Lecture C2. Discrete Time Markov Chain2

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차 례

Method 1 -eigen-decomposition p.12

```
import numpy as np


P=np.array([[0.7, 0.3],[0.5, 0.5]])
print(P)
```

```
## [[0.7 0.3]
##  [0.5 0.5]]
```

```

egien_value, egien_vector = np.linalg.eig(P.T) ## np.linalg,eig(P.T) returns egien_value, egienvector for P^t


print("egien_value :\n",egien_value)
```

```
## egien_value :
##  [1.  0.2]
```

```
print("egien_vector :\n",egien_vector)
```

```
## egien_vector :
##  [[ 0.85749293 -0.70710678]
##  [ 0.51449576  0.70710678]]
```

```
x_1=egien_vector[:,0]

print(x_1)
```

```
## [0.85749293 0.51449576]
```

```
v=x_1/np.sum(x_1)

print(v)
```

```
## [0.625 0.375]
```

Method2- system of linear equation p.15

```
import numpy as np

P=np.array([[0.7, 0.3],[0.5, 0.5]])

n=len(P)

I=np.identity(n)

A=np.c_[P-I,np.repeat(1,n)] # np.c_ == cbind in r

b=np.append(np.repeat(0,n), np.array(1))

print(A)
```

```
## [[-0.3  0.3  1. ]
##  [ 0.5 -0.5  1. ]]
```

```
print(b)
```

```
## [0 0 1]
```

```
v=np.linalg.solve(np.dot(A,A.T),np.dot(A,b.T))
print(v)
```

```
## [0.625 0.375]
```

Limiting Probability p.17

```
from numpy.linalg import matrix_power # provides matrix pwoer

P=np.array([[0.7, 0.3],[0.5, 0.5]])
print(P)
```

```
## [[0.7 0.3]
##  [0.5 0.5]]
```

```
print(np.dot(P,P)) # matrix multiplication
```

```
## [[0.64 0.36]
##  [0.6  0.4 ]]
```

```
print(matrix_power(P,3))
```

```
## [[0.628 0.372]
##  [0.62  0.38 ]]
```

```
print(matrix_power(P,4))
```

```
## [[0.6256 0.3744]
##  [0.624  0.376 ]]
```

```
print(matrix_power(P,20))
```

```
## [[0.625 0.375]
##  [0.625 0.375]]
```

The limiting distribution may or may not exit. For example p.19

```
from numpy.linalg import matrix_power

P=np.array([[0,1],[1,0]])
print(P)
```

```
## [[0 1]
##  [1 0]]
```

```
print(matrix_power(P,2))
```

```
## [[1 0]
##  [0 1]]
```

```
print(matrix_power(P,3))
```

```
## [[0 1]
##  [1 0]]
```

```
"Done, Lecture C2. Discrete Time Markov Chain2 "
```

```
## [1] "Done, Lecture C2. Discrete Time Markov Chain2 "
```