CmpE593 Multi-Agent Systems

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Project 2

1 Introduction

In this project we implemented a movie recommender agent, Squirtle, that helps our hero, Ash, to choose which movie to go. All the constraints from Assignment 1 holds and BDI agent Pikachu still does her duties.

2 Dataset

In this Project we used FilmTrust dataset. In this dataset each agent has trusted agents(trustee) and trust coefficient. We took trustee's as friends and coeficents as friendship level. Every trustee of our trustor is our agent's friend and our agent only listens friends or friends's friends.

Every agent has watched movie list and they rate those movies between 0 and 4.We change these values as (-2,2)

3 Trust Evaluation

Trusting an another agent does not mean that we took its rating for granted.We just consider their opinion when choosing a movie. To do this we look its relation between previous ratings and our IMDB ratings for the specific movie.

3.1 Movie Knowledge

Movie knowledge is Squirtle's friends' trust score. This is determined by two things. First is IMDB accuracy : Difference between averaged score and friend's score Where IMDB is the gold standard.

Second is Squirtle accuracy : Difference between our score and friend's score Where our score is the gold standard.

3.1.1 IMDB Accuracy

Like IMDB, Squirtle calculates each movies' average rating. (For the Pokemon's that have at least watched 5 movies). Then, Squirtle determines how much every Pokemon's movie ratings deviate from those average values.

$$IMDB\ Accuracy\ for\ one\ Pokemon = \frac{\sum Deviation\ Form\ Watched\ Movies}{Number\ Of\ Watched\ Movies}$$

IMDB Accuracy measures, how is the general movie taste of a Pokemon is. We assumed that, if a Pokemon gave similar points to the average movie points then it has a good movie taste.

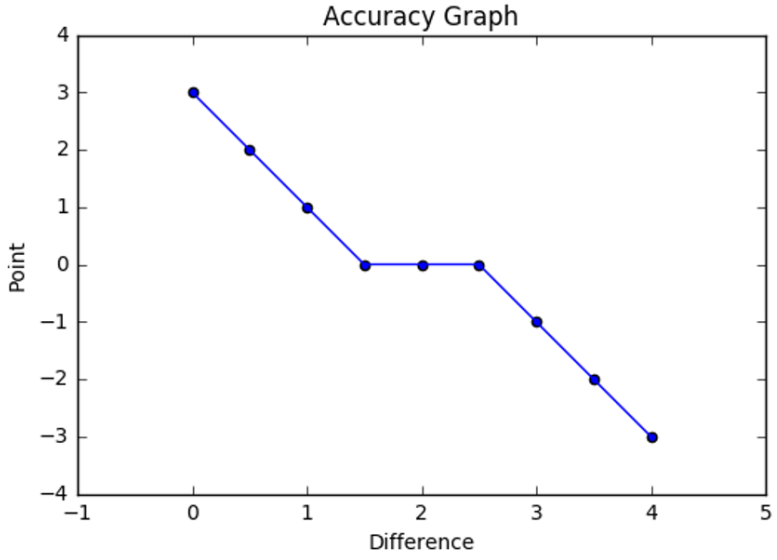


Figure 1: Function to transform Rating Difference to IMDB Accuracy.

