

CS7637 HW 1

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QUESTION 1:

The semantic network is attached on the next page. Below are some clarification and explanations.

To be concise, I have denoted R for Rey, S for Snoke, and K for Kylo. Each level in the semantic network (from top to bottom) contains all the possible states that are generated from all the states in the previous level. The states and its derivatives will be connected by a line. For example, there is a total of 4 possible moves from level 1 to level 2:

1. No one moves from planet to ship.
2. Rey moves from planet to ship.
3. Snoke moves from planet to ship.
4. Kylo moves from planet to ship.

Similar to what the professor was done in lecture, I use the arrow to denote the direction of each move. The left-to-right arrow indicates a move that is completed from planet to ship, and the right-to-left arrow indicates a move that is completed from ship to planet. The location of the arrowhead indicates also indicates where the shuttle is currently located.

However, not all moves would result in a valid state. We have the following restrictions:

1. Rey and Snoke (without Kylo) cannot be in the same location that is pointed by the arrowtail.
2. Rey and Kylo (without Snoke) cannot be in the same location that is pointed by the arrowtail.

Therefore, a tester is needed to eliminate any of the above invalid states. Additionally, the tester is responsible to eliminate any of the duplicated states that are previously explored because of unproductivity.

I have included the reasons I eliminate each state below it. The red and green cross denotes the above invalid states, respectively. The blue cross denotes a duplicated state, and I highlighted them together with the same color.

QUESTION 2:

The following is the production rules:

1. If you see your next player has only 1 card and you have a Draw card that matches the color. Then putting it down and go to 14.
2. If you see your next player has only 1 card and you have a Skip card that matches the color. Then putting it down and go to 14.
3. If you see your next player has only 1 card and you have a Wild 4 card. Then putting down that card and announce the color to be the one that you have the most in your hand and go to 14.
4. If you see your previous player has only 1 card. Then ignore rule 9 in this round.
5. If you see your next player has only 1 card and you have a Reverse card that matches the color. Then putting it down and go to 14.
6. If you see any player who has only 1 card and he/she placed a Wild card in the previous round and announce the color. Then,
 - a. If the current color on the top of Discard tile matches his/her announced color and if you have a card that match the number of the card on the top of Discard tile with different color. Then putting it down and go to 14.
 - b. If the current color on the top of Discard tile matches his/her announced color and if you have a Wild 4 card. Then putting it down and announce any color that is different to what he/she previously announced and go to 14.
7. If you have at least one card that matches the color of the card on the top of Discard tile. Then putting down one card of that color with the least number and go to 14.
8. If you have at least one card that match the number of the card on the top of Discard tile. Then putting down one card with the same number under the following priority: red, yellow, blue, green, and then go to 14.

9. If you have a reverse card that match the color or the card on pile is a Reverse card. Then putting it down and go to 14.
10. If you have a skip card that match the color. Then putting it down and go to 14.
11. If you have a Draw 2 card that match the color. Then putting it down and go to 14.
12. If you do not have a card with same color or number. Then go to 13
13. If you have a Wild card or Wild 4 card. Then putting down that card and announce the color to be the one that you have the most in your hand, and then go to 14.
14. If you only have only one card in your hand. Then say "Uno".
15. If you do not have any cards left. You won!
16. If you cannot perform any of the above operation. Then draw a card.

The following is the log of round of "Uno" I played and the reason for choosing the option. I chose to have 2 players.

The game starts. The agent has card: Red(3, 4), Blue(8, R), Green(3, 5, R), Blue(). The agent is going first. The first card on pile is Blue 7.

1. Putting down Blue 8 (Rule 7); opponent putting down Blue 6
2. Putting down Blue R (Rule 9);
3. Putting down Green R (Rule 9);
4. Putting down Green 3 (Rule 7); opponent putting down Red 3
5. Putting down Red 3 (Rule 7); opponent putting down Red 5
6. Putting down Red 4 (Rule 7) and say "Uno" (Rule 14); opponent putting down Wild card and announce Yellow.
7. Drawing a card (Rule 16) The card is Wild 4; opponent putting down Yellow 8
8. Putting down Wild 4 and announce the color to be Green (Rule 13).
9. Putting down Green 5 (Rule 7) and the agent won (Rule 15).

