OMSCS CS7637 Fall 2018 Assignment 1

ZHENG FU  
[ZFU66@GATECH.EDU](mailto:ZFU66@GATECH.EDU)

# Question 1

Figure 1 shows a semantic network representing this problem. The Red circle stands for the shuttle, blue square stands for Rey, yellow square stands for Snoke and green square stands for Kylo. The directions of the triangles represent the movements of the components during the transition from one state to another. At the Initial State, all components are in planet Quesh (right side of the frame), and at the Final State (problem solved), all components are in orbiting ship (left side of the frame).

  
**Figure 1.** A semantic network representing the problem.

Figure 2 includes the entire semantic network that solves this problem. Here we assume we have dump generator and dump tester. Starting from the Initial State, the generator generated 4 states and then tester tested them:

1. State 1: Rey is in shuttle, Snoke and Kylo are alone together, passed.
2. State 2: Rey and Kylo are alone together without shuttle, ruled out.
3. State 3: Rey and Snoke are alone together without shuttle, ruled out.
4. State 4: Rey, Snoke and Kylo are all together without shuttle, passed.

Since the following state of State 4 is the Initial State, now the generator produced the following state of State 1 and tester tested it:

1. State 5: Snoke and Kylo are alone together with shuttle, passed.



**Figure 2.** The entire semantic network that solves the problem.

Now the generator produced the following states of State 5 and tester tested them:

1. State 6: Rey and Kylo are alone together with shuttle, passed.
2. State 8: Rey and Snoke are alone together with shuttle, passed.
3. State 1: Already visited.

Now the generator produced the following states of State 6 and tester tested them:

1. State 7: Rey and Kylo are alone together without shuttle, ruled out.
2. State 11: Rey and Snoke are alone together with shuttle, passed.
3. State 5: Already visited.

Now the generator produced the following states of State 8 and tester tested them:

1. State 9: Rey and Snoke are alone together without shuttle, ruled out.
2. State 10: Rey and Kylo are alone together with shuttle, passed.
3. State 5: Already visited.

Now the generator produced the following states of State 11 and tester tested them:

1. State 12: Snoke and Kylo are alone together with shuttle, passed.
2. State 3 and State 6: Already visited.

Now the generator produced the following states of State 10 and tester tested them:

1. State 12: Snoke and Kylo are alone together with shuttle, passed.
2. State 2 and State 8: Already visited.

Now the generator produced the following states of State 12 and tester tested them:

1. State 13: Snoke and Kylo are alone together without shuttle, passed.
2. State 10 and State 11: Already visited.

Now the generator produced the following states of State 13 and tester tested them:

1. Final State: problem solved.
2. State 12: Already visited.

# Question 2

In this question I chose Elon Mask, the co-founder, CEO, and product architect of Tesla as a prominent AI cynic and LiLi Cheng, the corporate vice president of Microsoft AI & Research as a prominent AI optimist.

## AI cynic: Elon Mask

Elon Mask’s opinions towards the risks of artificial intelligence could be summarized as followings:

1. AI could overwhelmingly collect data through Internet, and extract features and learn from them. Then there is a possibility that AI shall make fake news and documents, manipulate emails and spread out counterfeit information via mass media, which consequently may trigger world war.
2. With the development of AI technologies, autonomous weapons will arise in battlefield who could determine and engage targets without human intervention. It will surely be the third revolution in warfare.
3. Unlike nuclear weapon, the technical barriers of AI**-**based autonomous weapons are quite low, which makes it ubiquitous to mass-produce. And if one of the major military powers has breakthroughs on AI**-**based autonomous weapons, a military AI arms race will definitely be inevitable. Moreover, there is no guarantee that these kinds of weapons will not flow in black market and in the hands of terrorists.
4. Based on the three points above, if one day AI goes rogue and becomes superintelligence, it would be the nightmare of entire human being, as described in “The Terminator” movies. Thus we should have regulatory oversight of AI at the national and international levels.

## AI optimist: LiLi Chen

LiLi Chen’s opinions towards the opportunities of artificial intelligence summarized as followings:

1. There are tremendous amounts of data in our world, only AI with limitless computing power could interpret it to the maximum extend. And it could definitely give solutions for some huge challenges in human society, including but not limited to energy, climates, health care and transportations.
2. AI could create an invisible interface between the client and the task. It may understand the users’ speeches and languages, and have vision, producing a personal guide based on users’ habits and preferences. Thus AI-based technologies adopt to human rather than making human to adopt technologies.

If we compare the views of these two people, we could see they are focusing on different angles of the same idea. Both of them agree that AI is a data-driven technology, yet their differences were which way AI will go after collecting and interpreting data. From my perspective, the route decisions depend on humanity instead of the AI itself, hereby these two visons of the future could co-exist. And according to my understandings of humanity, similar with Captain Nemo of *Nautilus,* I tend to agree with Elon Mask more that we should establish restricted regulations to supervise the development of AI. If the tendency has broken the boundary, some organizations could force it stopping to avoid the scenario becoming worse.

