

8_March_mongo_version

March 8, 2021

```
[185]: import numpy as np
import math
import random
import json
import requests
from matplotlib import pyplot as plt
from pymongo import MongoClient
import copy
```

```
[186]: # 460 queries
NUM_FEATURES=11
LB_LIMIT=-10
UB_LIMIT=10
MAX_ITR=10
MIN_COST=-999999 # ??/
POP_SIZE=20
MUT_RATE=0.4
RETENTION_RATE=0.2 # selection rate from prev generation
TODAY = "PROPER 8th March, STINT_3 CHECK AGAIN"
```

```
[187]: client = MongoClient("mongodb+srv://Raj:mongodb123@cluster0.lnsqb.mongodb.net/
→ml-proj?retryWrites=true&w=majority")
db = client['ml-proj']
coll = db['main-coll']
details = db['details-2']
```

```
[188]: surviving_members_num=math.floor(POP_SIZE*RETENTION_RATE)
if surviving_members_num%2==1:
    surviving_members_num-=1
num_cells_mutate=math.ceil((POP_SIZE-1)*NUM_FEATURES*MUT_RATE) ## ??????
num_matings_per_itr=math.ceil((POP_SIZE-surviving_members_num)/2)
print("surviving members num is ", surviving_members_num)
```

surviving members num is 4

```
[189]: #print(locals())
```

```
global_storage=[]
```

```
[190]: API_ENDPOINT = 'http://10.4.21.156'
MAX_DEG = 11
SECRET_KEY = 'BKeUYuWnLNaT7N2zzbmzI9VktYLNGrwbMX2lBfiGksBb3m6mOR'
# SECRET_KEY = "none"

def urljoin(root, path=''):
    if path:
        root = '/' .join([root.rstrip('/'), path.rstrip('/')])
    return root

def send_request(id, vector, path):
    api = urljoin(API_ENDPOINT, path)
    vector = json.dumps(vector)
    response = requests.post(api, data={'id': id, 'vector': vector}).text
    if "reported" in response:
        print(response)
        exit()

    return response

def get_errors(id, vector):
    for i in vector:
        assert 0 <= abs(i) <= 10
    assert len(vector) == MAX_DEG

    return json.loads(send_request(id, vector, 'geterrors'))
```

```
[191]: anmol_arr=[]
```

```
[192]: def get_fitness_value(coeff_arr, curr_gen_num):
    #coeff_arr=coeff_arr.tolist()

    #return [1,2]

    #return random.random()

    assert(len(coeff_arr)==NUM_FEATURES)
    for i in range(0,NUM_FEATURES):
        if coeff_arr[i]>=10:
            coeff_arr[i] = 10
        elif i<=-10:
            coeff_arr[i] = -10
```

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    val = get_errors(SECRET_KEY, coeff_arr)
    #print(f"coeff arr is {coeff_arr}")
    #print("val is ", val)
    annol_arr.append({"array_stuff":coeff_arr, "errors_returned":val, "gen":
↪curr_gen_num})

    ↵
↪#print("-----")

    return val

```

```

[193]: def get_fitness_value_alt(coeff_arr, curr_gen_num):
    assert(len(coeff_arr)==NUM_FEATURES)
    x=coeff_arr[0]
    y=coeff_arr[1]
    '''x_add=x*math.sin(4*x)
    y_add= 1.1 * y * math.sin(2*y)'''

    '''
    x_add=x*math.sin(4*x)
    y_add= 1.1 * y * math.sin(2*y)
    '''

    # x_add=x
    # y_add=y
    # print(f"x and x_add is {x} : {x_add}")
    # print(f"y and y_add is {y} : {y_add}")
    assert(x>=LB_LIMIT and x<=UB_LIMIT)
    assert(y>=LB_LIMIT and y<=UB_LIMIT)
    # val=x_add+y_add

    # val=0.01*( x*x*(y-2)*(y-3) - (x+y)**3 + y*y*y*(y-2*x))
    val_arr=[x+y]*2
    #print(val)
    #coeff_arr=coeff_arr.tolist()
    annol_arr.append({"array_stuff":coeff_arr, "errors_returned":val_arr, "gen":
↪curr_gen_num})
    #res_ret=[val,val]
    #print("val returned is ", res_ret)
    return val_arr

```

```

[194]: def create_starting_population(num_members, num_features, lb, ub):
    # Adam and Eve
    sample_pop = np.random.uniform(low=lb, high=ub,↵
↪size=(num_members,num_features))
    return sample_pop

```

```
[195]: def insert_single_member_into_db(gen_id, features, errors):
        coll.insert_one({
            'generation': gen_id,
            'try_vector': features,
            'errors': errors,
            'desc' : TODAY
        })
        details.update_one({"try_vector": features},
                           {"$set": {"errors": errors}})
```

```
[196]: global_json=[]
```

```
[197]: print(global_json)
```

```
[]
```

```
[198]: def calculate_fitness_for_curr_pop(members_list, curr_gen_num):
        '''receives a 2D array'''

        tot_len=len(members_list)
        fitness_arr=[]

        errors_traced=[]

        for i in range(0,tot_len):
            its_fitness_val = [0, 0]
            exist_vec = coll.find({'try_vector': members_list[i]}).count()

            print('exist? ', exist_vec)
            if exist_vec > 0:
                doc_found = coll.find_one({'try_vector': members_list[i]})
                its_fitness_val = doc_found['errors']
                details.update_one({"try_vector": members_list[i]},
                                   {"$set": {"errors": doc_found['errors']}})
                #print('DOC', doc_found)
                #print('VAL', its_fitness_val)
            else:
                its_fitness_val = get_fitness_value(members_list[i], curr_gen_num)
                insert_single_member_into_db(curr_gen_num,
                ↪members_list[i],its_fitness_val)

                ↪
                ↪#####

            fitness_val=0
            t=its_fitness_val[0]/(1e10)
            v=its_fitness_val[1]/(1e10)
```

```

    punish = 0

    punish += 100 if t < 22 else 0

    punish += 100 if v > 17 else 0

    fitness_val = t + v + punish

    #####3

    fitness_arr.append(fitness_val)

    if type(its_fitness_val)!=list:
        raise TypeError("WEIRD TYPE GOLIATH ERROR")
    errors_traced.append(its_fitness_val)
    #print("fitness arr being sent is ")
    #print(*fitness_arr, sep="\t")
    return fitness_arr,errors_traced

```

```

[199]: def sort_generation_members(members_list, curr_gen_num):
#     print(f"type is {type(members_list)} and arg is ")
#     print(*members_list, sep='\n')
    tot_len=len(members_list)
    cost_arr , unsorted_errors_traced_here = np.
    ↪array(calculate_fitness_for_curr_pop(members_list, curr_gen_num))

    sort_indices = np.argsort(cost_arr)

    # Descending
    #sort_indices=sort_indices[::-1]

    if type(members_list[0])!=list:
        raise TypeError("Friday error")

    sorted_members_list=[]
    sorted_costs=[]
    # print("member is ", members_list)
    for num in range(0,tot_len):
        i=sort_indices[num]
        #print(f"here member for {i} is ", members_list[i])

        sorted_members_list.append(members_list[i])
        sorted_costs.append(cost_arr[i])

```



```

for i in range(num_genes):
    max_val=max(parent1[i], parent2[i])
    min_val=min(parent1[i], parent2[i])

    lb=min_val-alpha*(max_val-min_val)
    ub=max_val+alpha*(max_val-min_val)

    set_val_1=random.uniform(lb, ub)
    child1[i]=set_val_1

    set_val_2=random.uniform(lb, ub)
    child2[i]=set_val_2

for i in range(len(child1)):
    child1[i]=max(child1[i],LB_LIMIT)
    child1[i]=min(child1[i],UB_LIMIT)

for i in range(len(child2)):
    child2[i]=max(child2[i],LB_LIMIT)
    child2[i]=min(child2[i],UB_LIMIT)

#print(f"CHILD 1 is {child1}")
#print(f"CHILD 2 is {child2}")

print("#-----")

return child1.tolist(), child2.tolist()

```

```

[202]: def crossover(parent1, parent2):

    '''
    Deb and Agrawal [196] developed the simulated binary crossover (SBX) to
    ↪simulate the
    behavior of the one-point crossover operator for binary representations.
    '''
    child1 = np.empty(NUM_FEATURES)
    child2 = np.empty(NUM_FEATURES)
    print(f"parent 1 is {parent1}")
    print(f"parent 2 is {parent2}")

    u = random.random()
    n_c = 1
    '''where  $r_j \sim U(0, 1)$ , and  $\eta > 0$  is the distribution index. Deb and Agrawal
    ↪suggested

```

```

    that = 1.

    '''The SBX operator generates offspring symmetrically about the parents,
    ↪which prevents
    bias towards any of the parents. For large values of  there is a higher
    ↪probability that
    offspring will be created near the parents. For small  values, offspring
    ↪will be more
    distant from the parents.'''

    if (u < 0.5):
        beta = (2 * u)**((n_c + 1)**-1)
    else:
        beta = ((2*(1-u))**(-1))**((n_c + 1)**-1)

    parent1 = np.array(parent1)
    parent2 = np.array(parent2)
    child1 = 0.5*((1 + beta) * parent1 + (1 - beta) * parent2)
    child2 = 0.5*((1 - beta) * parent1 + (1 + beta) * parent2)

    for i in range(len(child1)):
        child1[i]=max(child1[i],LB_LIMIT)
        child1[i]=min(child1[i],UB_LIMIT)

    for i in range(len(child2)):
        child2[i]=max(child2[i],LB_LIMIT)
        child2[i]=min(child2[i],UB_LIMIT)

    #child1=(parent1+parent2)/2
    #child2=(parent1-parent2)/2

    print(f"CHILD 1 is {child1}")
    print(f"CHILD 2 is {child2}")

    print("#-----")

    return child1.tolist(), child2.tolist()

```

```

[203]: def get_mutated_version(arr, really=False):
    mut_prob_now=0.7
    arr=arr.tolist().copy()
    if really:
        #arr=arr.tolist()
        #print(arr)
        len_arr=len(arr)
        for i in range(0,len_arr):

```



```

        probb=random.uniform(0, 1)
        if probb<=mut_prob_now:
            curr_val=arr[i]
            if curr_val==0:
                curr_val=1
            d_val=random.uniform(-abs(0.5*curr_val), abs(0.5*curr_val))
            arr[i]+=d_val
            arr[i]=min(arr[i],UB_LIMIT)
            arr[i]=max(arr[i],LB_LIMIT)
            #print(f"{i} mutated {curr_val}->{arr[i]}")
    return arr
else:
    return arr

```

```

[204]: # Iterations
#parents_now=sorted_initial_pop.copy()

CURR_GEN_NUM=1
init_arr=np.array(
[
    [-0.1427695714633879, -1.4351758102671513e-12, -8.23952024928039e-14, 3.
    ↪9792353931611e-11, -2.2891737891652097e-10, -1.2741372955243258e-15, 8.
    ↪498419408139292e-16, 2.2978273844682766e-05, -1.8661056044695021e-06, -9.
    ↪19468573928787e-09, 7.519936353791697e-10],
    [0.07144470438737868, -1.024341258927964e-12, -2.234254875776415e-14, 7.
    ↪518054647321033e-11, -1.801621324121818e-10, -1.3903926150219416e-15, 1.
    ↪0363630046234666e-15, 1.972934634335282e-05, -1.8376799350638052e-06, -7.
    ↪682037245173995e-09, 7.433548643729261e-10],
    [-0.12826988257084007, -1.3783500660791644e-12, -6.618301505877671e-14, 4.
    ↪627780406755569e-11, -1.7964979058119056e-10, -1.3330380203323678e-15, 7.
    ↪763006729384186e-16, 2.2757658578306265e-05, -1.9193275505106666e-06, -8.
    ↪894106807593951e-09, 7.758133607867065e-10],
    [0.0, -9.875299804205226e-13, -5.3944821589819837e-14, 7.
    ↪930563099592005e-11, -2.0984549655895666e-10, -1.4378337510064146e-15, 8.
    ↪060220128248057e-16, 2.2757658578306265e-05, -1.989031728863744e-06, -8.
    ↪908335865469784e-09, 8.161584966021705e-10]
]

)
#init_arr = np.array([5,5])

print(init_arr.shape)

#init_arr=np.array([LB_LIMIT+0.1,UB_LIMIT-0.1])

```

```

# # Create the initial population
starting_population_mat=create_starting_population(POP_SIZE, NUM_FEATURES,
↳LB_LIMIT, UB_LIMIT)

for i in range(0,POP_SIZE):
    if i<4:
        starting_population_mat[i]=get_mutated_version(np.array(init_arr[i%4]),
↳False)
    else:
        starting_population_mat[i]=get_mutated_version(np.
↳array(init_arr[i%4]),True)

'''starting_population_mat = np.array([
])
'''

starting_population_mat=starting_population_mat
print("\nStarting pop is \n")
print(*starting_population_mat, sep="\n\n")

generation_info=[]
generation_info.append({"members":starting_population_mat.tolist(),
↳"avg_fitness":0, "min_fitness":0})
#print(generation_info)

```

(4, 11)

Starting pop is

```

[-1.42769571e-01 -1.43517581e-12 -8.23952025e-14  3.97923539e-11
 -2.28917379e-10 -1.27413730e-15  8.49841941e-16  2.29782738e-05
 -1.86610560e-06 -9.19468574e-09  7.51993635e-10]

[ 7.14447044e-02 -1.02434126e-12 -2.23425488e-14  7.51805465e-11
 -1.80162132e-10 -1.39039262e-15  1.03636300e-15  1.97293463e-05
 -1.83767994e-06 -7.68203725e-09  7.43354864e-10]

[-1.28269883e-01 -1.37835007e-12 -6.61830151e-14  4.62778041e-11
 -1.79649791e-10 -1.33303802e-15  7.76300673e-16  2.27576586e-05
 -1.91932755e-06 -8.89410681e-09  7.75813361e-10]

[ 0.00000000e+00 -9.87529980e-13 -5.39448216e-14  7.93056310e-11
 -2.09845497e-10 -1.43783375e-15  8.06022013e-16  2.27576586e-05
 -1.98903173e-06 -8.90833587e-09  8.16158497e-10]

[-1.42769571e-01 -2.09724124e-12 -8.23952025e-14  3.97923539e-11
 -1.99555899e-10 -1.00327581e-15  8.49841941e-16  1.76986749e-05

```

-1.86610560e-06 -9.19468574e-09 7.51993635e-10]

[9.85642891e-02 -9.19144400e-13 -3.01298616e-14 4.65268396e-11
-1.80162132e-10 -1.39039262e-15 1.39779499e-15 1.86220772e-05
-2.52158968e-06 -7.68203725e-09 8.96927698e-10]

[-1.66610364e-01 -1.37835007e-12 -4.91291346e-14 5.64448826e-11
-1.18213591e-10 -1.45070503e-15 7.37320624e-16 1.76984414e-05
-2.78448375e-06 -8.16462715e-09 7.75813361e-10]

[-1.76360320e-01 -5.20059191e-13 -6.90426108e-14 1.16791156e-10
-2.63685337e-10 -1.55846676e-15 8.06022013e-16 3.06685918e-05
-1.22275887e-06 -4.81697921e-09 1.04431576e-09]

[-1.40851836e-01 -1.09028288e-12 -8.23952025e-14 3.97923539e-11
-2.86612690e-10 -1.41919041e-15 7.08369825e-16 3.42427786e-05
-2.47506133e-06 -6.40788647e-09 9.11263673e-10]

[7.18322782e-02 -1.02434126e-12 -2.23425488e-14 8.00136617e-11
-2.63499154e-10 -1.39039262e-15 1.03636300e-15 1.71209204e-05
-1.78195869e-06 -7.54230139e-09 5.59870219e-10]

[-1.03627876e-01 -1.21073592e-12 -6.61830151e-14 6.44686218e-11
-2.28013191e-10 -1.97755641e-15 7.76300673e-16 1.85866024e-05
-2.24871035e-06 -9.23633593e-09 5.63751716e-10]

[3.04774248e-02 -1.42088066e-12 -7.16255380e-14 4.78132107e-11
-2.09845497e-10 -1.02636637e-15 5.23940674e-16 1.18781177e-05
-2.33265716e-06 -6.90399882e-09 8.16158497e-10]

[-1.03765114e-01 -1.55907776e-12 -8.23952025e-14 2.96588665e-11
-2.28917379e-10 -8.14744389e-16 9.37028340e-16 1.35606268e-05
-9.56611392e-07 -9.19468574e-09 6.89980228e-10]

[8.99977156e-02 -1.02434126e-12 -2.23425488e-14 7.51805465e-11
-2.36721757e-10 -1.85992345e-15 1.03636300e-15 1.12321032e-05
-1.83767994e-06 -7.68203725e-09 1.10888106e-09]

[-1.28269883e-01 -1.28120787e-12 -8.55099767e-14 6.27297240e-11
-2.21337427e-10 -1.54570492e-15 9.99225161e-16 2.27576586e-05
-2.57919722e-06 -5.75145119e-09 7.75813361e-10]

[-4.01956103e-01 -9.56932381e-13 -4.76887464e-14 7.93056310e-11
-2.08079856e-10 -1.72227916e-15 8.06022013e-16 1.47250540e-05
-2.23905305e-06 -6.42321495e-09 8.16158497e-10]

[-1.32823185e-01 -1.43517581e-12 -8.23952025e-14 5.13974381e-11
-1.24052907e-10 -1.27413730e-15 9.26921288e-16 2.29782738e-05