To summarize, the production rule above for two players works fine. Rule 7-14 and 16 are usually used to address most of the cases since Rule 1-6 only applies when someone has only 1 card left. I believe the situation in multiple players will get more complicated.

I have noticed some improvements can be made. The above rules do not include the study of players' behavior. Study a player's actions may help the agent to make better decisions against certain players. Additionally, the goal of my implemented production systems is to win. If the goal of the AI agent is to make the game more entertained, it does not have to make the perfect move each time, and therefore, we may include some rules in the production system that the agent occasionally makes mistakes.

QUESTION 3

The General Data Protection Regulation (GDPR) that replaces the Data Protection Directive 95/46/ec states the laws of how EU companies should protect their user data (Digital Guardian, 2019). Meanwhile, GDPR allows users to control over their personal data, allowing them to determine what information is sent to the companies in an online digital world. In short, the GDPR sets out seven principles to account personal data:

1. The GDPR sets out seven key principles:
2. Lawfulness, fairness and transparency
3. Purpose limitation
4. Data minimisation
5. Accuracy
6. Storage limitation
7. Integrity and confidentiality
8. Accountability (ICO)

Some of the key privacy and data protection requirements of the GDPR include:

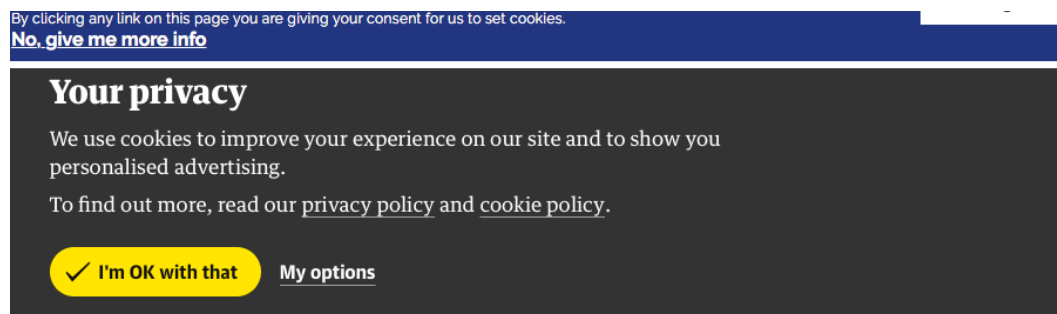
1. Requiring the consent of subjects for data processing
2. Anonymizing collected data to protect privacy
3. Providing data breach notifications
4. Safely handling the transfer of data across borders
5. Requiring certain companies to appoint a data protection officer to oversee GDPR compliance (Digital Guardian, 2019)

The GDPR has a tight restriction over the usage of personal data to personalize individual user experiences online. First, it requires the consent of individuals to

send data to the companies. For example, websites must notify visitors and request their consent before tracking cookies. Second, companies must make the ways of how and what personal data is used visible to the users. Third, companies must allow their users to manage their data, including deleting or deciding what data is shared with the companies. Fourth, companies are required to collect minimal data from their users. In other words, they are only allowed to collect data they need (Instapage, 2019).

The GDPR regulation undermines the existing method of using artificial intelligence to create personalized experiences because it limits the companies to collect and use data from its users. Data privacy and personalization is inversely proportional. In other words, using AI to create personalization experience requires the prior knowledge of the users. If no data is provided, the AI agent cannot make any personalized decisions.

For example, Google Ads is an online advertising platform that displays personalized Ads based on the user's location, searching history, etc. Personalization is deeply embedded in its functional purpose in order to advertise the content that the users might be interested. However, I think GDPR undermines the ability for the AI agent in Google Ads to recommend advertisement because of data deficiency from its users. Since GDPR makes the personal data collection more difficult, it cannot include advertisement that is relative to your personal data before the user's consent to allow Google to collect and use their data. This is actually a common practice today on many websites. For example, many websites require its users to accept the usage of cookies. The user must consent the data privacy policy before continuing to the website. The following image is an example:



(source: whatismybrowser.com)

In conclusion, I think it is impossible to allow users in the European Economic Area to use personalized tools without waiving their GDPR rights because personalized content is prohibited before users' consent to release their personal data. Therefore, requesting permission is the only option.