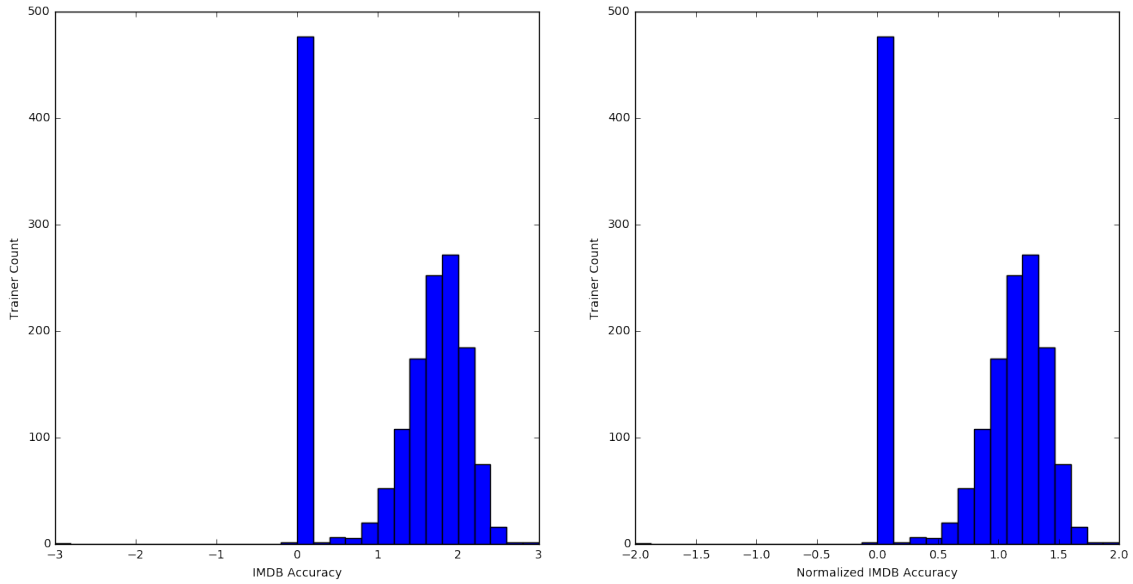


Figure 2: IMDB accuracy points of all trainers.

3.1.2 Squirtle Accuracy

Squirtle Accuracy measures, how similar a Pokemon's movie taste is to Squirtle's movie taste. For each Pokemon, Squirtle compares the ratings of movies that they watched in common. Then like IMDB accuracy, Squirtle determines how much every Pokemon's movie ratings deviate from his movie ratings.

$$Squirtle\ Accuracy\ for\ one\ Pokemon = \sum Deviation\ Form\ Common\ Movies$$

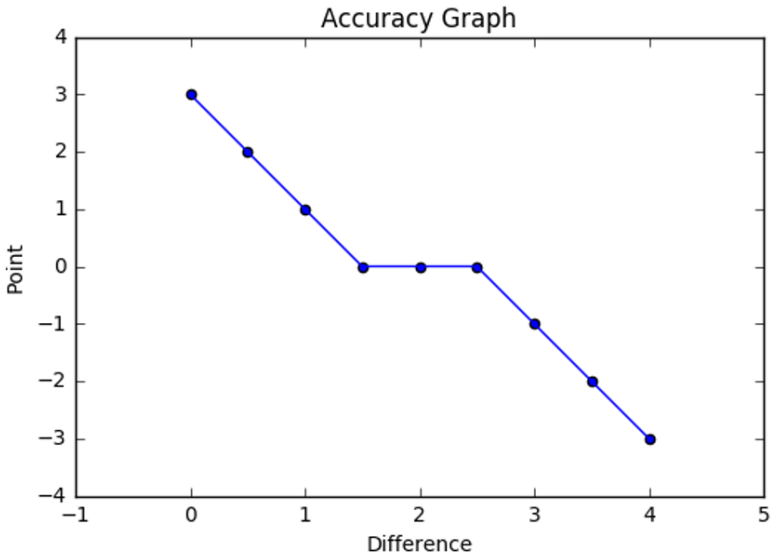


Figure 3: Function to transform Rating Difference to Squirtle Accuracy.

