

# Real-Time Game Analytics

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## 1 Installing Microgear Package

```
[1]: pip install microgear
```

```
Collecting microgear
  Downloading https://files.pythonhosted.org/packages/11/8a/3e2350e3848586aaad7d
26dd643275924ac062bf538a9291417c7c8e5027/microgear-1.2.7.tar.gz
Collecting paho-mqtt==1.2.3
  Downloading https://files.pythonhosted.org/packages/ce/27/28ac0859fb8d63
754ec51659be265bf3b89d1568c5f6736d21026e11ea85/paho-mqtt-1.2.3.tar.gz (72kB)
    |                                     | 81kB 4.1MB/s
Requirement already satisfied: requests in /usr/local/lib/python3.7/dist-
packages (from microgear) (2.23.0)
Requirement already satisfied: certifi in /usr/local/lib/python3.7/dist-packages
(from microgear) (2021.5.30)
Requirement already satisfied: chardet<4,>=3.0.2 in
/usr/local/lib/python3.7/dist-packages (from requests->microgear) (3.0.4)
Requirement already satisfied: idna<3,>=2.5 in /usr/local/lib/python3.7/dist-
packages (from requests->microgear) (2.10)
Requirement already satisfied: urllib3!=1.25.0,!1.25.1,<1.26,>=1.21.1 in
/usr/local/lib/python3.7/dist-packages (from requests->microgear) (1.24.3)
Building wheels for collected packages: microgear, paho-mqtt
  Building wheel for microgear (setup.py) ... done
  Created wheel for microgear: filename=microgear-1.2.7-cp37-none-any.whl
size=5627
sha256=795ee7dd3dad7ae23ef7cbcbf987f346312be639eab6be29425be2c72a5202b6
  Stored in directory: /root/.cache/pip/wheels/58/f9/a6/753dc9fe5a295f8e62fd0947
d0629f169d388c8e2d7f68fb0e
  Building wheel for paho-mqtt (setup.py) ... done
  Created wheel for paho-mqtt: filename=paho_mqtt-1.2.3-cp37-none-any.whl
size=41745
sha256=cf347752cfc427c448e52b6e6165cadff38d76ced78f1a66b2d2c73b27a1359a
  Stored in directory: /root/.cache/pip/wheels/db/5c/28/e7b7a4620a491c69b0890251
09ea834fb3bac94ef159521e6c
Successfully built microgear paho-mqtt
Installing collected packages: paho-mqtt, microgear
Successfully installed microgear-1.2.7 paho-mqtt-1.2.3
```

## 2 Uploading JSON Files

```
[2]: import io  
import pandas as pd  
from google.colab import files
```

```
[3]: uploaded = files.upload()
```

<IPython.core.display.HTML object>

Saving log-player-detailed.json to log-player-detailed.json

Saving log-player-updated.json to log-player-updated.json

Saving log-record.json to log-record.json

### 3 Message Handling

```
[4]: def pull(msg):
    ls = msg.strip('b\\').split(',')

    '''
        ls = [cur, player, state,
              x, y, coin, destroyed, shot]
    '''

    info = OrderedDict({
        'player': ls[1],
        'time': float(ls[0]),
        'state': ls[2],      # play, over, quit
        'x': int(ls[3]),
        'y': int(ls[4]),
        'coin': int(ls[5]),
        'destroyed': int(ls[6]),
        'shot': int(ls[7]),
        'shot_no_enemy': int(ls[7]) - int(ls[6])
    })

    return info

def push_record(info):
    filename = 'log-record.json'

    with open(filename, 'r') as infile:
        try:
            old_data = json.load(infile)
        except JSONDecodeError:
            old_data = []

    data = old_data + [info]

    with open(filename, 'w', encoding='utf-8') as outfile:
        json.dump(data, outfile, ensure_ascii=False, indent=4)
```

## 4 Classifier

```
[5]: import math
from sklearn.cluster import KMeans
import warnings

def classify(X):
    with warnings.catch_warnings():
        warnings.simplefilter("ignore")
        kmeans = KMeans(n_clusters=4, random_state=0).fit(X)
        list_label = kmeans.labels_
        list_centroid = kmeans.cluster_centers_

    list_group = ['a']*len(list_label)
    distinct_label = list(set(list_label))
    num_group = len(distinct_label)
    list_coin = [v[2] for v in list_centroid[:num_group]]
    list_destroyed = [v[3] for v in list_centroid[:num_group]]

    for k in range(num_group):
        if math.floor(k/2) == 0:
            adj = 'Hardcore'
        else:
            adj = 'Casual'

        if k % 2 == 0:
            label = list_coin.index(max(list_coin))
            overall_group = 'Achiever'
        else:
            label = list_destroyed.index(max(list_destroyed))
            overall_group = 'Killer'

        for i, v in enumerate(list_label):
            if v == label:
                list_group[i] = adj + ' ' + overall_group

    list_coin[label] = -10000
    list_destroyed[label] = -10000

    return list_group
```

