DSC 540 - Topic 6 - Assignment-Problem1

September 15, 2021

[2]:
```
import numpy as np
import matplotlib.pyplot as plt
import skfuzzy as fuzz
from skfuzzy import control as ctrl
```

Let us define the two input variables and the output sinc function

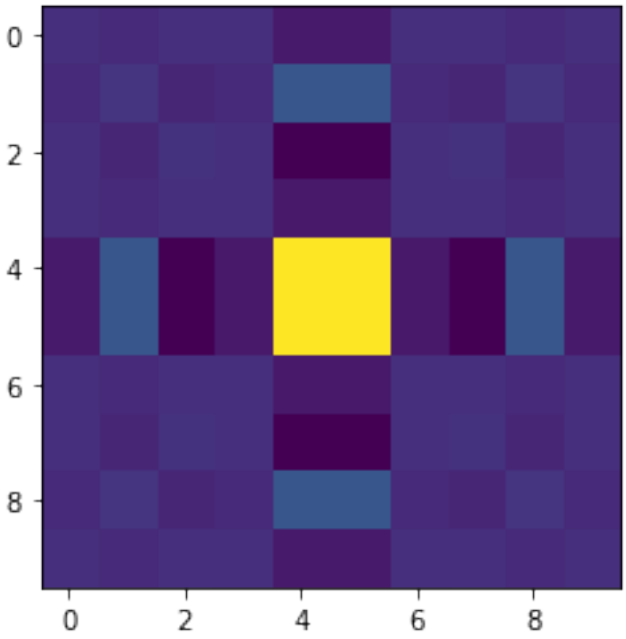
[3]:
```
x1 = np.linspace(-10, 10, 10)
x2 = np.linspace(-10, 10, 10)
```

[4]:
```
y = np.outer(np.sin(x1), np.sin(x2)) / np.outer(x1, x2)
```

[5]:
```
y
```

[5]:
```
array([[ 0.00295959, -0.00697426,  0.00651293,  0.00311019, -0.04387927,
        -0.04387927,  0.00311019,  0.00651293, -0.00697426,  0.00295959],
       [-0.00697426,  0.0164348 , -0.01534768, -0.00732915,  0.10340129,
         0.10340129, -0.00732915, -0.01534768,  0.0164348 , -0.00697426],
       [ 0.00651293, -0.01534768,  0.01433246,  0.00684434, -0.09656152,
        -0.09656152,  0.00684434,  0.01433246, -0.01534768,  0.00651293],
       [ 0.00311019, -0.00732915,  0.00684434,  0.00326845, -0.04611209,
        -0.04611209,  0.00326845,  0.00684434, -0.00732915,  0.00311019],
       [-0.04387927,  0.10340129, -0.09656152, -0.04611209,  0.65055997,
         0.65055997, -0.04611209, -0.09656152,  0.10340129, -0.04387927],
       [-0.04387927,  0.10340129, -0.09656152, -0.04611209,  0.65055997,
         0.65055997, -0.04611209, -0.09656152,  0.10340129, -0.04387927],
       [ 0.00311019, -0.00732915,  0.00684434,  0.00326845, -0.04611209,
        -0.04611209,  0.00326845,  0.00684434, -0.00732915,  0.00311019],
       [ 0.00651293, -0.01534768,  0.01433246,  0.00684434, -0.09656152,
        -0.09656152,  0.00684434,  0.01433246, -0.01534768,  0.00651293],
       [-0.00697426,  0.0164348 , -0.01534768, -0.00732915,  0.10340129,
         0.10340129, -0.00732915, -0.01534768,  0.0164348 , -0.00697426],
       [ 0.00295959, -0.00697426,  0.00651293,  0.00311019, -0.04387927,
        -0.04387927,  0.00311019,  0.00651293, -0.00697426,  0.00295959]])
```