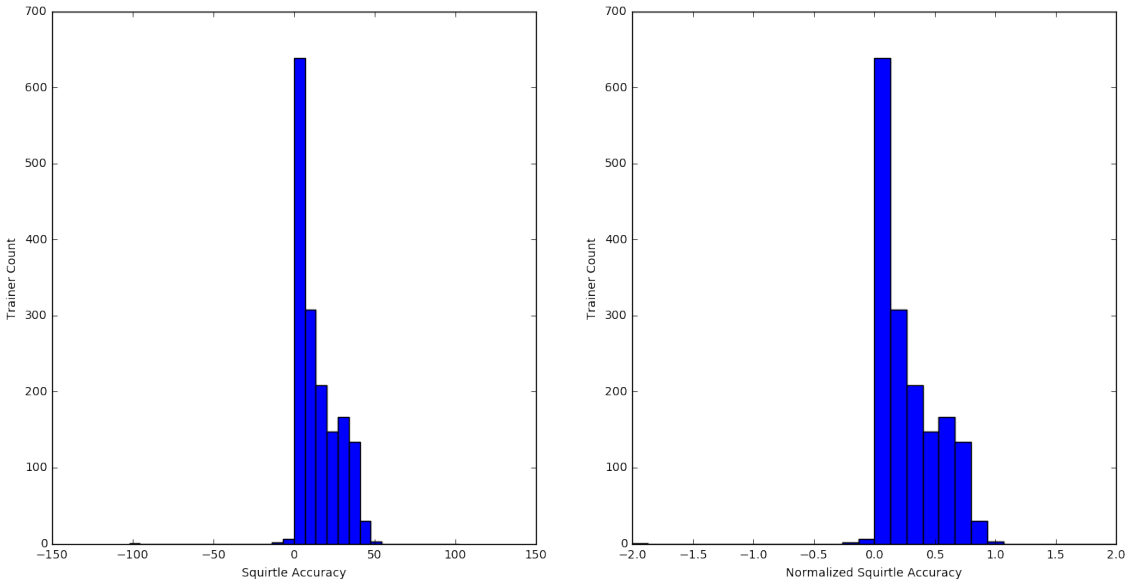


Figure 4: Squirtle accuracy points of all trainers..

After calculating IMDB Accuracy and Squirtle Accuracy we normalized their values to between $[-2, 2]$. Purpose of the normalization is to drag both equation to same value space to make calculations and also to make them comparable to real movie ratings.

