Project 3 Journal

Shanshan Jiang
sjiang97@gatech.edu

1.INTRODUCTION

According to a set of problems provided, it will divide the issues into problems of two by two and three by three in the whole project. And in project 1, it only focused on two by two problems, and I used visual method to solve problem B. I firstly provide some assumptions. Based on these assumptions, the program will run all the questions at one time. If it finds the answer, it will return a correct answer and an error value will be given. If it does not find the answer, it returns a -1 -1. Anyway, It finally returns a set of answers and a set of errors. Then find the correct answer in the group with the least error. In project 2, it focused on solving three by three problem. I solved one type of problems for each submission by using both verbal and visual method in problem C. I created a function for each problem. I tried two ways to solve some problems that do not return the correct answer: One randomly guesses one answer. Another way is all choose 7 as the answer. But neither method produces better results. So I continue to find the rule to solve the problems until the final result reaches the goal. In project 3, it will continue to solve the three by three problem in problem D&E. It also will create some assumption relationships function in the beginning, then using the code to implement these assumptions until they found the correct answer. I may borrow some rule of functions through the previous project to solve some similar problems. It is then solving left issues one by one by using Contour Recognition & Reasoning, Shape-Agnostic Transformation Recognition, and Hybrid Reasoning. For some challenge problems, I will do two ways, One way is to find the correct answer in the solutions with the least error. I will create several solutions. Then a problem will be scored by these solutions, and the one with the least error will be the correct answer. If any solution does not score a problem, the program will choose the first one as the answer.Another way is to guess an answer randomly.

2. JOURNAL ENTRIES

2.1 First time submission:

- The first submission was submitted on 2019-07-17 07:42:45 UTC.
- Changes and Reasons: For the first submission version, I did two things: Firstly, it just borrowed some rule of functions through the previous project. Secondly, I created a function for some easy problems to check the solution. Because these problems are easier to find the solution.
- Comparison between Agent and Human: For this version, the agent answered all the simple questions correctly, especially in Problem D. The response to the intricate pattern is feeble. So it lacks compared to humans.
- Performance and Review: Basic D got six correct answers showing Table 1. They are D-1,D-2,D-4, D-6,D-7, D-10. For D-1, I borrowed the function from the previous project. And others just fixed by a function. I have not started to solve Basic E yet, it could find the correct answer for certain problems, maybe because it used previous function.

	Basic D	Test D	Basic E	Test E
Incorrect	6	11	10	11
Skipped	0	0	0	0
Correct	6	1	2	1

Table 1. First Submission Result

- Struggle:

  In the Basic problem D, it has some complex patterns that the agent cannot recognize them. So I need to find some algorithm to solve it.

- Efficiencies: 4.3 Minutes.

2.2 Second time submission:

- The second submission was submitted on 2019-07-16 07:52:28 UTC.
- Changes and Reasons: For the second submission version, I added more solutions. Then a problem will be scored by these solutions, and the one with the least error will be the correct answer. If any solution does not

score a problem, the program will choose the first one as the answer. That is because of two reasons: Each problem needs a solution. Most of these problems have the first one as the correct answer.

- Comparison between Agent and Human: For this version, the agent answered most of the complicated questions correctly. But these complicated problems, the robot is not as intuitive as humans can see when judging. Robots need more and more complex algorithms, which is a robust calculation process.
- Performance and Review: Most of the problems in Basic D got fixed, we can see it in Table 4. Basic D got 11/12 correct answers except D-12. I created a solution for each problem because these problems are complicated. And most of them got correctly. But I still have not started to solve Basic E yet, it could find the correct answer for certain problems, maybe because it used previous solutions.

	Basic D	Test D	Basic E	Test E
Incorrect	1	8	9	8
Skipped	0	0	0	0
Correct	11	4	3	4

Table 2. Second Submission Result

- Struggle: In the Basic problem D,for each solution, I used logical AND, OR, or XOR. But only the D-12 could not find the correct answer. I spent a lot of time on it.
- Efficiencies: 4.3 Minutes.

2.3 Third time submission:

- The third submission was submitted on 2019-07-18 07:41:40 UTC
- Changes and Reasons: For the third submission version. Firstly, I started to add solutions for problem E. I used similar logical AND, OR and XOR like the second submission. Most of the basic problem E got fixed.

Secondly, In order to get more correct answers in both test D&E problem, I started focusing on solving the challenge problems. For example, the Challenge D-2, D-3 has Rotational relationship. The Challenge D-5 has the Symmetric relationship.

