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Project 1- Project Reflection

Section 1

Generate & Test and Semantic Network are common tools used to solve ravens problems. In my project 1, I did use these two methods. I also obtain the differences of two or more images by comparing images' pixels.
In the first step, I compared images by color pixel. There are black objects with white background in the images. In java, getRGB()function can get the value of color pixel. I accumulated all the color pixels of objects in image A and image B and Image C. Based on similar transformation principle, the difference pixel of (image A and B) or (image A and C) is the closest to the difference pixel of (the right answer and image C) or (the right answer and image B). In the second step, my agent applied Generate & Test with Semantic Network method. My agent compared attributes by reading verbal information. My agent tried to decide the transformation between image A and B or between image A and C. The transformation of image C to the right answer or image B to the right answer is most similar to the transformation between image A and B or between image A and C. Then my agent picked up the right answer.
In the design of my agent, I did not identify specific object if more objects exist in the image. But through virtual comparing, the error is eliminated. But I still ignored the transformation of the diagonal comparison. This could reduce the efficiency. It is possible to yield a wrong answer.

Section 2

The easiest problem is that no change between (image A and image B) or (image A and C). My agent can reason that there is no change between (the right answer and image C) or (the right answer and image B). If the transformation of image A to image B or image A to C is only filling, the agent can reason the transformation of the right answer to image C or the right answer to image B is only filling. If the transformation of image A to image B or image A to C is only clockwise or counter-clockwise 90 degree, the agent can reason the transformation of the right answer to image C or the right answer to image B is only clockwise or counter-clockwise 90 degree. If the transformation of image

A to image B or image A to C is only reflection, the agent can reason the transformation of the right answer to image C or the right answer to image B is only reflection.
My agent selects only the exact correct answer. It does not rate answers on a more continuous scale because the agent does not score the transformation.

Section 3

My agent can quickly and correctly solve 12 basic problems. These problems generally have a single and common transformation. The agent identified the transformation and picked up the right answer easily. But when my agent solves 12 challenge problems, it only gets four correct answers. So the agent has serious problem extension issues. It only solves some specific problems. And these challenge problems have no verbal representation and only virtual representation. The agent cannot get the detailed difference among images by image pixel. If the transformation is only rotation or reflection or filling or something else, the agent cannot figure out the difference and cannot provide the right answer. But for missing verbal representation, it will be easily solved. My agent can read verbal representation and obtain the attributes of objects in images and compare them as long as verbal representation is written. However the agent still has little learning abilities. In reality, the agent meets more complex and rich problems. The agent must record these new changes and store more information for future problems. But now the agent can solve limited problems.

Section 4

Given unlimited time and resources, I make much improvement to my agent. First, my agent has very limited working memory. My agent only is designed to 12 basic problems. It has significant limitations. I plan to add more common variations as production rules. For often- encountered problems, the agent has more production rules and can provide the right answer in a short time. For example, add rotation change function, size change function, number of objects change function and so on.
Secondly, my agent now identifies one object in one image. When there is more than one object, the agent cannot distinguish them in one image. This is a great defect. In many problems, it is possible one specified object has specific change. I must improve the level of granularity. I

plan to label every object and add more mapping relations to identify individual object in every one image.
Third, my agent has lack of learning ability. It only relies on production rules and working memory. Learning is a very important factor. As we know, reasoning, memory and learning are three key factors in the design of AI agent. In reality, we could many different new situations. If the agent cannot find a similar match with new situation, the agent will spend a long time solving problem and even it will be at a loss for which is the right answer. I plan to store the chosen answer to each answer and the problem itself the agent can look up.
Definitely, I think if these improvements are implemented, my agent's accuracy, efficiency and generality will be improved greatly.

Section 5

My agent did very well across multiple metrics. For 12 basic problems, all answers are correct. So my agent has very high accuracy. My agent uses very common production rules that are unchanged rule, filling rule, reflection rule and image pixel change rule. So my agent has good generality. Because of lack of a long-term memory, my agent's efficiency is not outstanding. I need add a long-term memory to my agent. My agent only considers very limited scenarios. In order to improve my agent's performance, other scenarios also should be considered. Rotation, change of angle, is a good metric. The number change of objects in images is a good metric, such as one less or one more. The change of the size of object in images is a good metric. The change of the shape of objects in images is a good metric. The change of the location of objects is a good metric. For more one object in one image, the change of the relative position is a good metric.
And my agent did not consider the diagonal correlation. In some problems, this could happen.

Section 6

My agent applies Generate & Test with semantic network method to solve ravens problems. Semantic network provide a level of abstraction at which the problem gets represented and analyzed. Knowledge representation ignores things that are at a low level of detail to avoid the problem too complex. Generate transformations from options to B or C. Test these transformations from A to B or from A to C. My agent finds out which one of transformations is closest

with transformation from A to B or from A to C. Then the agent will get the right answer. I rely on both verbal representations and visual representations. My agent can extract attributes of objects and compare these attributes from verbal representation. By comparing, my agent can infer transformations. My agent cannot process visual input into verbal representations, but it can reason over images themselves.
White pixel and black pixel are different. So they return different values. Objects are made up of pixels. My agent accumulates pixels in images and obtains a total image pixel value. The difference of two image pixel values reflects transformations. But it cannot figure out specific transformations. The single dependence on virtual representations is not enough. My agent chooses to combine verbal and virtual representations.

Section 7

Everyday we often use Generate & Test with semantic network as the problem-solving method. We cannot have a complete and correct knowledge system. We only have limited computational resources. For different scenarios, we do not always have resource to ensure the inference is correct. So we need come up with potential solutions to a problem, and test the solutions out.
My agent uses observations from verbal and virtual representations and forms basic transformations. Then the agent compares these transformations based on tests. The answer that has the closest correlation is picked up. A human does a same procedure when he solves a problem. But a human with a long memory and good intuition has deeper knowledge and better analysis ability. My agent has not. My agent gives me many insights into the way people solve these problems. It makes me understand deeply how we think and reason using knowledge when we try to solve complex problems.