Homework 1 (Summer 2020)

Anshuta Awasthi

aawasthi32@gatech.edu

1 QUESTION 1

1.1 Semantic Network : Representation

The figure shows the knowledge representation and states transition . The figure is self explanatory. The shuttle is shown with the shape of an arrow , where the direction of an arrow tells the direction in which shuttle is moving . The transition from one state to the other is represented with black arrow and it follows the top-down approach . The arrows are labeled with colored icon , where the label color indicates one of the characters, that is travelling in the shuttle.
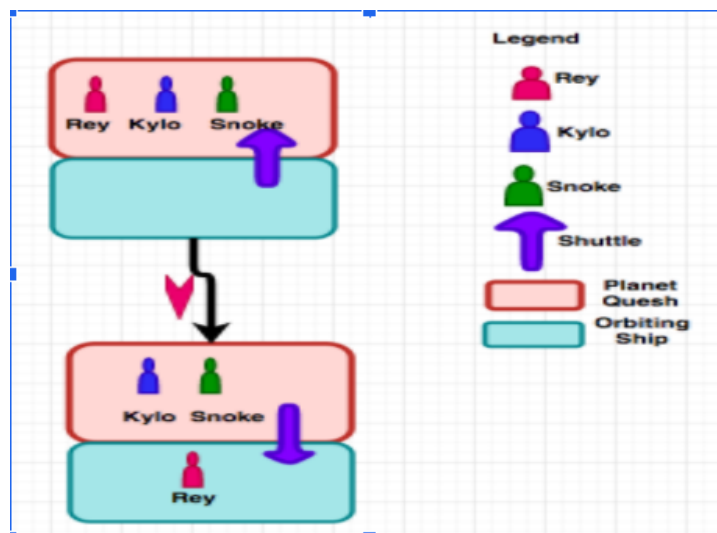

Figure 1—Representation of Semantic Network

1.2 Semantic Network : Generate and Test

The following figure shows the flow of subsequent transitions . The states are generated and tested against illegal moves. The illegal moves are represented with "Red Cross" and discarded. The "Black Cross" denotes that this state move has already happened before and hence discarded due to redundancy.
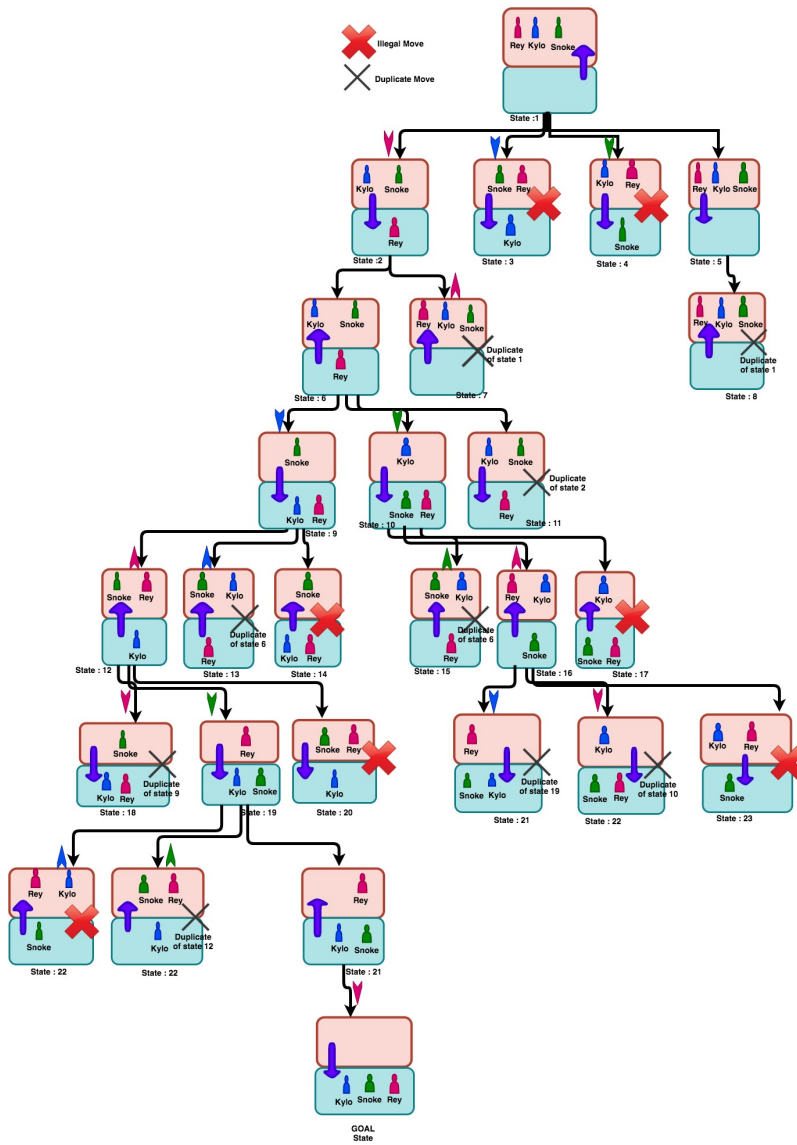
Figure 2—Semantic Network : Generate and Test

2 QUESTION 2

The Production System Rules for UNO game are given below.There are few assumptions such as a).It is 2-player game. b). Production Rules are written only for Agent and only Agent's move have been captured in the log.

