Bayesian_fitting_2016

August 25, 2023

[1]:
```
import P3_seenovate as p3
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt

df = pd.read_csv('data/2016_data.csv', delimiter = ",")
df["date"] = pd.to_datetime(df["date"], format = "%Y-%m-%d")
athok = [i for i in range(len(df)) if not pd.isnull(df.iloc[i,df.columns.
 ↪get_loc("athlete")])]
df = df.iloc[athok,:]
datok = [i for i in range(len(df)) if not pd.isnull(df.iloc[i,df.columns.
 ↪get_loc("date")])]
df = df.iloc[datok,:]

athletes_id = [x for x in df["athlete"].unique() if x != "H8"] # not enough␣
 ↪data for H8
np.random.seed(123)

mods = {}
for ath in athletes_id:
    mods[ath] = {}
    mods[ath]["Fitness"] = p3.Fitness (df.loc[df["athlete"] == ath,:].copy(),
                                       objective = "max",
                                       HL_fitness = 30)
    mods[ath]["Banister"] = p3.Banister(df.loc[df["athlete"] == ath,:].copy(),
                          objective = "max",
                          HL_fitness = 30,
                          HL_fatigue = 2)
```

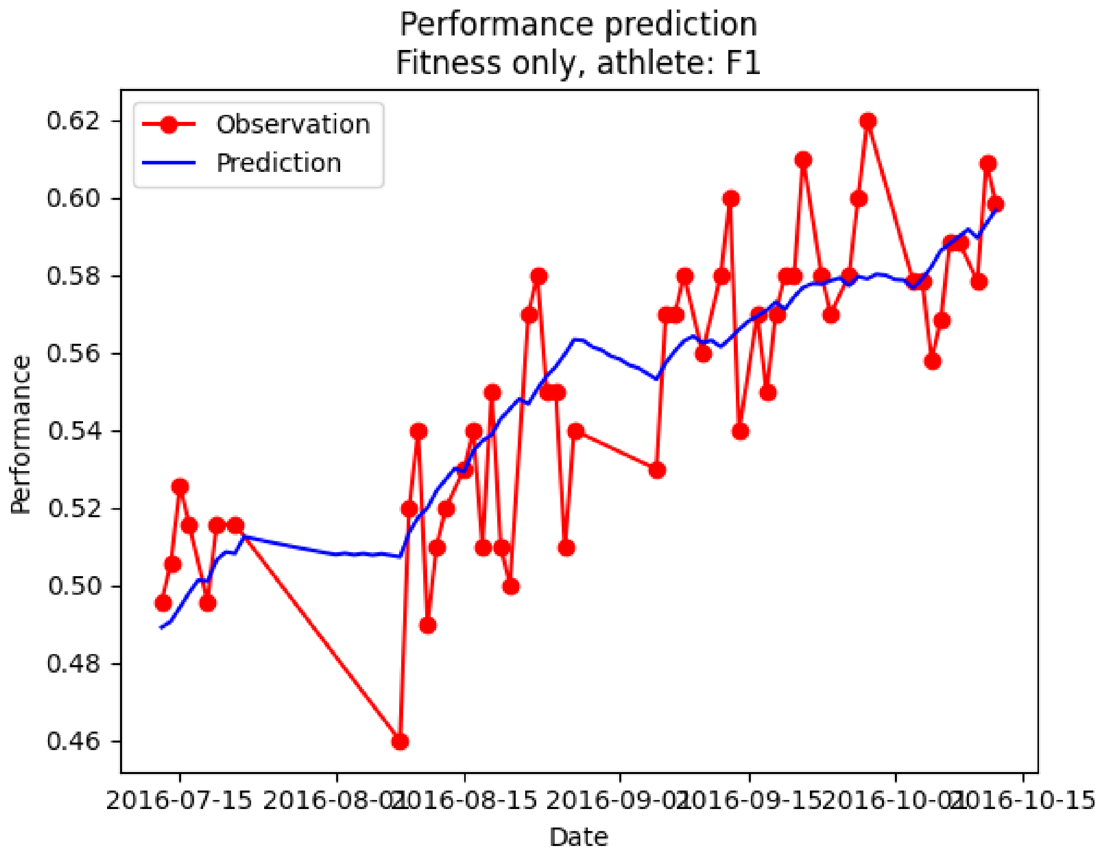
[2]:
```
freq = pd.read_csv("Performances_in_training_2016.csv")
```