[6]:
```
plt.imshow(y)
plt.show()
```

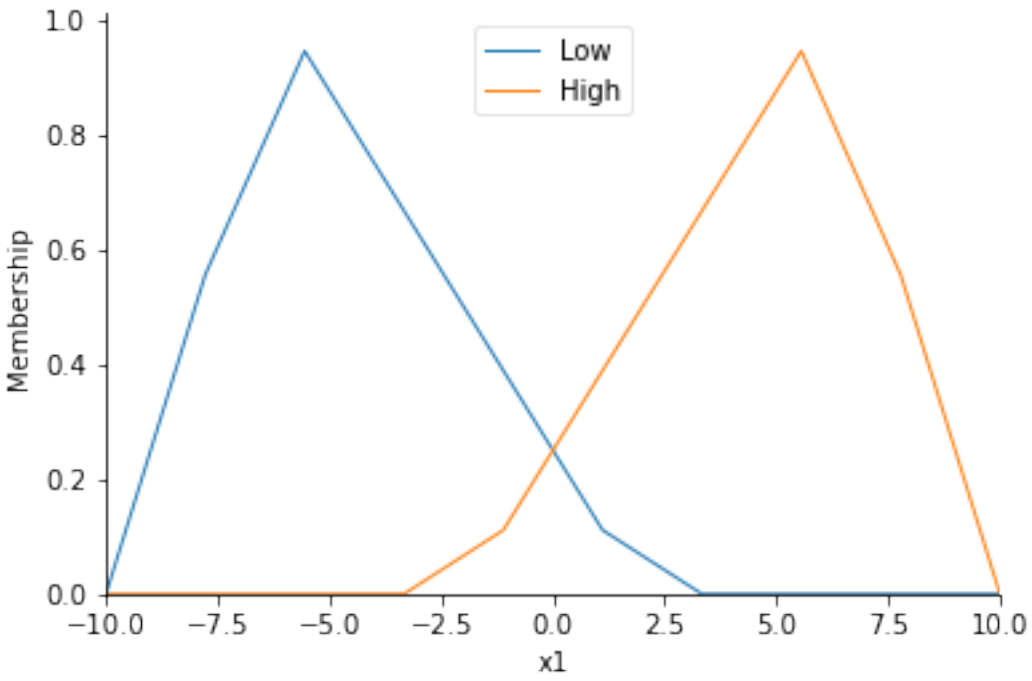


[7]:
```
x1_a=ctrl.Antecedent(x1,'x1')
x2_a=ctrl.Antecedent(x2,'x2')
```

[8]:
```
x1_a['Low'] = fuzz.trimf(x1_a.universe,[-10,-6,2])
x1_a['High'] = fuzz.trimf(x1_a.universe,[-2,6,10])
```

[9]:
```
x1_a.view()
```

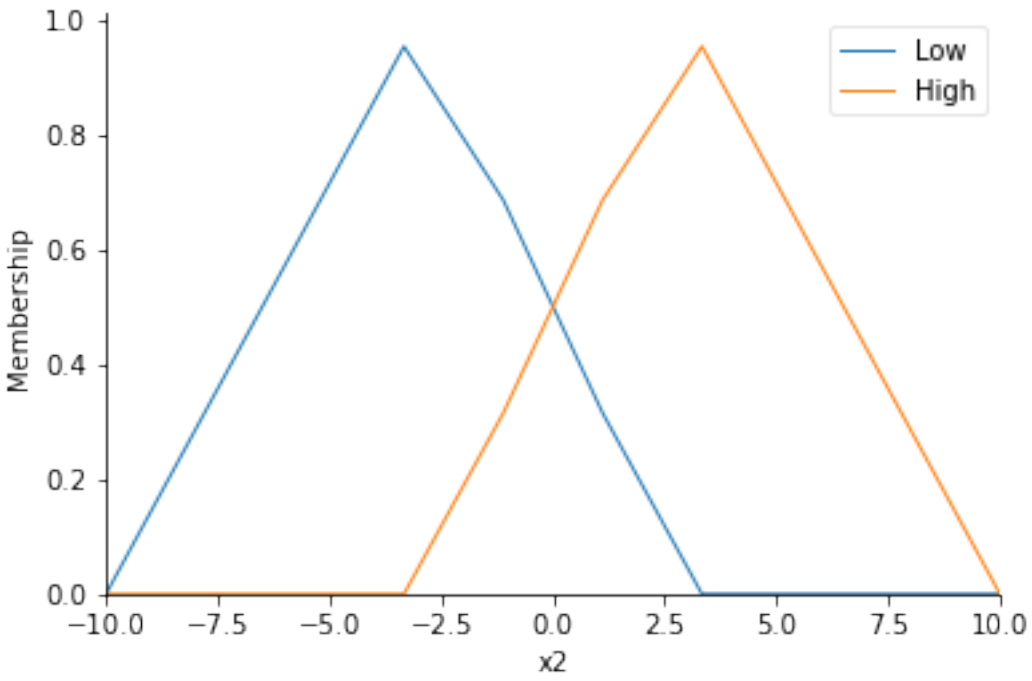
```
C:\Users\ua58809\Anaconda3\lib\site-
packages\skfuzzy\control\fuzzyvariable.py:122: UserWarning: Matplotlib is
currently using module://ipykernel.pylab.backend_inline, which is a non-GUI
backend, so cannot show the figure.
  fig.show()
```



