# Edith Cowan University
# CSG2341
# Intelligent Systems
# Assignment 1A

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# 1 Introduction

This report examines fuzzy logic and its practical use in a video game called Saucers. Saucers is a two player game, where each player indirectly controls their flying saucer using a fuzzy logic controller. The saucers meet on a battle space, a rectangular xy plane, with the purpose of destroying each other. The walls of this space cannot be travelled through, and will cause the saucer to ricochet off the wall when hit.

The saucers begin with equal amounts of energy at the start of the game, and this energy is consumed as they fly around or fire their auto-aiming cannon mounted on a rotating turret. The rounds fired from the cannon are ballistic. They travel in a straight line from the cannon and are not guided. When a saucer is hit by a round, energy is depleted. Amount of energy depletion depends on how far away the round was fired. In other words, rounds fired will lose energy the further they have to travel, and will eventually fade away. They are much more lethal in close combat.

Saucers cannot stop flying and will always consume energy. However, the speed of a saucer can be controlled. The slowest speed consumes the least amount of energy, while the fastest speed consumes the most. The saucer's heading can also be controlled, and can turn left or right in any direction. Currently, there is no energy penalty for turning. Each saucer is also equipped with a sensor, which determines how far away the opponent is, the opponent direction, and how much energy the opponent has, which are used as inputs for fuzzy logic.

When a saucer loses all of its energy, it disappears from the battle space and loses. The remaining saucer with energy left over is the winner. The goal of this report is to design a fuzzy logic controller so that it's saucer will have the most amount of remaining energy at the end of the battle.

# 2 Idea

The tactics of this controller are based on two facts:

- Saucers will always consume energy, no matter what they are doing.
- Cannon rounds are much more effective at close range.

Since saucers will always consume energy during all regimes of flight, it is much more efficient to be in a position to fire the weapon and attempt to degrade the enemy's energy at a faster rate, rather than fly defensively without firing at all. It is also more effective to be within close range of the enemy to cause more damage with the cannon, but on the other hand, the enemy's cannon will also be just as dangerous.

Therefore, the tactics of the controller will be as discussed below.

## 2.1 Flight regimes

If the enemy is far or near while winning or the score is even, commit to engagement and fly aggressively towards the enemy. Otherwise if the enemy is close, and winning or the score is even, fly at a slow speed to stay within close range. This will allow the enemy to pass so that the saucer can stay behind the enemy and avoid overshooting him. During winning or even scores, the saucer will always turn towards the enemy attempting to close the distance to a much more lethal firing range.

If losing, break contact and fly away from the enemy at the appropriate speed. If close, fly fast away from the enemy. If near, fly moderately, and if far, then fly at slow speed to conserve energy.

## 2.2 Weapon employment

# 3 Fuzzy variables

# 4 Sample fuzzy rule

# 5 Learnings

# 6 Conclusion

# References