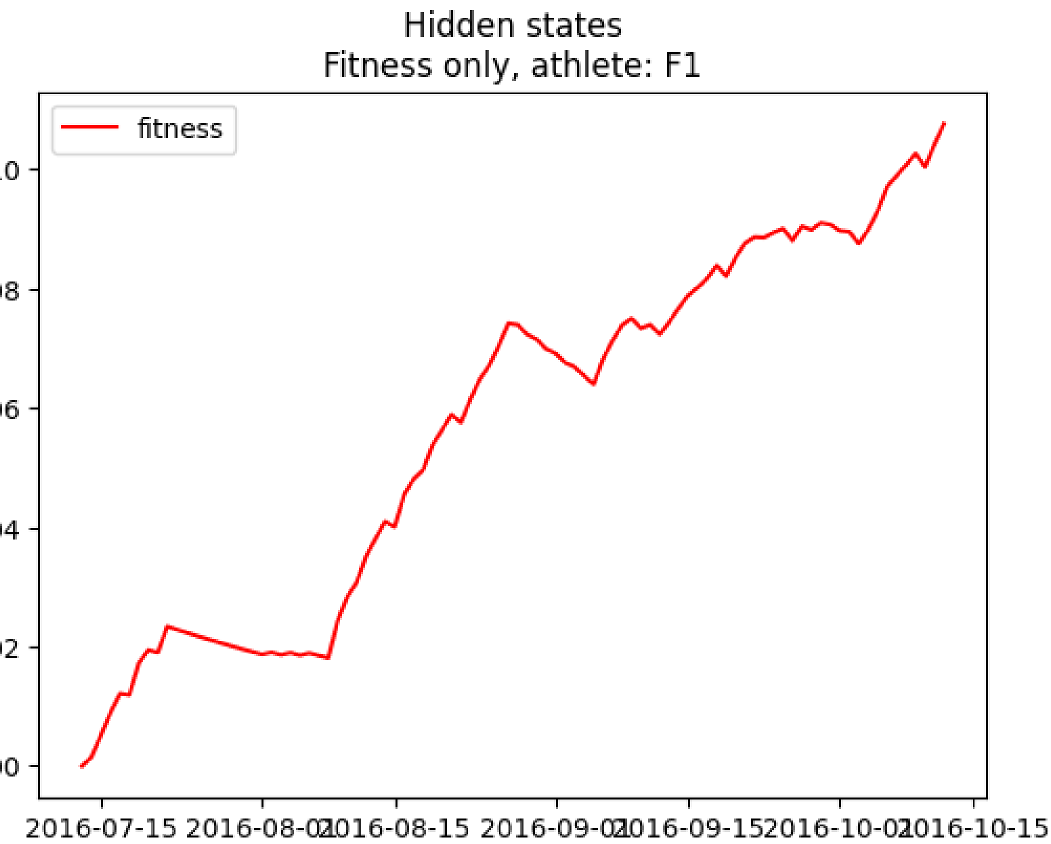
[ ]:
```
for model in ["Fitness", "Banister"]:
    for ath in athletes_id:
        pos = [x for x in range(len(freq)) if freq["model"].iloc[x] == model␣
 ↪and freq["athlete"].iloc[x] == ath]
        seed_bayes = np.random.randint(low = 1, high=1e5)
```