$$Movie\ Knowledge = (0.4 * IMDB\ accuracy) + (0.6 * Squirtle\ accuracy)$$

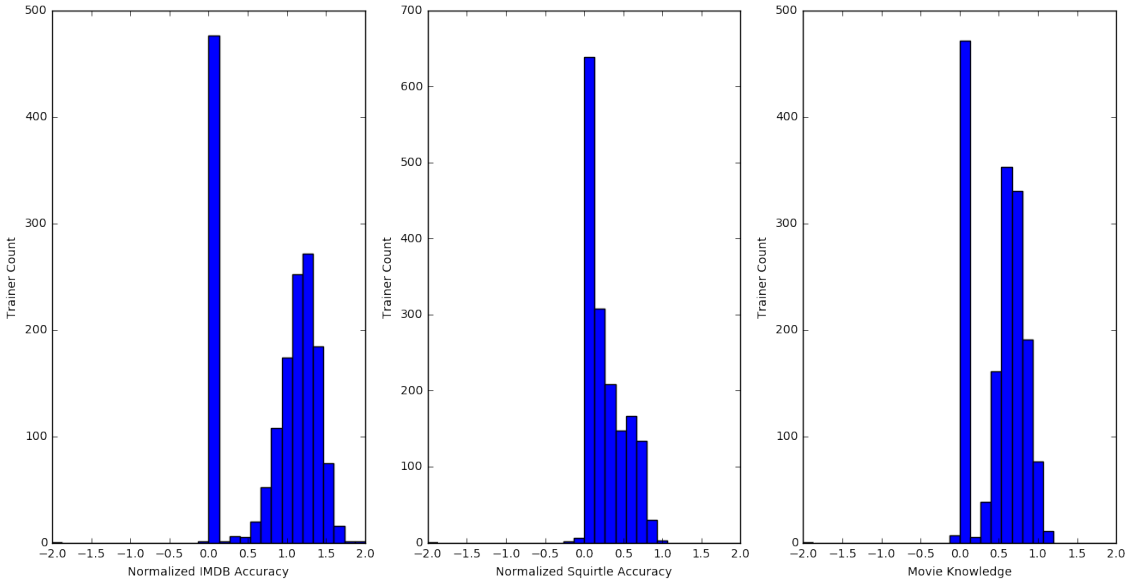
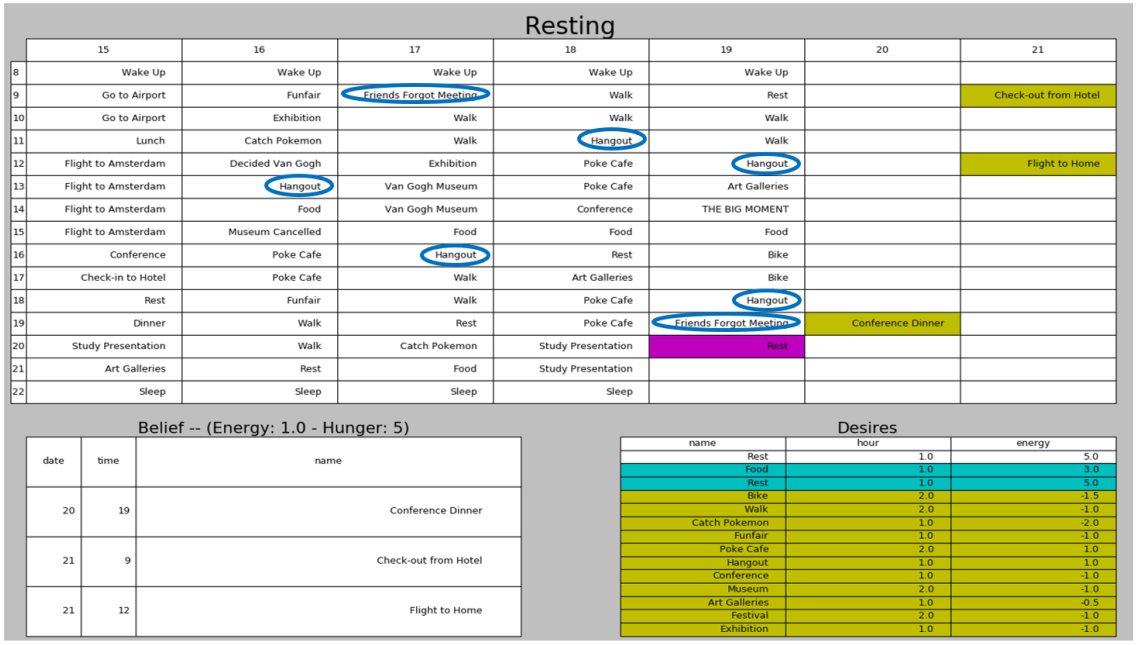


Figure 5: IMDB accuracy, Squirtle Accuracy and thier combination Movie Rating.

3.2 Friendship Level

Friendship level means that how closely Ash knows a person in terms of its movie taste. For his initial friends (from FilmTrust), the value is 1. The value is 0 for people who is not friend of Ash. For the new people Ash meets, Squirtle uses a formula to calculate friendship level.

We used Hangout random intention from the previous project as a mechanism of meeting with new friends. Hanging out with friends may result in either success or failure.