```
-2.46035887e-06 -1.17474229e-08 5.70491240e-10]
```

```
[ 4.32479714e-02 -1.37886592e-12 -1.44401661e-14 4.84726954e-11  
-1.63918736e-10 -1.39039262e-15 1.36937216e-15 1.53740003e-05  
-1.51328524e-06 -6.54888006e-09 7.45825954e-10]
```

```
[-1.46862854e-01 -1.74157588e-12 -4.97004664e-14 4.62778041e-11  
-1.79649791e-10 -1.33303802e-15 7.76300673e-16 2.72071539e-05  
-1.05726058e-06 -8.89410681e-09 8.23609047e-10]
```

```
[ 6.91004338e-02 -9.87529980e-13 -7.39050660e-14 7.93056310e-11  
-2.14879561e-10 -1.61858739e-15 8.06022013e-16 2.87887940e-05  
-2.21548722e-06 -1.18699565e-08 5.10349105e-10]
```

```
[205]: for member in starting_population_mat:  
        member=member.tolist()  
        details.insert_one({  
            'generation': CURR_GEN_NUM,  
            'try_vector': member, #after mutation  
            'errors': [-1,-1],  
            'mother_vec': member,  
            'father_vec': member,  
            'before_mutation': member,  
            'beta': -1,  
            'cross_over_point': -1,  
            'desc' : TODAY  
        })
```

```
[206]: trace_arr=[]  
        trace_now=[]  
  
        for i in range(0,POP_SIZE):  
            vec=copy.deepcopy(starting_population_mat[i])  
            vec=vec.tolist()  
            obj_to_store={  
                'generation': CURR_GEN_NUM,  
                'try_vector': vec, #after mutation  
                'errors': [-1,-1],  
                'mother_vec':vec,  
                'father_vec': vec,  
                'before_mutation':vec,  
                'beta': -1,  
                'cross_over_point': -1,  
                'desc' : TODAY,  
                'survived':False  
            }  
            trace_now.append(obj_to_store)
```

```
print(*trace_now, sep='\n\n')
```

```
{'generation': 1, 'try_vector': [-0.1427695714633879, -1.4351758102671513e-12,
-8.23952024928039e-14, 3.9792353931611e-11, -2.2891737891652097e-10,
-1.2741372955243258e-15, 8.498419408139292e-16, 2.2978273844682766e-05,
-1.8661056044695021e-06, -9.19468573928787e-09, 7.519936353791697e-10],
'errors': [-1, -1], 'mother_vec': [-0.1427695714633879, -1.4351758102671513e-12,
-8.23952024928039e-14, 3.9792353931611e-11, -2.2891737891652097e-10,
-1.2741372955243258e-15, 8.498419408139292e-16, 2.2978273844682766e-05,
-1.8661056044695021e-06, -9.19468573928787e-09, 7.519936353791697e-10],
'father_vec': [-0.1427695714633879, -1.4351758102671513e-12,
-8.23952024928039e-14, 3.9792353931611e-11, -2.2891737891652097e-10,
-1.2741372955243258e-15, 8.498419408139292e-16, 2.2978273844682766e-05,
-1.8661056044695021e-06, -9.19468573928787e-09, 7.519936353791697e-10],
'before_mutation': [-0.1427695714633879, -1.4351758102671513e-12,
-8.23952024928039e-14, 3.9792353931611e-11, -2.2891737891652097e-10,
-1.2741372955243258e-15, 8.498419408139292e-16, 2.2978273844682766e-05,
-1.8661056044695021e-06, -9.19468573928787e-09, 7.519936353791697e-10], 'beta':
-1, 'cross_over_point': -1, 'desc': 'PROPER 8th March, STINT_3 CHECK AGAIN',
'survived': False}
```

```
{'generation': 1, 'try_vector': [0.07144470438737868, -1.024341258927964e-12,
-2.234254875776415e-14, 7.518054647321033e-11, -1.801621324121818e-10,
-1.3903926150219416e-15, 1.0363630046234666e-15, 1.972934634335282e-05,
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'survived': False}
```

```
{'generation': 1, 'try_vector': [0.08999771558221258, -1.024341258927964e-12,
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-1.8599234475177e-15, 1.0363630046234666e-15, 1.1232103244541594e-05,
-1.8376799350638052e-06, -7.682037245173995e-09, 1.1088810605724232e-09],
'errors': [-1, -1], 'mother_vec': [0.08999771558221258, -1.024341258927964e-12,
-2.234254875776415e-14, 7.518054647321033e-11, -2.3672175704581953e-10,
-1.8599234475177e-15, 1.0363630046234666e-15, 1.1232103244541594e-05,
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-1.8599234475177e-15, 1.0363630046234666e-15, 1.1232103244541594e-05,
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-1.8599234475177e-15, 1.0363630046234666e-15, 1.1232103244541594e-05,
-1.8376799350638052e-06, -7.682037245173995e-09, 1.1088810605724232e-09],
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AGAIN', 'survived': False}
```

```
{'generation': 1, 'try_vector': [-0.12826988257084007, -1.2812078658695894e-12,
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-1.545704916794896e-15, 9.992251612165978e-16, 2.2757658578306265e-05,
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-1.2812078658695894e-12, -8.550997667806026e-14, 6.272972401597342e-11,
-2.2133742705225538e-10, -1.545704916794896e-15, 9.992251612165978e-16,
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-2.2133742705225538e-10, -1.545704916794896e-15, 9.992251612165978e-16,
2.2757658578306265e-05, -2.579197215904331e-06, -5.751451193541108e-09,
7.758133607867065e-10], 'before_mutation': [-0.12826988257084007,
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-2.2133742705225538e-10, -1.545704916794896e-15, 9.992251612165978e-16,
2.2757658578306265e-05, -2.579197215904331e-06, -5.751451193541108e-09,
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March, STINT_3 CHECK AGAIN', 'survived': False}
```

```
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-1.722279161703472e-15, 8.060220128248057e-16, 1.472505396479716e-05,
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-1.722279161703472e-15, 8.060220128248057e-16, 1.472505396479716e-05,
-2.23905304865633e-06, -6.423214946412731e-09, 8.161584966021705e-10],
'father_vec': [-0.4019561030793246, -9.569323810936197e-13,
-4.7688746427430405e-14, 7.930563099592005e-11, -2.0807985570210612e-10,
-1.722279161703472e-15, 8.060220128248057e-16, 1.472505396479716e-05,
-2.23905304865633e-06, -6.423214946412731e-09, 8.161584966021705e-10],
'before_mutation': [-0.4019561030793246, -9.569323810936197e-13,
-4.7688746427430405e-14, 7.930563099592005e-11, -2.0807985570210612e-10,
-1.722279161703472e-15, 8.060220128248057e-16, 1.472505396479716e-05,
-2.23905304865633e-06, -6.423214946412731e-09, 8.161584966021705e-10], 'beta':
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'survived': False}
```

```
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-1.2741372955243258e-15, 9.269212880455236e-16, 2.2978273844682766e-05,
-2.460358867094673e-06, -1.1747422934241095e-08, 5.704912401567465e-10],
'father_vec': [-0.1328231850865304, -1.4351758102671513e-12,
-8.23952024928039e-14, 5.1397438069324436e-11, -1.2405290723382605e-10,
-1.2741372955243258e-15, 9.269212880455236e-16, 2.2978273844682766e-05,
-2.460358867094673e-06, -1.1747422934241095e-08, 5.704912401567465e-10],
'before_mutation': [-0.1328231850865304, -1.4351758102671513e-12,
-8.23952024928039e-14, 5.1397438069324436e-11, -1.2405290723382605e-10,
-1.2741372955243258e-15, 9.269212880455236e-16, 2.2978273844682766e-05,
-2.460358867094673e-06, -1.1747422934241095e-08, 5.704912401567465e-10], 'beta':
-1, 'cross_over_point': -1, 'desc': 'PROPER 8th March, STINT_3 CHECK AGAIN',
'survived': False}
```

```
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-1.3903926150219416e-15, 1.3693721622665721e-15, 1.537400032261329e-05,
-1.5132852430960787e-06, -6.548880064831065e-09, 7.458259543197523e-10],
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-1.3903926150219416e-15, 1.3693721622665721e-15, 1.537400032261329e-05,
-1.5132852430960787e-06, -6.548880064831065e-09, 7.458259543197523e-10],
'father_vec': [0.04324797144501835, -1.3788659229934556e-12,
-1.4440166090034318e-14, 4.847269537152919e-11, -1.6391873615056195e-10,
```

```
-1.3903926150219416e-15, 1.3693721622665721e-15, 1.537400032261329e-05,
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'before_mutation': [0.04324797144501835, -1.3788659229934556e-12,
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-1.3903926150219416e-15, 1.3693721622665721e-15, 1.537400032261329e-05,
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'survived': False}
```

```
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-1.3330380203323678e-15, 7.763006729384186e-16, 2.7207153857657435e-05,
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-1.3330380203323678e-15, 7.763006729384186e-16, 2.7207153857657435e-05,
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-1.3330380203323678e-15, 7.763006729384186e-16, 2.7207153857657435e-05,
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-1, 'cross_over_point': -1, 'desc': 'PROPER 8th March, STINT_3 CHECK AGAIN',
'survived': False}
```

```
{'generation': 1, 'try_vector': [0.06910043382479847, -9.875299804205226e-13,
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-1.6185873867900723e-15, 8.060220128248057e-16, 2.8788793990883372e-05,
-2.215487223562236e-06, -1.1869956459890228e-08, 5.103491053709837e-10],
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-1.6185873867900723e-15, 8.060220128248057e-16, 2.8788793990883372e-05,
-2.215487223562236e-06, -1.1869956459890228e-08, 5.103491053709837e-10],
'before_mutation': [0.06910043382479847, -9.875299804205226e-13,
-7.390506601977957e-14, 7.930563099592005e-11, -2.1487956139596147e-10,
-1.6185873867900723e-15, 8.060220128248057e-16, 2.8788793990883372e-05,
-2.215487223562236e-06, -1.1869956459890228e-08, 5.103491053709837e-10], 'beta':
-1, 'cross_over_point': -1, 'desc': 'PROPER 8th March, STINT_3 CHECK AGAIN',
'survived': False}
```

```
[207]: verified=input("Have you taken care of get_fitness_vals, \nexist_vec!=0 ,\n
        ↳\ncollection name,\ndetails name ?\n\
        Have you switched on VPN ?\n JSON file name\n\n\
        HAVE YOU CHANGED METRIC IN FITNESS VALUE APPEND FUNCTION ?\
        ")
        if verified!='y':
            raise TypeError
```

Have you taken care of get_fitness_vals,
 exist_vec!=0 ,
 collection name,
 details name ?
 Have you switched on VPN ?
 JSON file name

HAVE YOU CHANGED METRIC IN FITNESS VALUE APPEND FUNCTION ?y

```
[128]: MUT_RATE
```

```
[128]: 0.4
```

```
[208]: mut_magnitude=0.05
        tot_crosses=0
        same_crosses=0

        if type(starting_population_mat)!=np.ndarray:
            raise TypeError("Mismatch of starting pop mat")

        for itr_num in range(0, MAX_ITR+1):
            #print("args being sent are \n")
            #print(*generation_info[-1]["members"],sep='\n')
            parents_now, sorted_fitness_vals, unsorted_errors_main, sorted_indices =\
            ↳sort_generation_members(generation_info[-1]["members"], CURR_GEN_NUM)

            for i in range(POP_SIZE):
                trace_now[i]["errors"]=unsorted_errors_main[i]

                '''if unsorted_errors_main[i]!=list:
                    raise TypeError("Pitts ERROR")'''

            trace_tmp=copy.deepcopy(trace_now)

            for i in range(0,POP_SIZE):
```

```

        trace_now[i]=copy.deepcopy(trace_tmp[sorted_indices[i]])

    trace_arr.append(copy.deepcopy(trace_now))

    #[{obj}] -> obj -> errors -> fitness value

    generation_info[-1]["avg_fitness"]=np.average(sorted_fitness_vals)
    generation_info[-1]["min_fitness"]=np.min(sorted_fitness_vals)
    generation_info[-1]["gen_number"]=CURR_GEN_NUM
    generation_info[-1]["fitness_vals_stored"]=sorted_fitness_vals
    print(f'Avg fitness is {generation_info[-1]["avg_fitness"]}' )
    print(f'MIN fitness is {generation_info[-1]["min_fitness"]}' )
    print(f"fitness vals are: -> \n")
    print(*sorted_fitness_vals, sep='\n')

    stop_or_not = input("Enter y to continue.")
    #stop_or_not = 'y'
    if stop_or_not!='y' or itr_num==MAX_ITR:
        break

    □
    ↪ #####

    CURR_GEN_NUM+=1
    # https://stackoverflow.com/a/7851237/6427607
    matings_pending=num_matings_per_itr
    probs=get_probabilities(POP_SIZE)
    cum_probs=np.cumsum(probs)
    # https://numpy.org/doc/stable/reference/generated/numpy.hstack.html
    cum_probs=np.hstack(([0],cum_probs))
    #print(f"Probs are {probs}\nCumProbs are {cum_probs}")

    '''Selection
    '''
    pick_1=np.random.uniform(low=0, high=1, size=(matings_pending))
    pick_2=np.random.uniform(low=0, high=1, size=(matings_pending))

    #print(f"PICK_1 is {pick_1} \n AND \nPICK_2 is {pick_2} ")
    mother_idx=[]

```

```

father_idx=[]

for ic in range(0,matings_pending):
    tot_crosses+=1
    for idx in range(1,POP_SIZE+1):

        if pick_1[ic]<=cum_probs[idx] and pick_1[ic]>cum_probs[idx-1]:
            mother_idx.append(idx-1)
        if pick_2[ic]<=cum_probs[idx] and pick_2[ic]>cum_probs[idx-1]:
            father_idx.append(idx-1)
    if mother_idx[-1]==father_idx[-1]:
        father_idx[-1]=(mother_idx[-1])+1)%POP_SIZE

new_parents=parents_now.copy()
for i in range(0, surviving_members_num):
    details.insert_one({
        'generation': CURR_GEN_NUM,
        'try_vector': new_parents[i], #after mutation
        'errors': [-1,-1],
        'mother_vec': new_parents[i],
        'father_vec': new_parents[i],
        'before_mutation': new_parents[i],
        #'beta': -1,
        #'cross_over_point': -1,
        'desc' : TODAY
    })
#trace_now=copy.deepcopy(trace_prev)

for mating_num in range(0, matings_pending):
    par_one_idx=mother_idx[mating_num]
    par_two_idx=father_idx[mating_num]

    child_one=parents_now[par_one_idx].copy()
    child_two=parents_now[par_two_idx].copy()

    child_one, child_two=crossover(child_one, child_two)

    '''CrossOver
    '''
    '''special_cell_idx=random.randint(0,NUM_FEATURES-1)

    beta=random.random()

    xy=parents_now[par_one_idx][special_cell_idx]-\
    parents_now[par_two_idx][special_cell_idx]

```

```

        child_one[special_cell_idx]=parents_now[par_one_idx][special_cell_idx]
↪ - beta*xy
        child_two[special_cell_idx]=parents_now[par_two_idx][special_cell_idx]
↪ + beta*xy

```

```

if special_cell_idx!=NUM_FEATURES-1:
    #print("CHILD ONE IS ", child_one)
    #print("CHILD TWO IS ", child_two)
    child_one[:] = np.hstack((child_one[:special_cell_idx] \
                               ,   child_two[special_cell_idx:]   ))

    child_two[:] = np.hstack((child_two[:special_cell_idx] \
                               ,   child_one[special_cell_idx:]   ))    '''

```

```

new_parents[surviving_members_num + 2* mating_num] = child_one
new_parents[surviving_members_num + 2* mating_num + 1] = child_two

```

```

if type(child_one)!=list:
    raise TypeError("NOT A LIST")

```

```

if type(parents_now[par_one_idx])!=list:
    raise TypeError("IT ALSO NOT A LIST")

```

```

obj_one={
'generation': CURR_GEN_NUM,
'try_vector': child_one, #after mutation
'errors': [-1,-1],
'mother_vec':parents_now[par_one_idx],
'father_vec': parents_now[par_two_idx],
'before_mutation': child_one,
#'beta': beta,
#'cross_over_point': special_cell_idx,
'desc' : TODAY,
'survived':False,
"mut_rate":MUT_RATE
}

```

```

obj_two={
'generation': CURR_GEN_NUM,
'try_vector': child_two, #after mutation
'errors': [-1,-1],
'mother_vec':parents_now[par_one_idx],
'father_vec': parents_now[par_two_idx],
'before_mutation': child_two,

```



```

        #'beta': beta,
        # 'cross_over_point': special_cell_idx,
        'desc' : TODAY,
        'survived':False,
        "mut_rate":MUT_RATE

    }

    trace_now[surviving_members_num + 2* mating_num]=obj_one
    trace_now[surviving_members_num + 2* mating_num + 1] =obj_two
    details.insert_one(copy.deepcopy(obj_one))
    details.insert_one(copy.deepcopy(obj_two))


    #print("OLD Parents are \n")
    #print(*parents_now, sep='\n')
    #print("NEW Parents are \n")
    #print(*new_parents, sep='\n')

    '''
    %-----
    % Mutate the population
    '''

    #mut_rows=np.random.uniform(low=0, high=1, size=(num_cells_mutate))
    #mut_rows*=(POP_SIZE-1)
    # https://numpy.org/doc/stable/reference/random/generated/numpy.random.
    ↪randint.html
    mut_rows=np.random.randint(POP_SIZE, size=num_cells_mutate)
    for i in range(0,len(mut_rows)):
        # mut_rows[i]=int(math.round(mut_rows[i]))
        assert(mut_rows[i]<POP_SIZE)
    mut_rows.sort()

    # mut_cols=np.random.uniform(low=0, high=1, size=(num_cells_mutate))
    # mut_cols*=(NUM_FEATURES-1)

    mut_cols=np.random.randint(NUM_FEATURES, size=num_cells_mutate)

    for i in range(0,len(mut_cols)):
        #mut_cols[i]=int(math.round(mut_cols[i]))
        assert(mut_cols[i]<NUM_FEATURES)

    for i in range(0,num_cells_mutate):
        row_c=int(mut_rows[i])
        col_c=int(mut_cols[i])
        #print(f"Contenders are {row_c}:{col_c}")

```

```

    #new_parents[row_c][col_c]=random.random()*(UB_LIMIT-LB_LIMIT)+LB_LIMIT
    CHNG = mut_magnitude * (new_parents[row_c][col_c])
    add=random.uniform(-CHNG,CHNG)
    #print(f"mut mag is {mut_magnitude}\tChange is {CHNG} and \tadd is_
→{add}")

    upd_val = new_parents[row_c][col_c] + add
    upd_val = max(LB_LIMIT, upd_val)
    upd_val = min(UB_LIMIT, upd_val)

    old_vec= copy.deepcopy(new_parents[row_c])
    new_parents[row_c][col_c] = upd_val
    details.update_one({"before_mutation": old_vec},
                      {"$set": {"try_vector": new_parents[row_c]}})

    ##////////////////////////////////////
→////////

    for i in range(POP_SIZE):
        if type(new_parents[i])!=list:
            raise TypeError("Pegasus type error")
        #trace_now[i]["try_vector"]=new_parents[i]
        trace_now[i]["try_vector"]=copy.deepcopy(new_parents[i])
        if i< surviving_members_num:
            trace_now[i]["survived"]=True
        ##////////////////////////////////////
→////////

    print("Generation info is ", generation_info)

    □
→#####3
    x_c=[]
    y_min=[]
    y_avg=[]
    #print(len(generation_info))
    for j in range(0,len(generation_info)):
        x_c.append(j)

```

```

        y_min.append(generation_info[j]["min_fitness"])
        y_avg.append(generation_info[j]["avg_fitness"])

plt.figure(figsize=(8,8))
plt.plot(x_c, y_min, label="min")
plt.show()
plt.figure(figsize=(8,8))
plt.plot(x_c, y_avg, label="avg")
#print('Min: ',y_min[-1])
#print('Avg: ',y_avg[-1])
#print('Vector: ',generation_info[-1]["members"])
#print(*y_min,sep='\n')
plt.legend()
plt.show()
#####
print("-----")

# random_rows=

'''
%-----
% The new offspring and mutated chromosomes are
% evaluated
'''
#print(type(new_parents))

parents_now=new_parents
generation_info.append({"members":new_parents, "mut_magnitude":
↪mut_magnitude})

mut_magnitude=float(input("Enter mutation magnitude:"))
MUT_RATE=float(input("Enter fraction of cells you want to mutate:"))
num_cells_mutate=math.ceil((POP_SIZE-1)*NUM_FEATURES*MUT_RATE) ## ??????

```

/home/anmolagarwal/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:11: DeprecationWarning: count is deprecated. Use Collection.count_documents instead.

This is added back by InteractiveShellApp.init_path()

```

exist? 1
exist? 1
exist? 1
exist? 1
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0

```

```

exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
Avg fitness is 11870.205215352235
MIN fitness is 37.66959541129176
fitness vals are: ->

```

```

37.66959541129176
45.5110447324014
45.929105439799876
152.43199131703398
429.6464499161035
629.0690990311971
2101.2441833187613
2330.6460863453644
3315.6499083756325
4540.203128920208
4885.900864298375
6993.060766700109
8183.670481702824
10202.798635706535
21968.644147989235
22220.704510507236
22653.01422342624
27197.371245034483
32497.40263823141
66973.53620064049

```

Enter y to continue.y

```

parent 1 is [0.07144470438737868, -1.024341258927964e-12,
-2.234254875776415e-14, 7.518054647321033e-11, -1.801621324121818e-10,
-1.3903926150219416e-15, 1.0363630046234666e-15, 1.972934634335282e-05,
-1.8376799350638052e-06, -7.682037245173995e-09, 7.433548643729261e-10]
parent 2 is [-0.12826988257084007, -1.3783500660791644e-12,
-6.618301505877671e-14, 4.627780406755569e-11, -1.7964979058119056e-10,
-1.3330380203323678e-15, 7.763006729384186e-16, 2.2757658578306265e-05,
-1.9193275505106666e-06, -8.894106807593951e-09, 7.758133607867065e-10]
CHILD 1 is [ 5.05855715e-02 -1.06131561e-12 -2.69214537e-14 7.21618078e-11
-1.80108621e-10 -1.38440223e-15 1.00920087e-15 2.00456375e-05
-1.84620760e-06 -7.80863150e-09 7.46744983e-10]
CHILD 2 is [-1.07410750e-01 -1.34137572e-12 -6.16041101e-14 4.92965427e-11

```

```

-1.79703302e-10 -1.33902840e-15 8.03462809e-16 2.24413674e-05
-1.91079989e-06 -8.76751255e-09 7.72423242e-10]
#-----
parent 1 is [0.08999771558221258, -1.024341258927964e-12,
-2.234254875776415e-14, 7.518054647321033e-11, -2.3672175704581953e-10,
-1.8599234475177e-15, 1.0363630046234666e-15, 1.1232103244541594e-05,
-1.8376799350638052e-06, -7.682037245173995e-09, 1.1088810605724232e-09]
parent 2 is [0.04324797144501835, -1.3788659229934556e-12,
-1.4440166090034318e-14, 4.847269537152919e-11, -1.6391873615056195e-10,
-1.3903926150219416e-15, 1.3693721622665721e-15, 1.537400032261329e-05,
-1.5132852430960787e-06, -6.548880064831065e-09, 7.458259543197523e-10]
CHILD 1 is [ 1.28146564e-01 -7.35041119e-13 -2.87910716e-14 9.69747567e-11
-2.96130668e-10 -2.24307122e-15 7.64620005e-16 7.85222161e-06
-2.10239334e-06 -8.60671912e-09 1.40514223e-09]
CHILD 2 is [ 5.09912351e-03 -1.66816606e-12 -7.99164321e-15 2.66784852e-11
-1.04509825e-10 -1.00724484e-15 1.64111516e-15 1.87538820e-05
-1.24857184e-06 -5.62419819e-09 4.49564781e-10]
#-----
parent 1 is [0.0, -9.875299804205226e-13, -5.3944821589819837e-14,
7.930563099592005e-11, -2.0984549655895666e-10, -1.4378337510064146e-15,
8.060220128248057e-16, 2.2757658578306265e-05, -1.989031728863744e-06,
-8.908335865469784e-09, 8.161584966021705e-10]
parent 2 is [0.07144470438737868, -1.024341258927964e-12,
-2.234254875776415e-14, 7.518054647321033e-11, -1.801621324121818e-10,
-1.3903926150219416e-15, 1.0363630046234666e-15, 1.972934634335282e-05,
-1.8376799350638052e-06, -7.682037245173995e-09, 7.433548643729261e-10]
CHILD 1 is [-1.96876225e-02 -9.77386100e-13 -6.26532853e-14 8.04423577e-11
-2.18025177e-10 -1.45090684e-15 7.42548218e-16 2.35921539e-05
-2.03073891e-06 -9.24626020e-09 8.36220591e-10]
CHILD 2 is [ 9.11323269e-02 -1.03448514e-12 -1.36340850e-14 7.40438197e-11
-1.71982452e-10 -1.37731952e-15 1.09983680e-15 1.88948511e-05
-1.79597276e-06 -7.34411291e-09 7.23292770e-10]
#-----
parent 1 is [0.0, -9.875299804205226e-13, -5.3944821589819837e-14,
7.930563099592005e-11, -2.0984549655895666e-10, -1.4378337510064146e-15,
8.060220128248057e-16, 2.2757658578306265e-05, -1.989031728863744e-06,
-8.908335865469784e-09, 8.161584966021705e-10]
parent 2 is [-0.12826988257084007, -1.3783500660791644e-12,
-6.618301505877671e-14, 4.627780406755569e-11, -1.7964979058119056e-10,
-1.3330380203323678e-15, 7.763006729384186e-16, 2.2757658578306265e-05,
-1.9193275505106666e-06, -8.894106807593951e-09, 7.758133607867065e-10]
CHILD 1 is [-2.98433421e-02 -1.07845840e-12 -5.67921665e-14 7.16213585e-11
-2.02820147e-10 -1.41345192e-15 7.99107029e-16 2.27576586e-05
-1.97281432e-06 -8.90502532e-09 8.06771775e-10]
CHILD 2 is [-9.84265405e-02 -1.28742165e-12 -6.33356702e-14 5.39620766e-11
-1.86675140e-10 -1.35741985e-15 7.83215656e-16 2.27576586e-05
-1.93554496e-06 -8.89741735e-09 7.85200082e-10]
#-----

```

```

parent 1 is [0.04324797144501835, -1.3788659229934556e-12,
-1.4440166090034318e-14, 4.847269537152919e-11, -1.6391873615056195e-10,
-1.3903926150219416e-15, 1.3693721622665721e-15, 1.537400032261329e-05,
-1.5132852430960787e-06, -6.548880064831065e-09, 7.458259543197523e-10]
parent 2 is [-0.10362787598594772, -1.2107359160132754e-12,
-6.618301505877671e-14, 6.446862178987708e-11, -2.280131908679095e-10,
-1.9775564074727657e-15, 7.763006729384186e-16, 1.8586602432957104e-05,
-2.248710346603828e-06, -9.236335929578608e-09, 5.637517157724549e-10]
CHILD 1 is [ 1.17493190e-01 -1.46385504e-12 1.17156599e-14 4.03868115e-11
-1.31519217e-10 -1.09358341e-15 1.66916769e-15 1.37500414e-05
-1.14153047e-06 -5.19038069e-09 8.37863834e-10]
CHILD 2 is [-1.77873094e-01 -1.12574680e-12 -9.23388411e-14 7.25545057e-11
-2.60412710e-10 -2.27436561e-15 4.76505146e-16 2.02105614e-05
-2.62046512e-06 -1.05948353e-08 4.71713836e-10]
#-----
parent 1 is [0.0, -9.875299804205226e-13, -5.3944821589819837e-14,
7.930563099592005e-11, -2.0984549655895666e-10, -1.4378337510064146e-15,
8.060220128248057e-16, 2.2757658578306265e-05, -1.989031728863744e-06,
-8.908335865469784e-09, 8.161584966021705e-10]
parent 2 is [-0.4019561030793246, -9.569323810936197e-13,
-4.7688746427430405e-14, 7.930563099592005e-11, -2.0807985570210612e-10,
-1.722279161703472e-15, 8.060220128248057e-16, 1.472505396479716e-05,
-2.23905304865633e-06, -6.423214946412731e-09, 8.161584966021705e-10]
CHILD 1 is [ 3.69758076e-01 -1.01567661e-12 -5.96997642e-14 7.93056310e-11
-2.11469704e-10 -1.17617337e-15 8.06022013e-16 3.01468247e-05
-1.75903795e-06 -1.11943903e-08 8.16158497e-10]
CHILD 2 is [-7.71714180e-01 -9.28785752e-13 -4.19338038e-14 7.93056310e-11
-2.06455649e-10 -1.98393954e-15 8.06022013e-16 7.33588781e-06
-2.46904683e-06 -4.13716051e-09 8.16158497e-10]
#-----
parent 1 is [-0.12826988257084007, -1.3783500660791644e-12,
-6.618301505877671e-14, 4.627780406755569e-11, -1.7964979058119056e-10,
-1.3330380203323678e-15, 7.763006729384186e-16, 2.2757658578306265e-05,
-1.9193275505106666e-06, -8.894106807593951e-09, 7.758133607867065e-10]
parent 2 is [-0.16661036391814915, -1.3783500660791644e-12,
-4.912913462857786e-14, 5.6444882564354586e-11, -1.182135905112091e-10,
-1.4507050301933423e-15, 7.373206241232383e-16, 1.769844143342871e-05,
-2.784483746993891e-06, -8.164627152374065e-09, 7.758133607867065e-10]
CHILD 1 is [-1.22255702e-01 -1.37835007e-12 -6.88581281e-14 4.46829715e-11
-1.89286822e-10 -1.31458049e-15 7.82415178e-16 2.35512596e-05
-1.78361705e-06 -9.00853475e-09 7.75813361e-10]
CHILD 2 is [-1.72624545e-01 -1.37835007e-12 -4.64540216e-14 5.80397151e-11
-1.08576559e-10 -1.46916256e-15 7.31206119e-16 1.69048404e-05
-2.92019425e-06 -8.05019921e-09 7.75813361e-10]
#-----
parent 1 is [0.07183227815927462, -1.024341258927964e-12,
-2.234254875776415e-14, 8.001366166590123e-11, -2.634991542353353e-10,
-1.3903926150219416e-15, 1.0363630046234666e-15, 1.7120920382653567e-05,

```

```

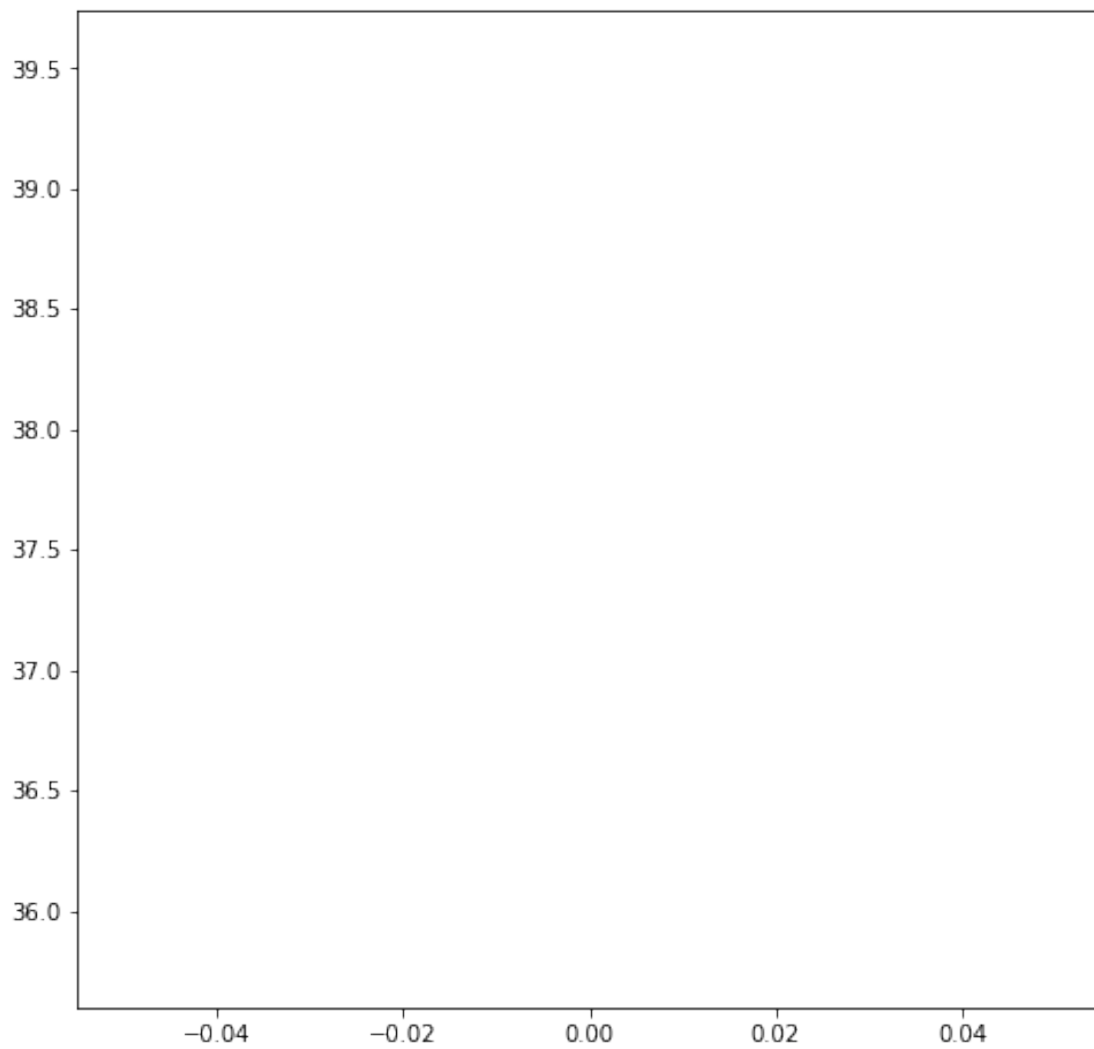
-1.7819586898511678e-06, -7.542301387608643e-09, 5.598702193322884e-10]
parent 2 is [-0.14085183603650164, -1.0902828842145369e-12,
-8.23952024928039e-14, 3.9792353931611e-11, -2.86612689687068e-10,
-1.4191904123010063e-15, 7.083698245121705e-16, 3.424277861220111e-05,
-2.4750613311765787e-06, -6.407886474021009e-09, 9.112636728858148e-10]
CHILD 1 is [ 3.46735505e-01 -9.39108915e-13 5.52780499e-14 1.32001406e-10
-2.33623931e-10 -1.35317024e-15 1.46030808e-15 -5.00980662e-06
-8.86094168e-07 -9.00858071e-09 1.05679297e-10]
CHILD 2 is [-4.15755062e-01 -1.17551523e-12 -1.60015801e-13 -1.21953900e-11
-3.16487913e-10 -1.45641279e-15 2.84424746e-16 5.63735056e-05
-3.37092585e-06 -4.94160715e-09 1.36545460e-09]
#-----
Generation info is [{'members': [[-0.13915778812982646,
-1.4351758102671513e-12, -8.23952024928039e-14, 3.9792353931611e-11,
-2.1891932288373778e-10, -1.2741372955243258e-15, 8.116695971628484e-16,
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7.443993562483374e-10], [0.07037735484644053, -1.024341258927964e-12,
-2.234254875776415e-14, 7.716405737305545e-11, -1.801621324121818e-10,
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-1.8376799350638052e-06, -7.682037245173995e-09, 7.408557333642838e-10],
[-0.13442909604093198, -1.3783500660791644e-12, -6.618301505877671e-14,
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-5.3944821589819837e-14, 8.168384121951816e-11, -2.0589716264246227e-10,
-1.4378337510064146e-15, 8.433007970389184e-16, 2.2757658578306265e-05,
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[-0.1427695714633879, -2.097241238218167e-12, -8.23952024928039e-14,
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-1.801621324121818e-10, -1.3903926150219416e-15, 1.3977949924929011e-15,
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[-0.17636031977458821, -5.20059190905748e-13, -6.904261080205444e-14,
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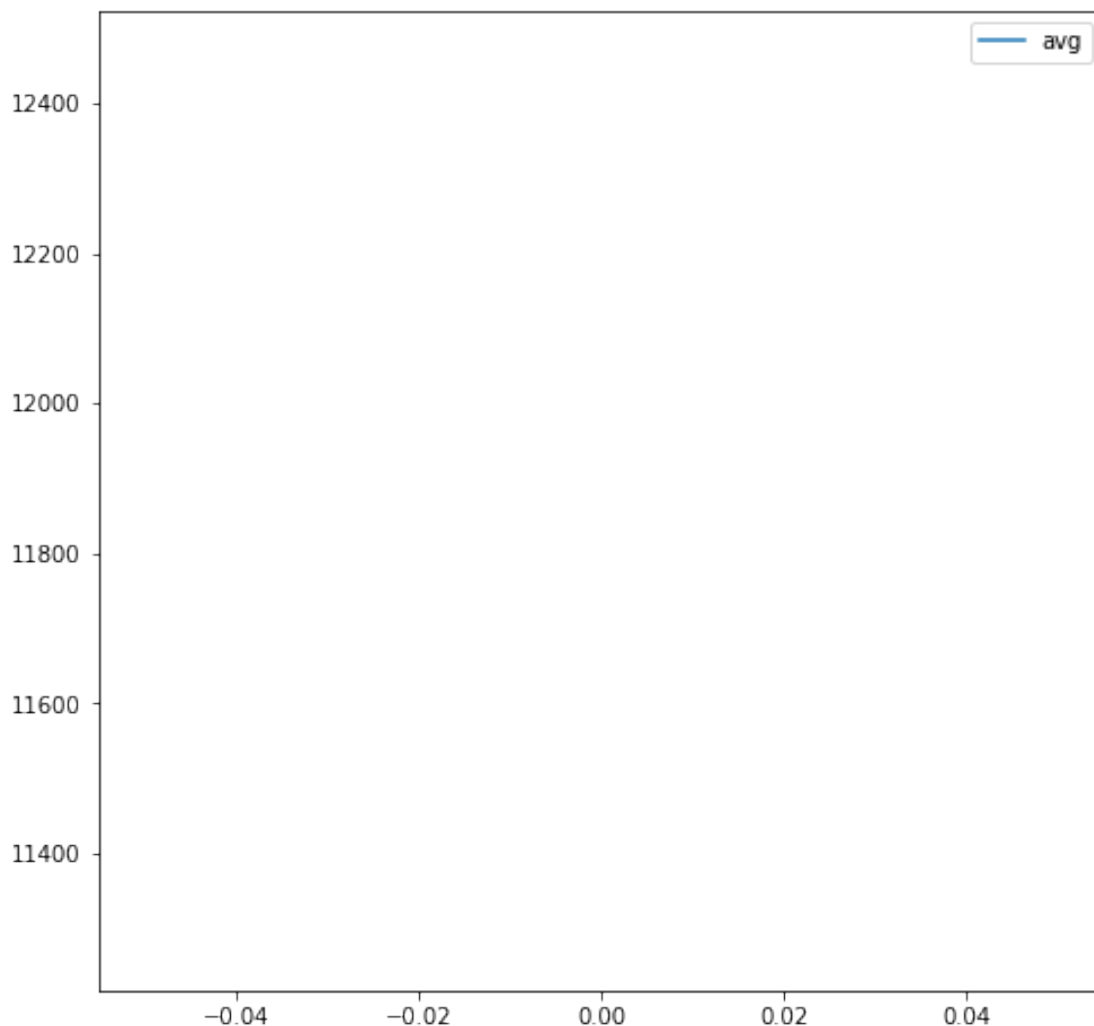
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Enter fraction of cells you want to mutate:0.4  
  
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Collection.count_documents instead.  
  # This is added back by InteractiveShellApp.init_path()  
  
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MIN fitness is 38.42136590553627
fitness vals are: ->

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Enter y to continue.y
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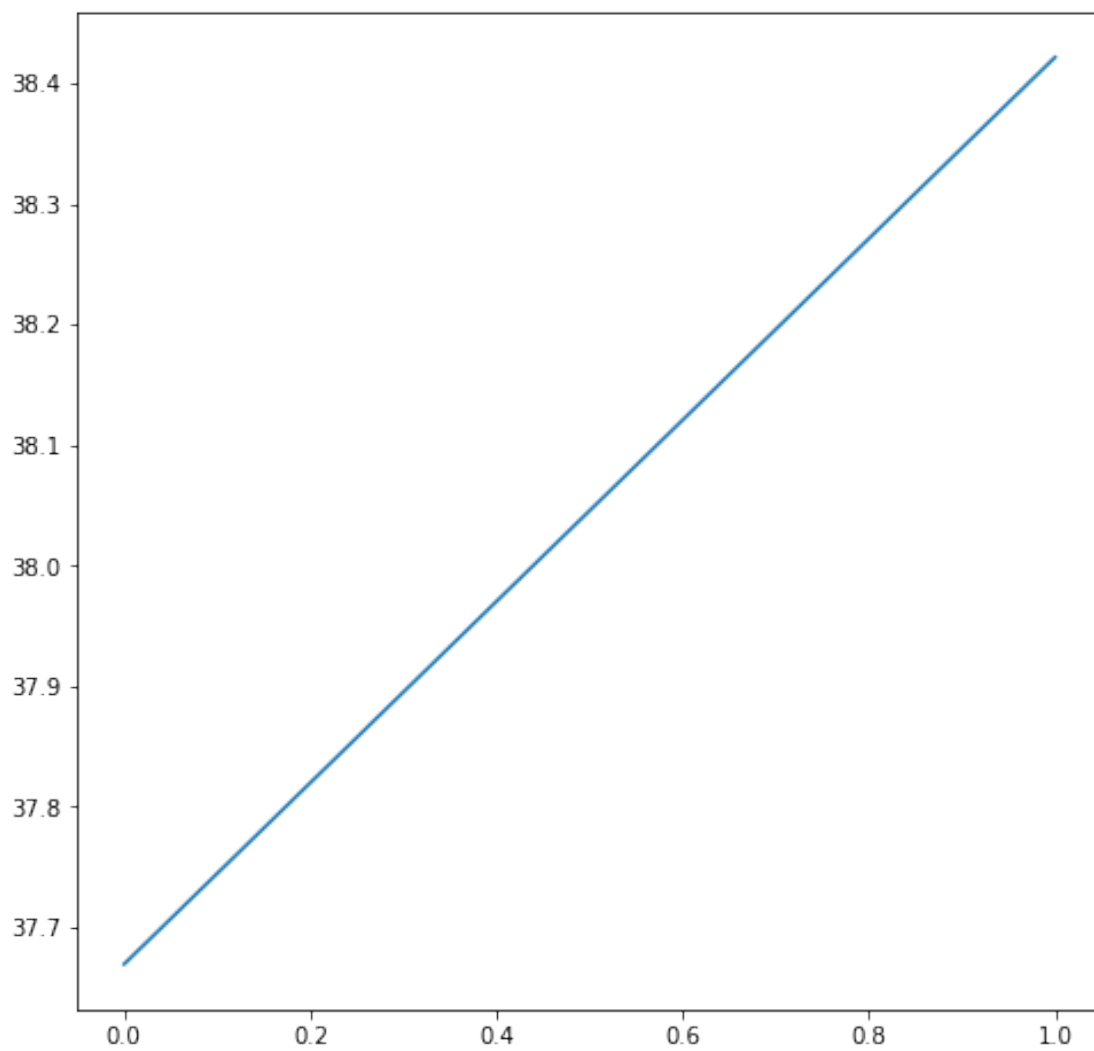
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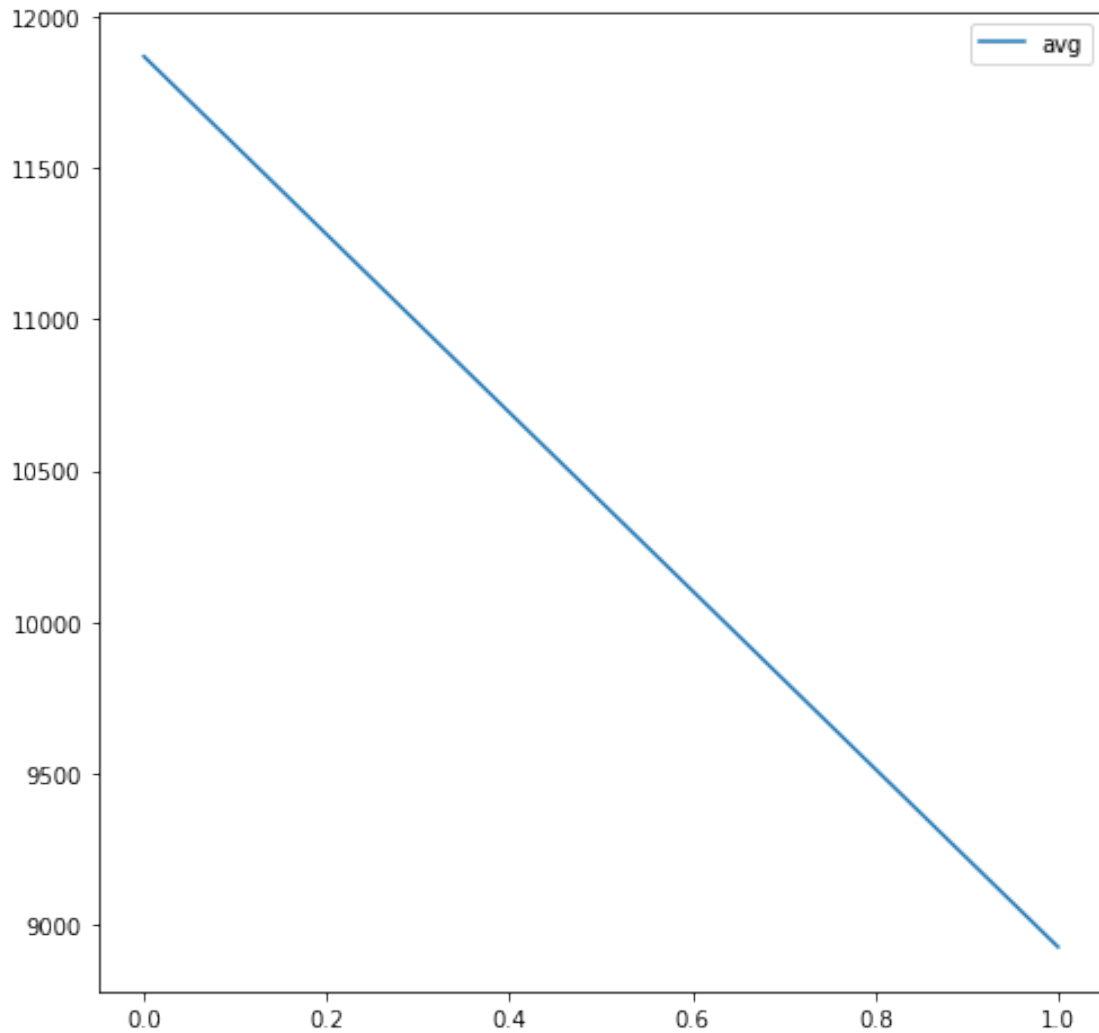
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Enter fraction of cells you want to mutate:0.4  
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Collection.count_documents instead.  
    # This is added back by InteractiveShellApp.init_path()  
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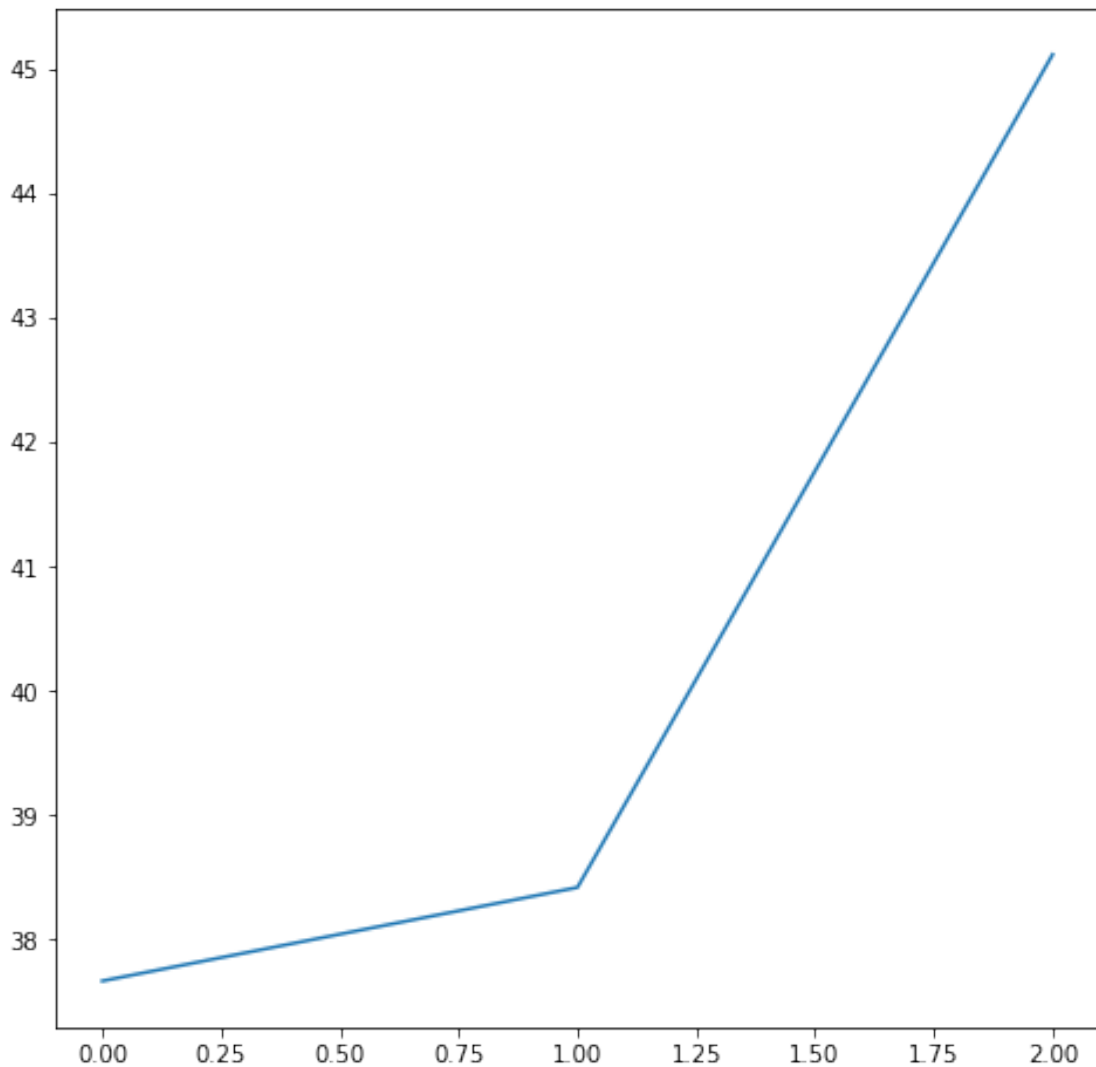
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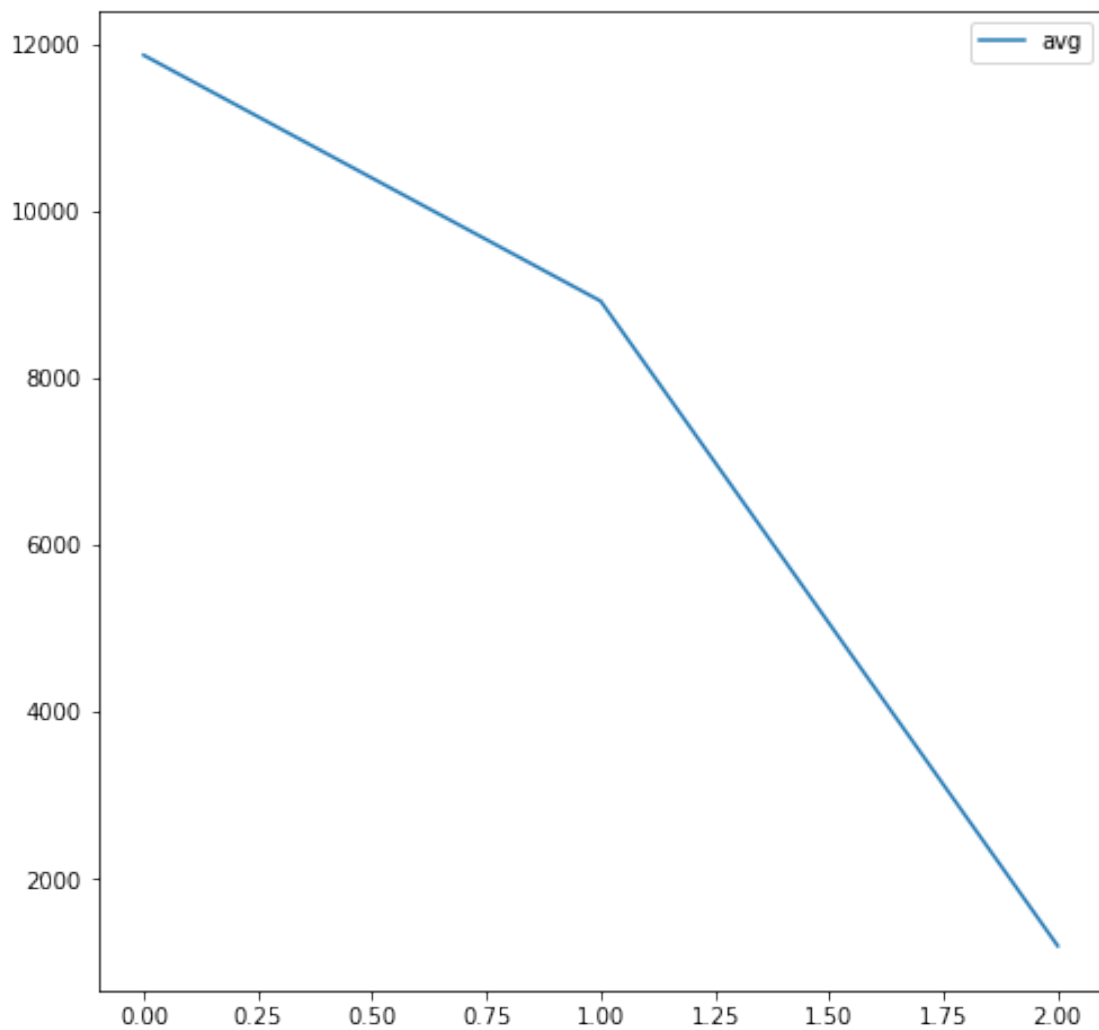
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Enter mutation magnitude:0.4
Enter fraction of cells you want to mutate:0.6
/home/anmolagarwal/anaconda3/lib/python3.7/site-
packages/ipykernel_launcher.py:11: DeprecationWarning: count is deprecated. Use
Collection.count_documents instead.
  # This is added back by InteractiveShellApp.init_path()
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0

```

```

exist? 0
exist? 0
exist? 0
exist? 0
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Avg fitness is 266.42762487903576
MIN fitness is 46.77658161765315
fitness vals are: ->

```

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46.77658161765315
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Enter y to continue.y
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CHILD 2 is [-1.49164014e-01 -1.38745578e-12 -7.11585330e-14 4.36297118e-11
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-1.94257566e-06 -8.82466398e-09 7.83802792e-10]
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-1.90343764e-06 -9.13841721e-09 7.72611047e-10]
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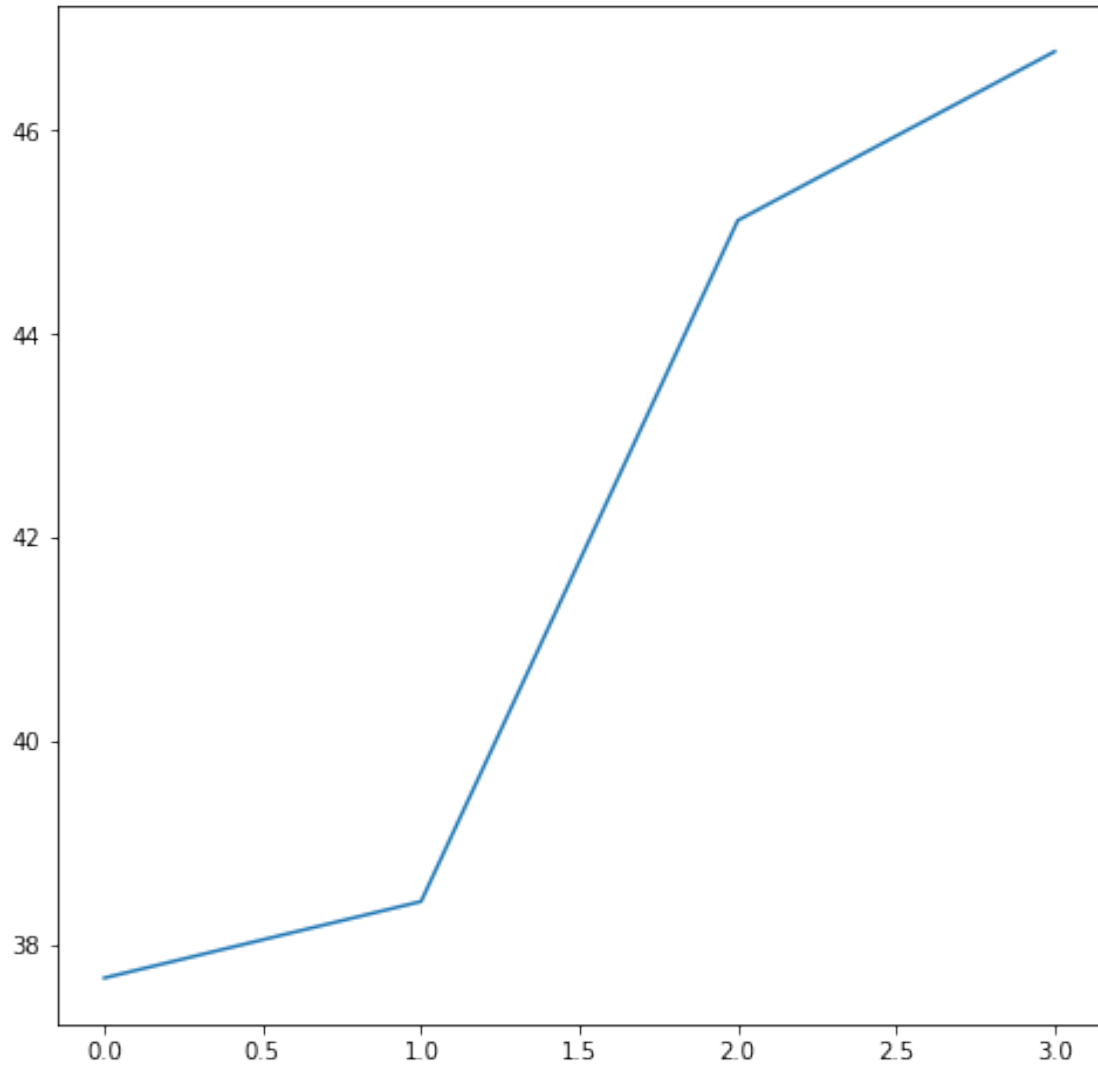
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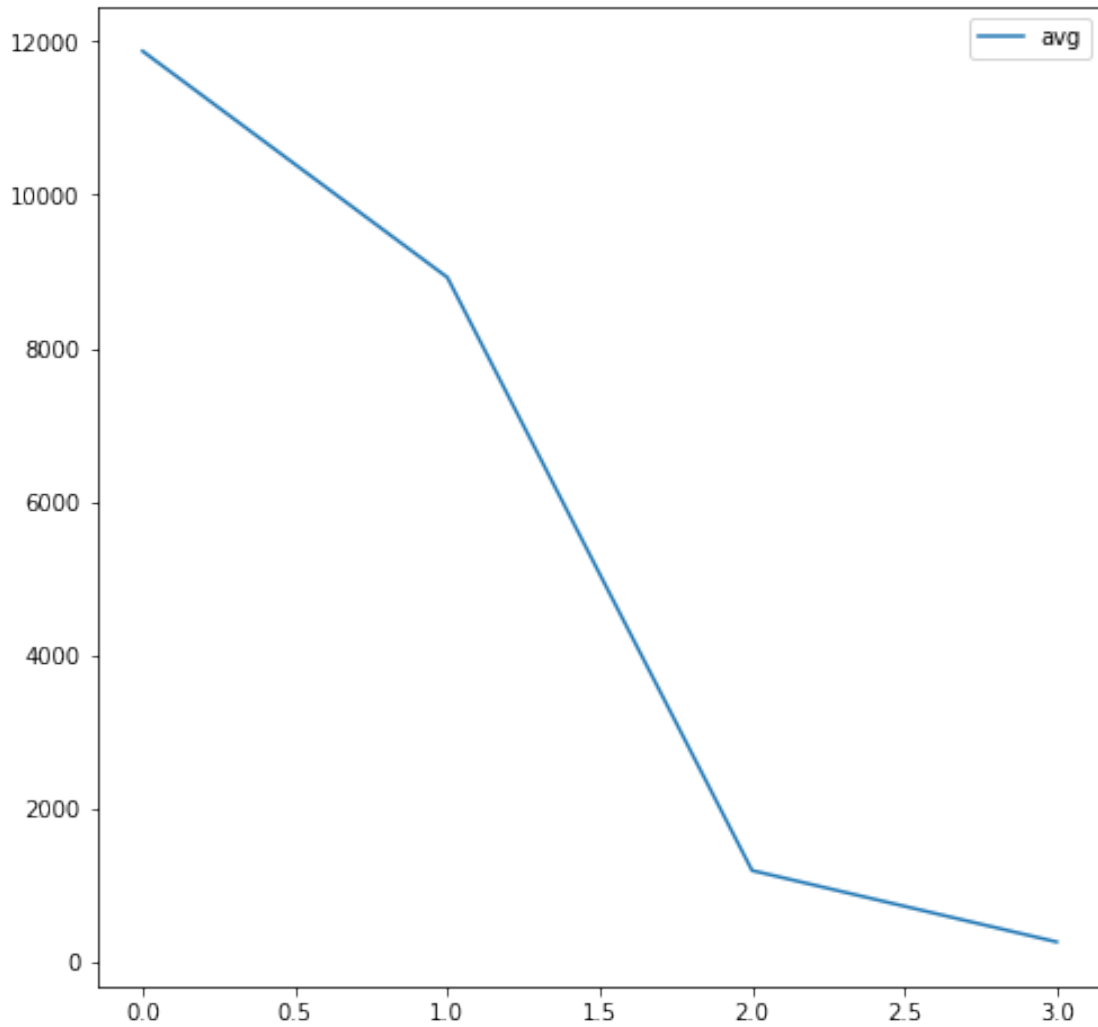
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Enter fraction of cells you want to mutate:0.9  
  
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Collection.count_documents instead.  
# This is added back by InteractiveShellApp.init_path()  
  
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MIN fitness is 158.62202782370895
fitness vals are: ->

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Enter y to continue.y
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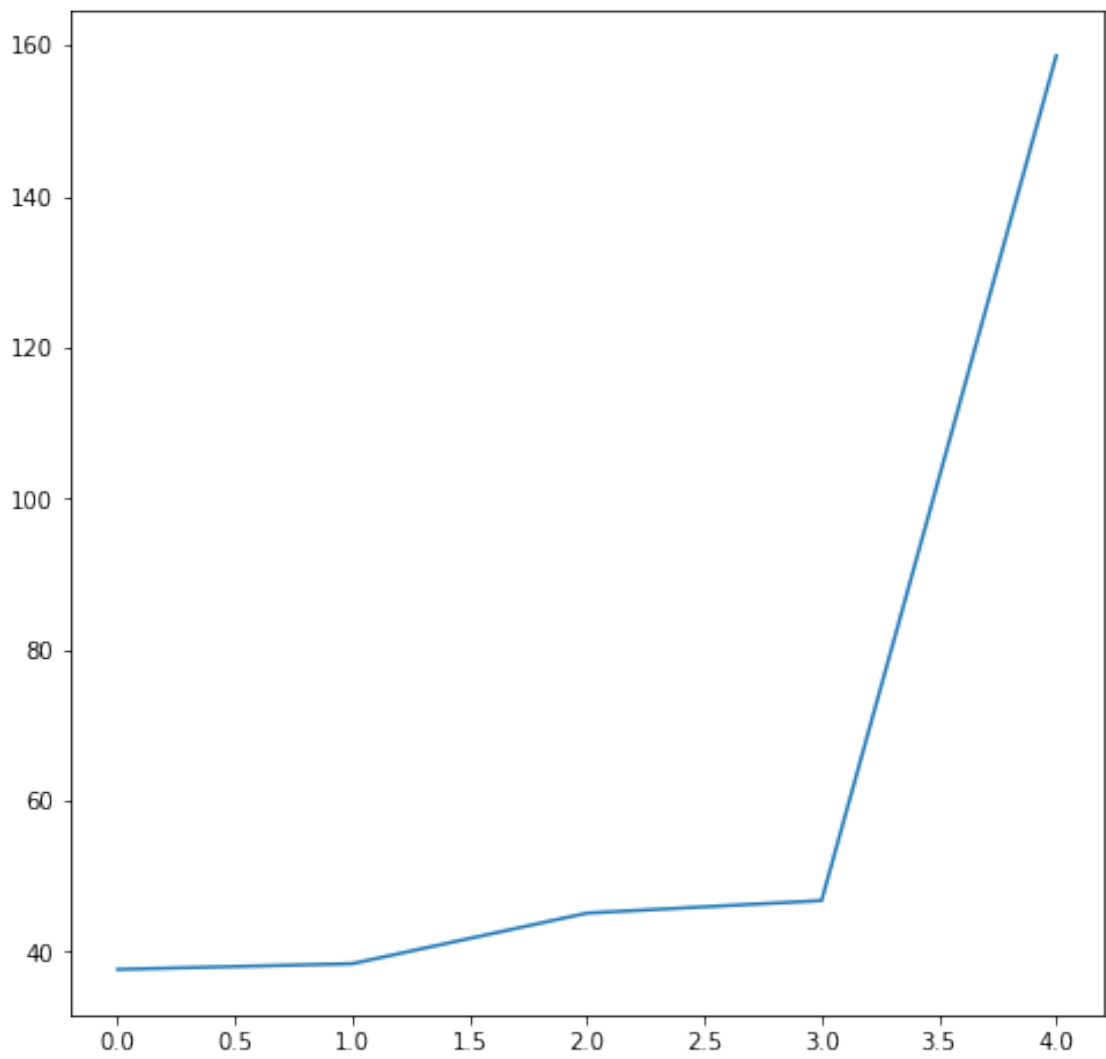
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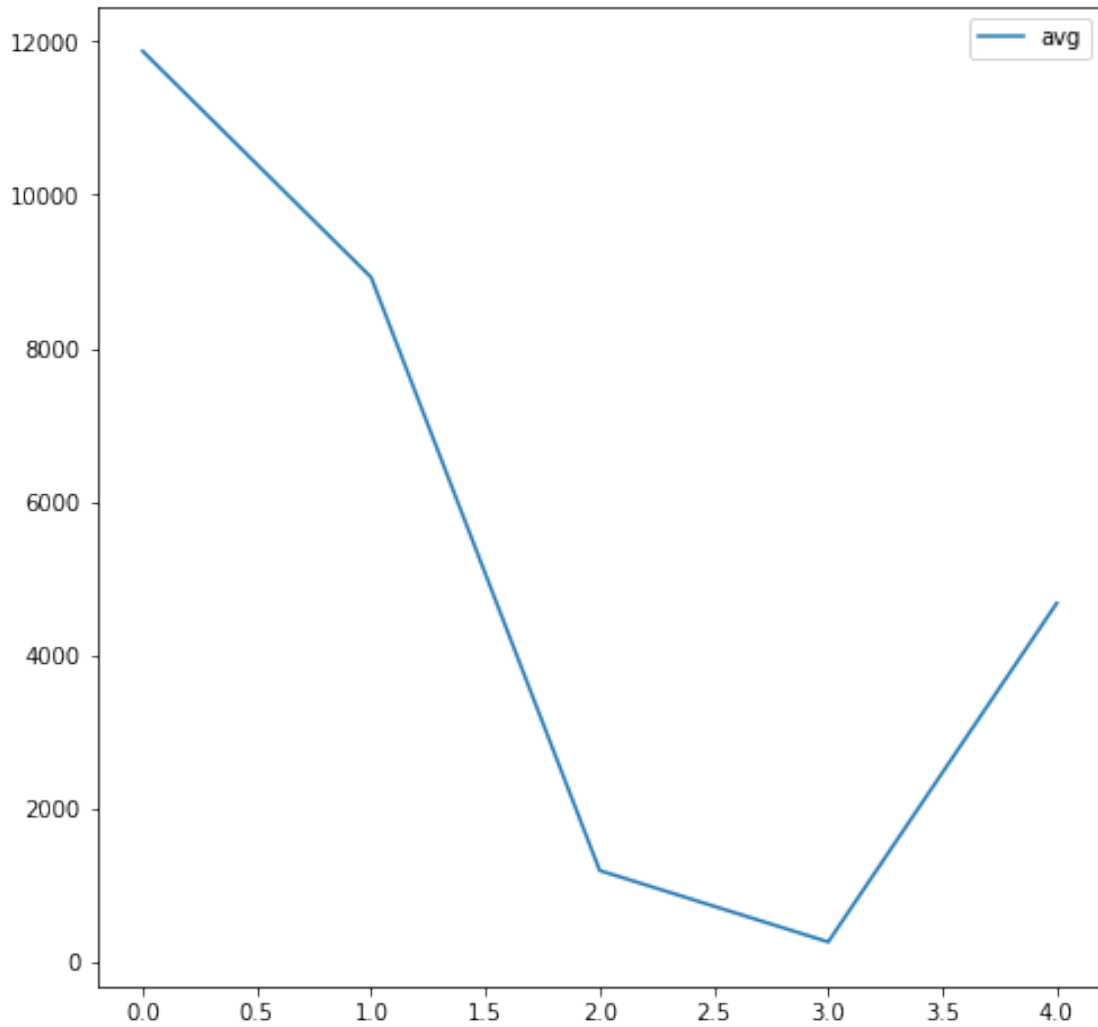
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Enter mutation magnitude:0.9  
Enter fraction of cells you want to mutate:0.7  
  
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packages/ipykernel_launcher.py:11: DeprecationWarning: count is deprecated. Use  
Collection.count_documents instead.  
  # This is added back by InteractiveShellApp.init_path()  
  
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Avg fitness is 2965.8831192186
MIN fitness is 174.8269834080489
fitness vals are: ->

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Enter y to continue.y

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CHILD 2 is [-1.12038160e-01 -1.48137653e-12 -7.35538467e-14 4.97876901e-11
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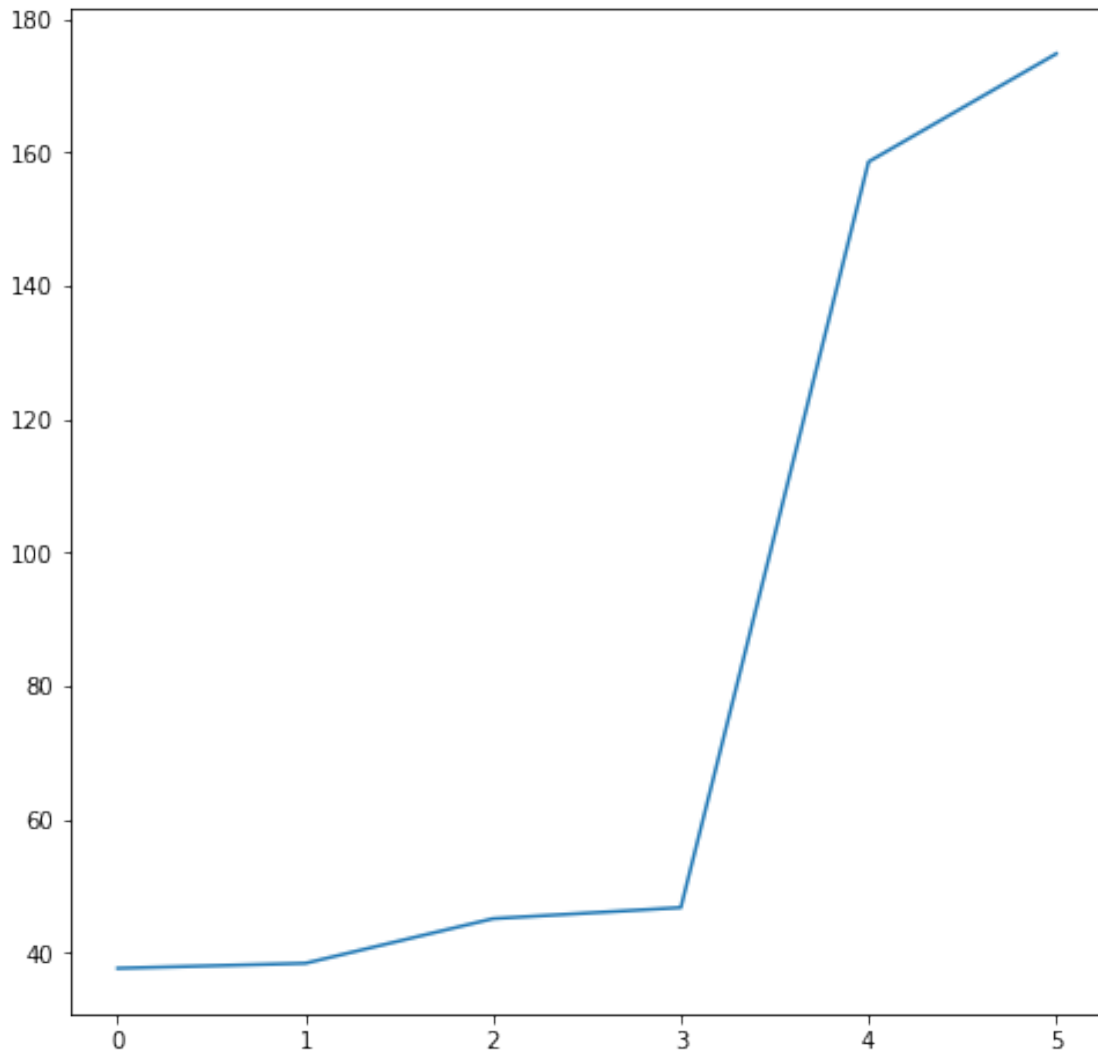
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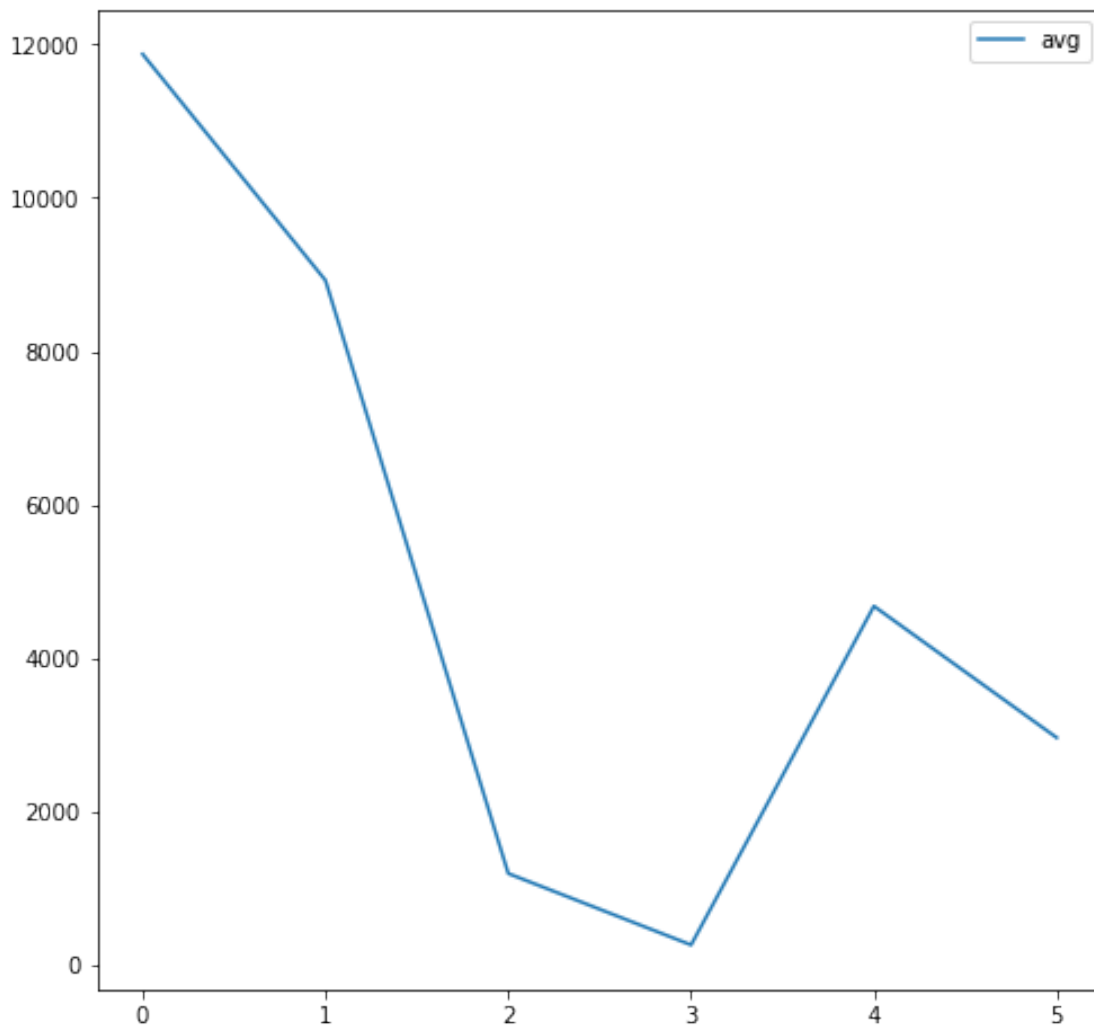
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611.1945801197467, 810.2501755496901, 1221.4577677285026, 1529.5463267968034,
1536.7051842124838, 2111.595942630512, 2557.6269478998665, 3074.2255068832164,
3096.365082008144, 3177.574953990577, 14751.115869132984, 22485.941031324714]]]

```





```

-----
Enter mutation magnitude:1.6
Enter fraction of cells you want to mutate:0.6
/home/anmolagarwal/anaconda3/lib/python3.7/site-
packages/ipykernel_launcher.py:11: DeprecationWarning: count is deprecated. Use
Collection.count_documents instead.