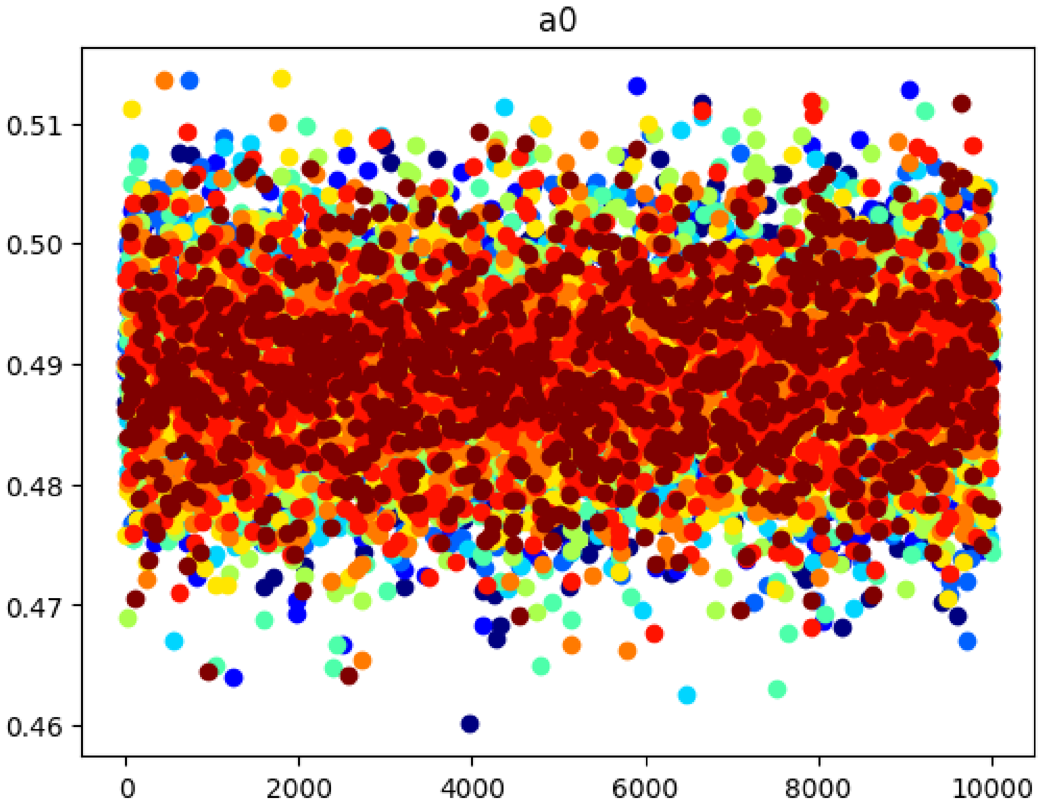
```python
        if model == "Fitness":
            init_values = {"a0":    float(freq["a0"].iloc[pos]),
                           "tauG":  mods[ath]["Fitness"].tau["G"],
                           "sigma": float(freq["RMSE"].iloc[pos])}
        else:
            init_values = {"a0":    float(freq["a0"].iloc[pos]),
                           "tauG":  mods[ath]["Banister"].tau["G"],
                           "tauH":  mods[ath]["Banister"].tau["H"],
                           "sigma": float(freq["RMSE"].iloc[pos])}

        mods[ath][model].fitBayes(hyparams = {"sd_a0":    5, # flat
                                              "sd_k":     5, # flat
                                              "sd_sigma": 25,
                                              "b_tau":    2},
                                  bounds = {"a0": (-1e4,1e4),
                                            "k" : (0,1),
                                            "tauG": (0,100),
                                            "tauH": (0,100)},
                                  info_tau = True,
                                  init = init_values,
                                  num_chains = 10,
                                  num_warmup = 4e4,
                                  num_samples = 1e4,
                                  num_thin = 10,
                                  seed_bayes = seed_bayes)
```

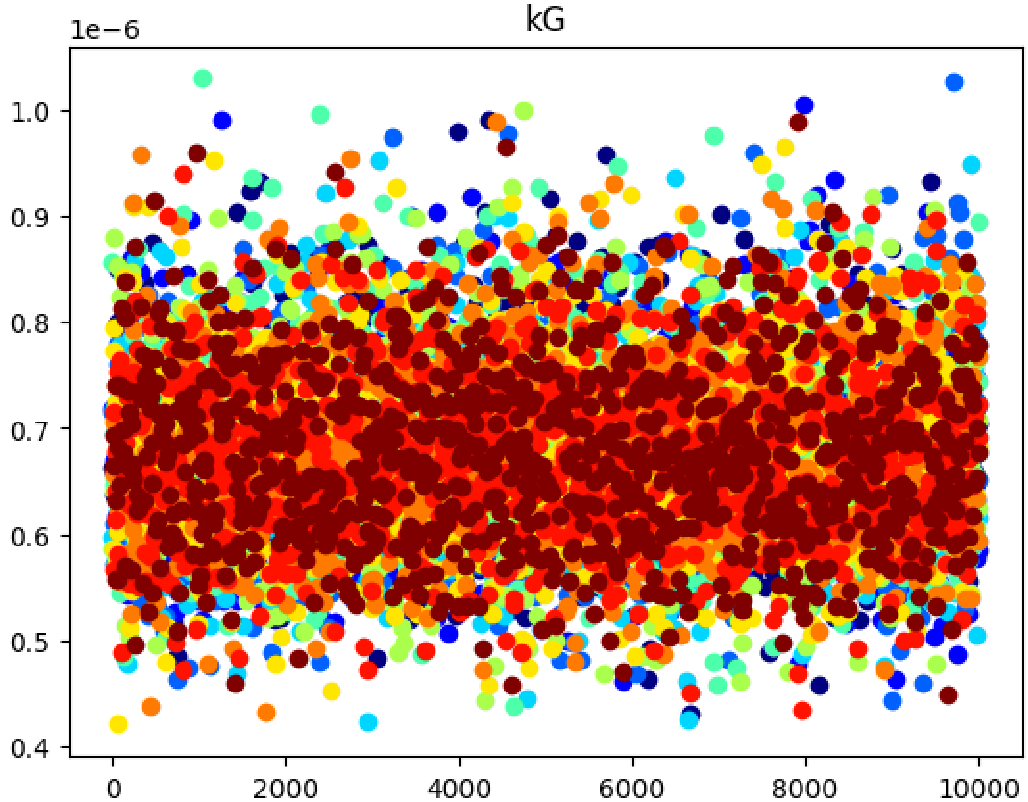
[4]:

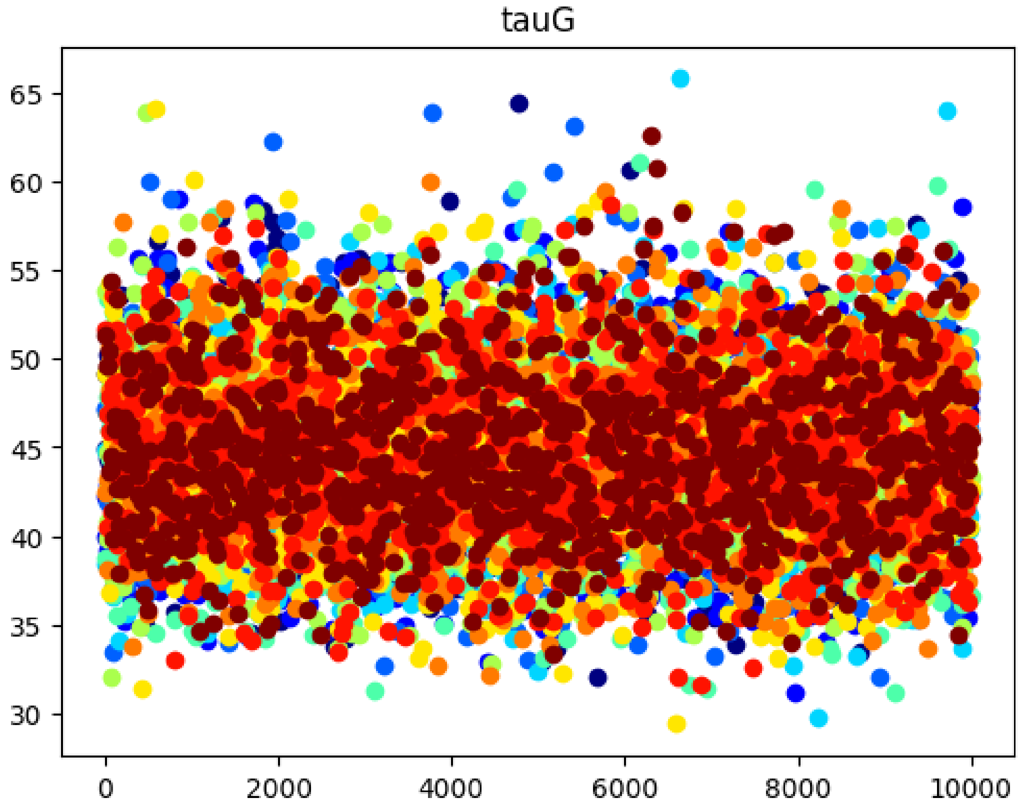
```python
for ath in athletes_id:
    mods[ath]["Fitness"].train.plot_perf(show = False)
    plt.title("Performance prediction\nFitness only, athlete: "+ath)
    plt.legend()
    plt.show()

    mods[ath]["Fitness"].train.plot_state(show = False)
    plt.title("Hidden states\nFitness only, athlete: "+ath)
    plt.legend()
    plt.show()

    mods[ath]["Fitness"].train.plot_rawchains()
    mods[ath]["Fitness"].train.plot_posteriors()
```

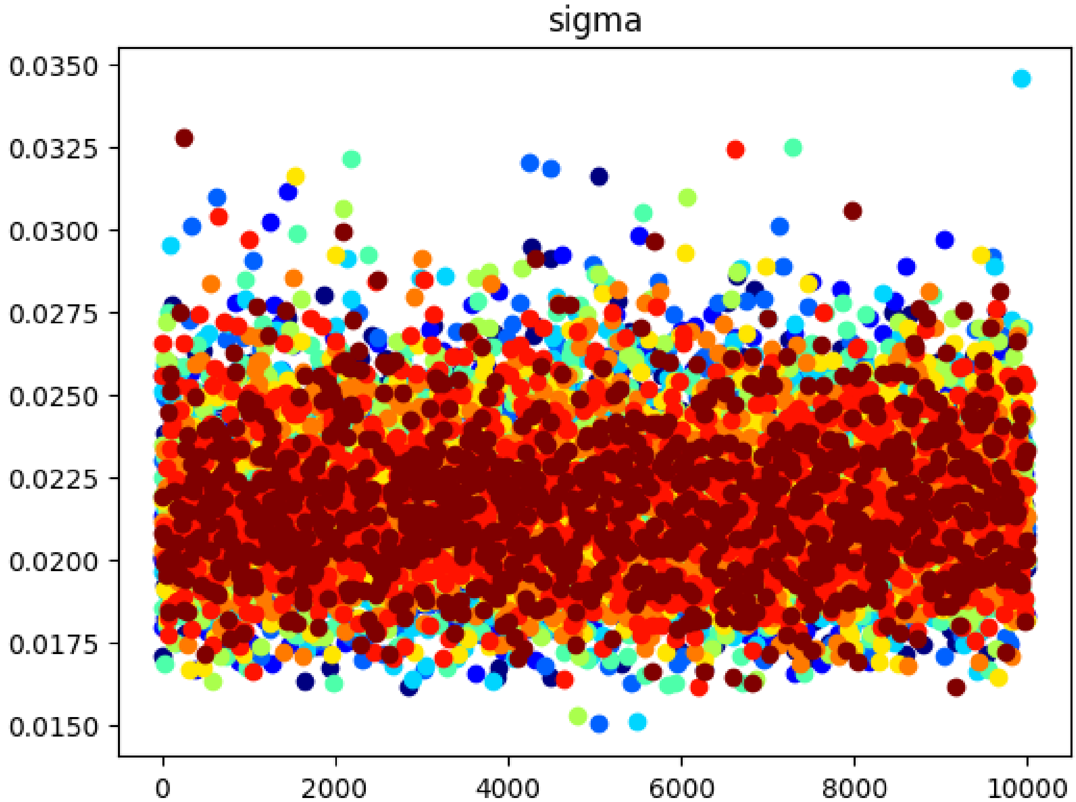

Performance prediction
Fitness only, athlete: F1
Observation
Prediction
Performance
Date
0.62
0.60
0.58
0.56
0.54
0.52
0.50
0.48
0.46
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