However that does not necessarily mean I totally agree all Elon Mask’s assertions. One of my biggest concerns about Elon Mask’s view is his attitude towards “Superintelligence”. I could use the development of airplane as an example to elucidate my opinions. For thousand years human beings have a dream to fly in the blue sky. And we tried enormous methods to mimic the bird behaviors and all of them are failed, until we encoded air dynamics, the First Principle of flying. Then human beings were able to produce airplane based on that, a masterpiece that could fly higher and longer than any birds. Similarly, the most powerful AI in this era is still in the stage of bionics. Superintelligence will never appear unless we thoroughly understand what human consciousness is and how it is originated, which is the First Principle of AI. And such tasks are almost impossible because they include things we do not know we don’t know. HBO Westworld series gave an answer of these questions based on Julian Jaynes's famous book “The Origin of Consciousness in the Breakdown of the Bicameral Mind”, yet it is still a hypothesis based on cognitive archaeology. In one word, I believe the development of AI technologies will speed up, and AI itself will not significantly threat human society as Elon Mask’s apocalypse.

Actually people have the same ideas as mine are not minority, and they could be categorized as “AI realists”. One example is Andrus Ansip, the Vice President of the European Commission, who believes AI will never fully replace humans and there is no need to worry about “The Terminator”-style scenario. AI will be complementary to and assist people with specific tasks and enhance our abilities, and the ways it changes our society will finally balance out.

# Question 3

The General Data Protection Regulation (GDPR) of EU is applicable on as of May 25th, 2018 and comparing with its predecessor Data Protection Directive 95/46/ec, it has a few major changes in terms of using personal data to personalize individual user experiences online.

## Data collection and data ownership

In the past decades, most companies could gather all kinds of user’s data by merely receiving a vogue consent with user’s agreement. Now under the GDPR, companies must disclose some information to the user before collecting the user’s personal data, including but not limited to 1). What they are using these data for; 2). What kinds of personal data they will store; 3). How they'll protect these personal data and prevent unauthorized access. All these questions indicate the user has the full ownership of his/her personal data and companies must unveil the full scope of personal data they collect. It makes data collection harder and more expensive than before, especially for start-up companies, who do not have strong first-party data stream as giant companies. The insufficiency of data source may cause imbalanced datasets and trigger the modifications of their AI models.

## Data storage

The GDPR also regulates that companies could not store user’s data to eternity. They are subject to set a limit about how long they will store the user’s personal data for their business purpose. And users have the right to require companies to alter and/or erase their data whenever they want. However, some users’ personal data, especially the metadata, might be stored in unstructured database. Thus when companies receive such requests they might develop more powerful algorithms to change or get rid of users’ data and avoid false positive and false negative, which will increase companies’ costs for sure. For instance, if the user askes for deleting his/her Social Security number, and in some collected documents, it was marked as “SSN” and in others it was marked as “Social Security number”, companies may spend few months to clean all SSN and avoid to mis-delete other information.

## Automated decision-making and data explanation

According to Article 22(1) GDPR, the user or any person has 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”.

That means companies could not make a decision solely based on automated processing if it has legal effects or similarly significantly affects on the user. More than that, if companies have made automated decisions within the scope of Article 22(1) GDPR, they must notice the users about "the existence of automated decision-making" and provide them with

"meaningful information about the logic involved, as well as the significance and the envisaged consequences of such processing for the data subject (Article 15, EU GDPR)."

This section is also known as “the right of explanation” and gives rise to one of the biggest challenges AI industry shall encounter. Since the most popular machine learning model used in AI industry nowadays is deep neural network, which is composed of tremendous non-linear functions. After many rounds of training with colossal data, the weighting factors of the network were optimized followed by automated decision making. However even the most experienced data scientist could not fully explain the logic and reasons underlying the decision due to the complexity of the network. And if the training dataset changed, the decision may be altered as well. Hence currently the priority of AI industry is not to increase the accuracy and predictive ability of their machine learning models, but focusing on how to explain the AI results to the users in human language with meaningful information.

## Data outsourcing

One renowned scandal of data outsourcing occurred recently was Cambridge Analytica improperly access to more than 50 million Facebook users’ private information, and by abusing such data it developed tools capable to influence the behaviors of American voters. Under GDPR, such data outsourcing is surely forbidden and more than that, even outsourcing AI itself is highly regulated. For instance, if a genetic test company has collected a group of patients’ information from hospital A and enhanced its cancer prediction AI model based on that. Once the company uses such model to foresee the cancer risk of patients in hospital B, it ought to guarantee the information of patients in hospital B are fully protected and will not be unnecessarily used for other purpose.

Further, the GDPR does have significant impacts on companies for which personalization is deeply embedded in their business models. One example is the Fintech companies. Such companies are accustomed to employ AI analyzing the applicant’s private information and automatedly make a decision of his/her financial applications. Under GDPR, it is difficult for them to analyze and predict applicants’ economic situations with automated processing. Yet it is still possible for users in the European Economic Area to use Fintech services without waiving their GDPR rights. The key is these kinds of companies should be adapted to the GDPR restrictions. For instance, after the automated decision was made, a human agent might interpret it to the applicant with the reasonings and logics of AI algorithm. If the application is rejected and the client appeal it, a further investigation should be carried out with the cooperation among the client, the loan agent and the AI engineer.

# Question 4

In this question I chose R2-D2 in Star Wars as an example in popular culture that portrays AI in a positive light, and the “Arkangel” system in second episode of the fourth series of anthology series Black Mirror as an example in popular culture that portrays AI in a negative light.

## Portraying AI in a positive light

R2-D2 is one of the classical characters in Star Wars movie series. It is a 0.96 meter high astromech droid with masculine programming and was designed as starship mechanic and fighter pilot's assistant. Its major function is to repair and maintain starships, and it could also compute hyperspace coordinates and program it into the ship's navicomputer.

A picture containing indoor

Description generated with very high confidence  
**Figure 3.** R2-D2 was repairing the broken shield of the Naboo Royal Starship.

In the ten Star Wars films to date, R2-D2 appears nine of them and it was portrayed as a royal servant of its masters. It always managed to bring the tough scenarios through at the last minutes, and its bravery and ingenuity saved the galaxy many times. Followings are some highlight moments of R2-D2 in the films:

1. After Trade Federation invaded Naboo, Queen Amidala attempts to escape her world with the Royal Starship. It was R2-D2 successfully repaired the damaged shields of Royal Starship under heavy fire and allowed it to jump to the hyperspace.
2. In the Battle of Yavin, R2-D2 and C-3PO navigated the Imperial computer system and offered timely assistances to the rescuers of Princess Leia who was finally being free.

## Portraying AI in a negative light

Arkangel is a fictional AI system that allows parents to track and monitor their children and serves as dangerous hinderance. After implanting a neural chip into the kid’s brain without any pains, the following major features of Arkangel will be activated:

1. Parents could check the geolocation and healthy status of children in real-time via a tablet connected to the chip.
2. Parents could access the immediate eyesight of the children and determine if censoring their views is necessary. And the AI system will pixelize all obscenities that may cause stress and uncomfortable feelings, along with audio distortions.
3. Parents could use reverse image search and find out what their children have seen in the past.

The leading actress, Sara, was implanted this AI system when she was a little girl. Yet she becomes more social outcast and frustrated while growing up, since she was never fully exposed to stressful scenario and eager to see the real world. Sara’s overprotective mom, Marie, who initiated the implanting of Arkangel, finally brought her to the psychologist and was told this AI-system was banned because of its disadvantages in children recognition and emotion development. The implanted device could not be removed yet the parents could turn off the tablet and throw it away. Not surprisingly, Maria selected to keep monitor and track Sara’s behaviors via the Arkangel system. After Sara entering adolescence, the mother-daughter relationship becomes strained. At the end of the drama Sara injured Maria unconsciously due to the activation of obscenity blockage and then ran away from home.

From my perspective, these two portraits of AI could exist in the same fictional universe, since they are the two sides of the same coin. One major motivation of developing AI is that human beings intend to simplify complicated tasks with more “automation”. Surely human body is vulnerable to repair and maintain spaceship in the outer space, and AI could finish such complex tasks quicker and better. Yet not all sophisticated jobs, such as parenting and educating children, could be simplified by AI. I always believe the technology itself is 'neutral' or 'value-free', and it is the way we use it to make it “good” or “evil”. People including me may be more or less prone to apply simple and effective ways in parenting, and the appearance of AI just facilitate such tendency as described in Arkangel. This is a warning sign that with the development of AI, we might more rely on technology itself instead of deep and thorough communications with people surrounding us especially our family members. We should be aware of the importance of communications between humans and avoid unconsciously using AI to fill the blanks in our relationships with the beloved ones.

# References

1. An open letter from AI and robotics researchers urging a ban on offensive autonomous weapons beyond meaningful human control. Jul 28, 2015, <https://futureoflife.org/open-letter-autonomous-weapons/>.
2. An open letter on maximizing the societal benefits of AI. Jan 11, 2015, <https://futureoflife.org/ai-open-letter/>.
3. Why You Shouldn't Be Afraid of Artificial Intelligence. Jan 4, 2018, <http://time.com/5087385/why-you-shouldnt-be-afraid-of-artificial-intelligence/>.
4. EU GDPR Information Portal. <https://eugdpr.org>.
5. Wikipedia of R2-D2. <https://en.wikipedia.org/wiki/R2-D2>.
6. Wikipedia of Arkangel. <https://en.wikipedia.org/wiki/Arkangel_(Black_Mirror)>.