

# smallTraining-figs

July 24, 2023

```
[59]: import json
import torch
import os
import numpy as np
import torch
import torch.multiprocessing as mp
import torch
from torch.utils.data import DataLoader
import matplotlib
%matplotlib inline
import matplotlib.pyplot as plt
from dnaDataloader import experimentDataloader
from dnaDataloader import addData
from dnaModelUtil import test
from dnaModelUtil import printStats
from IPython.core.interactiveshell import InteractiveShell
import seaborn as sns
import pandas as pd
device = torch.device("cuda:1" if torch.cuda.is_available() else "cpu")
cpu = torch.device("cpu")
batch_size = 25
device
```

```
[59]: device(type='cuda', index=1)
```

```
[2]: try:
    mp.set_start_method('spawn')
except RuntimeError:
    pass # throws error if run twice without resetting the kernal, if its
    ↵already set we dont care that this errors
```

```
[3]: with open("./Models/modelsFromFirstRunOnSmallSet10minLength/results.json", 'r') as file:
    results = file.read()
results = json.loads(results)
results
```

```
[3]: {'1800_nM_AR_out': {'path': './Models/modelsFromFirstRunOnSmallSet10minLength/1800_nM_AR_out.pt',
  'acc': 0.54},
 '800_nM_AR_out': {'path': './Models/modelsFromFirstRunOnSmallSet10minLength/800_nM_AR_out.pt',
  'acc': 0.3700000000000005},
 '1200_nM_AR_out': {'path': './Models/modelsFromFirstRunOnSmallSet10minLength/1200_nM_AR_out.pt',
  'acc': 0.53},
 '400_nM_AR_out': {'path': './Models/modelsFromFirstRunOnSmallSet10minLength/400_nM_AR_out.pt',
  'acc': 0.4300000000000005},
 '50_nM_AR_out': {'path': './Models/modelsFromFirstRunOnSmallSet10minLength/50_nM_AR_out.pt',
  'acc': 0.8500000000000001},
 '100_nM_AR_out': {'path': './Models/modelsFromFirstRunOnSmallSet10minLength/100_nM_AR_out.pt',
  'acc': 0.52}}
```

```
[4]: folders = [d[0] for d in os.walk("/home/khood/GitHub/SNN-DNA-project/
 ↪Prepocessing/sorted_10min")][1:] # remove first one is it is "/home/khood/
 ↪GitHub/SNN-DNA-project/Prepocessing/sorted"
len(folders)
```

```
[4]: 6
```

```
[5]: datasets = []
featIn = 0
for d in folders:
    data = experimentDataloader(
        f"{d}/index.csv",
        f"{d}",
    )
    rawData = [d for d in data]
    featIn = len(rawData[0][0])
    trainValidData = []
    testData = []
    addData(testData, trainValidData, rawData, rhsSize=300)
    print(len(testData))

    np.random.shuffle(trainValidData)
    trainData = []
    validData = []
    addData(trainData, validData, trainValidData, ↪
        rhsSize=int(len(trainValidData)*(1/3)))

    datasets.append({"name": f"{os.path.basename(d)}",
```

```

        "train":DataLoader(trainData, batch_size=batch_size, u
↳shuffle=True) ,
        "valid":DataLoader(validData, batch_size=batch_size, u
↳shuffle=True) ,
        "test":DataLoader(testData, batch_size=len(testData), u
↳shuffle=True) ,
        "model": {}
    )

print(f"Training dataset size: {len(trainData)}")
print(f"Testing dataset size: {len(testData)}")
print(f"Valid dataset size: {len(validData)}")
print(f"Total: {len(trainData) + len(validData) + len(testData)}")

```

588

Training dataset size: 200

Testing dataset size: 588

Valid dataset size: 100

Total: 888

264

Training dataset size: 200

Testing dataset size: 264

Valid dataset size: 100

Total: 564

494

Training dataset size: 200

Testing dataset size: 494

Valid dataset size: 100

Total: 794

177

Training dataset size: 200

Testing dataset size: 177

Valid dataset size: 100

Total: 477

340

Training dataset size: 200

Testing dataset size: 340

Valid dataset size: 100

Total: 640

199

Training dataset size: 200

Testing dataset size: 199

Valid dataset size: 100

Total: 499

[6]: featIn

[6]: 12000

```
[7]: for d in datasets:
    print(f"-- {d['name']} --")
    print(f"train: {len(d['train'])}")
    print(f"valid: {len(d['valid'])}")
    print(f"test : {len(d['test'])}")

-- 1800_nM_AR_out --
train: 8
valid: 4
test : 1
-- 800_nM_AR_out --
train: 8
valid: 4
test : 1
-- 1200_nM_AR_out --
train: 8
valid: 4
test : 1
-- 400_nM_AR_out --
train: 8
valid: 4
test : 1
-- 50_nM_AR_out --
train: 8
valid: 4
test : 1
-- 100_nM_AR_out --
train: 8
valid: 4
test : 1

[8]: t = np.array([np.array(i[1]) for i in d['test']])
t.shape
```

[8]: (1, 199, 1)

```
[9]: manager = mp.Manager()
return_dict = manager.dict()
```

```
[10]: processes = []
devices = [torch.device("cuda:0"), torch.device("cuda:1"), torch.device("cuda:2"), torch.device("cuda:3")]
epochs = 1
error_margin = 20
for d in datasets:
    processes.append(mp.Process(target=test, args=(d["test"], results[d["name"]]["path"], d["name"], featIn, return_dict, epochs, error_margin, devices[0])))