## 5 Server

```
[ ]: import microgear.client as client
import logging
import time

from collections import OrderedDict
import json
from json.decoder import JSONDecodeError

appid = "SongkomkritIoT"
gearkey = "8btiHfpRazatGmb"
gearsecret = "RohBYJNo7zoAk4onKvpjltPB"

client.create(gearkey, gearsecret, appid, {'debugmode': True})
client.setalias("SERVER")

def callback_connect():
    print("Now I am connected with netpie")

with open('log-player-updated.json', 'r') as infile:
    try:
        summary = json.load(infile)
    except JSONDecodeError:
        summary = OrderedDict()

num_players = len(summary)
X = [[-1000*v]*6 for v in range(1,5)]
reserved = '#@$'
P = [reserved]*4

if num_players > 0:
    i = 0

    for player in summary.keys():
        X.append(summary[player]['attr'])
        P.append(player)

        if i < 4:
            X.pop(0)
            P.pop(0)

        i += 1
```

```

def callback_message(topic, msg):
    print(topic, ": ", msg)
    global summary, num_players, X, P
    info = pull(msg)
    push_record(info)
    player = info['player']

    if player not in summary:
        # attr = avg of ['x', 'y', 'coin', 'destroyed', 'shot', 'shot_no_enemy']
        summary.update(OrderedDict({player: {'group': 'null',
                                                'time': 0,
                                                'count': 0,
                                                'attr': [0]*6}}))

        if num_players < 4:
            X.pop(0)
            P.pop(0)

    if info['state'] != 'play':
        summary[player]['time'] = info['time']
        summary[player]['count'] += 1
        count = summary[player]['count']

        cur_attr = []

        for i, v in enumerate(['x', 'y', 'coin', 'destroyed', 'shot',
↪ 'shot_no_enemy']):
            cur_attr.append(info[v])
            summary[player]['attr'][i] = ((count-1)*summary[player]['attr'][i]
↪ + info[v])/count

        if player in P:
            X.pop(P.index(player))
            P.remove(player)
        else:
            num_players += 1

    X.append(summary[player]['attr'])
    P.append(player)
    list_group = classify(X)

```

```

for i in range(len(P)):
    if P[i] != '#@$':
        summary[P[i]]['group'] = list_group[i]

    client.publish("/group", player + ',' + summary[player]['group'] + ',' +
↪+ str(info['time']))

with open('log-player-updated.json', 'w', encoding='utf-8') as outfile:
    json.dump(summary, outfile, ensure_ascii=False, indent=4)

current = OrderedDict({'player': player,
                        'group': summary[player]['group'],
                        'time': info['time'],
                        'count': count,
                        'attr': cur_attr})

with open('log-player-detailed.json', 'r') as infile:
    try:
        old_data = json.load(infile)
    except JSONDecodeError:
        old_data = []

data = old_data + [current]

with open('log-player-detailed.json', 'w', encoding='utf-8') as outfile:
    json.dump(data, outfile, ensure_ascii=False, indent=4)

def callback_error(msg):
    print("error", msg)

client.on_connect = callback_connect
client.on_message = callback_message
client.on_error = callback_error
client.subscribe("/game")
client.connect(True)

```

## 6 Server Logs

### 6.1 Game 1: Sam

In his first game, Sam collects no coin and destroys no enemy. He accidentally quits the program.

```
[7]: with open('log-record.json', 'r') as infile:
    try:
        print(json.dumps(json.load(infile), indent=4))
    except JSONDecodeError:
        pass
```

```
[
  {
    "player": "SAM",
    "time": 1625221660.2034533,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625221661.2065723,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625221662.0598617,
    "state": "quit",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  }
]
```



However, Sam is a hardcore achiever based on his first performance.

```
[8]: with open('log-player-detailed.json', 'r') as infile:
      try:
          print(json.dumps(json.load(infile), indent=4))
      except JSONDecodeError:
          pass
```

```
[
  {
    "player": "SAM",
    "group": "Hardcore Achiever",
    "time": 1625221662.0598617,
    "count": 1,
    "attr": [
      0,
      0,
      0,
      0,
      0,
      0
    ]
  }
]
```

```
[9]: with open('log-player-updated.json', 'r') as infile:
      try:
          print(json.dumps(json.load(infile), indent=4))
      except JSONDecodeError:
          pass
```

```
{
  "SAM": {
    "group": "Hardcore Achiever",
    "time": 1625221662.0598617,
    "count": 1,
    "attr": [
      0.0,
      0.0,
      0.0,
      0.0,
      0.0,
      0.0
    ]
  }
}
```