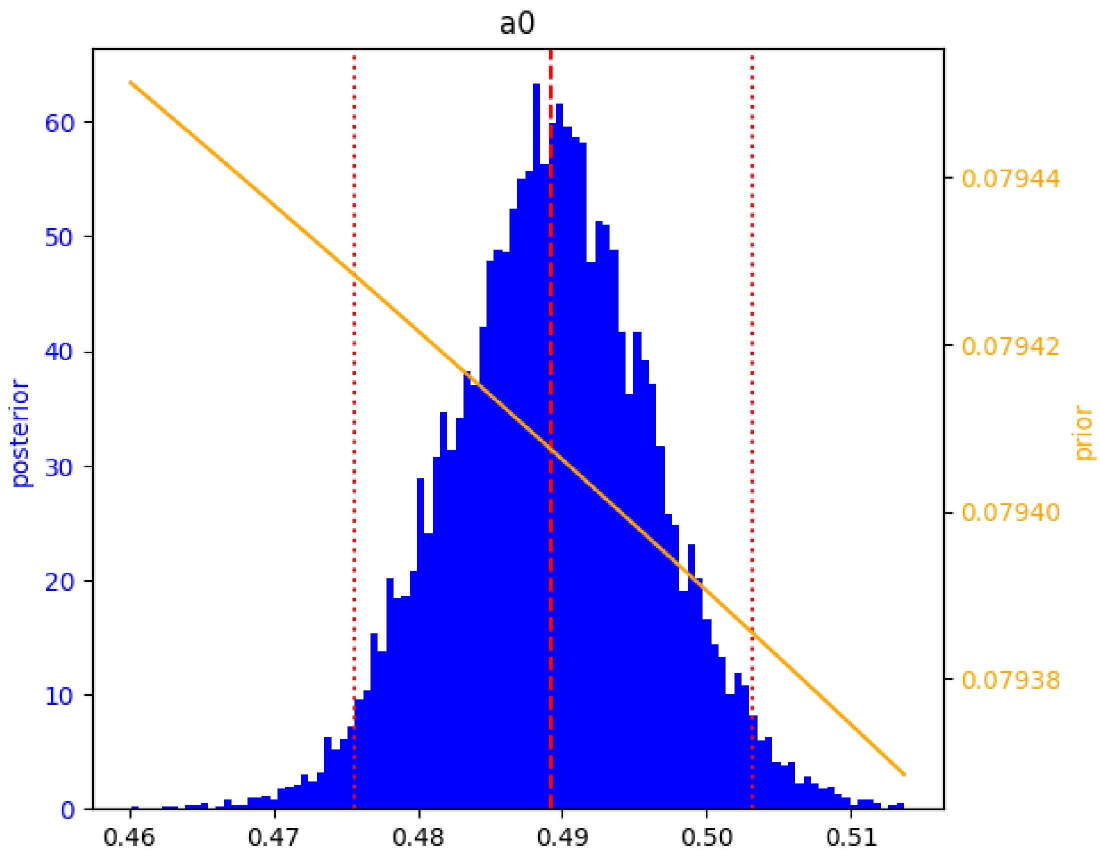

Hidden states
Fitness only, athlete: F1
fitness
0.10
0.08
0.06
0.04
0.02
0.00
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

