AI LAB 9

IMPLEMENTATION OF DEMPSTER SHAFER THEORY

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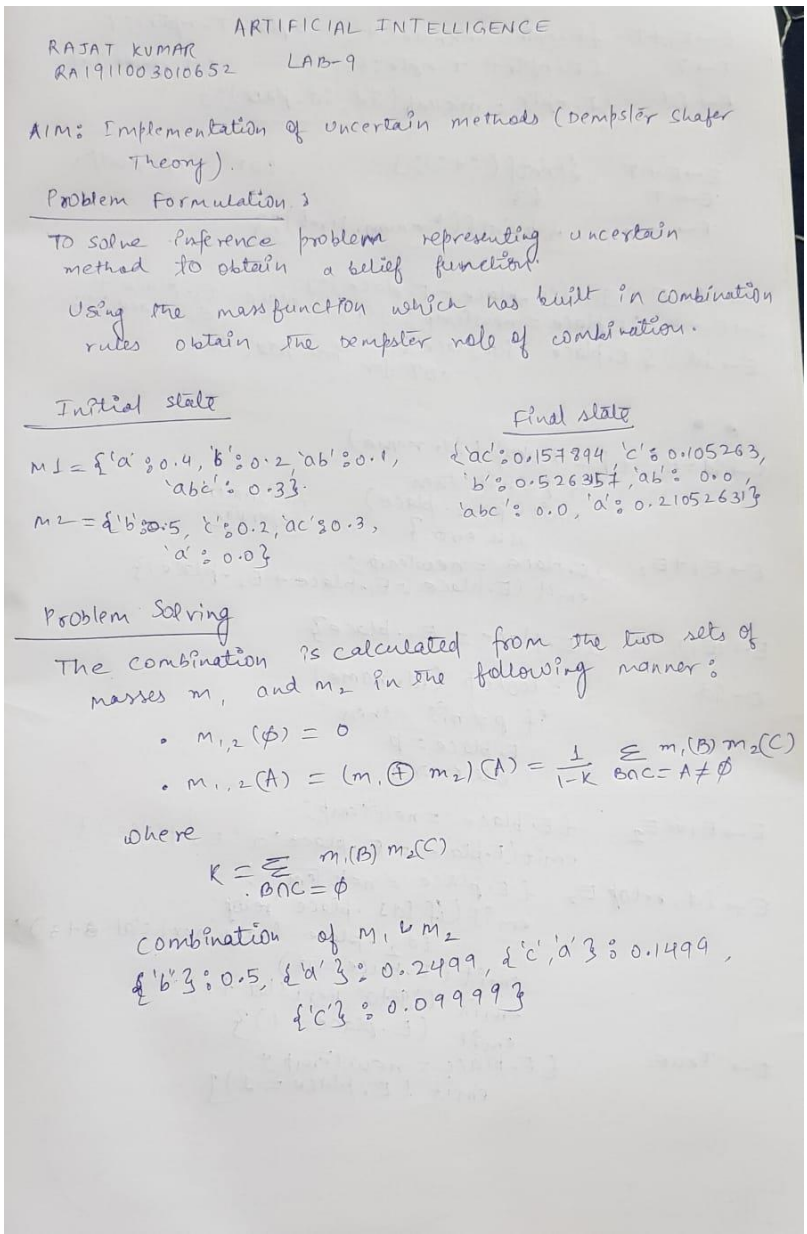

ARTIFICIAL INTELLIGENCE

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AIM: Implementation of uncertain methods (Dempster Shafer Theory).

Problem Formulation:

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

Using the mass function which has built in combination rules obtain the dempster rule of combination.

Initial state

$M1 = \{'a': 0.4, 'b': 0.2, 'ab': 0.1, 'abc': 0.3\}$

$M2 = \{'b': 0.5, 'c': 0.2, 'ac': 0.3, 'a': 0.0\}$

Final state

$\{'ac': 0.157894, 'c': 0.105263, 'b': 0.526357, 'ab': 0.0, 'abc': 0.0, 'a': 0.21052631\}$

Problem Solving

The combination is calculated from the two sets of masses m_1 and m_2 in the following manner:

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

where

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

combination of m_1 & m_2

$\{'b'\}: 0.5, \{'a'\}: 0.2499, \{'c','a'\}: 0.1499, \{'c'\}: 0.099999$

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:

- $m1,2(\emptyset) = 0$
- $m1,2(A)=(m1 \oplus m2)(A)=(1/1-K) \sum B \cap C=A \neq \emptyset \; m1(B) \; m2(C)$

Where,

- $K=\sum B \cap C=\emptyset \; m1(B) \; m2(C) \; K$

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

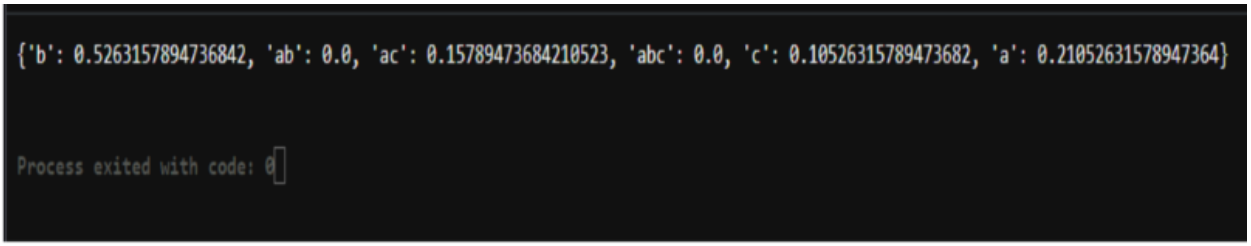
SOURCE CODE:

```
from numpy import *
def DempsterRule(m1,m2):
   ##extract the from 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]

      ##normalize the results
      f=sum(list(result.values()))
      for i in result.keys():
         result[i]/=f

      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 was successfully done.