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| **CMP304 AI Part**  **Project Report (50%)**  **Car Racing with Fuzzy Logic** |
| Instructions:  - This is a template that you should use to complete your assignment report.  - Please read the assessment brief document before attempting this.  - The gray text is meant as guidelines. You are to replace it with your own.  - You may add subtitles as you see fit.  - Delete this instructions part and any gray text before submission.  - After you complete this report, save it as a pdf, and submit it along with the compressed folder of your application. |
| **by: Lewis Thomson - 1601828** |

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| **1. Introduction (5%)** |
| I have chosen to assignment of creating a “racing game” application using a Fuzzy Inference System as an AI to control the steering of the car. I should then compare my developed FIS with another AI system, in which I am going to choose the most simple, basic type of ‘Artificial Intelligence’, that being an if-else system.  Fuzzy logic is the process of taking numbers in, making them a lot more vague and ‘fuzzy’, and then letting what is essentially a case system make decisions based on the values that are used and the rules in place. The process of making the numbers and values ‘fuzzy’, is similar to using vague, more ‘human’ conventions. For example, a range of 0 – 10 (similar to what this program uses). The number 2 is precisely 2 digits from the origin, 0. In fuzzy terms, this could be considered to be “near” to 0. However you could also change it and add another rule, meaning that it could be “very near”, and “near” would start at 3. Etc.  The idea of using words like “close” or “far” is what will allow this FIS to function and “steer” the car towards the line.  For the development, I am using the MATLAB toolkit to create the AI and am developing the testing application in Visual Studio C++, also making use of SFML for the graphical interface. |
| **2. Methodology (15%)** |
| I started by analysing the problem and looking up some documentation and examples on how to operate Matlab. I decided it would be ideal to have 5 states possible for the possible outcomes. This allows the “car” to either drastically change its direction, or only slightly adjust it. After familiarising myself with the tools and completing a few example exercises, I set to work at implementing my states. I defined my rules by using a fuzzy associative map. (fig 1).  https://i.gyazo.com/a47c0a2aba70f9ce25be32f077a7d0ae.png  Figure 1  M:\GitHub\CMP304-FuzzyLogic\FuzzyCarLogic\Documents\GUI.pngUsing this, I was able to develop the FIS system to be used, now the only problem was implementing it into an application, for this, I decided to use an opensource API called ‘FuzzyLite’, which allows for the importing of FIS files. As previously stated, I have opted to also use SFML to integrate a GUI system into the application (fig 2).  For the design of the application, I decided to facilitate the different stages of the task, I would make the application open on a console, and then allow the user to select which stage they would like to use. This will allow thorough testing of each iteration of development. This also allows for the code design to be slightly object oriented, with each stage being contained in its own class.  Figure 2  As for the FIS, it was created using MATLABs Fuzzy Logic Toolbox. The system in question uses two input variables and one output.  Description of the steps followed and methods used including a complete explanation and rationale for the techniques and features chosen. You should also acknowledge the data and tools you used. |
| **3. Results (10%)** |
| Comment on the performance of your application, including test cases. Tabulate and discuss your results. A quantitative measure of performance must be presented. |
| **4. Conclusion (10%)** |
| Full analysis and summary of the project. |
| **5. References (5%)** |
| A number of references properly cited in Cite Them Right Harvard style. |

Structure, style, formatting, spelling, grammar, coherence (5%)