# Introduction

This is a report for assignment 2 of Artificial Intelligence. This report is about fuzzy logic controller of a washing machine.

Fuzzy logic is a way to computing value base on “degrees of the factor”. It is different to usual programing “Boolean” on true or false, so different input factor can be taken care. In this assignment, fuzzy logic controller is going to control a washing machine to calculate correct washing time base on the condition of the clothes.

The architecture of the washing machine fuzzy logic controller is based on the dirtiness of the clothes ad the type of the dirt of the clothes. Basically, dirtier will cause longer washing time. Also, more inputs will by add in to the controller, this will be discussing more detailly in the report.

# Why do we need fuzzy logic controller on washing machines?

Reason can be simple, it is because washing machine does not like real human, if no fuzzy logic implemented, it will only be switch on or off, and wash all type of clothes in a fixed time with no matter how dirty they are. On of the characteristics of fuzzy logic can take care multiple type of input and calculate output by “degrees of the factor”. So that implement fuzzy logic on controller can make washing machine take care different types of clothes conditions (e.g. dirtiness, types of the dirt), by this way washing machine can be smarter and working more like a human thinking.

# Fuzzy logic controller architecture

The architecture of the fuzzy logic controller is shown in figure 1.

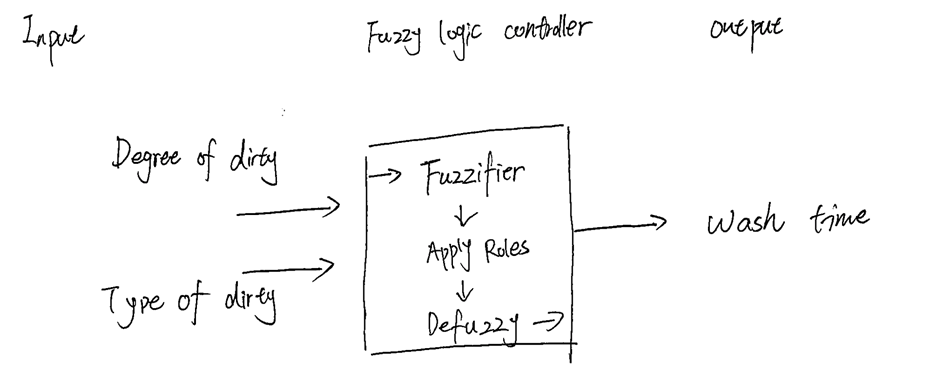


Figure basic architecture of fuzzy logic controller

Fuzzy logic controller will process the information given by the sensors on the machine and calculate an output of wash time.

There are two type of data should be input

1. Degree of dirty
2. Type of dirty

Degree of dirty data can be read from the washing machine sensors by scan the dirt partials on the clothes, more dirt partials means dirtier.

Type of dirty will be determined by time of water get dirty, longer time means greasier (greasy is harder to dissolve).

After user put clothes into the washing machine and water added to the machine, there are will be a time that sensors get stable data reading. At this time, machine will begin to calculate the output wash time.

# Detail of the set applied

## Fuzzifier

Fuzzifier is a process to convert clear input value into a fuzzy value, in first, there are only two variables input so that there are two membership functions user to map input to fuzzy value.

Figure 2 shows membership function of DegreeOfDirty with range 0 to 100

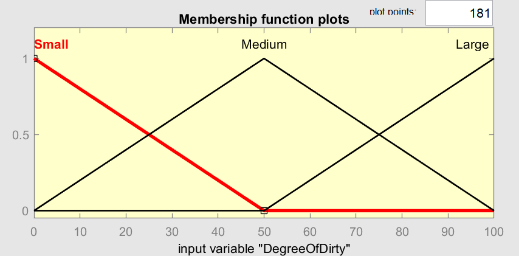


Figure Membership function:DegreeOfDirty

Figure 3 shows membership function of TypeOfDirty with range 0 to 100

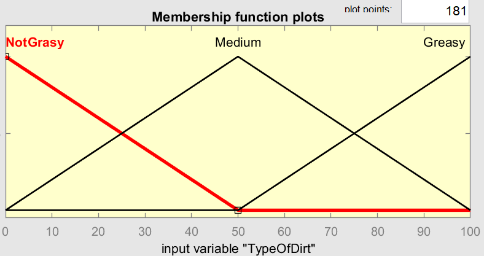


Figure Membership function: TypeOfDirt

For example: If now has input 10 to membership function DegreeOfDirty, fuzzy output can be ‘Small’ .

## Roles:

Roles are how the decisions made by fuzzy controller, there stored in knowledge database. In high level understand, roles are if-then statements and it is based on input variables, and easy to understand.

Roles that used in this report is based on the sense of dirtier – longer, and their listed in table 1 down below.

Table Roles: two input type

|  |
| --- |
| 1. If dirtiness\_of\_clothes is Large and type\_of\_dirt is Greasy then wash\_time is VeryLong; |
| 2. If dirtiness\_of\_clothes is Medium and type\_of\_dirt is Greasy then wash\_time is Long; |
| 3. If dirtiness\_of\_clothes is Small and type\_of\_dirt is Greasy then wash\_time is Long; |
| 4. If dirtiness\_of\_clothes is Large and type\_of\_dirt is Medium then wash\_time is Long; |
| 5. If dirtiness\_of\_clothes is Medium and type\_of\_dirt is Medium then wash\_time is Medium; |
| 6. If sdirtiness\_of\_clothes is Small and type\_of\_dirt is Medium then wash\_time is Medium; |
| 7. If dirtiness\_of\_clothes is Large and type\_of\_dirt is NotGreasy then wash\_time is Medium; |
| 8. If dirtiness\_of\_clothes is Medium and type\_of\_dirt is NotGreasy then wash\_time is Short; |
| 9. If dirtiness\_of\_clothes is Small and type\_of\_dirt is NotGreasy then wash\_time is VeryShort |

## About ‘and’ operator and ‘or’ operator:

‘and’ operator: The ‘and’ operator will take the lower value of member functions

‘or’ operator: The ‘or’ operator will take the higher value of the member functions

## Defuzzied and output

After apply role, fuzzy controller will have a bit clearer value to do the defuzzy processes. A membership function will cover the output and help defuzzy the value back to normalized clear value. Output membership function shown down below.