```

```

    devices.append(devices.pop(0))

processes

[10]: [<Process name='Process-2' parent=2921487 initial>,
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[11]: print(f"{{return_dict}}")

{}

[12]: processesList = list(range(len(processes)))

while processesList:
    run = processesList[:4]
    processesList = processesList[4:]
    for i in run:
        processes[i].start()
    for i in run:
        processes[i].join()
        processes[i].terminate()
print(return_dict)

test 1800_nM_AR_out on cuda:0...
test 800_nM_AR_out on cuda:1...
test 1200_nM_AR_out on cuda:2...
test 400_nM_AR_out on cuda:3...
test 50_nM_AR_out on cuda:0...
test 100_nM_AR_out on cuda:1...
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[15]: defultePlotSize = plt.rcParams['figure.figsize']
plt.rcParams['figure.figsize'] = [20, 5]
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[16]: return_dict.keys()
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[66]: oringalFontSize = matplotlib.rcParams['font.size']
matplotlib.rcParams.update({'font.size': 25})
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matplotlib.rcParams.update({'font.size': oringalFontSize})
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[66]: 10.0
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[122]: oringalFontSize = matplotlib.rcParams['font.size']
matplotlib.rcParams.update({'font.size': 45})
for k in return_dict.keys():
    title = k.split("_")
    title.pop()
    title = ' '.join(title)
```

```

outputPlot = return_dict[k]["outputPlot"].astype("int32")
targetPlot = return_dict[k]["targetPlot"].astype("int32")
diffs = []
for i in range(len(outputPlot)):
    diffs.append(outputPlot[i] - targetPlot[i])
# printStats(targetPlot.flatten(), name=f"{title}")
printStats(diffs, name=f"{title} (prediction - real)" ,other=[f"accuracy:{return_dict[k]['acc']}"])
defultePlotSize = plt.rcParams['figure.figsize']
plt.rcParams['figure.figsize'] = [100, 40]
plt.subplot(1, 2, 1)
plt.title(f"{title}")
outputPlot = return_dict[k]["outputPlot"].astype("int32")
targetPlot = return_dict[k]["targetPlot"].astype("int32")
outputPlot = [i[0] for i in outputPlot]
targetPlot = [i[0] for i in targetPlot]
data = pd.DataFrame(data=np.stack((targetPlot, outputPlot)).T, columns=["actual", "predicted"])
data = data.melt(var_name='dataset', value_name='Number of Events')
# plt.figure(figsize=(7, 8))
plt.title(f"{title}")
ax = sns.barplot(x="dataset", y="Number of Events", data=data, errorbar='sd', capsize=.4)
plt.subplot(1, 2, 2)
plt.title(f"{title}")
ax = sns.boxplot(x="dataset", y="Number of Events", data=data)
plt.show()

outputPlot = return_dict[k]["outputPlot"].astype("int32")
targetPlot = return_dict[k]["targetPlot"].astype("int32")
outputPlot = [i[0] for i in outputPlot]
targetPlot = [i[0] for i in targetPlot]
data = np.stack((targetPlot, outputPlot))
data = data.T
data = data[data[:, 0].argsort()]
targetSort = data.T
data = np.stack((targetPlot, outputPlot))
data = data.T
data = data[data[:, 1].argsort()]
outputSort = data.T
plt.rcParams['figure.figsize'] = [150, 25]
plt.plot(range(len(targetSort[0])), targetSort[0], label="actual", lw=6)
plt.plot(range(len(targetSort[0])), targetSort[1], label="predicted", lw=6)
plt.fill_between(list(range(len(targetSort[0]))), targetSort[0], targetSort[1], alpha=0.25, color='teal')
plt.legend(ncol=2, loc='upper left')
plt.title(f"{title} \n sorted by actual")

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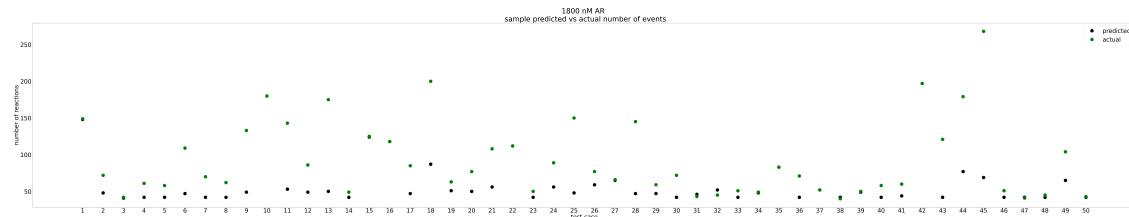
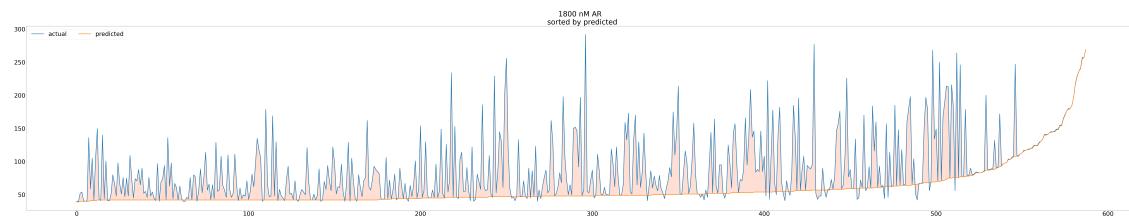
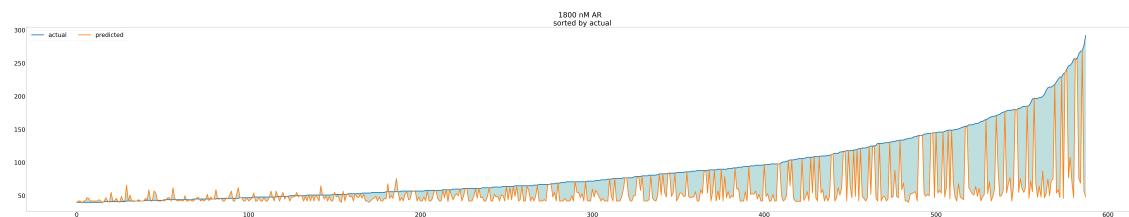
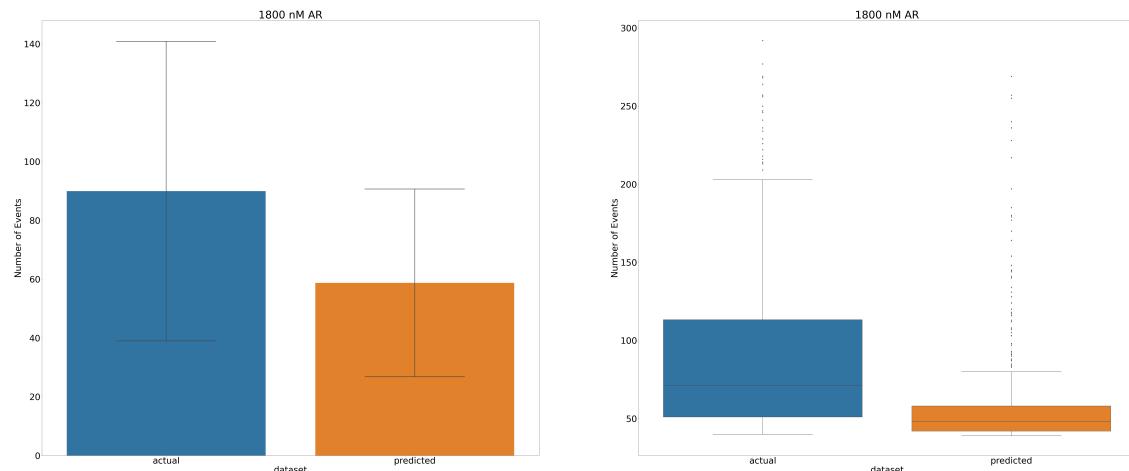
plt.show()
plt.plot(range(len(outputSort[0])), outputSort[0], label="actual", lw=4)
plt.plot(range(len(outputSort[0])), outputSort[1], label="predicted", lw=4)
plt.fill_between(list(range(len(outputSort[0]))), outputSort[0], □
↳outputSort[1], alpha=0.25, color='coral')
plt.legend(ncol=2, loc='upper left')
plt.title(f"title] \n sorted by predicted")
plt.show()
outputPlot = outputPlot[:50]
targetPlot = targetPlot[:50]
x_marks = [i + 1 for i in list(range(len(outputPlot)))]
plt.plot(x_marks, outputPlot, 'o', color='black', label="predicted", □
↳markersize=25)
plt.plot(x_marks, targetPlot, 'o', color='green', label="actual", □
↳markersize=25)
plt.xticks(ticks=x_marks, labels=x_marks)
plt.xlabel('test case')
plt.ylabel('number of reactions')
plt.title(f"title] \n sample predicted vs actual number of events")
plt.legend(loc='upper right')
plt.show()

matplotlib.rcParams.update({'font.size': oringalFontSize})

