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Experiment - 9

Aim → Implementation of uncertain method (Dempster Shafer Theory)

Problem formulation

To solve inference problem representing uncertain method to obtain a belief function.

Using the Massfunction which has built in combination rules obtain the Dempster rule of combination

Initial State

$m_1 = \{'a': 0.4, 'b': 0.2, 'ab': 0.1, 'abc': 0.3\}$

$m_2 = \{'b': 0.5, 'c': 0.2, 'ac': 0.3, 'a': 0.0\}$

final state

{'ac': 0.157894
'c': 0.105263,
'b': 0.5263157,
'ab': 0.0,
'abc': 0.0,
'a': 0.21052631}

Problem Solving

The Combination is calculated from the two sets of masses m_1 and m_2 in the following manner.

- $m_{1,2}(\phi) = 0$
- $m_{1,2}(A) = (m_1 \oplus m_2)(A) = \frac{1}{1-K} \sum_{B \cap C} m_1(B) m_2(C)$

where $K = \sum_{B \cap C = \phi} m_1(B)\, m_2(C)$

combination of m_1 & m_2

$\{b'\} = 0.5$, $\{a'\} = 0.2499$, $\{c', a'\} = 0.1499$

& $\{c'\} = 0.0999$

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EXPERIMENT NO: 9

IMPLEMENTATION OF UNCERTAIN METHODS – DEMPSTER SHAFER THEORY

Algorithm:

Step 1: Start

Step 2: Each piece of evidence is represented by a separate belief function ***Step 3:*** Combination rules are then used to successively fuse all these belief functions in order to obtain a belief function representing all available evidence.

Step 4: Specifically, the combination (called the *joint mass*) is calculated from the two sets of masses m1 and m2 in the following manner:

- $m_{1,2}(\emptyset) = 0$
- $m_{1,2}(A) = (m_1 \oplus m_2)(A) = (1/1-K) \sum_{B \cap C = A \neq \emptyset} m_1(B)\, m_2(C)$

where,

- $K = \sum_{B \cap C = \emptyset} m_1(B)\, m_2(C)$ K

K is a measure of the amount of conflict between the two mass sets.

Step 5: In python Mass-Function has the built-in combination rules.

Step 6: Stop

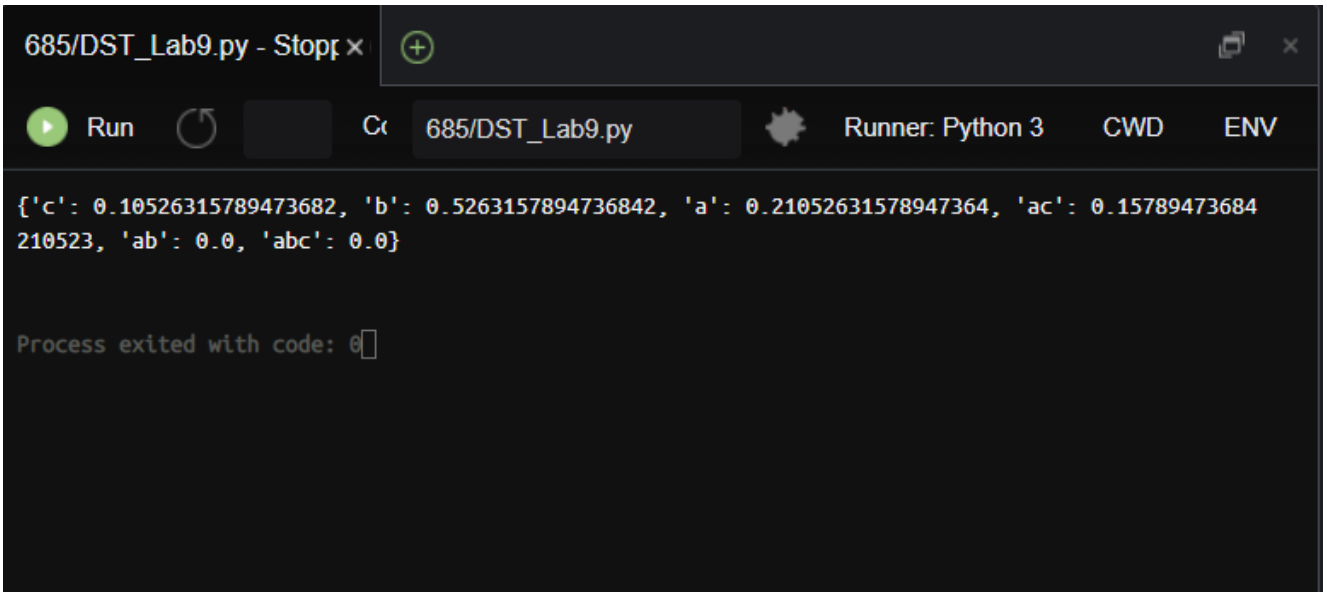
Source code:

```
 from numpy import *

def DempsterRule(m1, m2):

    ## extract the frame of discernment

    sets=set(m1.keys()).union(set(m2.keys()))

    result=dict.fromkeys(sets,0)

    ## Combination process

    for i in m1.keys():

        for j in m2.keys():

            if set(str(i)).intersection(set(str(j))) == set(str(i)):

                result[i]+=m1[i]*m2[j]

            elif set(str(i)).intersection(set(str(j))) == set(str(j)):

                result[j]+=m1[i]*m2[j]


    ## normalize the results

    f= sum(list(result.values()))

    for i in result.keys():

        result[i] /=f

    return result


m1 = {'a':0.4, 'b':0.2, 'ab':0.1, 'abc':0.3}
```

m2 = {'b':0.5, 'c':0.2, 'ac':0.3, 'a':0.0}

print(DempsterRule(m1, m2))

Output:



Result:

Hence, the Implementation of Dempster Shafer Theory is done successfully.