	15	16	17	18	19	20	21
8	Wake Up	Wake Up	Wake Up	Wake Up	Wake Up		
9	Go to Airport	Funfair	Friends Forgot Meeting	Walk	Rest		Check-out from Hotel
10	Go to Airport	Exhibition	Walk	Walk	Walk		
11	Lunch	Catch Pokemon	Walk	Hangout	Walk		
12	Flight to Amsterdam	Decided Van Gogh	Exhibition	Poke Cafe	Hangout		Flight to Home
13	Flight to Amsterdam	Hangout	Van Gogh Museum	Poke Cafe	Art Galleries		
14	Flight to Amsterdam	Food	Van Gogh Museum	Conference	THE BIG MOMENT		
15	Flight to Amsterdam	Museum Cancelled	Food	Food	Food		
16	Conference	Poke Cafe	Hangout	Rest	Bike		
17	Check-in to Hotel	Poke Cafe	Walk	Art Galleries	Bike		
18	Rest	Funfair	Walk	Poke Cafe	Hangout		
19	Dinner	Walk	Rest	Poke Cafe	Friends Forgot Meeting	Conference Dinner	
20	Study Presentation	Walk	Catch Pokemon	Study Presentation	Rest		
21	Art Galleries	Rest	Food	Study Presentation			
22	Sleep	Sleep	Sleep	Sleep			

date	time	name
20	19	Conference Dinner
21	9	Check-out from Hotel
21	12	Flight to Home

name	hour	energy
Rest	1.0	5.0
Food	1.0	3.0
Rest	1.0	5.0
Bike	2.0	-1.5
Walk	2.0	-1.0
Catch Pokemon	1.0	-2.0
Funfair	1.0	-1.0
Poke Cafe	2.0	1.0
Hangout	1.0	1.0
Conference	1.0	-1.0
Museum	2.0	-1.0
Art Galleries	1.0	-0.5
Festival	2.0	-1.0
Exhibition	1.0	-1.0

Figure 6: Sample screen shot of Ash's schedule with circled Hangout intentions.

3.2.1 Hangout Success

Ash meets with a new person who is a friend of the Ash's hangout friend. Squirtle adds the new person to Ash's friend list with the following Friendship Level:

$$Friendship\ Level\ of\ new\ friend = Friendship\ Level\ of\ Ash's\ prior\ friend * Movie\ Knowledge\ of\ Ash's\ prior\ frien$$

(*): Movie Knowledge of Ash's prior friend is mapped between (0.5, 1) for this equation.

user	trust	IMDB acc.	Squirtle acc	Movie Knowledge
Onix	1	1.45645173056	0.176470588235	0.688463045164
Charmender	1	1.39472702768	0.313725490196	0.746126105188
Mew	1	1.07338661944	0.117647058824	0.499942883071
Zubat	1	1.11352192881	0.490196078431	0.739526418583
Staryu	0.854892			

Figure 7: Squirtle hangs out with Charmender who brings Staryu with him. So Squirtle adds Staryu as a new friend to the friends list.

user	trust	IMDB acc.	Squirtle acc	Movie Knowledge
Onix	1	1.45645173056	0.176470588235	0.688463045164
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Mew	1	1.07338661944	0.117647058824	0.499942883071
Zubat	1	1.11352192881	0.490196078431	0.739526418583
Staryu	0.854892	1.40175090455	0.372549019608	0.784229773585
Togepi	0.697518			

Figure 8: Squirtle hangs out with Staryu who brings Togepi with her. So Squirtle adds Togepi as a new friend to the friends list. Togepi's trust value is lower than Staryu as expected.

3.2.2 Hangout Failures

Ash got cross with his friend and Squirtle cross out this person from Ash's friend list.

To summarize:

$$Trust = Movie\ Knowledge * Friendship\ Level \tag{1}$$

$$Trust = ((0.4 * IMDB\ Accuracy) + (0.6 * Squirtle\ Accuracy)) * Friendship\ Level \tag{2}$$

4 Choosing The Movie

After calculating trust values for each friend of Ash, Squirtle calculates new movie ratings of friends' as follows:

New Movie Rating = Trust value of Ash's friend * Movie Score of Ash's friend

It is important to note:

- New Movie Rating is between [-4, 4] while Normal Movie Rating is between [-2, 2].
- Squirtle normalizes the new movie ratings to compare.
- But the important part is that the purpose of the new movie rating is for purely comparison.
- So the values are not that important.