## 6.2 Game 2: Pat

In his first game, Pat collects a coin and destroys six enemies. The game is over. He quits the program.

```
[11]: with open('log-record.json', 'r') as infile:
      try:
          print(json.dumps(json.load(infile), indent=4))
      except JSONDecodeError:
          pass
```

```
[
  {
    "player": "SAM",
    "time": 1625221660.2034533,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625221661.2065723,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625221662.0598617,
    "state": "quit",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221781.6594229,
```

```
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221782.6722002,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221783.6826255,
    "state": "play",
    "x": 1,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221784.6915903,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 1,
    "shot": 1,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221785.7048168,
    "state": "play",
    "x": 1,
    "y": 0,
    "coin": 0,
```

```
    "destroyed": 1,
    "shot": 1,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221786.719005,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 1,
    "shot": 2,
    "shot_no_enemy": 1
  },
  {
    "player": "PAT",
    "time": 1625221787.7333183,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 1,
    "shot": 3,
    "shot_no_enemy": 2
  },
  {
    "player": "PAT",
    "time": 1625221788.7393677,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 2,
    "shot": 3,
    "shot_no_enemy": 1
  },
  {
    "player": "PAT",
    "time": 1625221789.7407355,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 3,
    "shot": 4,
    "shot_no_enemy": 1
  },
}
```

```
{
  "player": "PAT",
  "time": 1625221790.7440042,
  "state": "play",
  "x": 1,
  "y": 0,
  "coin": 0,
  "destroyed": 4,
  "shot": 5,
  "shot_no_enemy": 1
},
{
  "player": "PAT",
  "time": 1625221791.7566867,
  "state": "play",
  "x": 0,
  "y": 0,
  "coin": 0,
  "destroyed": 4,
  "shot": 5,
  "shot_no_enemy": 1
},
{
  "player": "PAT",
  "time": 1625221792.7643702,
  "state": "play",
  "x": 0,
  "y": 0,
  "coin": 0,
  "destroyed": 4,
  "shot": 6,
  "shot_no_enemy": 2
},
{
  "player": "PAT",
  "time": 1625221793.765902,
  "state": "play",
  "x": 0,
  "y": 0,
  "coin": 1,
  "destroyed": 5,
  "shot": 6,
  "shot_no_enemy": 1
},
{
  "player": "PAT",
  "time": 1625221794.776921,
  "state": "play",
```

```
    "x": 0,  
    "y": 0,  
    "coin": 1,  
    "destroyed": 5,  
    "shot": 7,  
    "shot_no_enemy": 2  
  },  
  {  
    "player": "PAT",  
    "time": 1625221795.7906733,  
    "state": "play",  
    "x": 0,  
    "y": 1,  
    "coin": 1,  
    "destroyed": 6,  
    "shot": 7,  
    "shot_no_enemy": 1  
  },  
  {  
    "player": "PAT",  
    "time": 1625221796.6378002,  
    "state": "over",  
    "x": 0,  
    "y": 1,  
    "coin": 1,  
    "destroyed": 6,  
    "shot": 7,  
    "shot_no_enemy": 1  
  }  
]
```

Pat is a hardcore achiever based on his performance in comparison to Sam.

```
[12]: with open('log-player-detailed.json', 'r') as infile:
      try:
          print(json.dumps(json.load(infile), indent=4))
      except JSONDecodeError:
          pass
```

```
[
  {
    "player": "SAM",
    "group": "Hardcore Achiever",
    "time": 1625221662.0598617,
    "count": 1,
    "attr": [
      0,
      0,
      0,
      0,
      0,
      0
    ]
  },
  {
    "player": "PAT",
    "group": "Hardcore Achiever",
    "time": 1625221796.6378002,
    "count": 1,
    "attr": [
      0,
      1,
      1,
      6,
      7,
      1
    ]
  }
]
```