```

```

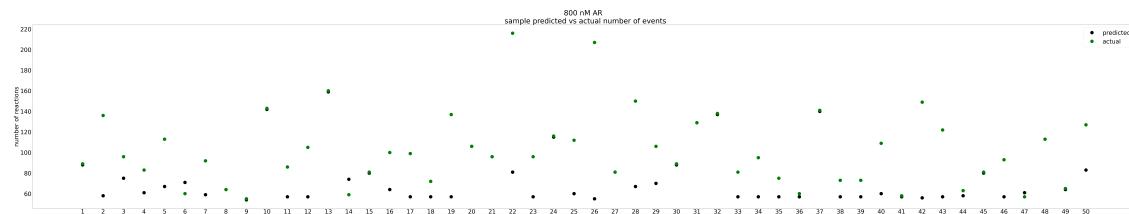
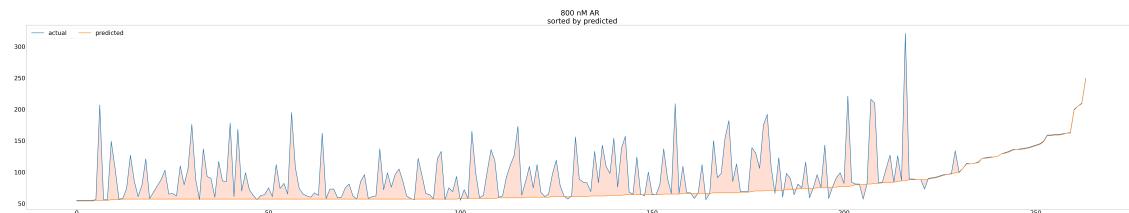
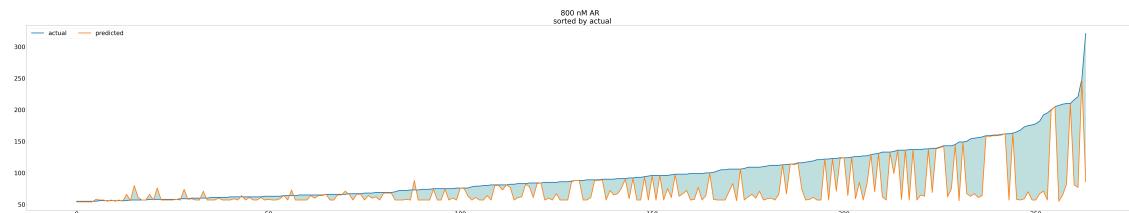
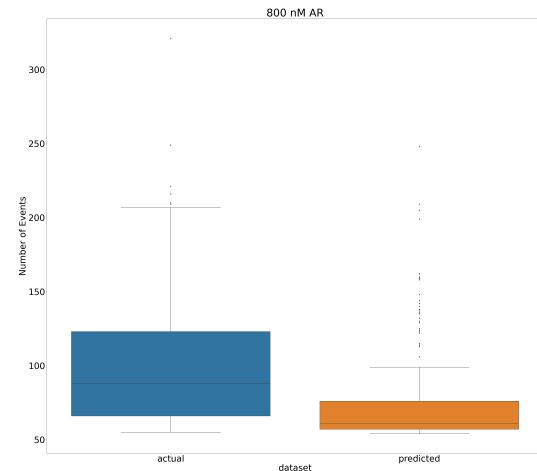
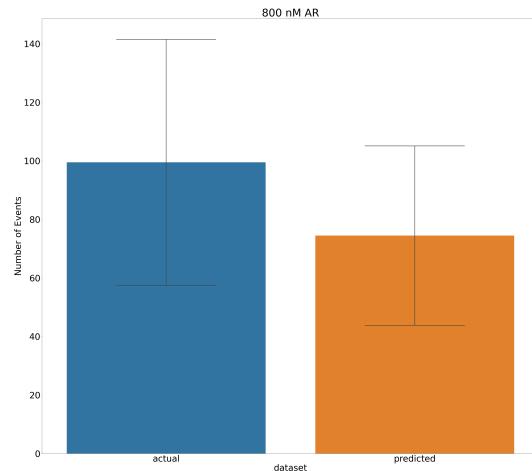
----- 1800 nM AR (prediction - real) -----
| total number of experiments: 588
| min: -244
| max: 24
| average: -31.19047619047619
| median: -12.0
| mode: ModeResult(mode=array([-1], dtype=int32), count=array([85]))
| std: 44.27040185864166
| average difference: 43.787690203849856
| accuracy: 0.5850340136054422
-----
```



```
+----- 800 nM AR (prediction - real) -----
| total number of experiments: 264
| min: -235
| max: 23
| average: -25.049242424242426
```