2.1 Production System Rules:

Rule 1: If the top card on the discard pile is a number card AND (Agent has the number card with color matching with the top card OR Agent has the card of any other color with number matching with the top card).
Then an agent may play the card with the maximum number of all the matching color cards OR with a matching number card of any color - whichever has higher value.

Rule 2: If the top card on discard pile is number card AND agent has matching color "Draw 2 Cards".
Then the Agent may play "Draw 2 Cards".

Rule 3: If the top card on the discard pile is a number card AND agent has matching color "Reverse" card.
Then the Agent may play "Reverse Card" .

Rule 4 : If the top card on the discard pile is a number card AND agent has matching color "Skip" card.
Then the Agent may play the "Skip" card.

Rule 5: If the top card on the discard pile is a number card AND agent has a "Wild Card" card.
Then the Agent may play the "Wild Card" and declares one color (Select random color present in Agent's deck)

Rule 6: From rule no. 1 to 5 , if more than 1 rule is true.
Then the rule with the highest preference number will be followed by the agent. The preference order is:
5 - Rule 5, 4 - Rule 4, 3 - Rule 3, 2 - Rule 2, 1 - Rule 1

Rule 7: If top card is number card AND Agent does not have any matching number or color card but has "Wild Draw 4 Cards".
Then the Agent plays "Wild Draw 4 Cards" and declares one color (Select ran-

dom color present in Agent's deck)

Rule 8 : If the top card is a number card and Agent does not have any matching number or matching color card and agent also does not have any wild cards.
Then the Agent draws the card from the draw pile first. If the color or number of the card drawn matches the top card it plays this card otherwise don't play any card.

Rule 9: If the top card on the discard pile is a "Draw 2 Cards" card AND this card is played by the opponent.
Then Agent will draw 2 cards from the draw pile and don't play on this turn.

Rule 10: If the top card on the discard pile is a "Draw 2 Cards" card AND this card is played by the Agent only on the previous move.
Then pass on the color of the required/matching card to Rule 19.

Rule 11: If the top card on the discard pile is a "skip" card AND this card is played by the opponent.
Then the Agent will not play any card on this .

Rule 12. If the top card on the discard pile is a "skip" card AND this card is played by the Agent only on the previous move .
Then pass on the color of the required/matching card to Rule 19.

Rule 13: If the top card on the discard pile is a "reverse" card AND this card is played by the opponent.
Then the Agent will not play any card on this .

Rule 14: If the top card on the discard pile is a "reverse" card AND this card is played by the Agent only on the previous move.
Then pass on the color of the required/matching card to Rule 19.

Rule 15 : If the top card on the discard pile is "Wild Card" and the color is given by the opponent.
Then pass on the color of the required card to Rule 19.

Rule 16: The top card is "Wild Draw 4 Cards" AND this card is played by the opponent.
Then the Agent has to draw 4 cards from the draw pile and the agent will not play on this turn.

Rule 17: The top card is "Wild Draw 4 Cards" AND this card is placed by the Agent on the previous move.

Then pass on the color of the required card to Rule 19.

Rule 18: If Agent has only one card left.

Then the Agent shouts UNO!

Rule 19 :

If the Agent has at least 1 matching color card or it has a "wild card".

Then Agent will play the card of highest precedence. The precedence order from highest to lowest is given below:

Wild Card>Skip > Reverse > Draw 2 Cards > Number (with highest number among all number cards of the given color)

Else if : The Agent does not have any matching color card , but it has "Wild draw 4 cards" card

Then Agent plays "Wild draw 4 cards".

Else if : The Agent does not have any matching color card and does not have any wild card.

Then the Agent draws the card from the draw pile first. If the color of the card drawn matches the required color it plays this card otherwise don't play any card.

2.2 Logs of the game played :

1. **Top card is number 7 Red color card.**
   Rule 1 ,3 and 5 are true . Agent played "Wild Card" and declared the color "Red" - Based on Rule 6

2. **Top card is number 4 Red color card.**
   Rule 1 and Rule 3 are true . Agent played "Reverse" red card - Rule no. 6

3. **Top card is the Red "Reverse" card , played by the agent in the previous step.**
   Rule 14 is applicable. It takes to Rule 19 - My Agent played number 4 Red colored Card.

