SCT Experiment No: 4

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Aim:

Implementing union, intersection, complement and difference operations on fuzzy sets.

Introduction:

Words like young, tall, good or high are fuzzy.

• There is no single quantitative value which defines the term young.

• For some people, age 25 is young, and for others, age 35 is young.

• The concept young has no clean boundary.

• Age 35 has some possibility of being young and usually depends on the context in which it is being considered.

Fuzzy sets theory is an extension of classical set theory.

• Elements have varying degree of membership. A logic based on two truth values,

• True and False is sometimes insufficient when describing human reasoning.

• Fuzzy Logic uses the whole interval between 0 (false) and 1 (true) to describe human reasoning.

• A Fuzzy Set is any set that allows its members to have different degree of membership, called membership function, having interval [0,1].

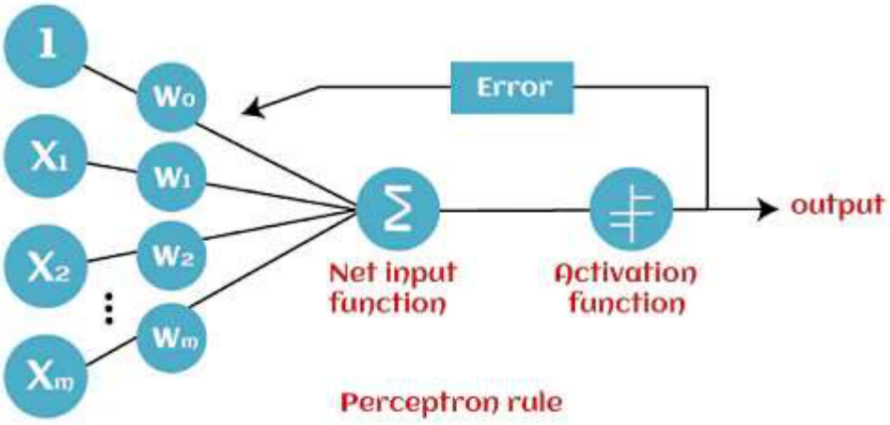
Fuzzy sets:

Fuzzy sets were introduced by Lotfi Zadeh (1921–2017) in 1965.

Unlike crisp sets, a fuzzy set allows partial belonging to a set, that is defined by a degree of membership, denoted by μ, that can take any value from 0 (element does not belong at all in the set) to 1 (element belongs fully to the set).

It is evident that if we remove all the values of belonging except from 0 and 1, the fuzzy set will collapse to a crisp set that was described in the previous section.

The membership function of the set is the relationship between the elements of the set and their degree-of-belonging.



Perceptron rule

```
        #print(A_value)

        if A_value < B_value:
            Y[A_key] = A_value
        else:
            Y[B_key] = B_value

print('Fuzzy Set Intersection is :', Y)
```

```
The First Fuzzy Set is : {'a': 0.2, 'b': 0.3, 'c': 0.6, 'd': 0.6}
The Second Fuzzy Set is : {'a': 0.9, 'b': 0.9, 'c': 0.4, 'd': 0.5}
Fuzzy Set Intersection is : {'a': 0.2, 'b': 0.3, 'c': 0.4, 'd': 0.5}
```

Example of Compliment¶

In [3]:

```
#  Example to Demonstrate the
#  Compliment of Two Fuzzy Sets
A = dict()
B = dict() Y
= dict()

A = {"a": 0.2, "b": 0.3, "c": 0.6, "d": 0.6}

print('The First Fuzzy Set is :', A)


for A_key in A:
        Y[A_key] = 1-A[A_key]

print('Fuzzy Set Compliment is :', Y)
```

```
The First Fuzzy Set is : {'a': 0.2, 'b': 0.3, 'c': 0.6, 'd': 0.6}
Fuzzy Set Compliment is : {'a': 0.8, 'b': 0.7, 'c': 0.4, 'd': 0.4}
```

Difference¶

In [4]:

```
#  Example to Demonstrate the
#  Difference of Two Fuzzy Sets

import math
A = dict()
B = dict()
Y = dict()

A = {"a": 0.2, "b": 0.3, "c": 0.6, "d": 0.6}
B = {"a": 0.9, "b": 0.9, "c": 0.4, "d": 0.5}

print('The First Fuzzy Set is :', A)
print('The Second Fuzzy Set is :', B)
```

```
for A_key, B_key in zip(A, B):
        A_value = A[A_key]
        B_value = B[B_key]
        B_value = 1 - B_value

        if A_value < B_value:
                Y[A_key] = A_value
        else:
                Y[B_key] = B_value

print('Fuzzy Set difference is : ' , Y)
```

```
The First Fuzzy Set is : {'a': 0.2, 'b': 0.3, 'c': 0.6, 'd': 0.6}
The Second Fuzzy Set is : {'a': 0.9, 'b': 0.9, 'c': 0.4, 'd': 0.5}
Fuzzy Set difference is :          {'a': 0.09999999999999998, 'b': 0.0999999999999
9998, 'c': 0.6, 'd': 0.5}
```

Conclusion:

Fuzzy operations are performed on fuzzy sets, whereas crisp operations are performed on crisp sets. Fuzzy operations are very useful in the design of a Fuzzy Logic Controller. It allows the manipulation of fuzzy variables by different means.

Reference:

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