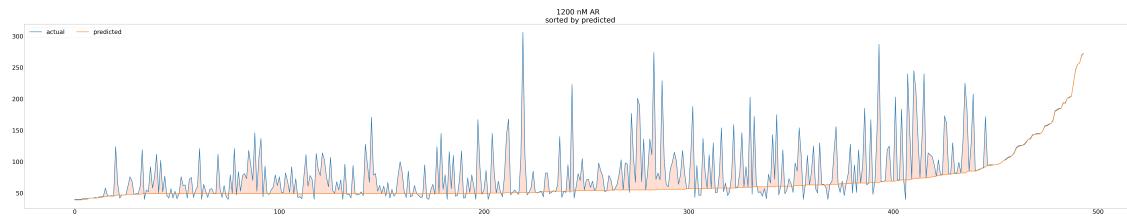
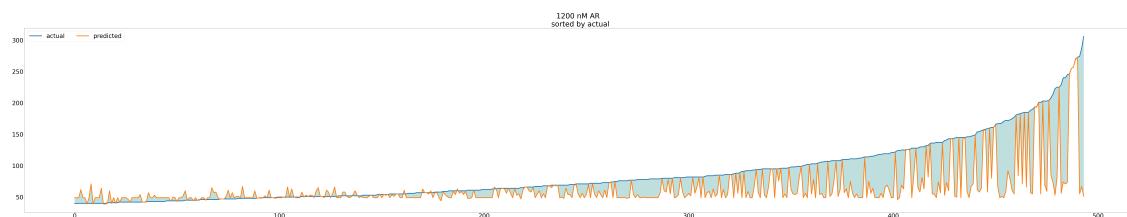
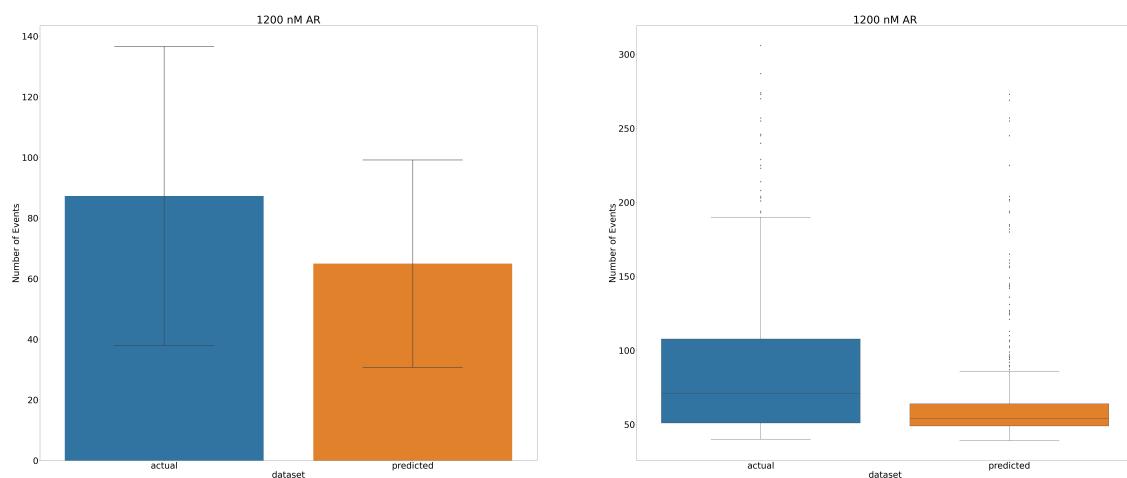
```

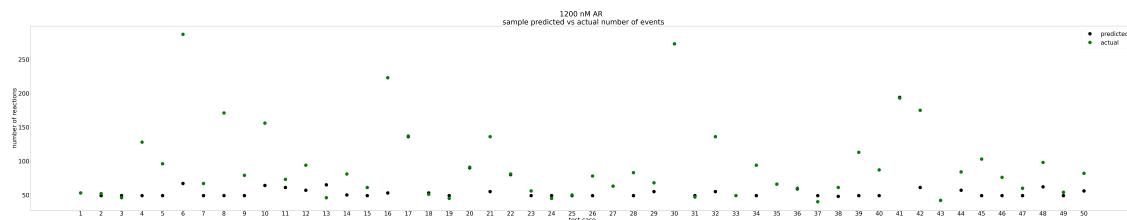
| median: -7.0
| mode: ModeResult(mode=array([-1], dtype=int32), count=array([70]))
| std: 36.87912071729239
| average difference: 35.60125014402581
| accuracy: 0.6136363636363636
+-----
```



```

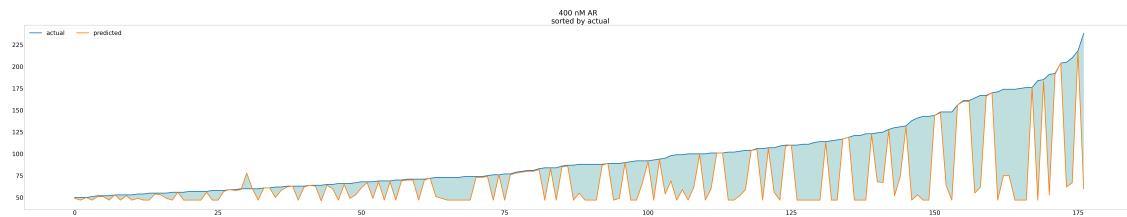
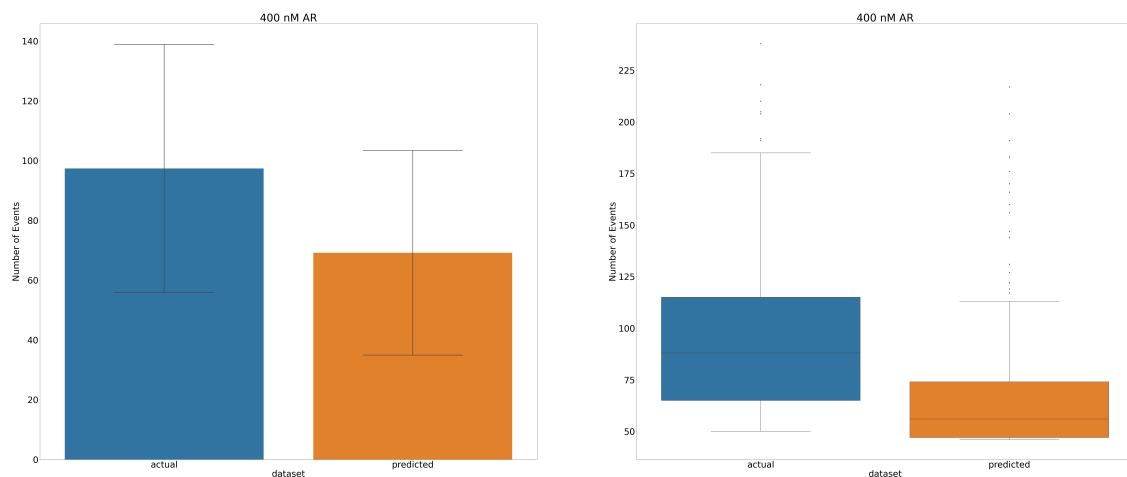
+----- 1200 nM AR (prediction - real) -----
| total number of experiments: 494
| min: -255
| max: 31
| average: -22.329959514170042
| median: -3.0
| mode: ModeResult(mode=array([-1], dtype=int32), count=array([80]))
| std: 39.40116566123327
| average difference: 36.88898834697917
| accuracy: 0.645748987854251
+-----
```

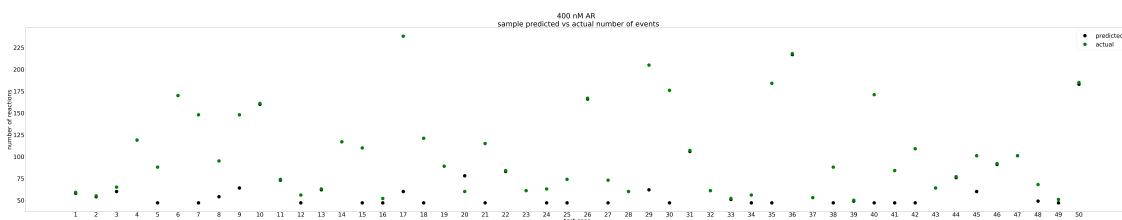
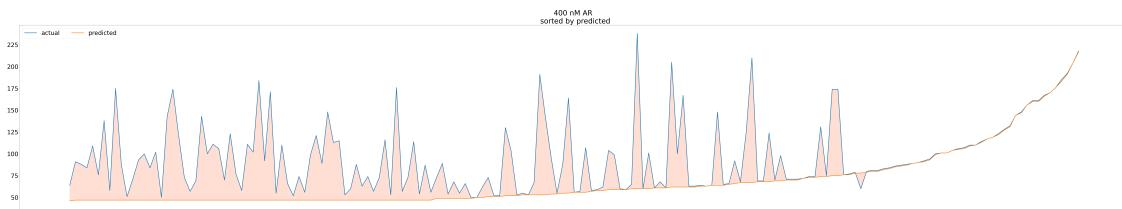