4. **Top card is "Wild draw 4 cards" , played by the opponent.**
   Rule no. 16 - My Agent drew 4 cards from "Draw pile".

5. **Top card is number 1 - yellow card.**
   Rule 1 ,4 and 5 are true. Agent played "Wild card" as per Rule 6 and Rule 5. And selected the color "yellow".

6. **Top card on the discard pile is number 3 - yellow color.**

   Rule 1 and Rule 4 are true. My Agent played "skip" yellow color card based on Rule 6 and Rule 4.

7. **Top card is skip- yellow color card played by the agent in previous move.**

   Rule 12 is applicable , that leads to rule 19 . Played number 7 -yellow colored card.

8. **Top card is the number 1 yellow color card.**

   Only rule 1 is applicable. My agent played number 2 yellow color card.

9. **Top card is "wild card" played by the opponent and the color given is green.**

   Rule 15 is applicable . That leads to Rule 19 . Based on that my Agent played a green "skip" card.

10. **Top card is a green "skip" card played by the agent in the previous move.**

    Rule 12 is applicable . That leads to Rule 19 - My agent played number 8 green card.

11. **Top card is the number 3 Green color card.**

    Only Rule 1 is applicable , my agent played number 3 - Red color card

12. **Top card is the number 9 Red color card.**

    Rule 8 is applicable . Agent draws a card from the "draw pile" . The drawn card is number 9 -Blue color card , which is playable . Agent plays number 9 - blue color card.

13. **In the next move, opponent plays its last blue color "skip" card and the opponent wins the game My Agent lost the game.**

2.3 Reflection for Improvement:

The game can certainly be improved :

a). By keeping track of the cards played by the opponent. Such as - at what color opponent had to draw a card from pile.This can be used as an opportunity to make the opponent draw more cards while we have chance to switch the color. Production rules above do not take into account the cards played by the opponent in the past.

b). Another strategy of switching color can be switching to the color with which you have most number of cards. As per above production rules - agent is randomly selecting a color of any available cards. Right now Agent does not keep track of the total number of cards of each color.

There can be many better strategies for playing UNO , which will make the rules

more complex , but I am not discussing them here, due to space constraints.

3 QUESTION 3:

3.1 Description:

GDPR gives individuals the right to restrict the processing of their personal data in certain circumstances. This means that an individual can limit the way that an organisation uses their data. A Company cannot personalize the user experience without the individual's consent. GDPR aims to protect customer's data as part of fundamental rights to privacy. I perceive this as good step towards building trust between people and organizations,treating people fairly and openly and recognising that they have right to to maintain the privacy about their own identity and their interactions with others.

3.2 Effect on Personalized User Experience :

According to Article 6 the processing of data other than the intended task should be done only after users consent on extent to which data will be used , duration for which data is going to be stored/processed ,method of data processing and some other aspects. Most companies,now a days are feeding the customer data to AI and Machine Learning algorithms which interpret human behavior based on their credit history , purchase history etc. and anticipate what the potential user will do next in order to provide personalized experience. Article 22 of GDPR states that- *The data subject shall have the right not to be subject to a decision based solely on automated processing, including profiling, which produces legal effects concerning him or her or similarly significantly affects him or her."* -Article 22
I am not going into the detailed interpretation of above article , but it is clear that without user's consent the personal data should not be used for automated processing.

Personalized experience makes it easier and convenient for customers to use the services.The fact that 80 percent of views on Netflix come from personalized recommendations alone is an example of how customers are liking it. GDPR does not kill the personalized user experience but it has made it little difficult for businesses which have been collecting tons of data and using it the way they want in the past. Now the businesses will have to make certain amendments to make the process and data more transparent to users , get the customer's consent and abide by the laws.

3.3 Examples:

There are many businesses which are thriving solely on user's personal data. Few examples are: a). **Finance Apps like "MINT" and "Personal Capital"**. These are financial tracking and budgeting apps which store all of your investments, transactions, and account balances. They use this information to calculate your total net worth and even provide personalized tips on how to improve your credit score.Personal Capital provides suggestions on retirement plan, budgeting too. b). **Fashion apps like 3DLook** are solely based on personal data. It recommends the clothes based on the shoppers' body size and shape taken by a 2D image uploaded by the customer. It compares the image with 3D models. Company is training neural networks to enable the technology to detect and measure the human body. The CEO of 3DLOOK has claimed that algorithms are trained on a data set that contains 200,000 body images, to reach an accuracy of 98 percent.3DLOOK

Similarly there are many companies recommending the diet , medical advice based on personal data of age ,gender, weight ,height, existing illnesses etc. In Covid 19 times there are contact tracing apps used in many countries which collect users location at all time to alert the person of any corona positive individual in the vicinity of 6 feet.