- Comparison between Agent and Human: In this part, I think that the agent cannot develop themselves yet. The objects in each image can give the human a clue to solve. For example, it is easy for a human to find that the first row equal to second row plus third row in each column about the basic E-4. But the agent cannot think such a simple way. It needs to be more robust in responding to problems with traps.

- Performance and Review: After submission, the result got over 7/12 for all problem sets, which is showing Table 3. Basic D got 10 correct answers and 2 skipped. Test D got 7 correct answers, 3 skipped and 2 Incorrect. Basic E got 10 correct answers and 2 skipped. Test E got 8 correct answers, 2 skipped and 2 Incorrect. I found most of these problems have the Logical AND, OR and XOR relationships. Some of them has Rotational relationship, Symmetric relationship and Shadow relationships.

	Basic D	Test D	Basic E	Test E
Incorrect	0	2	0	2
Skipped	2	3	2	2
Correct	10	7	10	8

Table 3. Third Submission Result

- Struggle: I spent a lot of time passing the test, but it's not very easy. So I started to analyze all the challenges one by one. But some challenges problem have some tricks. For example, for the E-9, I tried several ways to solve it until I found it has the kind of Copy/Paste relationships.
- Efficiencies: 7.1 Minutes.

2.4 Fourth time submission:

- The Fourth submission was submitted on 2019-07-19 05:37:07 UTC.
- Changes and Reasons: For the fourth submission version, According to the result of the third submission, I did two things: First, I changed the rule of the process not to skip any problem. Second, I tried to make a more robust program so that it could lower execution time.
- Comparison between Agent and Human: In this part, I think that the agent is very similar to human being's thought because when I tried to change the process of the program, the agent can understand what the program is doing. It does not skip any problem again.
- Performance and Review: After submission, the result got improvement than the third submission a little bit because there are no skipped questions in the version. And some of the problems that were skipped in the third submission got the Correct answer.

	Basic D	Test D	Basic E	Test E
Incorrect	2	5	2	3
Skipped	0	0	0	0
Correct	10	7	10	9

Table 3. Third Submission Result

- Struggle: Until now, I have already created several solutions for these problems, and some of these problems are so complex. For example, a problem has both rotation and shadow relationships, which requires a multi-step algorithm, so it is a significant challenge in reducing the time complexity.
- Efficiencies: 7.1 Minutes.

3. Conclusion:

I made four times submissions. For the first submission, I created a solution to some problems in Basic problem D set, because I found that D-1, D-2, D4, D7, and D10 in the Basic set are very similar. And I also called some of the previous solutions. As a result, it reached the 6/11 correct answer in the Basic D problem set, and the 2/11 correct answer in the Basic problem E set. The second submission, I made some adjustments. It still focuses on the Basic problem D set. I added more solutions for this version. Then a problem will be scored by these solutions, and the one with the least error will be the correct answer. If any solution does not score a problem, the program will choose the first one as the answer. Another way is to guess an answer randomly. I found that even if the Basic problem could reach 7/11 correct answers, the test set could not reach the goal. So for the third submission, I concentrated on adding solutions to Basic problem E. And I tried to solve some of the problems of the challenges set of D&E. These problems are more complicated and tricky, and I created a solution for almost every problem. As a result, the number of correct answers is an improvement, but the execution time also increased. But after solving several challenge problems, it is helpful for the increasing number of correct answers to the Test problem. Because there are several Skipped problems and big execution time, I made some changes for the fourth submission. I let the Skipped problems to select an answer randomly. I re-adjusted several of my plans to reduce time and get more correct results. In short, if the symmetry or rotational relationship only happens in one problem, it is easy for both human and agent to figure out the answer in simple steps. So the idea of agent and humans are similar. But if symmetry, rotation, shadows, and logical relationships occur in one problem at the same time, it is difficult for agents to judge these complex problems like humans. If I could have more time, I would like to solve more challenging problems without considering the execution time. It is exciting to solve these problems.

References

1. Digital image processing. (2019, May 29). Retrieved May 30, 2019, from https://en.wikipedia.org/wiki/Digital_image_processing

2. S. Jiang, Project 1 Journal

3. S. Jiang, Project 2 Journal

4. Joyner, D. A., Bedwell, D., Graham, C., Lemmon, W., Martinez, O., & Goel, A. K. (2015, June). Using Human Computation to Acquire Novel Methods for Addressing Visual Analogy Problems on Intelligence Tests. In *ICCC* (pp. 23-30).