+----- 400 nM AR (prediction - real) -----

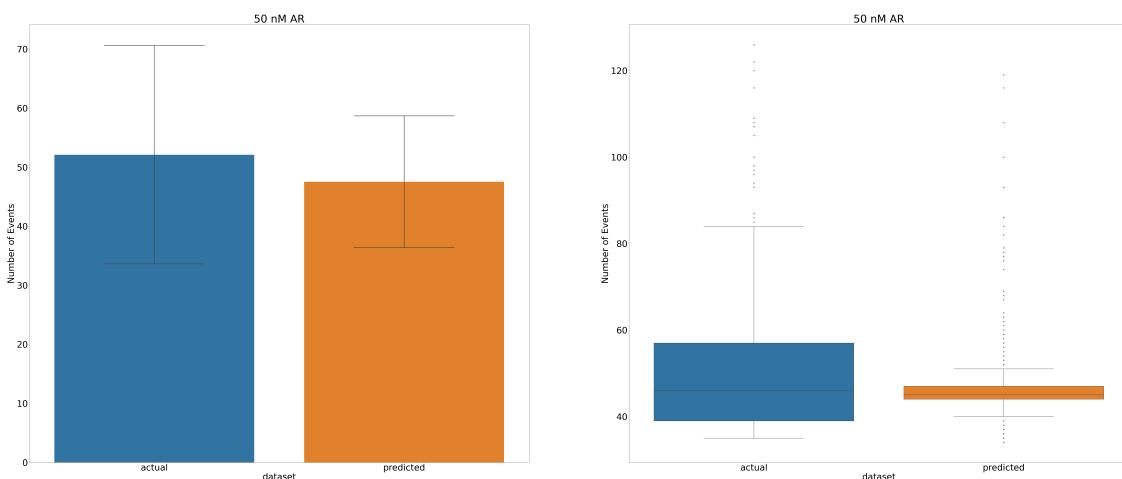
```
| total number of experiments: 177
| min: -178
| max: 18
| average: -28.2090395480226
| median: -8.0
| mode: ModeResult(mode=array([-1], dtype=int32), count=array([50]))
| std: 38.286554523352216
| average difference: 38.158063687724706
| accuracy: 0.5875706214689266
+-----
```

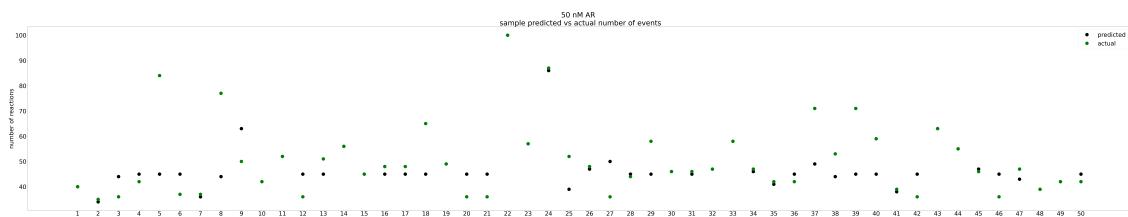
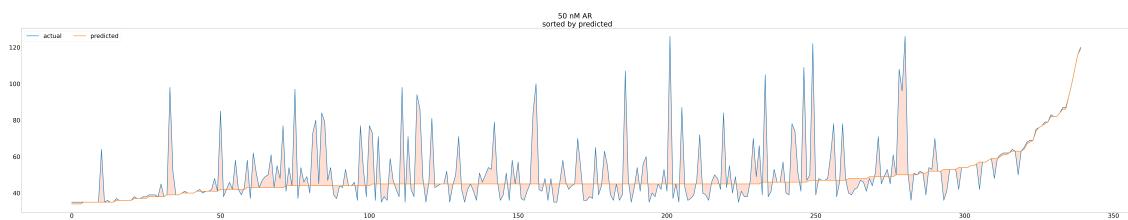
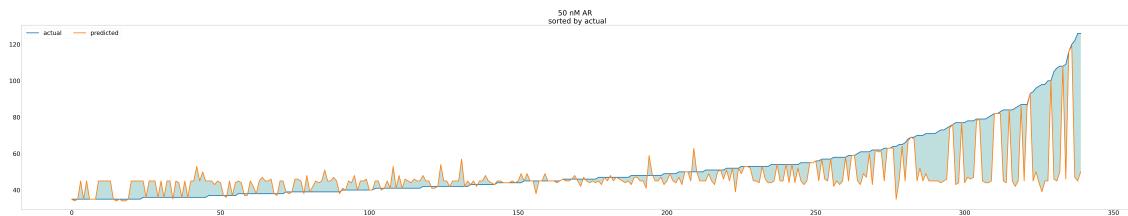