QUESTION 4

Was Watson more intelligent than Jennings and Rutter? To address this problem, we must first define the notion of intelligence. In general, an intelligent agent requires the ability to perceive or infer knowledge, and to apply its knowledge to exterior behaviors depending on the content or environment. In the context of answering questions in Jeopardy, an intellect agent must satisfy the following requirements:

1. The ability to perceive and understand the question
2. The ability to search through its knowledge base and to decide its answer.
3. The ability to phase and give out the answer in the required format.

Since answering Jeopardy questions generally does not fully reflect the 3rd requirement above because the response is usually a word, an object, or a short phrase after a "What is" statement, I will first closely analyze the first two requirements according to Watson's and Jennings and Rutter's performance.

It is a well-known fact that Watson banked more money than Jennings and Rutter combined, \$77,147 to \$45,600 (\$24,000 for Jennings, \$21,600 for Rutter). Therefore, Watson is clearly superior in searching through its knowledge base and find an answer correctly and promptly.

First, human's cognition is usually much slower than a machine's. Reading and understanding the question takes the most time in human cognition. Unlike humans, Watson processes the information differently. It looks for keywords in the question and searches for an answer in its knowledge base that gives the best match. Similar to typing in a keyword and getting related information on a search engine that usually taking only several milliseconds, Watson's ability to perceive the question is much faster than that of humans.

Second, the professor discussed in lecture that deliberation process (reasoning, learning, and memory) is one part of overall architecture of what knowledge-based AI agent. In fact, the three components are the cornerstone of intelligence. Most computational neuroscientists tend to estimate human storage capacity somewhere between 10 terabytes and 100 terabytes, though the full spectrum of guesses ranges from 1 terabyte to 2.5 petabytes. (AI Impact, 2011) However, Watson and other machines can always extend their memory by embedding more memory chips into their system. Additionally, Watson's learning ability is better than that of any human. When human perceives information, it is stored in the short-term memory section of the brain. Only a small fraction of information can access long term memory, and else discarded. This is the reason why we constantly learning and forgetting things. Unlike humans, machines have permanent storage as long as the information is not wiped out in its memory. Therefore, Watson is superior in both learning and memory part of the deliberation process.

However, Watson is not omniscient and omnipotent. There are instances that Watson gives a response that is not even close to the answer. The following is an example.

On Tuesday evening during Final Jeopardy, the category was U.S. Cities and the clue was: "Its largest airport is named for a World War II hero; its second largest for a World War II battle."

Watson drew guffaws from many in the television audience when it responded "What is Toronto?????" (Markoff, 2017)

The reason of why Watson giving out a far-fetched answer deals with Watson's internal algorithm of parsing keyword. It was the final Jeopardy and Watson had to give a response although the system indicates a very low confidence in its response. An IBM researcher concludes:

"the reality is that there's lots of data where the title is U.S. cities and the answers are countries, European cities, people, mayors. Even though it says U.S. cities, we had very little confidence that that's the distinguishing feature." (Markoff 2017)

To conclude, I agree that Watson is more intelligent in answering Jeopardy questions than Jennings and Rutter. However, this does not mean that Watson is more intelligent than Jennings and Rutter or any human being in the world overall because the context is limited to Jeopardy. Since no machines has passed the Turing Test, Watson's intelligence cannot be equal to or exceed human intelligence in every area. There would be infinitely many of cases where Watson cannot perform tasks or answering some questions that are straightforward to humans.

REFERENCES

- says:, Ayo, and Anonymous Says: “Information Storage in the Brain.” *AI Impacts*, 28 Sept. 2017, aiimpacts.org/information-storage-in-the-brain/.
- Markoff, John. “Computer Wins on 'Jeopardy!': Trivial, It's Not.” *The New York Times*, The New York Times, 16 Feb. 2011, www.nytimes.com/2011/02/17/science/17jeopardy-watson.html.
- “What Is the General Data Protection Regulation? Understanding & Complying with GDPR Requirements in 2019.” *Digital Guardian*, 5 Aug. 2020, digitalguardian.com/blog/what-gdpr-general-data-protection-regulation-understanding-and-complying-gdpr-data-protection.
- “The Principles.” *ICO*, ico.org.uk/for-organisations/guide-to-data-protection/guide-to-the-general-data-protection-regulation-gdpr/principles/.
- “How Much Personalization Is Still Possible in the Post-GDPR Era?” *Instapage*, 2 July 2019, instapage.com/blog/personalization-and-gdpr.