3.4 Adaptation to GDPR Restriction:

It is the responsibility of the organizations to build privacy protection into the system,make data processing more transparent and ensuring that all processing is conducted in compliance with the rules. There are several technologies discussed in Artificial Intelligence and privacy document, which can help to achieve this.Here is the very short explanation of how diff1erent softwares , tools and methods a can be helpful here

a). Many AI and ML algorithms need large amount of data to infer meaningful information.However the dependency on data can be reduced by generating synthetic data using GAN(Generative Adversarial Networks) Or may be the variants of neural networks named "Matrix Capsule"can be used, which requires lot less data for learning.

b). The usage of Homomorphic Encryption can be helpful in ensuring data privacy. This encryption makes it possible to process encrypted data.

c). Instead of building models from scratch , the existing similar models can be

utilized by making just small change in them.It is possible to achieve the same result with much less data and shorter time.

d).Models based on deep learning and neural networks are complex and are less transparent to users.To make the details of data processing understandable to ordinary users , the process should be explained in a way that is easy to comprehend . The ideas and approaches like Explainable AI and LIME (Local Interpretable Model-agnostic Explanations) can be used for this.

With the above discussion it is clear that GDPR is not going to kill businesses which are based on personalized user experience , neither it is going to ask users to stop using such applications. Instead, companies will have to provide personalized user experience by following GDPR rules, regulations and laws and customers will be more satisfied due to fair, transparent and lawful experience.

4 QUESTION 4:

In my opinion Watson has a long way to go before it matches the human intelligence. There are many definitions of intelligence and it will be unfair to use any single one of them here. But I would say that Watson is more "Learned" than "Intelligent" . According to me Intelligence is - *The abilities to plan or create an idea, solve a problem, be logical in your creativity,make favorable results in a bad situation and comprehend the complexities and intricacies of the subject rather than just taking something at it's face value."* Watson or any AI enabled machine has great learning capabilities , enormous memory , fast responses which will prove to be superior to human brain anytime if compared in the areas like calculations , games , searching the info from database etc where the rules are predefined and the goals are clear.

4.1 How Watson won Jeopardy?:

Watson was powered by a cluster of ninety IBM Power 750 servers with 16TB of data.It could process natural language content using IBM's DeepQA technology. Watson had access to 200 million pages data , past jeopardy clues and other data along with entire wikipedia of 2011. It took about 20 researchers three years to reach a level where it could compete in show against best contestants and emerged as a winner looking like smarter than humans. No big deal.

4.2 What is Watson lacking?:

Henry Lieberman (An AI research Scientist at MIT) has given a very apt example where Watson failed in Jeopardy quiz :

Clue: It was this anatomical oddity of US gymnast George Eyser....

Ken Jennings' answer: Missing a hand (wrong)

Watson's answer: leg (wrong)

Correct answer: Missing a leg

What Watson failed to realize was that the word "leg," by itself, wasn't actually an answer to the question.This is common sense for people, because "leg" is an anatomical part, not an anatomical oddity, though Watson did realize that legs were involved somehow. The brains behind Watson reasoned that the presence of word "Oddity" caused the failure.(Lieberman,2011) For humans "Oddity" is something which is not normal, but to understand that one should have common sense of what is normal. (Source)

In another instance , for question about naming a U.S. city whose first airport is named after a World War II hero and its second after a World War II battle, it gave the answer as Toronto. Absolutely wrong! Both the human contestants on the program knew the correct answer was Chicago. The question was not hard at all! Any ordinary person who has travelled to these places would know the answer. Because humans travel , they learn from experiences and they have ability to link/relate their knowledge of different fields . In this scenario that is combining historical and geographical knowledge , learned by past experience which was lacking in Watson.

4.3 Conclusion:

Although I do agree that "Jeopardy" is not a trivial question-answers quiz , that not only needs encyclopedic recall , but also needs to comprehend the convoluted statements sometimes. Watson did great on that. According to Ken Jennings and Brad Rutter - the buzzing factor in the game had a big contribution to Watson's victory. When it comes to speed , human reflexes have limitations while powerful machines can speed up the response many folds. "Speed" is not "Intelligence" according to my definition of intelligence (Some may argue). Jennings and Rutter lost against Watson , but only in the game of "Jeopardy" which we see. Behind the scenes there was much more human effort ,money and time involved in making Watson ready for "Jeopardy" than human contestants.

5 REFERENCES

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