  # This is added back by InteractiveShellApp.init_path()
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0

```

```

exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
Avg fitness is 27320.98678529047
MIN fitness is 299.96705614467515
fitness vals are: ->

```

```

299.96705614467515
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875.1986475757731
880.0568519724819
1627.107656845928
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3345.8048863722793
4724.471137538644
9667.240315727631
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39810.012963436006
69644.315178368
71662.89733248262
75714.13831396046
123934.36235920979

```

Enter y to continue.y

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parent 1 is [-0.17284845164411453, -1.8010531139312029e-12,
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8.654580412104763e-16, 1.839196878144582e-05, -1.7414867386348738e-06,
-9.257657103041594e-09, 7.244859801818488e-10]

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CHILD 1 is [-1.85023224e-01 -1.78555923e-12 -9.33277660e-14 3.51822960e-11
-2.03881538e-10 -1.24262949e-15 6.50275414e-16 1.95465267e-05
-1.39905898e-06 -7.47253746e-09 6.43783278e-10]

CHILD 2 is [-7.63552859e-02 -1.92385243e-12 -9.97351909e-14 3.22187916e-11
-1.77663263e-10 -1.96978961e-15 8.92608146e-16 1.82462955e-05
-1.78469166e-06 -9.48288990e-09 7.34668432e-10]

#-----

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8.654580412104763e-16, 1.839196878144582e-05, -1.7414867386348738e-06,
-9.257657103041594e-09, 7.244859801818488e-10]

parent 2 is [-0.11203816024069116, -1.4813765292055968e-12,
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-1.0734778564000637e-15, 7.991574692495561e-16, 4.44510900571031e-05,
-2.538461678721365e-06, -1.2181999125769202e-08, 1.1815136838284204e-09]

CHILD 1 is [-6.92355868e-02 -2.25880762e-12 -1.19916689e-13 1.84035001e-11
-2.89989201e-10 -2.55711062e-15 9.19874792e-16 -2.99627356e-06
-1.08736287e-06 -6.85747886e-09 3.49376659e-10]

CHILD 2 is [-1.31332632e-01 -1.13092746e-12 -5.26544828e-14 6.39350022e-11
6.20652592e-11 -4.04688388e-16 7.44740719e-16 6.58393324e-05
-3.19258554e-06 -1.45821774e-08 1.55662300e-09]

#-----

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parent 2 is [-0.11174969223032805, -1.797746080143959e-12,
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CHILD 1 is [7.62551956e-03 -1.46929130e-12 -3.34802368e-14 6.81188278e-11
-2.98341688e-10 -1.43798704e-15 1.52841107e-16 1.55099440e-05
-8.07729698e-07 -6.05403861e-09 4.62341452e-10]

CHILD 2 is [-1.10770739e-01 -1.79505254e-12 -7.39623406e-14 3.83171743e-11
-1.73850295e-10 -2.43582492e-15 7.17017149e-16 2.35871625e-05
-1.80380816e-06 -1.42114159e-08 7.50804217e-10]

#-----

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CHILD 1 is [-9.12246867e-02 -1.89552202e-12 -9.61485502e-14 3.31913998e-11
-1.79697833e-10 -1.95281620e-15 8.48772896e-16 1.90026192e-05
-1.74967490e-06 -9.84036603e-09 7.27816994e-10]