This changes Sam to be a hardcore killer instead.

```
[13]: with open('log-player-updated.json', 'r') as infile:
      try:
          print(json.dumps(json.load(infile), indent=4))
      except JSONDecodeError:
          pass
```

```
{
  "SAM": {
    "group": "Hardcore Killer",
    "time": 1625221662.0598617,
    "count": 1,
    "attr": [
      0.0,
      0.0,
      0.0,
      0.0,
      0.0,
      0.0
    ]
  },
  "PAT": {
    "group": "Hardcore Achiever",
    "time": 1625221796.6378002,
    "count": 1,
    "attr": [
      0.0,
      1.0,
      1.0,
      6.0,
      7.0,
      1.0
    ]
  }
}
```



### 6.3 Game 3: Sam

In his second game, Sam still collects no coin and destroys no enemy. The game is over, but Sam will play the game again. The program is still running.

```
[15]: with open('log-record.json', 'r') as infile:
      try:
          print(json.dumps(json.load(infile), indent=4))
      except JSONDecodeError:
          pass
```

```
[
  {
    "player": "SAM",
    "time": 1625221660.2034533,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625221661.2065723,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625221662.0598617,
    "state": "quit",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221781.6594229,
```

```
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221782.6722002,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221783.6826255,
    "state": "play",
    "x": 1,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221784.6915903,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 1,
    "shot": 1,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221785.7048168,
    "state": "play",
    "x": 1,
    "y": 0,
    "coin": 0,
```

```
    "destroyed": 1,
    "shot": 1,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221786.719005,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 1,
    "shot": 2,
    "shot_no_enemy": 1
  },
  {
    "player": "PAT",
    "time": 1625221787.7333183,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 1,
    "shot": 3,
    "shot_no_enemy": 2
  },
  {
    "player": "PAT",
    "time": 1625221788.7393677,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 2,
    "shot": 3,
    "shot_no_enemy": 1
  },
  {
    "player": "PAT",
    "time": 1625221789.7407355,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 3,
    "shot": 4,
    "shot_no_enemy": 1
  },
}
```

```
{
  "player": "PAT",
  "time": 1625221790.7440042,
  "state": "play",
  "x": 1,
  "y": 0,
  "coin": 0,
  "destroyed": 4,
  "shot": 5,
  "shot_no_enemy": 1
},
{
  "player": "PAT",
  "time": 1625221791.7566867,
  "state": "play",
  "x": 0,
  "y": 0,
  "coin": 0,
  "destroyed": 4,
  "shot": 5,
  "shot_no_enemy": 1
},
{
  "player": "PAT",
  "time": 1625221792.7643702,
  "state": "play",
  "x": 0,
  "y": 0,
  "coin": 0,
  "destroyed": 4,
  "shot": 6,
  "shot_no_enemy": 2
},
{
  "player": "PAT",
  "time": 1625221793.765902,
  "state": "play",
  "x": 0,
  "y": 0,
  "coin": 1,
  "destroyed": 5,
  "shot": 6,
  "shot_no_enemy": 1
},
{
  "player": "PAT",
  "time": 1625221794.776921,
  "state": "play",
```

```
    "x": 0,  
    "y": 0,  
    "coin": 1,  
    "destroyed": 5,  
    "shot": 7,  
    "shot_no_enemy": 2  
  },  
  {  
    "player": "PAT",  
    "time": 1625221795.7906733,  
    "state": "play",  
    "x": 0,  
    "y": 1,  
    "coin": 1,  
    "destroyed": 6,  
    "shot": 7,  
    "shot_no_enemy": 1  
  },  
  {  
    "player": "PAT",  
    "time": 1625221796.6378002,  
    "state": "over",  
    "x": 0,  
    "y": 1,  
    "coin": 1,  
    "destroyed": 6,  
    "shot": 7,  
    "shot_no_enemy": 1  
  },  
  {  
    "player": "SAM",  
    "time": 1625221931.7301683,  
    "state": "play",  
    "x": 0,  
    "y": 0,  
    "coin": 0,  
    "destroyed": 0,  
    "shot": 0,  
    "shot_no_enemy": 0  
  },  
  {  
    "player": "SAM",  
    "time": 1625221932.745238,  
    "state": "play",  
    "x": 0,  
    "y": 0,  
    "coin": 0,  
    "destroyed": 0,
```

```
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625221933.751109,
    "state": "play",
    "x": 1,
    "y": 1,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625221934.7578068,
    "state": "play",
    "x": 1,
    "y": 1,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625221935.018242,
    "state": "over",
    "x": 1,
    "y": 1,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  }
]
```