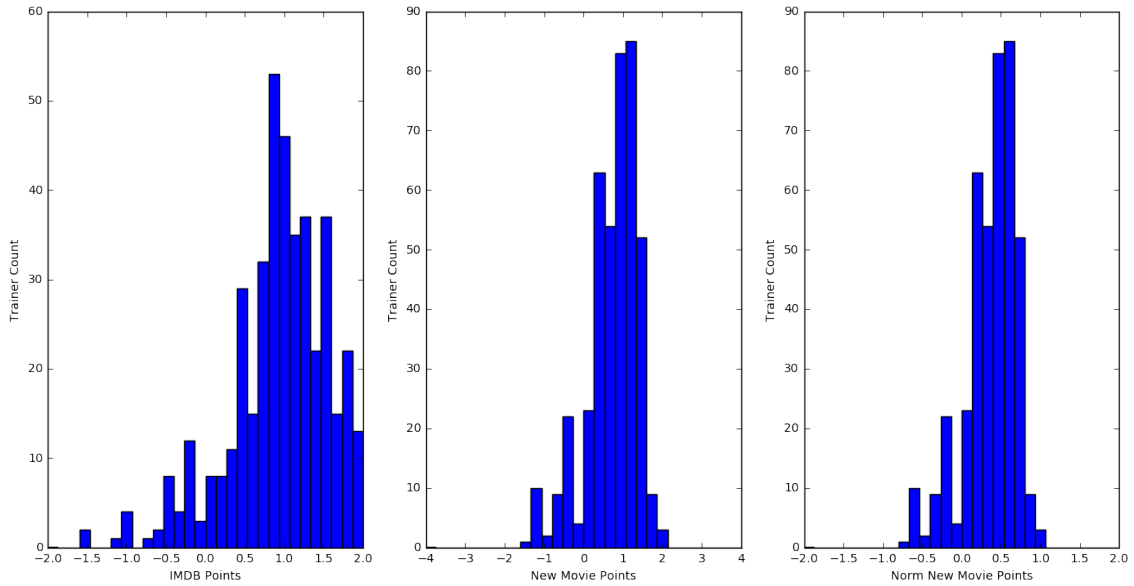

Figure 9: a) Friends' movie ratings on recommended movies. b) Friends' new movie ratings on recommended movies. c) Normalized version of b.

There are two possibility when deciding the movie:

- If the movie recommendations are reliable:
  - He takes the movie with the highest new movie rating, and makes a group of candidate movies from the movies that are at most 0.15 points less than the highest rated movie.
  - choses a movie probabilistically from the candidate list according to movies new ratings.
  - *Reliability: If there is at least a movie with more than new movie rating of 1 or 3 movies with more than new movie rating of 0.8.
- If the movie recommendations are not reliable:
  - Squirtle finds all the friends of Ash's friends.
  - Squirtle treats those new people as Ash's friends according to the Hangout new friend adding process.*
  - Then without checking the reliability constraint, Squirtle chooses a movie for Ash with the method mentioned in the previous slide.
  - * If there is a person who is friend of more than one person, then take the average trust of all the persons to calculate its friendship level.

5 Pseudocode

1. Choose a trainer
2. Calculate IMDB and Squirtle accuracy
3. Calculate Friendship Level
4. Calculate Trust coefficient using IMDB,Squirtle Accuracy and Friendship Level
5. Calculate New movie scores
6. Until the movie time in each Hangout activity:
   (a) If hangout is Successful add a new friends' friend with Friendship Level $\approx$ Trust Coefficient of friend
   (b) If hangout is failed delete that friend
7. After the movie date comes calculate final movie scores and decide a movie
   (a) If we can't get a reliable data get all friends's friends and calculate again.

6 Conclusion

In this project we constructed a Movie Recommender Agent, Squirtle, that works with existing BDI agent, Pikachu. Squirtle chooses movies based on trustees' opinions. This opinions later modified to calculate their true scores. We achieved our predicted results which we think that reflects the real life situations.