CHILD 2 is [-1.09055064e-01 -1.81058261e-12 -7.71658400e-14 3.74301733e-11
-1.73723778e-10 -2.37958044e-15 7.38367153e-16 2.30432982e-05
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CHILD 2 is [-8.85787020e-02 -1.90780355e-12 -9.92256691e-14 3.23825345e-11
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-1.74534893e-06 -9.26015394e-09 7.26445228e-10]
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-2.54952379e-10 -2.09205002e-15 4.34397340e-16 1.88806025e-05
-2.54427930e-06 -8.87218851e-09 7.75967835e-10]
CHILD 2 is [-9.32188134e-02 -1.66809553e-12 -6.81896720e-14 7.16297664e-11
-2.76264242e-10 -1.88052973e-15 5.34982170e-16 1.64328889e-05
-2.28653164e-06 -8.83357224e-09 7.77494478e-10]
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2.09889235e-07 -1.46090138e-08 8.02270867e-11]
CHILD 2 is [-7.62669493e-02 -1.47273608e-12 -4.14899586e-14 4.32721902e-11
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-1.50547549e-06 -7.95635062e-09 6.84386466e-10]
CHILD 2 is [-1.15544749e-01 -1.49981049e-12 -7.47354931e-14 4.89263331e-11
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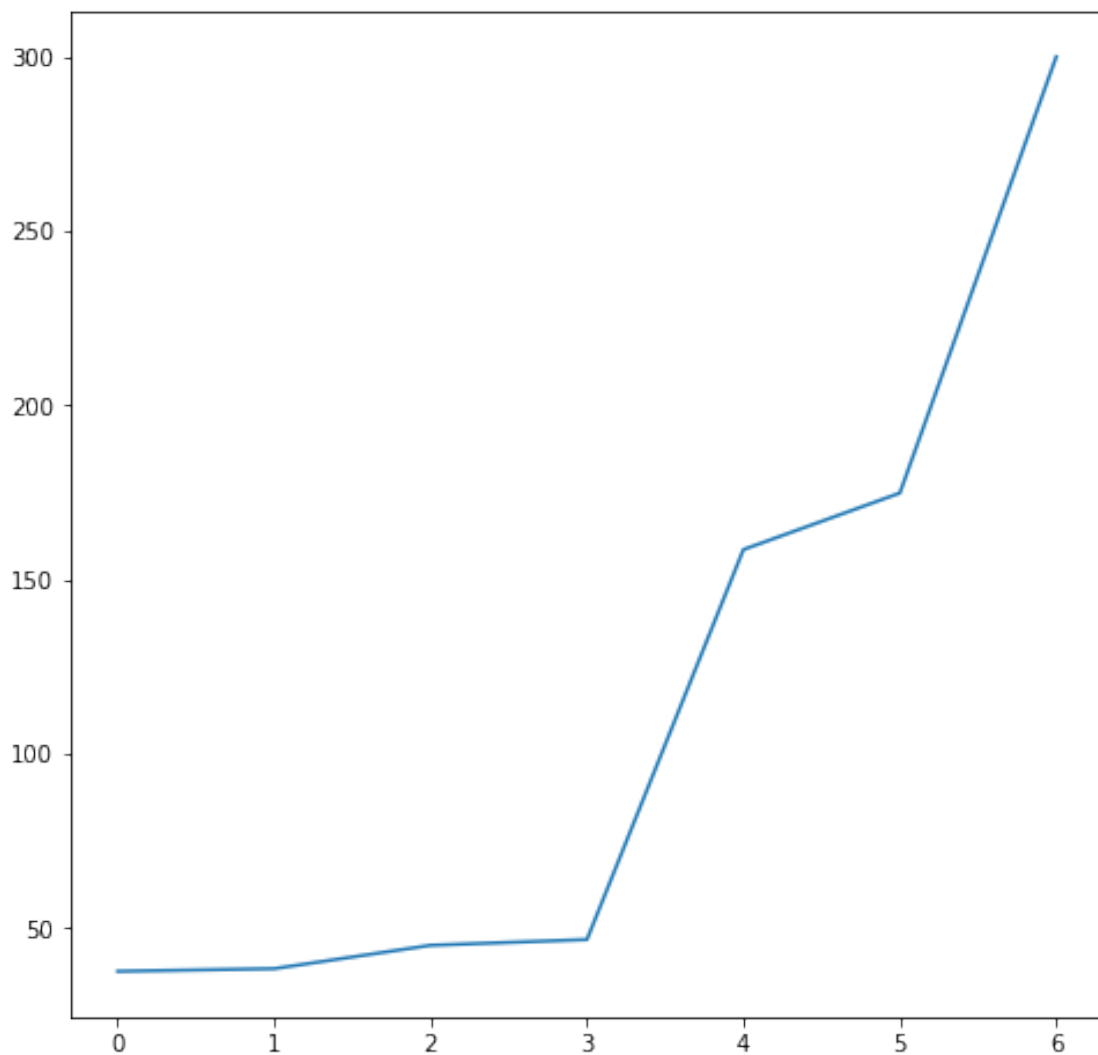
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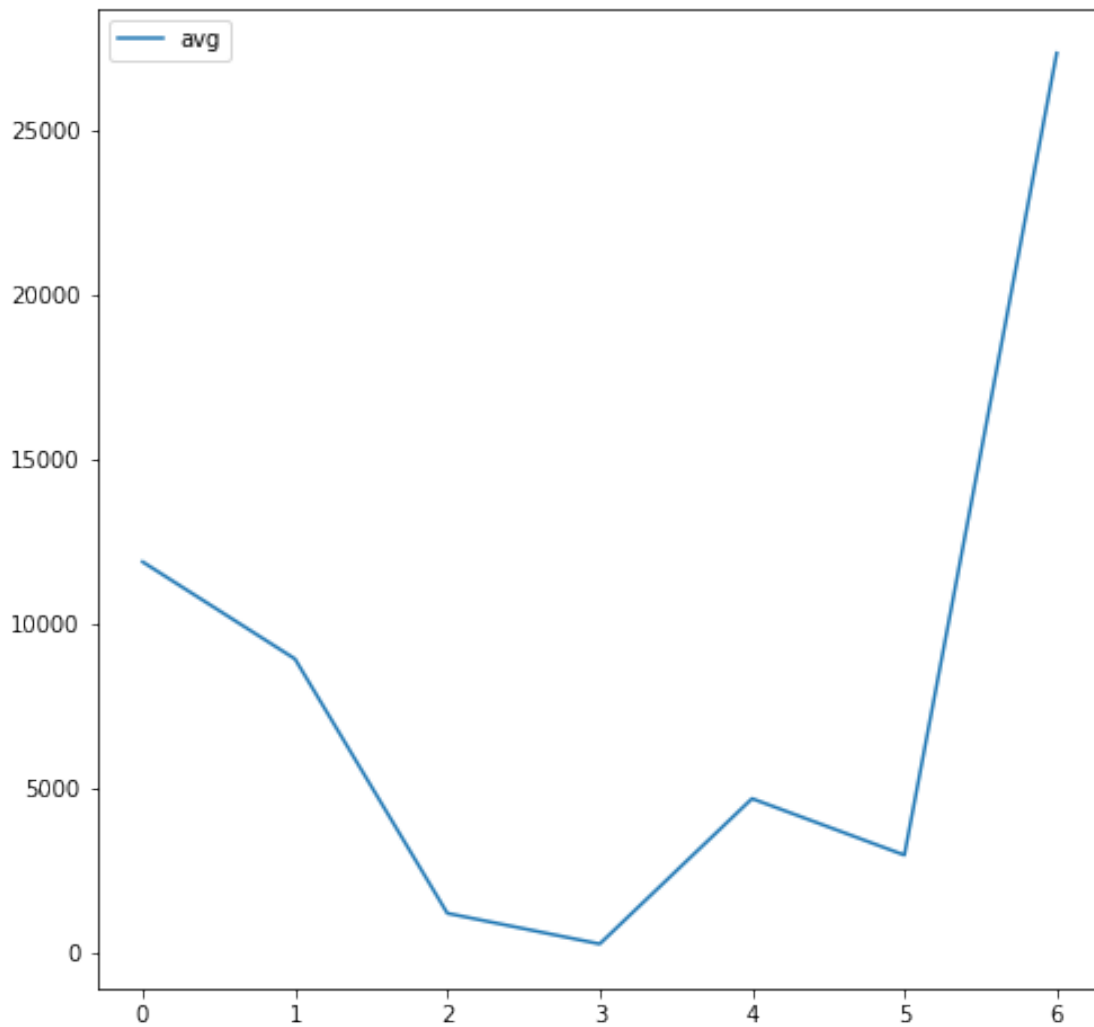
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Enter fraction of cells you want to mutate:0.9  
  
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Collection.count_documents instead.  
# This is added back by InteractiveShellApp.init_path()  
  
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fitness vals are: ->

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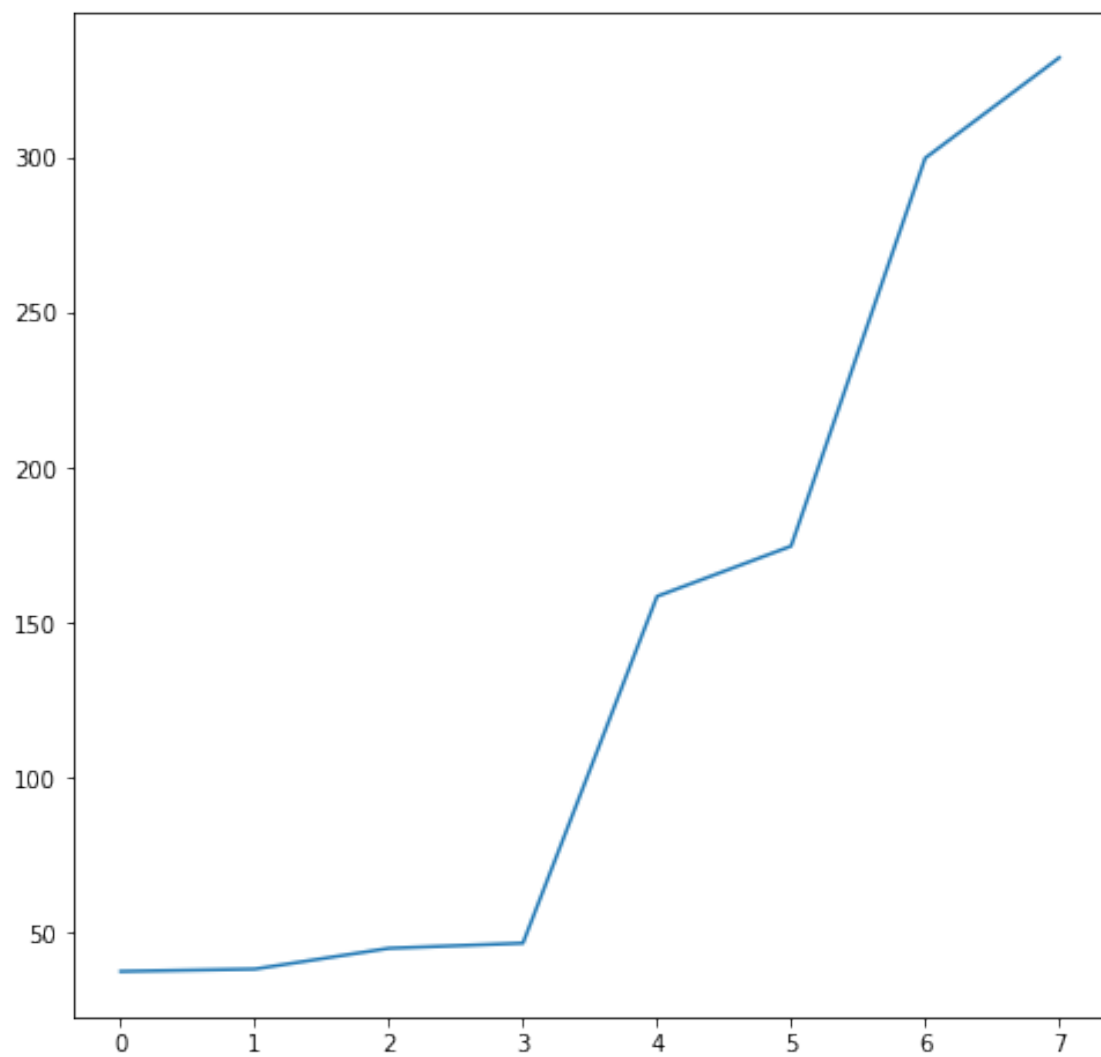
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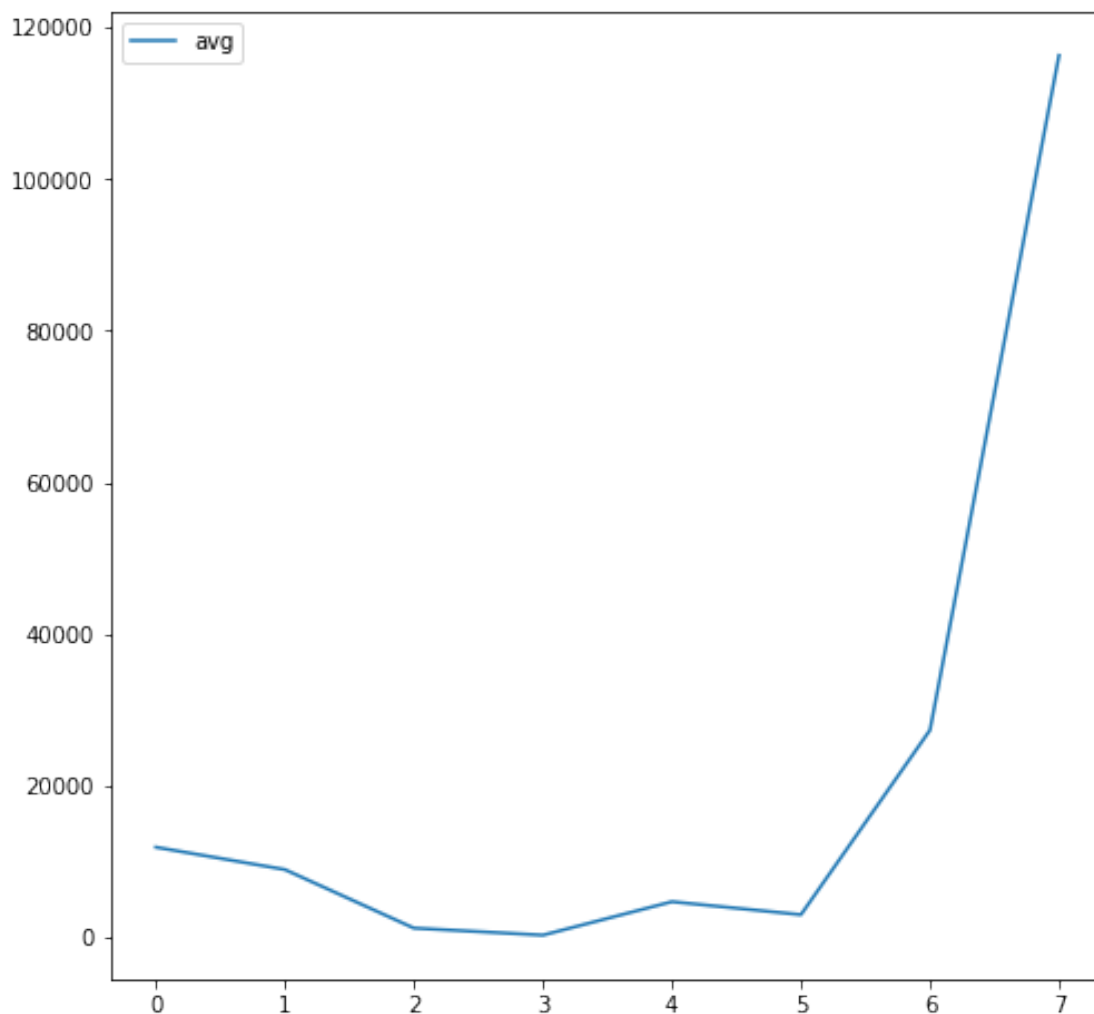
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Enter mutation magnitude:4
Enter fraction of cells you want to mutate:0.9
/home/anmolagarwal/anaconda3/lib/python3.7/site-
packages/ipykernel_launcher.py:11: DeprecationWarning: count is deprecated. Use
Collection.count_documents instead.
  # This is added back by InteractiveShellApp.init_path()

exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0

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exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
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exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
exist? 0
Avg fitness is 56832.206038447664
MIN fitness is 190.6320587837999
fitness vals are: ->

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190.6320587837999
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14018.73542439428
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Enter y to continue.y