Although Sam is a hardcore achiever in his first game, he is now a hardcore killer in his second game. This is based on his average performance in comparison to Pat.

```
[16]: with open('log-player-detailed.json', 'r') as infile:
      try:
          print(json.dumps(json.load(infile), indent=4))
      except JSONDecodeError:
          pass
```

```
[
  {
    "player": "SAM",
    "group": "Hardcore Achiever",
    "time": 1625221662.0598617,
    "count": 1,
    "attr": [
      0,
      0,
      0,
      0,
      0,
      0
    ]
  },
  {
    "player": "PAT",
    "group": "Hardcore Achiever",
    "time": 1625221796.6378002,
    "count": 1,
    "attr": [
      0,
      1,
      1,
      6,
      7,
      1
    ]
  },
  {
    "player": "SAM",
    "group": "Hardcore Killer",
    "time": 1625221935.018242,
    "count": 2,
    "attr": [
      1,
      1,
      0,
      0,

```

```

        0,
        0
    ]
}
]

```

After Sam finishes his second game, Pat is still a hardcore achiever.

```

[17]: with open('log-player-updated.json', 'r') as infile:
    try:
        print(json.dumps(json.load(infile), indent=4))
    except JSONDecodeError:
        pass

```

```

{
  "SAM": {
    "group": "Hardcore Killer",
    "time": 1625221935.018242,
    "count": 2,
    "attr": [
      0.5,
      0.5,
      0.0,
      0.0,
      0.0,
      0.0
    ]
  },
  "PAT": {
    "group": "Hardcore Achiever",
    "time": 1625221796.6378002,
    "count": 1,
    "attr": [
      0.0,
      1.0,
      1.0,
      6.0,
      7.0,
      1.0
    ]
  }
}

```



## 6.4 Game 4: Sam

In his third game, Sam makes a significant improvement: 10 collected coins and 29 destroyed enemies.

```
[19]: with open('log-record.json', 'r') as infile:
      try:
          print(json.dumps(json.load(infile), indent=4))
      except JSONDecodeError:
          pass
```

```
[
  {
    "player": "SAM",
    "time": 1625221660.2034533,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625221661.2065723,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625221662.0598617,
    "state": "quit",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221781.6594229,
```

```

    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221782.6722002,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221783.6826255,
    "state": "play",
    "x": 1,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221784.6915903,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 1,
    "shot": 1,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221785.7048168,
    "state": "play",
    "x": 1,
    "y": 0,
    "coin": 0,

