Probably everybody’s zeal for computers originated from playing video games, and I am no exception. I was crazy about a shooting game called “Counter-Strike” when I was in middle school. Apart from improving my skills of playing the game, I did plenty of research on how to change the game by modifying its source code, which intrigued my first touch of coding. Sampling changing indexes was not programming, but it inspired me to explore more in this magical field.

My passion for programming peaked in high school. As an inquisitive teenager, I was constantly seeking more challenges and began to learn Java by myself by reading a book called “Introduction to Java Programming” by Y. Daniel Liang. Later, when I was learning Matrix-Multiplication in maths, I coded an algorithm using triple-nested loops and two-dimensional arrays. During the debug process, I noticed that some calculations are duplicated which intrigues my consideration of the efficiency of algorithms. I enjoyed thinking high-efficiency algorithms to make my mind more active by making a comparison with old ones and I always could learn a new way of programming to save time. The Big O notation in ‘Introduction to Algorithms’ allows further development of my understanding of the efficiency of algorithms. I am able to digitally imitate the speed of algorithms. The classic game Tower of Hanoi gives me the idea of recursion method. I found that the recursion method is an ideal means to solve some problem such as factorial, but it also sometimes complicates the calculate when solving Fibonacci numbers which may lead to a huge recursion tree. In this case, storing all the previously calculated numbers in an array might be a better idea. When I read the Strassen algorithm, I learnt that divide-and-conquer strategy could make the recursion tree smaller which speed up Matrix-Multiplication from the third power of n to approximate 2.8 power of n. Then I noticed that Matrix-Multiplication is massively used in graphics display which needs a huge amount of matrix translation. Although the calculation speed of one Matrix-Multiplication is not improved much, a huge improvement is made at graphics display when a lot of calculations are involved. As I dived more into the ocean of algorithms, the many nuanced but powerful variance of algorithms constantly pushed me to explore further into the region.

Computer Science never failed to fascinate me with its seamless flow of logic. In last year’s summer vacation, I made a personalised TicTacToe AI for my cousin. In the beginning, this AI is working through judging various situations and coded by complicated if statements. It is well known that the result of TicTacToe game must be a draw when two players are playing optimally. As a result, I started to modify my algorithm by applying more advanced algorithms. Then, the MiniMax algorithm emerged. The logic behind piqued my interest which drives me to delve deeper into a more detailed study of that. I learnt that the essence of the MiniMax algorithm is a BFS search algorithm that fits for two-player zero-sum game. For TicTacToe game with such a small board, MiniMax algorithm can easily handle this by purposefully solving all of the possible situations to determine the best move which makes it unbeatable. In addition, efficiency can be further optimised by combining Alpha-beta pruning which is able to prune unnecessary branches to reduce the number of nodes traversed. In fact, by passing two parameters alpha and beta to the recursive MiniMax function and making comparisons, we could crop a node and the entire subtree of the node. This efficiency optimisation process could save more than half of the original time required. The MiniMax algorithm gives me an idea of search algorithms and I started to think and solve more classical problems.

Furthermore, extra-curricular activities have strengthened my learning skills. In a summer program organised by the University of Cambridge in 2018, I learned Python language and basic knowledge of Machine Learning. Academically, I also received a Global Silver Award in the British Physics Olympiad, the Gold Award in the Rising Star Chemistry Challenge (top 3%) and a high distinction and credit in Australian’s Chemistry and Math Competitions.

With the knowledge I had for Computer Science, I hope to be immersed in computer science at a higher level, exploring the area that I am interested in and good at. I believe the opportunity to study in one of the most outstanding institutions will guide me in my exploration and enable me to construct new solutions to problems.