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CHILD 2 is [-2.01785382e-01 -2.27071212e-12 -1.69766435e-13 7.16093434e-11
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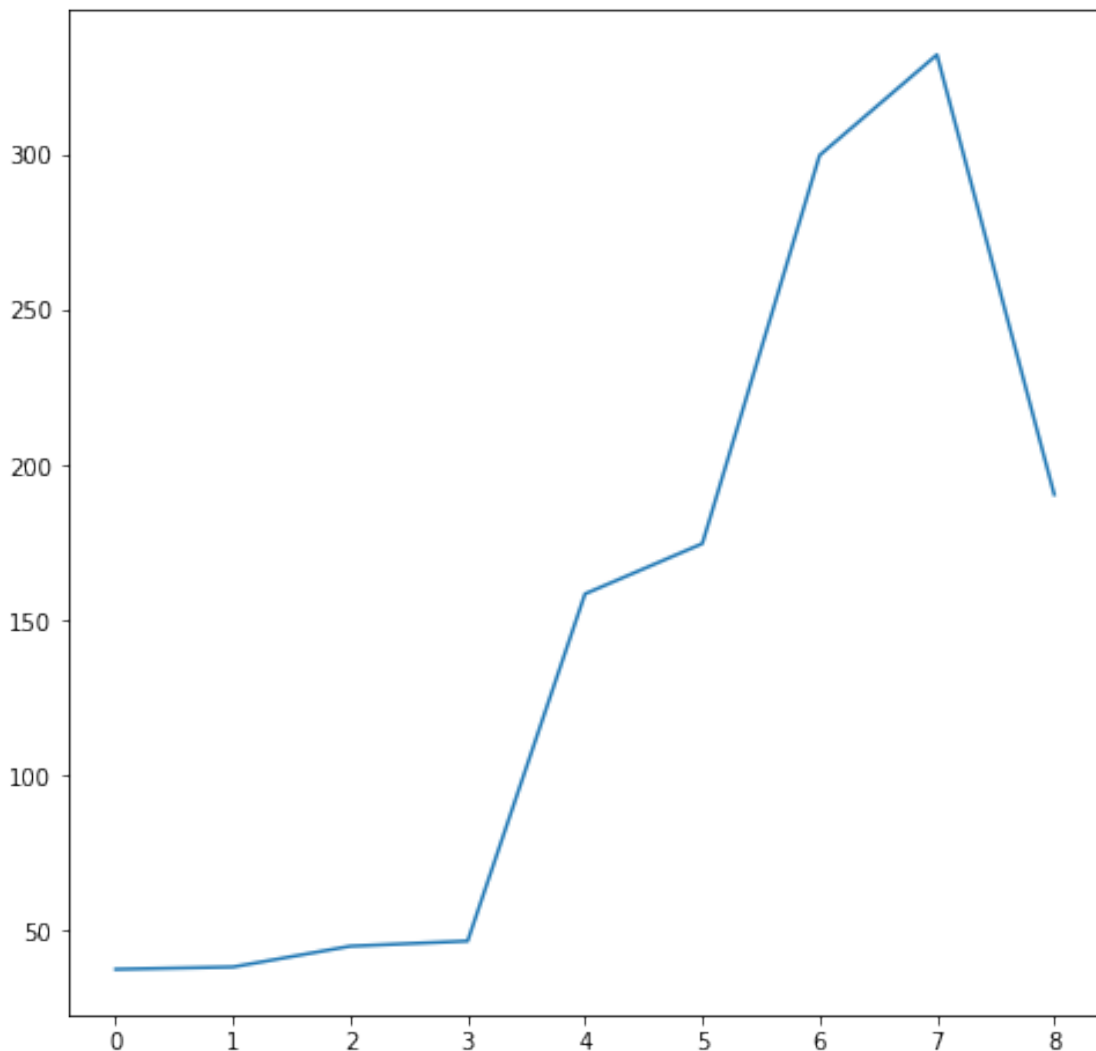
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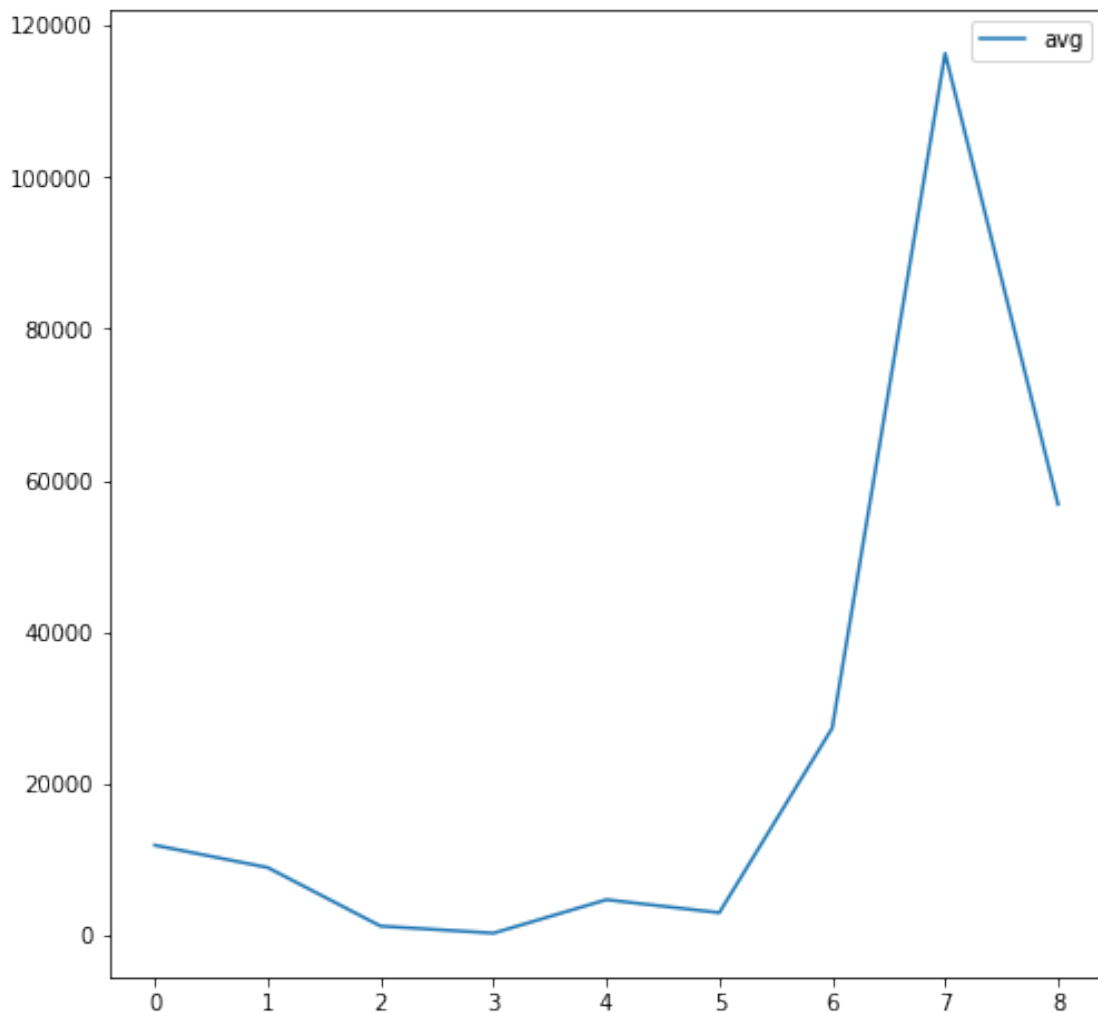
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Enter mutation magnitude:3
Enter fraction of cells you want to mutate:0.8

/home/anmolagarwal/anaconda3/lib/python3.7/site-
packages/ipykernel_launcher.py:11: DeprecationWarning: count is deprecated. Use
Collection.count_documents instead.
  # This is added back by InteractiveShellApp.init_path()

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exist?  0
exist?  0
exist?  0
exist?  0

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exist? 0
exist? 0
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Avg fitness is 1086290.4953115224

MIN fitness is 666.7157423071716

fitness vals are: ->

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Enter y to continue.y

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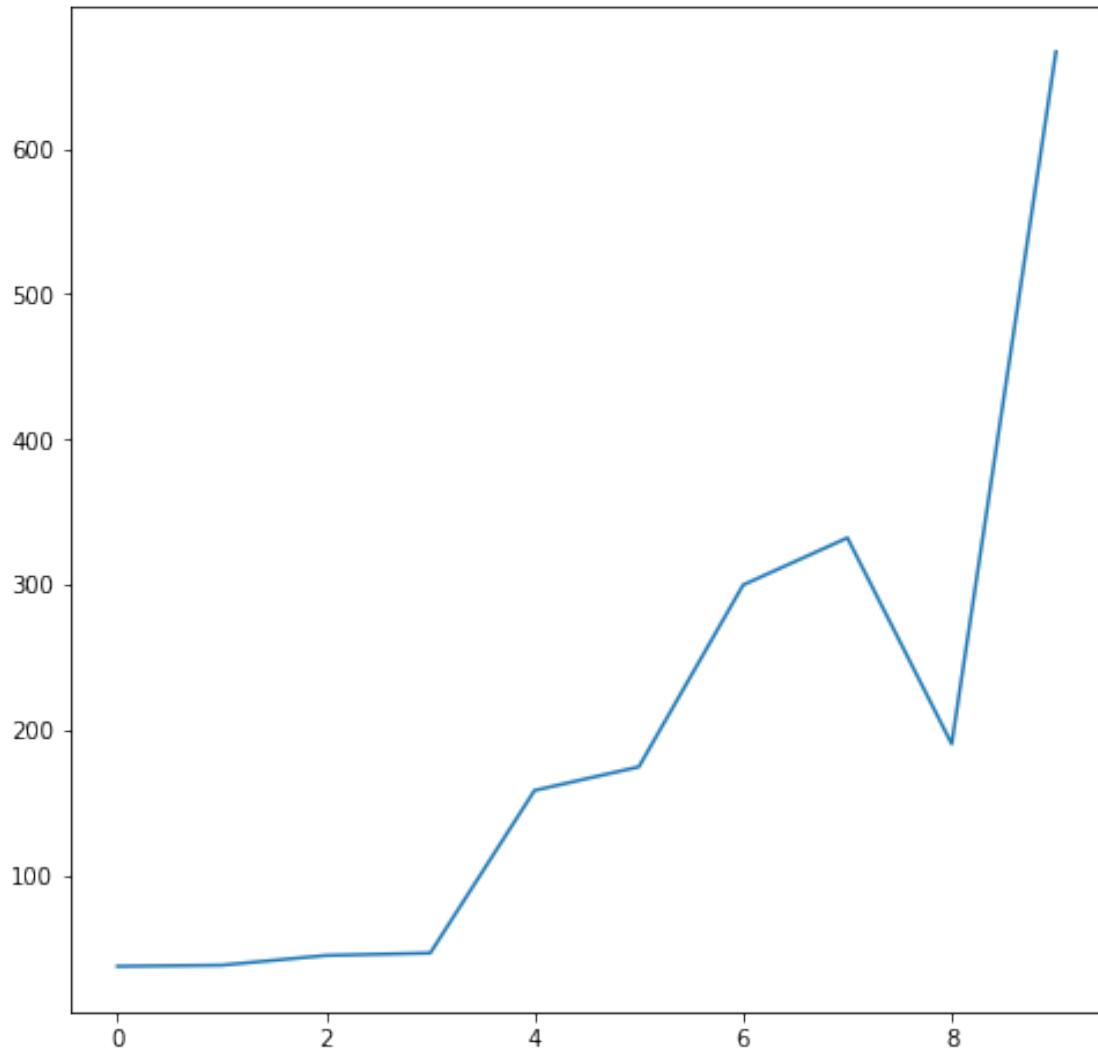
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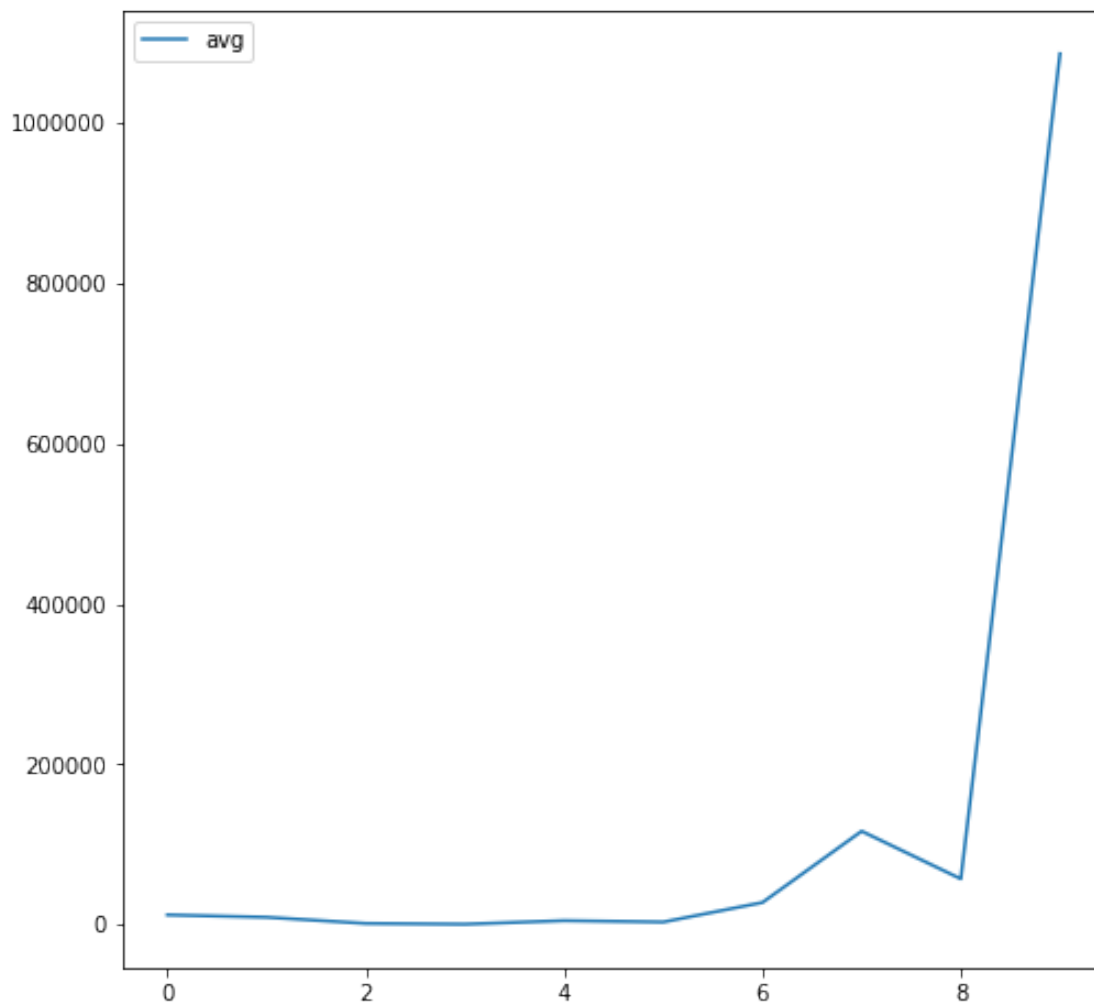
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```

-----
Enter mutade magnitude:6
Enter fraction of cells you want to mutate:0.9

/home/anmolagarwal/anaconda3/lib/python3.7/site-
packages/ipykernel_launcher.py:11: DeprecationWarning: count is deprecated. Use
Collection.count_documents instead.
  # This is added back by InteractiveShellApp.init_path()

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exist?  0
exist?  0
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```

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exist? 0
exist? 0
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Avg fitness is 2304277.050999244
MIN fitness is 1920.1355061603972
fitness vals are: ->
```

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26075718.518851373
Enter y to continue.y
```

```
[209]: print(tot_crosses)
       print(same_crosses)
```

```
80
0
```

```
[210]: print(len(generation_info))
```

```
11
```

```
[211]: generation_info[0]
```

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```
[29]: #print(get_fitness_value(generation_info[0]["members"][0]))
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```
[212]: print(anmol_arr)
```

```

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        obj={}
        print(type(anmol_arr[0]["errors_returned"]))
        obj["anmol_arr"]=anmol_arr
        obj["generation_info"]=generation_info
        obj["trace_arr"]=trace_arr
```

```
#print(type(anmol_arr))
#obj["b"]=[1,2,3,4]
json.dump(obj, fd)
```

```
<class 'list'>
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```
#print(len(generation_info)) with open('json_dump.txt','w') as fd: for obj in generation_info:
#print(obj) obj = {'members': obj['members'].tolist()} json.dump(obj, fd)
```

1 json.dumps(generation_info)

2 print(generation_info)

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[214]: print("trace_arr is ", trace_arr)
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    for i in range(0, 11):
        data[i].append(doc['try_vector'][i])

    data['errors_training'].append(doc['errors'][0])
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# print(data)

df = pd.DataFrame(data).sort_values(
    by=['errors_training', 'errors_validation'])
print(df)
with open('history.txt', 'w') as f:
    print(df, file=f)

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[]:

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