```

```
    "destroyed": 1,
    "shot": 1,
    "shot_no_enemy": 0
  },
  {
    "player": "PAT",
    "time": 1625221786.719005,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 1,
    "shot": 2,
    "shot_no_enemy": 1
  },
  {
    "player": "PAT",
    "time": 1625221787.7333183,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 1,
    "shot": 3,
    "shot_no_enemy": 2
  },
  {
    "player": "PAT",
    "time": 1625221788.7393677,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 2,
    "shot": 3,
    "shot_no_enemy": 1
  },
  {
    "player": "PAT",
    "time": 1625221789.7407355,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 3,
    "shot": 4,
    "shot_no_enemy": 1
  },
}
```

```
{
  "player": "PAT",
  "time": 1625221790.7440042,
  "state": "play",
  "x": 1,
  "y": 0,
  "coin": 0,
  "destroyed": 4,
  "shot": 5,
  "shot_no_enemy": 1
},
{
  "player": "PAT",
  "time": 1625221791.7566867,
  "state": "play",
  "x": 0,
  "y": 0,
  "coin": 0,
  "destroyed": 4,
  "shot": 5,
  "shot_no_enemy": 1
},
{
  "player": "PAT",
  "time": 1625221792.7643702,
  "state": "play",
  "x": 0,
  "y": 0,
  "coin": 0,
  "destroyed": 4,
  "shot": 6,
  "shot_no_enemy": 2
},
{
  "player": "PAT",
  "time": 1625221793.765902,
  "state": "play",
  "x": 0,
  "y": 0,
  "coin": 1,
  "destroyed": 5,
  "shot": 6,
  "shot_no_enemy": 1
},
{
  "player": "PAT",
  "time": 1625221794.776921,
  "state": "play",
```

```
    "x": 0,  
    "y": 0,  
    "coin": 1,  
    "destroyed": 5,  
    "shot": 7,  
    "shot_no_enemy": 2  
  },  
  {  
    "player": "PAT",  
    "time": 1625221795.7906733,  
    "state": "play",  
    "x": 0,  
    "y": 1,  
    "coin": 1,  
    "destroyed": 6,  
    "shot": 7,  
    "shot_no_enemy": 1  
  },  
  {  
    "player": "PAT",  
    "time": 1625221796.6378002,  
    "state": "over",  
    "x": 0,  
    "y": 1,  
    "coin": 1,  
    "destroyed": 6,  
    "shot": 7,  
    "shot_no_enemy": 1  
  },  
  {  
    "player": "SAM",  
    "time": 1625221931.7301683,  
    "state": "play",  
    "x": 0,  
    "y": 0,  
    "coin": 0,  
    "destroyed": 0,  
    "shot": 0,  
    "shot_no_enemy": 0  
  },  
  {  
    "player": "SAM",  
    "time": 1625221932.745238,  
    "state": "play",  
    "x": 0,  
    "y": 0,  
    "coin": 0,  
    "destroyed": 0,
```

```
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625221933.751109,
    "state": "play",
    "x": 1,
    "y": 1,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625221934.7578068,
    "state": "play",
    "x": 1,
    "y": 1,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625221935.018242,
    "state": "over",
    "x": 1,
    "y": 1,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625222109.2713842,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
```

```
    "player": "SAM",
    "time": 1625222110.2811248,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625222111.288099,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625222112.2929077,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625222113.3007379,
    "state": "play",
    "x": 1,
    "y": 0,
    "coin": 0,
    "destroyed": 0,
    "shot": 0,
    "shot_no_enemy": 0
  },
  {
    "player": "SAM",
    "time": 1625222114.3069515,
    "state": "play",
    "x": 0,
```

```
    "y": 0,  
    "coin": 0,  
    "destroyed": 1,  
    "shot": 1,  
    "shot_no_enemy": 0  
  },  
  {  
    "player": "SAM",  
    "time": 1625222115.3112104,  
    "state": "play",  
    "x": 1,  
    "y": 0,  
    "coin": 0,  
    "destroyed": 1,  
    "shot": 1,  
    "shot_no_enemy": 0  
  },  
  {  
    "player": "SAM",  
    "time": 1625222116.311626,  
    "state": "play",  
    "x": 1,  
    "y": 0,  
    "coin": 0,  
    "destroyed": 2,  
    "shot": 2,  
    "shot_no_enemy": 0  
  },  
  {  
    "player": "SAM",  
    "time": 1625222117.3206189,  
    "state": "play",  
    "x": 0,  
    "y": 0,  
    "coin": 0,  
    "destroyed": 3,  
    "shot": 3,  
    "shot_no_enemy": 0  
  },  
  {  
    "player": "SAM",  
    "time": 1625222118.3259568,  
    "state": "play",  
    "x": 0,  
    "y": 0,  
    "coin": 0,  
    "destroyed": 3,  
    "shot": 4,
```



```

    "shot_no_enemy": 1
  },
  {
    "player": "SAM",
    "time": 1625222119.329775,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 0,
    "destroyed": 3,
    "shot": 5,
    "shot_no_enemy": 2
  },
  {
    "player": "SAM",
    "time": 1625222120.3376591,
    "state": "play",
    "x": 1,
    "y": 0,
    "coin": 0,
    "destroyed": 4,
    "shot": 6,
    "shot_no_enemy": 2
  },
  {
    "player": "SAM",
    "time": 1625222121.337904,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 1,
    "destroyed": 5,
    "shot": 7,
    "shot_no_enemy": 2
  },
  {
    "player": "SAM",
    "time": 1625222122.3511088,
    "state": "play",
    "x": 1,
    "y": 0,
    "coin": 1,
    "destroyed": 6,
    "shot": 7,
    "shot_no_enemy": 1
  },
  {
    "player": "SAM",

```

```
    "time": 1625222123.3619573,  
    "state": "play",  
    "x": 1,  
    "y": 0,  
    "coin": 1,  
    "destroyed": 7,  
    "shot": 8,  
    "shot_no_enemy": 1  
  },  
  {  
    "player": "SAM",  
    "time": 1625222124.3764427,  
    "state": "play",  
    "x": 0,  
    "y": 0,  
    "coin": 1,  
    "destroyed": 7,  
    "shot": 9,  
    "shot_no_enemy": 2  
  },  
  {  
    "player": "SAM",  
    "time": 1625222125.387129,  
    "state": "play",  
    "x": 1,  
    "y": 0,  
    "coin": 1,  
    "destroyed": 8,  
    "shot": 9,  
    "shot_no_enemy": 1  
  },  
  {  
    "player": "SAM",  
    "time": 1625222126.3874156,  
    "state": "play",  
    "x": 0,  
    "y": 0,  
    "coin": 1,  
    "destroyed": 8,  
    "shot": 10,  
    "shot_no_enemy": 2  
  },  
  {  
    "player": "SAM",  
    "time": 1625222127.395734,  
    "state": "play",  
    "x": 0,  
    "y": 0,
```

```

    "coin": 2,
    "destroyed": 9,
    "shot": 11,
    "shot_no_enemy": 2
  },
  {
    "player": "SAM",
    "time": 1625222128.4003205,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 2,
    "destroyed": 10,
    "shot": 12,
    "shot_no_enemy": 2
  },
  {
    "player": "SAM",
    "time": 1625222129.4136791,
    "state": "play",
    "x": 1,
    "y": 0,
    "coin": 2,
    "destroyed": 10,
    "shot": 12,
    "shot_no_enemy": 2
  },
  {
    "player": "SAM",
    "time": 1625222130.4201477,
    "state": "play",
    "x": 1,
    "y": 0,
    "coin": 2,
    "destroyed": 11,
    "shot": 13,
    "shot_no_enemy": 2
  },
  {
    "player": "SAM",
    "time": 1625222131.4215124,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 2,
    "destroyed": 11,
    "shot": 14,
    "shot_no_enemy": 3
  }