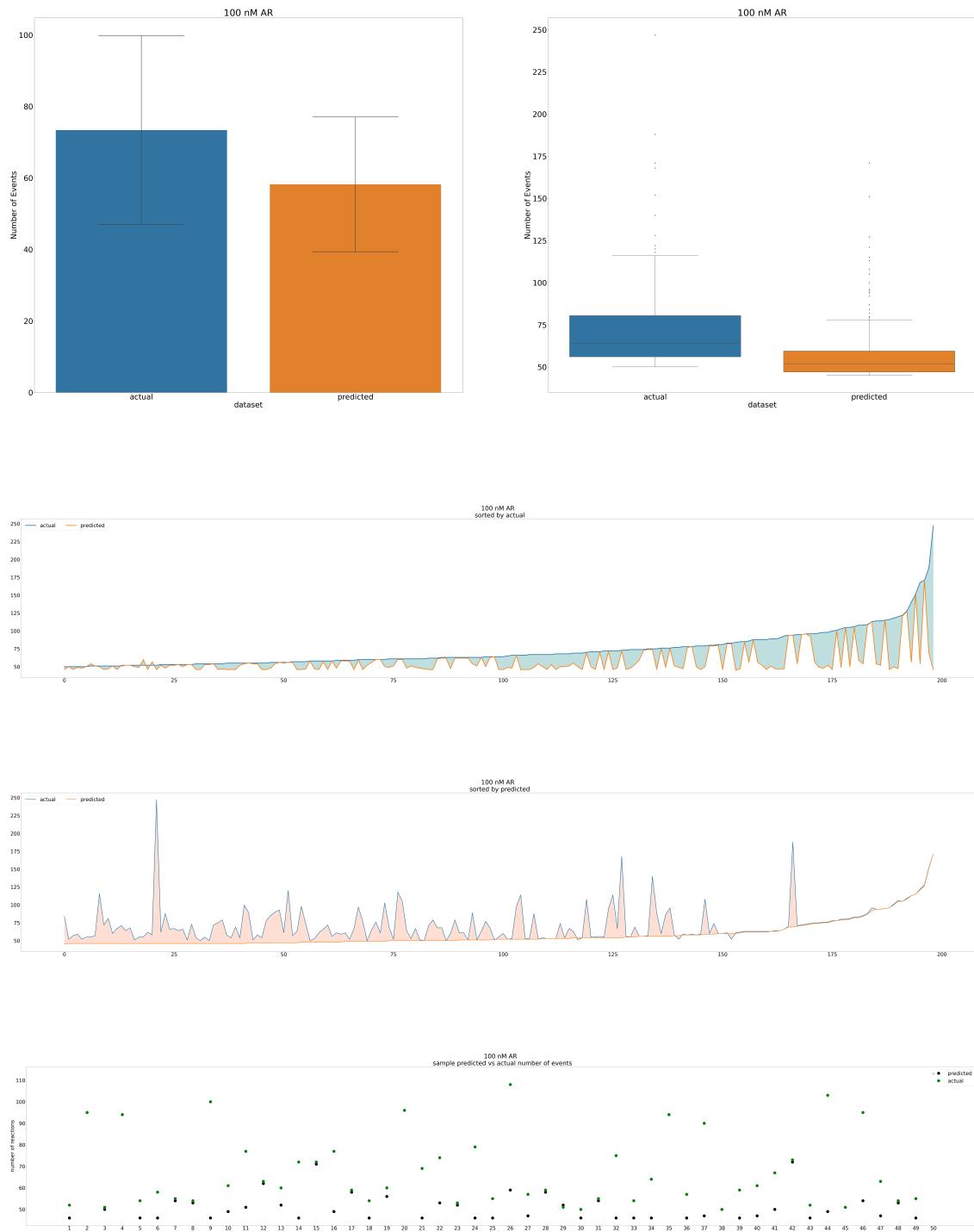
+----- 50 nM AR (prediction - real) -----

```
| total number of experiments: 340
| min: -81
| max: 17
| average: -4.576470588235294
| median: 0.0
| mode: ModeResult(mode=array([0], dtype=int32), count=array([86]))
| std: 15.626242234356344
| average difference: 14.142599340621205
| accuracy: 0.8794117647058823
+-----
```





```
+----- 100 nM AR (prediction - real) -----
| total number of experiments: 199
| min: -201
| max: 8
| average: -15.175879396984925
| median: -7.0
| mode: ModeResult(mode=array([-1], dtype=int32), count=array([50]))
| std: 24.014321964247507
| average difference: 20.73336378864017
| accuracy: 0.7487437185929648
+-----
```



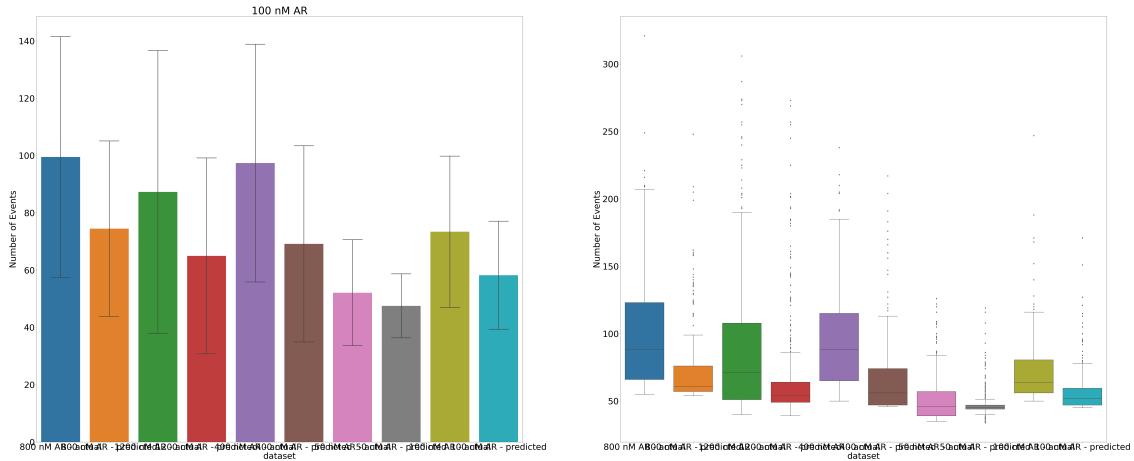
- make error graph
- make verance graph
- compair movie lengths

```
[120]: dfs = []
for k in return_dict.keys()[1:]:
    title = k.split("_")
    title.pop()
    title = ' '.join(title)
    outputPlot = return_dict[k]["outputPlot"].astype("int32")
    targetPlot = return_dict[k]["targetPlot"].astype("int32")
    outputPlot = [i[0] for i in outputPlot]
    targetPlot = [i[0] for i in targetPlot]
    data = pd.DataFrame(data=np.stack((targetPlot,outputPlot)).T,columns=[f"{title} - actual",f"{title} - predicted"])
    dfs.append(data)
data = pd.concat(dfs)
data = data.melt(var_name='dataset', value_name='Number of Events')
data
```

		dataset	Number of Events
12896	100	nM AR - actual	NaN
12778	100	nM AR - actual	NaN
12777	100	nM AR - actual	NaN
12776	100	nM AR - actual	NaN
12775	100	nM AR - actual	NaN
..	..	..	..
1963	800	nM AR - predicted	NaN
1962	800	nM AR - predicted	NaN
1961	800	nM AR - predicted	NaN
1970	800	nM AR - predicted	NaN
1841	800	nM AR - predicted	NaN

[14740 rows x 2 columns]

```
[105]: defultePlotSize = plt.rcParams['figure.figsize']
plt.rcParams['figure.figsize'] = [100, 40]
plt.subplot(1, 2, 1)
plt.title(f"{title}")
ax = sns.barplot(x="dataset", y="Number of Events", data=data, errorbar='sd', capsize=.4)
plt.subplot(1, 2, 2)
ax = sns.boxplot(x="dataset", y="Number of Events", data=data)
plt.show()
```



```
[101]: title = return_dict.keys()[0].split("_")
title.pop()
title = ' '.join(title)
columns = [f"{title} - actual", f"{title} - predicted"]
outputPlot = return_dict[k]["outputPlot"].astype("int32")
targetPlot = return_dict[k]["targetPlot"].astype("int32")
outputPlot = [i[0] for i in outputPlot]
targetPlot = [i[0] for i in targetPlot]
data = np.stack((targetPlot, outputPlot)).T
for k in return_dict.keys()[1:]:
    title = k.split("_")
    title.pop()
    title = ' '.join(title)
    columns = columns + [f"{title} - actual", f"{title} - predicted"]
    outputPlot = return_dict[k]["outputPlot"].astype("int32")
    targetPlot = return_dict[k]["targetPlot"].astype("int32")
    outputPlot = [i[0] for i in outputPlot]
    targetPlot = [i[0] for i in targetPlot]
    tmp = np.stack((targetPlot, outputPlot)).T
    for i in range(len(data)):
        data[i] = data[i] + tmp[i]

# plt.rcParams['figure.figsize'] = [100, 40]
# plt.subplot(1, 2, 1)
# plt.title(f"{title}")
# outputPlot = return_dict[k]["outputPlot"].astype("int32")
# targetPlot = return_dict[k]["targetPlot"].astype("int32")
# outputPlot = [i[0] for i in outputPlot]
# targetPlot = [i[0] for i in targetPlot]
# np.stack((targetPlot, outputPlot)).T
data = pd.DataFrame(data=data, columns=columns)
```

```

data = data.melt( var_name='dataset', value_name='Number of Events')
data
# # plt.figure(figsize=(7, 8))
# ax = sns.barplot(x="dataset", y="Number of Events", data=data, errorbar='sd', □
#                   caps=.4)
# plt.subplot(1, 2, 2)
# ax = sns.boxplot(x="dataset", y="Number of Events", data=data)
# plt.show()