[10]:
```
x2_a['Low'] = fuzz.trimf(x1_a.universe,[-10,-3,3])
x2_a['High'] = fuzz.trimf(x1_a.universe,[-3,3,10])
```

[11]:
```
x2_a.view()
```

```
C:\Users\ua58809\Anaconda3\lib\site-
packages\skfuzzy\control\fuzzyvariable.py:122: UserWarning: Matplotlib is
currently using module://ipykernel.pylab.backend_inline, which is a non-GUI
backend, so cannot show the figure.
  fig.show()
```

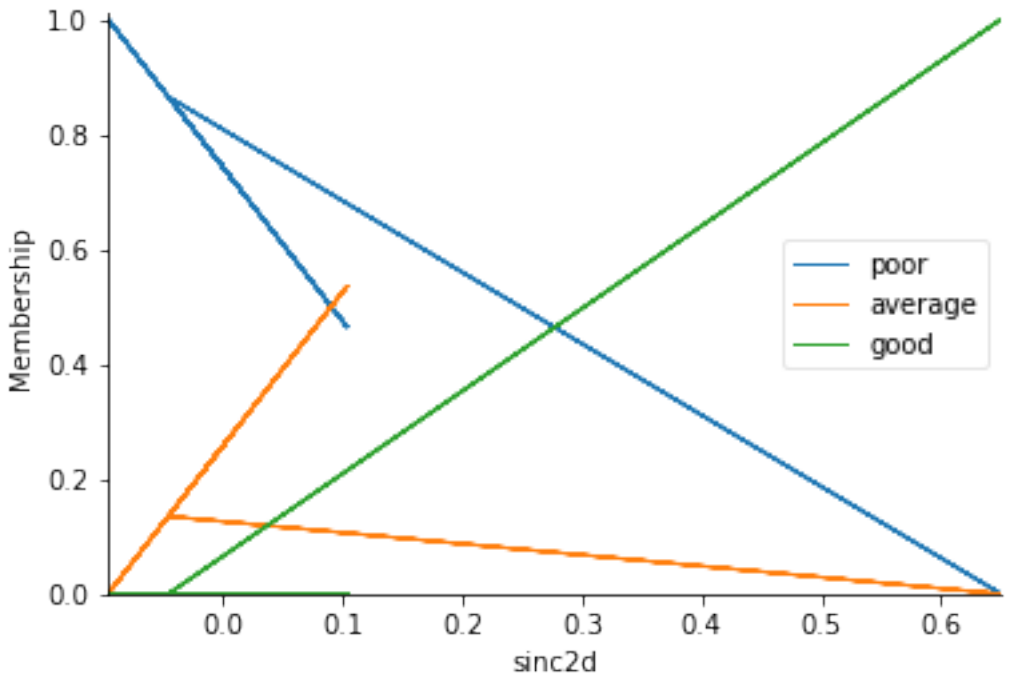


[12]:
```
#sinc2d = ctrl.Consequent(np.arange(-1,1,0.01),'sinc2d')
#sinc2d = ctrl.Consequent(np.reshape(y,100),'sinc2d')
sinc2d = ctrl.Consequent(np.reshape(y,100),'sinc2d')
```

[13]:
```
sinc2d.automf(3)
```

[14]:
```
sinc2d.view()
```

```
C:\Users\ua58809\Anaconda3\lib\site-
packages\skfuzzy\control\fuzzyvariable.py:122: UserWarning: Matplotlib is
currently using module://ipykernel.pylab.backend_inline, which is a non-GUI
backend, so cannot show the figure.
  fig.show()
```



[15]:
```
rule1 = ctrl.Rule(x1_a['Low'] & x2_a['Low'], sinc2d['poor'])
```

[19]:
```
rule1
```

[19]:
```
IF x1[Low] AND x2[Low] THEN sinc2d[poor]
        AND aggregation function : fmin
        OR aggregation function  : fmax
```

[ ]:

[ ]:

[ ]:

[ ]: