KP_PSO

April 26, 2022

[1]:
```
import numpy as np
import pandas as pd

df = pd.read_csv('./knapsack.csv')
df.sum()
```

[1]:
```
Unnamed: 0     45
Weight         52
Profit        520
dtype: int64
```

[2]:
```
df
```

[2]:
```
   Unnamed: 0  Weight  Profit
0           0       3      10
1           1       3      90
2           2       6      30
3           3       9      90
4           4       5      10
5           5       1      40
6           6       7      80
7           7       8      60
8           8       9      40
9           9       1      70
```

[17]:
```
gen_individu = lambda n_individu,n_kota,a,b: np.random.uniform(␣
 ↪a,b,(n_individu,n_kota))

def f_constrain(X,df,lim):
    return np.sum( X* df['Weight'].values ) <= lim

def f_profit(X,df):
    return np.sum(X * df['Profit'].values)

def f_obj(X,df,lim):
    return f_profit(X,df) if f_constrain(X,df,lim) else 0
```

```python
def diskritisasi(partikels):
    return np.round( 1/ ( 1 + np.exp(-1 * partikels) ) )

def calculate_fitness(partikels,df,p):
    d_partikels = diskritisasi(partikels)
    fitness = np.array(  list(map( lambda x:f_obj(x,df,p['lim']) , d_partikels␣
 ↪)) )
    return fitness

def idx_sort_individu(fitnesses):
    return fitnesses.argsort()[::-1]

def sort_PX(P,X,fts):
    return P[fts] , X[fts]

def solusi(partikels_w_f):
    df_kota = pd.DataFrame(diskritisasi(partikels_w_f[:,:-1]))
    cols = [ 'Barang ' + str(i+1) for i in range( df_kota.shape[1]) ]
    df_kota.columns = cols
    df_kota['Profit'] =  partikels_w_f[:,-1].reshape(-1,1)
    return df_kota

def new_v( V, X , P, G ,p):
    r1 = np.random.uniform(0,1)
    r2 = np.random.uniform(0,1)
    term1 = p['W1'] * r1 * ( P-X )
    term2 = p['W2'] * r2 * ( G-X)
    return  V + term1 + term2

def check_v(v,vmax):
    return np.array( [ vel if vel<vmax else vmax for vel in v ] )

def check_v_all(V,vmax):
    return np.array( [  check_v(v,vmax) for v in V ] )

def check_x(x,a,b):
    return np.array( [ a if xel < a else b if xel> b else xel for xel in x ] )

def check_x_all(X,a,b):
    return np.array( [check_x(x,a,b) for x in X ] )

def new_v_all(V,X,P,p):
    return np.array( [ new_v(V[i],X[i],P[i],P[0],p) for i in range(V.shape[0])␣
 ↪] )

def new_x_all(X,V):
    return X + V
```

```
def new_p(P,X_new):
    return P if P[-1] > X_new[-1] else X_new

def new_p_all(P,X,fts_P,fts_X):
    return np.array( [ P[i,:] if fts_P[i] > fts_X[i] else X[i,:] for i in␣
 ↪range(P.shape[0]) ] )


def inisialisasi(params,df):
    partikels =␣
 ↪gen_individu(int(params['n_individu']),int(params['n_kota']),params['a'],params['b'])
    return partikels

def inisialisasi_v(params,X):
    return np.zeros_like(X)

def inisialisasi_p(params,X):
    return X.copy()

def PSO(params,df):

    generasi = 0

    X = inisialisasi(params,df)
    V = inisialisasi_v(params,X)
    P = inisialisasi_p(params,X)

    fts_P = calculate_fitness(P,df,params)
    idxs_1 = idx_sort_individu(fts_P)
    P,V = sort_PX(P,X,idxs_1)


    while generasi<params['max_generasi']:

        V = new_v_all(V,X,P,params)
        V = check_v_all(V,params['vmax'])
        X = new_x_all(X,V)
        X = check_x_all(X,params['a'],params['b'])

        fts_X = calculate_fitness(X,df,params)
        idxs_2 = idx_sort_individu(fts_X)
        P,X = sort_PX(P,X,idxs_2)

        P = new_p_all(P,X,fts_P[idxs_2],fts_X[idxs_2])
        fts_P = calculate_fitness(P,df,params)
        idxs_1 = idx_sort_individu(fts_P)
        P,X = sort_PX(P,X,idxs_1)

        generasi = generasi+1


    return solusi(np.concatenate((P,fts_P[idxs_1].reshape(-1,1)), axis=1))

def run_PSO(dfparams,df):
    return [ PSO( dfparams.loc[i].to_dict() ,df) for i in range( dfparams.
 ↪shape[0]) ]

def save_PSO(hasils):
    for h in enumerate(hasils):
        pd.DataFrame(h[1]).to_csv('hasil/PSO_KP_hasil_' + str(h[0]) + '.csv')
```

[20]:
```
params = {
    "n_individu":30,
    "n_kota":10,
    "a":-4,
    "b":4,
    "W1":2,
    "W2":2,
    "max_generasi":10,
    "lim":30,
    "vmax":8
}

PSO(params,df)
```

[20]:
```
    Barang 1  Barang 2  Barang 3  Barang 4  Barang 5  Barang 6  Barang 7  \
0        0.0       1.0       0.0       1.0       0.0       1.0       1.0
1        0.0       1.0       0.0       1.0       0.0       1.0       1.0
2        0.0       1.0       0.0       1.0       0.0       1.0       1.0
3        0.0       1.0       0.0       1.0       0.0       0.0       1.0
4        0.0       1.0       0.0       1.0       0.0       0.0       1.0
5        0.0       1.0       0.0       1.0       0.0       0.0       1.0
6        0.0       1.0       0.0       1.0       0.0       0.0       1.0
7        0.0       1.0       0.0       1.0       0.0       0.0       1.0
8        0.0       1.0       0.0       0.0       0.0       1.0       1.0
9        0.0       1.0       0.0       0.0       0.0       1.0       1.0
10       0.0       1.0       0.0       0.0       0.0       1.0       1.0
11       0.0       1.0       0.0       0.0       0.0       1.0       1.0
12       0.0       1.0       0.0       0.0       0.0       1.0       1.0
13       0.0       1.0       0.0       0.0       0.0       1.0       1.0
14       0.0       1.0       0.0       0.0       0.0       1.0       1.0
15       0.0       1.0       0.0       0.0       0.0       1.0       1.0
16       0.0       1.0       0.0       0.0       0.0       1.0       1.0
```

```
17        0.0        1.0        0.0        0.0        0.0        1.0        1.0
18        0.0        1.0        0.0        0.0        0.0        1.0        1.0
19        0.0        1.0        0.0        1.0        1.0        1.0        0.0
20        0.0        1.0        0.0        1.0        1.0        1.0        0.0
21        0.0        1.0        0.0        0.0        0.0        1.0        1.0
22        0.0        1.0        0.0        0.0        0.0        1.0        1.0
23        0.0        1.0        0.0        0.0        0.0        1.0        1.0
24        0.0        1.0        1.0        0.0        0.0        0.0        1.0
25        0.0        1.0        0.0        0.0        0.0        1.0        1.0
26        0.0        1.0        1.0        0.0        1.0        1.0        1.0
27        0.0        1.0        0.0        0.0        0.0        0.0        1.0
28        0.0        0.0        0.0        1.0        0.0        0.0        1.0
29        1.0        1.0        0.0        0.0        0.0        0.0        1.0

    Barang 8  Barang 9  Barang 10  Profit
0        1.0       0.0        1.0   430.0
1        1.0       0.0        1.0   430.0
2        1.0       0.0        1.0   430.0
3        1.0       0.0        1.0   390.0
4        1.0       0.0        1.0   390.0
5        1.0       0.0        1.0   390.0
6        1.0       0.0        1.0   390.0
7        1.0       0.0        1.0   390.0
8        1.0       1.0        1.0   380.0
9        1.0       1.0        1.0   380.0
10       1.0       1.0        1.0   380.0
11       1.0       1.0        1.0   380.0
12       1.0       1.0        1.0   380.0
13       1.0       1.0        1.0   380.0
14       1.0       1.0        1.0   380.0
15       1.0       1.0        1.0   380.0
16       1.0       1.0        1.0   380.0
17       1.0       1.0        1.0   380.0
18       1.0       1.0        1.0   380.0
19       1.0       0.0        1.0   360.0
20       1.0       0.0        1.0   360.0
21       1.0       0.0        1.0   340.0
22       1.0       0.0        1.0   340.0
23       1.0       0.0        1.0   340.0
24       1.0       0.0        1.0   330.0
25       0.0       1.0        1.0   320.0
26       1.0       0.0        0.0   310.0
27       1.0       0.0        1.0   300.0
28       0.0       1.0        1.0   280.0
29       1.0       1.0        0.0   280.0
```

[134]:
```
# Main Program
dfparams = pd.read_csv('./params/FA_params_KP.csv')
dfparams['n_kota'] = 10
dfparams['lim'] = 30
dfparams['a'] = -8
dfparams['b'] = 8
dfparams['alpha'] = 3
dfparams['max_generasi'] = 2
# dfparams['']
dfparams
```

[134]:
```
   n_individu  n_kota  a  b  max_generasi  alpha  beta0    gamma  lim
0         100      10 -8  8             2      3      1  0.00001   30
1          50      10 -8  8             2      3      1  0.10000   30
2          30      10 -8  8             2      3      1  0.10000   30
3          20      10 -8  8             2      3      1  0.10000   30
4          10      10 -8  8             2      3      1  0.10000   30
5          10      10 -8  8             2      3      1  0.01000   30
6          10      10 -8  8             2      3      1  0.00100   30
```

[135]:
```
hasils = run_FA(dfparams,df)
```

[6]:
```
# save_FA(hasils)
```

[136]:
```
hasils[4]
```

[136]:
```
   Barang 1  Barang 2  Barang 3  Barang 4  Barang 5  Barang 6  Barang 7  \
0       1.0       1.0       0.0       0.0       0.0       1.0       0.0
1       0.0       1.0       0.0       0.0       1.0       0.0       0.0
2       1.0       0.0       1.0       0.0       0.0       1.0       0.0
3       1.0       1.0       1.0       1.0       1.0       1.0       1.0
4       1.0       1.0       1.0       1.0       1.0       1.0       1.0
5       1.0       1.0       1.0       1.0       1.0       1.0       1.0
6       1.0       1.0       1.0       1.0       1.0       1.0       1.0
7       1.0       1.0       1.0       1.0       1.0       1.0       1.0
8       1.0       1.0       1.0       1.0       1.0       1.0       1.0
9       1.0       1.0       1.0       1.0       1.0       1.0       1.0

   Barang 8  Barang 9  Barang 10  Profit
0       1.0       1.0        0.0   240.0
1       0.0       1.0        1.0   210.0
2       0.0       0.0        1.0   150.0
3       1.0       1.0        1.0     0.0
4       1.0       1.0        1.0     0.0
5       1.0       1.0        1.0     0.0
6       1.0       1.0        1.0     0.0
7       1.0       1.0        1.0     0.0
```

```
8        1.0        1.0          1.0      0.0
9        1.0        1.0          0.0      0.0
```

[ ]:

```
```

[ ]:

```
```