```

---

**IndexError** Traceback (most recent call last)

Cell In[101], line 21

```

19     tmp = np.stack((targetPlot,outputPlot)).T
20     for i in range(len(data)):
--> 21         data[i] = data[i] + tmp[i]
23 # plt.rcParams['figure.figsize'] = [100, 40]
24 # plt.subplot(1, 2, 1)
25 # plt.title(f"{title}")
(...)

29 # targetPlot = [i[0] for i in targetPlot]
30 # np.stack((targetPlot,outputPlot)).T
31 data = pd.DataFrame(data=data, columns=columns)

```

IndexError: index 177 is out of bounds for axis 0 with size 177

[18]: data = [i[0] for i in return\_dict[k]["targetPlot"].astype("int32")]
printStats(data, name=str(k) + "targetPlot")
data = [i[0] for i in return\_dict[k]["outputPlot"].astype("int32")]
printStats(data, name=str(k) + "outputPlot")

```

----- 100_nM_AR_outtargetPlot -----
| total number of experiments: 199
| min: 50
| max: 247
| average: 73.38693467336684
| median: 64.0
| mode: ModeResult(mode=55, count=10)
| std: 26.355055967041373
| average difference: 24.743718592964825
-----
----- 100_nM_AR_outoutputPlot -----
| total number of experiments: 199
| min: 45
| max: 171
| average: 58.21105527638191
| median: 52.0
| mode: ModeResult(mode=46, count=41)

```

```
| std: 18.804887592826873
| average difference: 16.23095274351556
+-----
```

```
[19]: outputPlot = return_dict[k]["outputPlot"].astype("int32")
targetPlot = return_dict[k]["targetPlot"].astype("int32")
outputPlot = [i[0] for i in outputPlot]
targetPlot = [i[0] for i in targetPlot]

targetPlot
```

```
[19]: [52,
95,
51,
94,
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58,
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100,
61,
77,
63,
60,
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72,
77,
59,
54,
60,
96,
69,
74,
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79,
55,
108,
57,
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64,
94,
57,
```

90,  
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59,  
61,  
67,  
73,  
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103,  
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95,  
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101,  
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109,  
106,  
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72,  
56,  
64,  
55,  
81,  
68,  
88,  
67,  
152,  
57,  
70,  
59,  
51,  
116,  
52,

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84,  
63,  
61,  
72,  
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81,  
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97,  
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67,  
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78,  
62,  
61,  
68,  
68,  
188,  
67,  
105,  
73,  
74,  
76,  
114,  
168,  
83,  
96,  
69,  
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115,  
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60,  
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67,

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63,  
140,  
62,  
98,  
120,  
58,  
53,  
88,  
58,  
247,  
61,  
50,  
118,  
59,  
63,  
66,  
62,  
51,  
66,  
85,  
55,  
63,  
53,  
74,  
52,  
128,  
89,  
78,  
60,  
61,  
64,  
114,  
88,  
61,  
64,  
75,  
89,  
171,  
108,  
56,  
66,  
50,  
58,  
52,

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83,  
67,  
96,  
51,  
61,  
71,  
52,  
64,  
105,  
66,  
63,  
71,  
122,  
85,  
51,  
58,  
63,  
53,  
54,  
63,  
56,  
50]
```

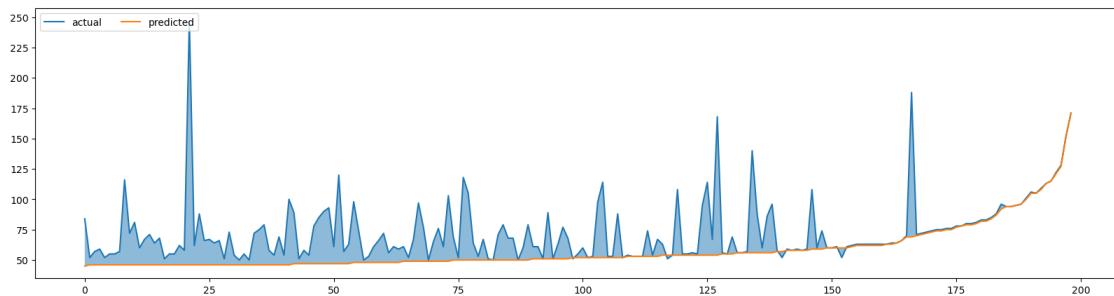
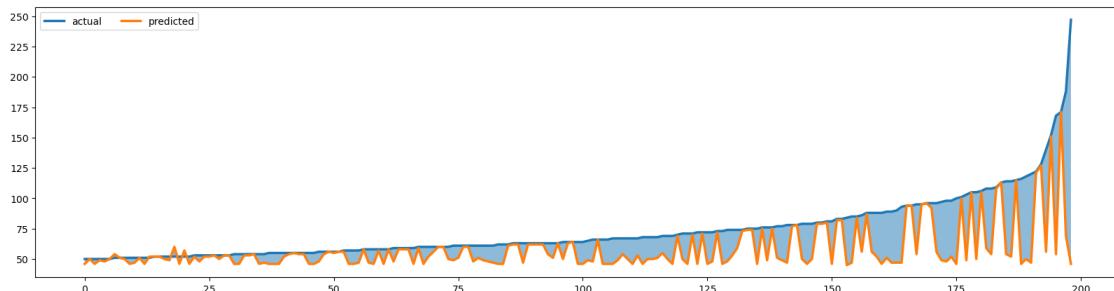
```
[20]: return_dict[k] ["acc"]
```

