My interest in computer science can be captured in a sentence: “Computer Science enable people to solve problems in brand new way” When I first touched programming, I realized that it is not only fulfilling when you ran your own program successfully, but also really marvelous that it could create many amazing functions which only computers can do. Just like the creation of Enigma breaker for code breaking, and the color map problem which is the first major theorem proved with the help of computer. Computing is such a wonderful way for people to solve problems which people are not able to do before and this is the reason why I am so keen on this subject.

I once attended the summer camp for using computer algorithms to solve the Sudoku problems. We needed to make sure that each grid must contain no more than one value and should be between 1 and 9. In addition, in each row, column and box, the value in each grid must be unique. I firstly thought about letting the computer solve the Sudoku in constraint programming which is similar to human ways that does the eliminations for each row, column and box. For some simple Sudoku, it worked really fast. However, for some Sudoku needed guesses, this method could not work. Then, I tried to use the computer algorithms that computer could try numbers on each grid and returned the correct one. Thus, the ones came up in my mind are the Depth First Search Algorithms (DFS) and Breadth First Search Algorithm (BFS) which related to graph theory. Considering the Sudoku as a graph with 81 vertices. Each time, assigning a “color” from 1 to 9 to the vertex and the edges which connect them together cannot be assigned the same color. For instance, the all grids in the same row, column or block will have edges between their corresponding vertices. Then, make a function to check the correctness of the Sudoku and save the valid ones in the stack(DFS) or in the queue(BFS). If it is wrong, it will backtrack to the previous one. By doing this recursively, we can work out the correct answers.

Unfortunately, the Sudoku problem is a NP complete problem. Although, we could verify a correct solution quickly, it still took a long time to solve it. For some harder Sudoku, for example, the hardest Sudoku in the world only has 17 clues. This result was also done by using computers that trying every possible scenario for every possible configuration and also used some methods to trim down the number of possibilities to reduce the amount of testing. It will be very inefficient. Thus, in order to decrease the time taken further, I tried to reduce the number of possibilities needed tests through pruning. I firstly tried to do the constraint programming each time the candidate Sudoku is popped out from the stack in DFS method. On the other hand, I tried to make a list of integers available for each blank grid by checking the rows, columns and boxes before trying to put numbers in. Therefore, we didn’t need to try the numbers which was definitely wrong.

Apart from these methods, we could also use stochastic search to solve Sudoku with genetic algorithms. In this case, we will have a fitness function to evaluate the solution demand and do the selection from integers 1 to 9 and do the crossover and mutation. Next, go to the next generation until there is one candidate meet the constraints.

Through testing different methods, we found that in different situations, the speed of algorithms varies. It could be possible to use machine learning to create mathematical models and let the program to choose the most suitable solution for different situations.

Apart from computer science, I am also very interested in Mathematics. I achieved a gold certificate in the UK Senior Mathematical Challenge 2018. I have also achieved the First Place Certificate for the Problem Solving Round in the High School Team Maths Competition in 2018.

After class, I am also an active person. I am one member of our school student council and usually organize some events. I have also attended a winter camp which is about how to use 3D printing to make the artificial limbs for the hands disables children. I enjoy these experience and I have learnt that it is important for us to corporate and divide our tasks when we do a group work so that we can work efficiently. It is also important to listen to others’ thoughts and combine them together.

I enjoyed the understanding from dedicating myself to these projects and take this commitment into university. Also, I love the fact that computer science can be applied to our daily life and make our life more convenient. I cannot wait to learn more at a higher level.