```

```
},
{
  "player": "SAM",
  "time": 1625222132.435194,
  "state": "play",
  "x": 1,
  "y": 0,
  "coin": 2,
  "destroyed": 11,
  "shot": 14,
  "shot_no_enemy": 3
},
{
  "player": "SAM",
  "time": 1625222133.4363651,
  "state": "play",
  "x": 1,
  "y": 0,
  "coin": 2,
  "destroyed": 12,
  "shot": 15,
  "shot_no_enemy": 3
},
{
  "player": "SAM",
  "time": 1625222134.443802,
  "state": "play",
  "x": 1,
  "y": 0,
  "coin": 3,
  "destroyed": 13,
  "shot": 16,
  "shot_no_enemy": 3
},
{
  "player": "SAM",
  "time": 1625222135.4540632,
  "state": "play",
  "x": 1,
  "y": 0,
  "coin": 3,
  "destroyed": 13,
  "shot": 17,
  "shot_no_enemy": 4
},
{
  "player": "SAM",
  "time": 1625222136.461122,
```

```
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 3,
    "destroyed": 13,
    "shot": 18,
    "shot_no_enemy": 5
  },
  {
    "player": "SAM",
    "time": 1625222137.4637244,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 3,
    "destroyed": 15,
    "shot": 19,
    "shot_no_enemy": 4
  },
  {
    "player": "SAM",
    "time": 1625222138.4664936,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 3,
    "destroyed": 15,
    "shot": 19,
    "shot_no_enemy": 4
  },
  {
    "player": "SAM",
    "time": 1625222139.4672754,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 3,
    "destroyed": 15,
    "shot": 19,
    "shot_no_enemy": 4
  },
  {
    "player": "SAM",
    "time": 1625222140.469678,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 3,
```

```
    "destroyed": 16,  
    "shot": 21,  
    "shot_no_enemy": 5  
  },  
  {  
    "player": "SAM",  
    "time": 1625222141.4709733,  
    "state": "play",  
    "x": 0,  
    "y": 0,  
    "coin": 3,  
    "destroyed": 16,  
    "shot": 21,  
    "shot_no_enemy": 5  
  },  
  {  
    "player": "SAM",  
    "time": 1625222142.4846,  
    "state": "play",  
    "x": 0,  
    "y": 0,  
    "coin": 3,  
    "destroyed": 16,  
    "shot": 22,  
    "shot_no_enemy": 6  
  },  
  {  
    "player": "SAM",  
    "time": 1625222143.4913101,  
    "state": "play",  
    "x": 1,  
    "y": 0,  
    "coin": 4,  
    "destroyed": 17,  
    "shot": 23,  
    "shot_no_enemy": 6  
  },  
  {  
    "player": "SAM",  
    "time": 1625222144.4927514,  
    "state": "play",  
    "x": 0,  
    "y": 0,  
    "coin": 4,  
    "destroyed": 17,  
    "shot": 24,  
    "shot_no_enemy": 7  
  },  
}
```

```
{
  "player": "SAM",
  "time": 1625222145.4946048,
  "state": "play",
  "x": 0,
  "y": 0,
  "coin": 5,
  "destroyed": 19,
  "shot": 25,
  "shot_no_enemy": 6
},
{
  "player": "SAM",
  "time": 1625222146.5016575,
  "state": "play",
  "x": 0,
  "y": 0,
  "coin": 5,
  "destroyed": 20,
  "shot": 26,
  "shot_no_enemy": 6
},
{
  "player": "SAM",
  "time": 1625222147.5160763,
  "state": "play",
  "x": 0,
  "y": 0,
  "coin": 5,
  "destroyed": 20,
  "shot": 26,
  "shot_no_enemy": 6
},
{
  "player": "SAM",
  "time": 1625222148.5280342,
  "state": "play",
  "x": 0,
  "y": 0,
  "coin": 6,
  "destroyed": 21,
  "shot": 27,
  "shot_no_enemy": 6
},
{
  "player": "SAM",
  "time": 1625222149.5347295,
  "state": "play",
```

```
    "x": 0,
    "y": 0,
    "coin": 6,
    "destroyed": 21,
    "shot": 28,
    "shot_no_enemy": 7
  },
  {
    "player": "SAM",
    "time": 1625222150.5463967,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 6,
    "destroyed": 23,
    "shot": 29,
    "shot_no_enemy": 6
  },
  {
    "player": "SAM",
    "time": 1625222151.5465193,
    "state": "play",
    "x": 1,
    "y": 0,
    "coin": 7,
    "destroyed": 24,
    "shot": 30,
    "shot_no_enemy": 6
  },
  {
    "player": "SAM",
    "time": 1625222152.5681565,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 7,
    "destroyed": 24,
    "shot": 31,
    "shot_no_enemy": 7
  },
  {
    "player": "SAM",
    "time": 1625222153.5704672,
    "state": "play",
    "x": 0,
    "y": 0,
    "coin": 8,
    "destroyed": 26,
```



```

    "shot": 32,
    "shot_no_enemy": 6
  },
  {
    "player": "SAM",
    "time": 1625222154.586861,
    "state": "play",
    "x": 1,
    "y": 0,
    "coin": 9,
    "destroyed": 27,
    "shot": 33,
    "shot_no_enemy": 6
  },
  {
    "player": "SAM",
    "time": 1625222155.5985153,
    "state": "play",
    "x": 1,
    "y": 0,
    "coin": 9,
    "destroyed": 28,
    "shot": 35,
    "shot_no_enemy": 7
  },
  {
    "player": "SAM",
    "time": 1625222156.6047728,
    "state": "play",
    "x": 1,
    "y": 0,
    "coin": 10,
    "destroyed": 29,
    "shot": 36,
    "shot_no_enemy": 7
  },
  {
    "player": "SAM",
    "time": 1625222156.7387648,
    "state": "over",
    "x": 1,
    "y": 0,
    "coin": 10,
    "destroyed": 29,
    "shot": 37,
    "shot_no_enemy": 8
  }
}