```
[20]: 0.7487437185929648
```

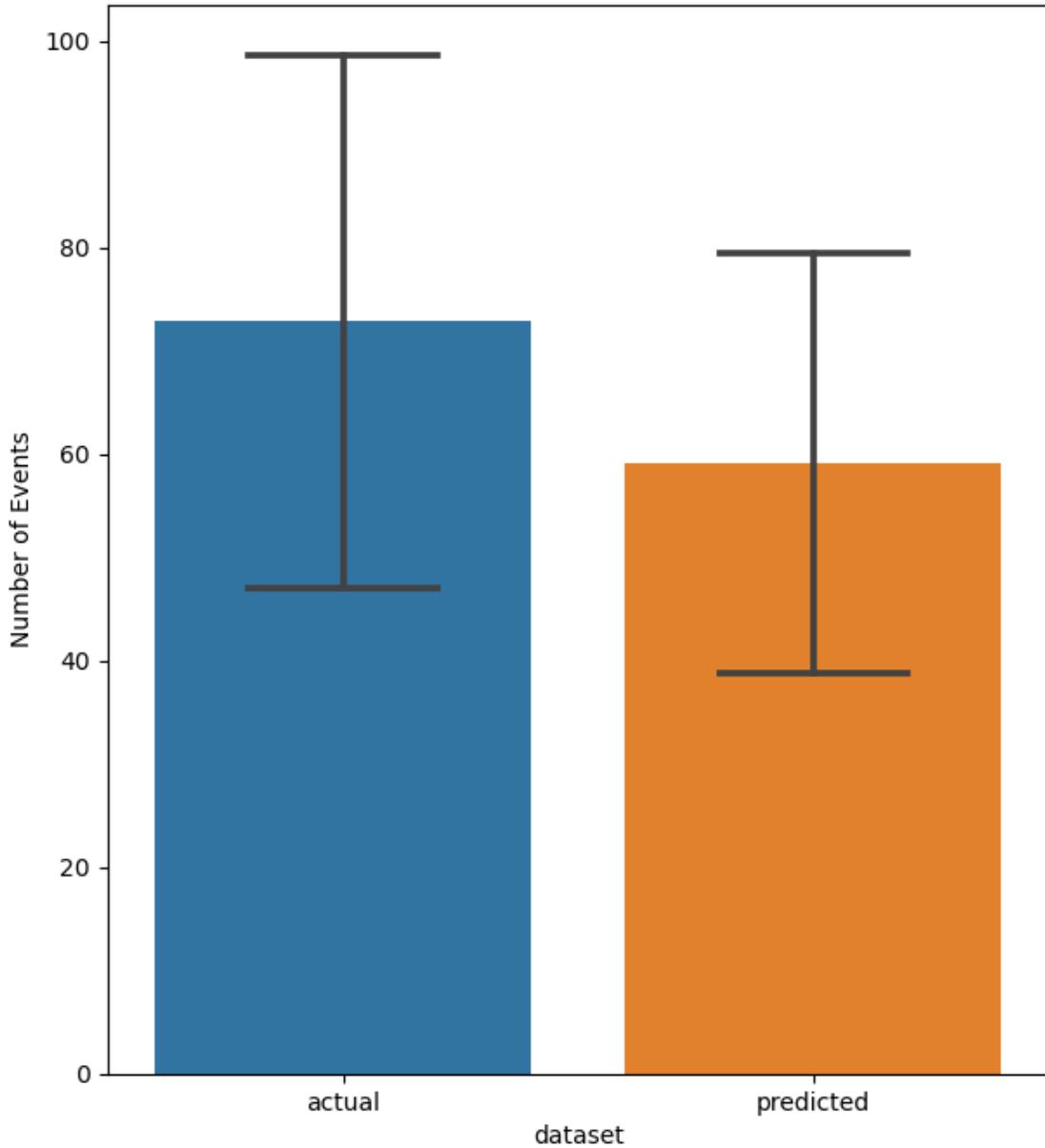
```
[38]: data = np.stack((targetPlot, outputPlot))  
data = data.T  
data = data[data[:, 0].argsort()]  
targetSort = data.T  
  
data = np.stack((targetPlot, outputPlot))  
data = data.T  
data = data[data[:, 1].argsort()]  
outputSort = data.T
```

```
[49]: plt.plot(range(len(targetSort[0])), targetSort[0], label="actual", lw=2.5)  
plt.plot(range(len(targetSort[0])), targetSort[1], label="predicted", lw=2.5)  
plt.fill_between(list(range(len(targetSort[0]))), targetSort[0], targetSort[1],  
    alpha=0.5)  
plt.legend(ncol=2, loc='upper left')  
plt.show()  
plt.plot(range(len(outputSort[0])), outputSort[0], label="actual")  
plt.plot(range(len(outputSort[0])), outputSort[1], label="predicted")  
plt.fill_between(list(range(len(outputSort[0]))), outputSort[0], outputSort[1],  
    alpha=0.5)
```

```
plt.legend(ncol=2, loc='upper left')
plt.show()
```

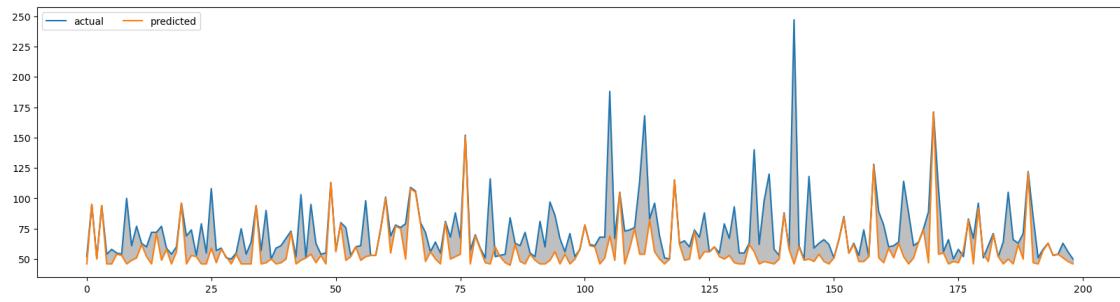


```
[128]: outputPlot = return_dict[k]["outputPlot"].astype("int32")
targetPlot = return_dict[k]["targetPlot"].astype("int32")
outputPlot = [i[0] for i in outputPlot]
targetPlot = [i[0] for i in targetPlot]
data = pd.DataFrame(data=np.stack((targetPlot, outputPlot)).T, ↴
    ↪columns=["actual", "predicted"])
data = data.melt(var_name='dataset', value_name='Number of Events')
plt.figure(figsize=(7, 8))
ax = sns.barplot(x="dataset", y="Number of Events", data=data, errorbar='sd', ↴
    ↪capsize=.4)
```



```
[50]: outputPlot = return_dict[k]["outputPlot"].astype("int32")
targetPlot = return_dict[k]["targetPlot"].astype("int32")
outputPlot = [i[0] for i in outputPlot]
targetPlot = [i[0] for i in targetPlot]
plt.plot(range(len(targetPlot)), targetPlot, label="actual")
plt.plot(range(len(outputPlot)), outputPlot, label="predicted")
plt.fill_between(list(range(len(targetPlot))), outputPlot, targetPlot,
                 color='grey', alpha=0.5)
plt.legend(ncol=2, loc='upper left')
```

```
plt.show()
```



```
[ ]:
```