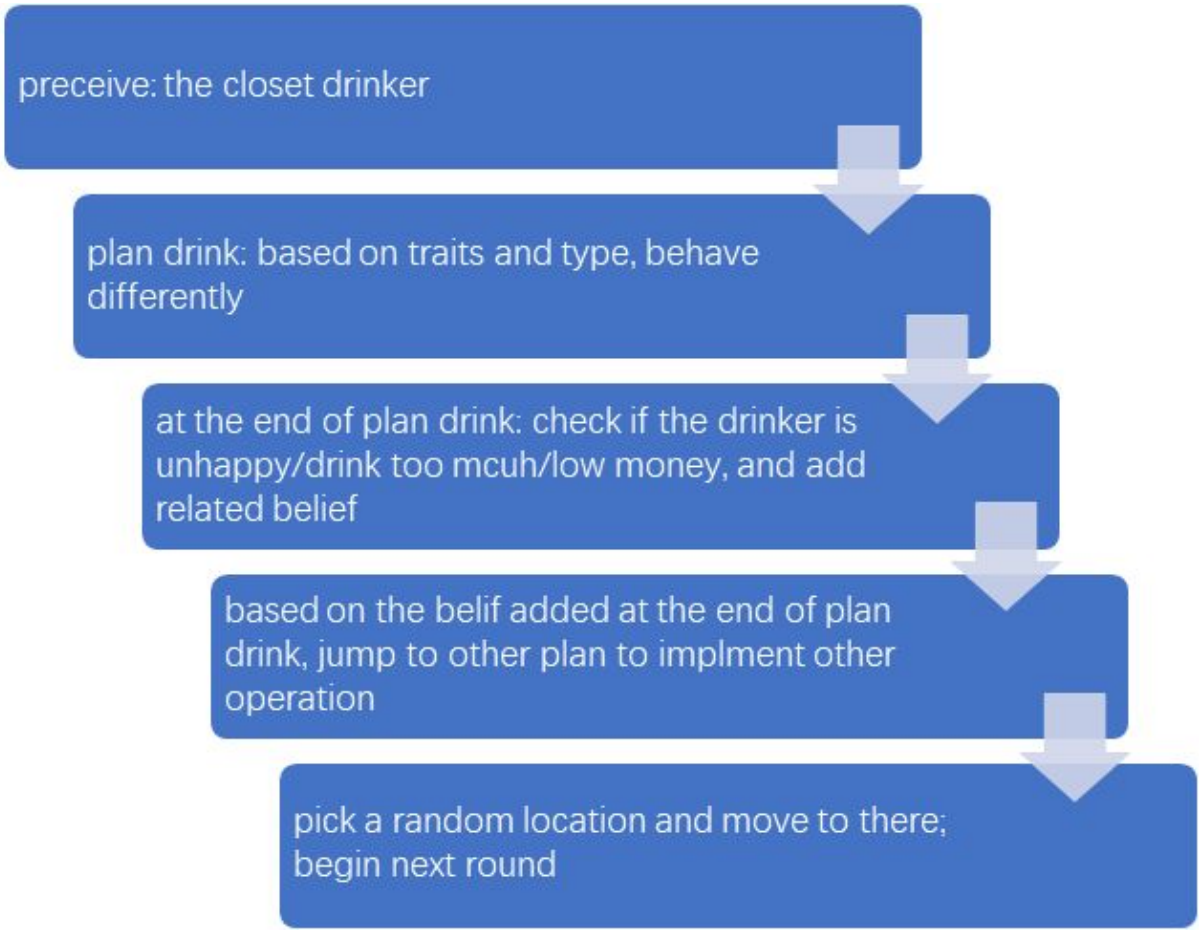
for challenge one, the rules of interaction between different alcohol lovers are the same. those three personal traits with their type of drinks will still influence how they act to each other. when agents are running out of money they will go the ATM to withdraw more; when agents drink too much which is beyond their capacity, they will then go to the toilet to relax (vomit and continue maybe?）. a new species thief will wander near the bar and try to steal money from the drinkers. however, if the drinker has the personal trait “aggressive” with a value beyond 50, the drinker will fight back and causes the thief losing money. the personal characteristic “happiness” now has a more complicated mechanism - its value will decrease when drinker needs to withdraw more money or drinks too much or is stolen by the thief. when the happiness value drops below 0, the drinker will begin to wander and recovery 1 point of happiness each cycle.

• Experiments & results

the program for the challenge part has in total 7 species:

1. thief
2. whiskey_lover
3. beer_lover
4. cider_lover
5. bar
6. toilet
7. ATM

among them, those three types of drinker and thief are programmed using BDI. drinkers have roughly the same architecture in BDI.

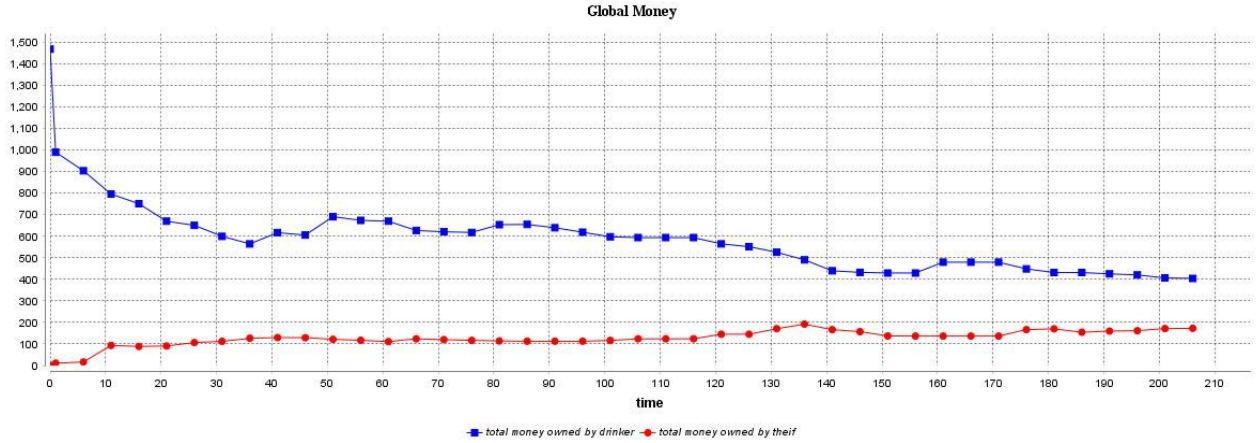


there is a total of five rules in the drinkers BDI system, with increasing strength. thus, if the drinker is both unhappy and drinks too mcuh, he/she will go wandering to recover happiness first and then go to the toilet.

as for the thief species, it will also perceive the closest drinker and implement do_steal plan. however, as mentioned before, the stealing is not 100% success - if the drinker's aggressive is too high, stealing will fail and cause thief itself loses money.

the BDI version of program chooses the total money owned by all the drinkers and the total money owned by all the thieves as two values to be monitored and displayed. the graph will be shown in the next section.

• Discussions and Conclusion



from the graph above, it can be indicated that the total money of the drinker will have a sharp drop in the beginning but then tend to be stable at around 500. the overall trend is still decreasing. the total stolen money is also stable and reaches around 100 with a slightly increasing trend, which leads to a result that in this simulation the number of aggressive drinkers may be less the non-aggressive ones.