```

]

As a result, Sam's player type changes from a hardcore killer to a hardcore achiever.

```
[20]: with open('log-player-detailed.json', 'r') as infile:
      try:
          print(json.dumps(json.load(infile), indent=4))
      except JSONDecodeError:
          pass
```

```
[
  {
    "player": "SAM",
    "group": "Hardcore Achiever",
    "time": 1625221662.0598617,
    "count": 1,
    "attr": [
      0,
      0,
      0,
      0,
      0,
      0
    ]
  },
  {
    "player": "PAT",
    "group": "Hardcore Achiever",
    "time": 1625221796.6378002,
    "count": 1,
    "attr": [
      0,
      1,
      1,
      6,
      7,
      1
    ]
  },
  {
    "player": "SAM",
    "group": "Hardcore Killer",
    "time": 1625221935.018242,
    "count": 2,
    "attr": [
      1,
      1,
      0,
      0,
      0,
      0
    ]
  }
]
```

```

        0
    ]
},
{
    "player": "SAM",
    "group": "Hardcore Achiever",
    "time": 1625222156.7387648,
    "count": 3,
    "attr": [
        1,
        0,
        10,
        29,
        37,
        8
    ]
}
]

```

Now, Pat becomes a hardcore killer in comparison to Sam's average performance across three games.

```

[21]: with open('log-player-updated.json', 'r') as infile:
    try:
        print(json.dumps(json.load(infile), indent=4))
    except JSONDecodeError:
        pass

```

```

{
  "SAM": {
    "group": "Hardcore Achiever",
    "time": 1625222156.7387648,
    "count": 3,
    "attr": [
      0.6666666666666666,
      0.3333333333333333,
      3.3333333333333335,
      9.666666666666666,
      12.333333333333334,
      2.6666666666666665
    ]
  },
  "PAT": {
    "group": "Hardcore Killer",
    "time": 1625221796.6378002,
    "count": 1,
    "attr": [
      0.0,
      1.0,

```

1.0,  
6.0,  
7.0,  
1.0

]

}

}