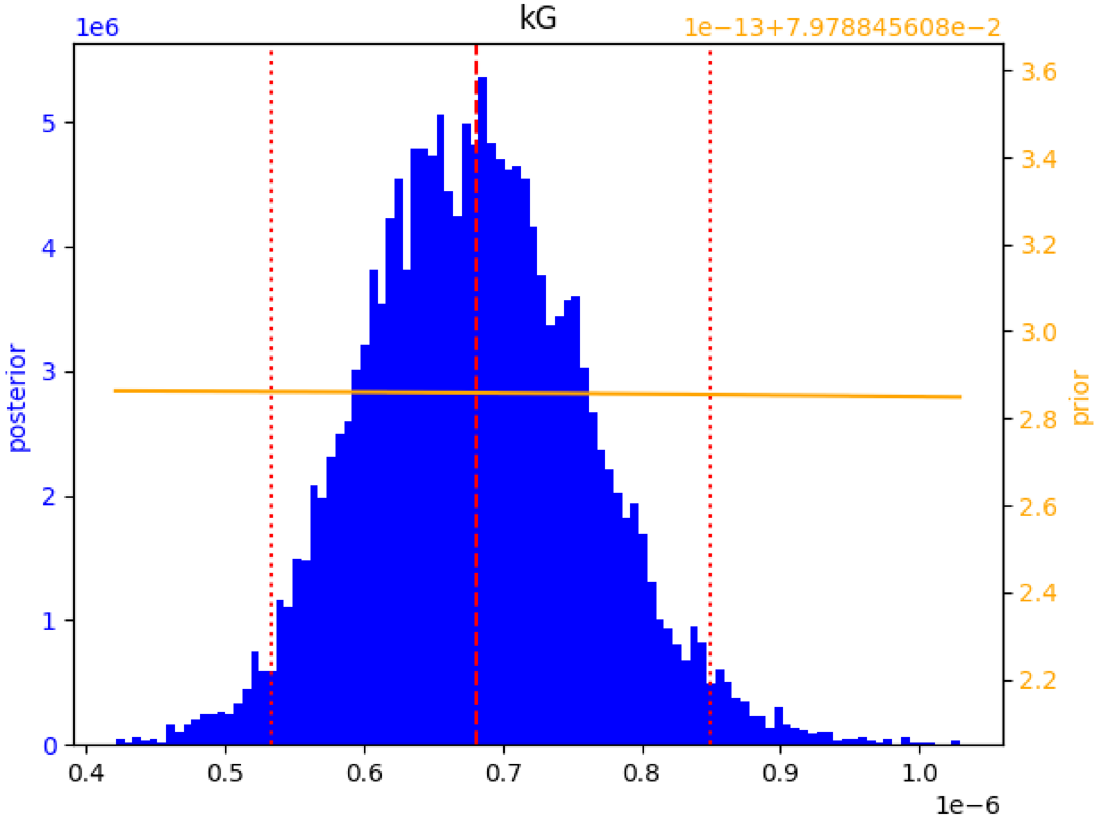

a0
0.51
0.50
0.49
0.48
0.47
0.46
0
2000
4000
6000
8000
10000


kG
1e−6
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0
2000
4000
6000
8000
10000

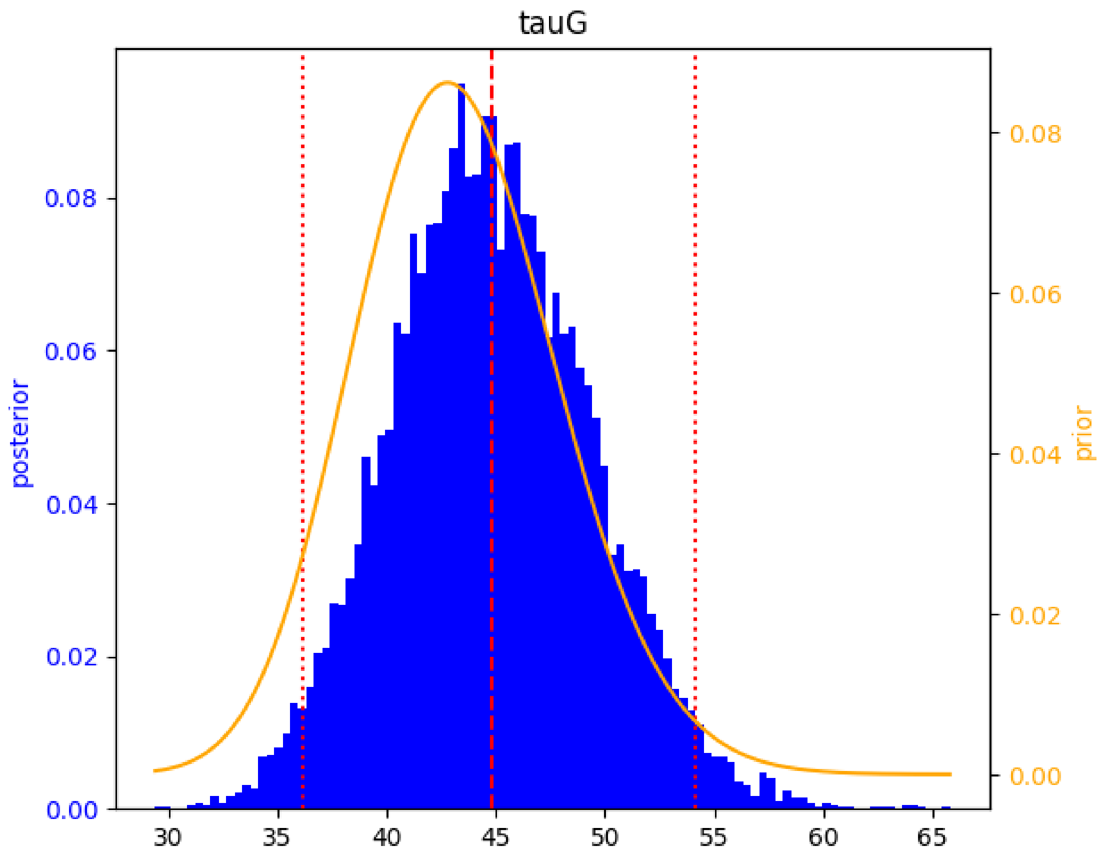

tauG
65
60
55
50
45
40
35
30
0
2000
4000
6000
8000
10000

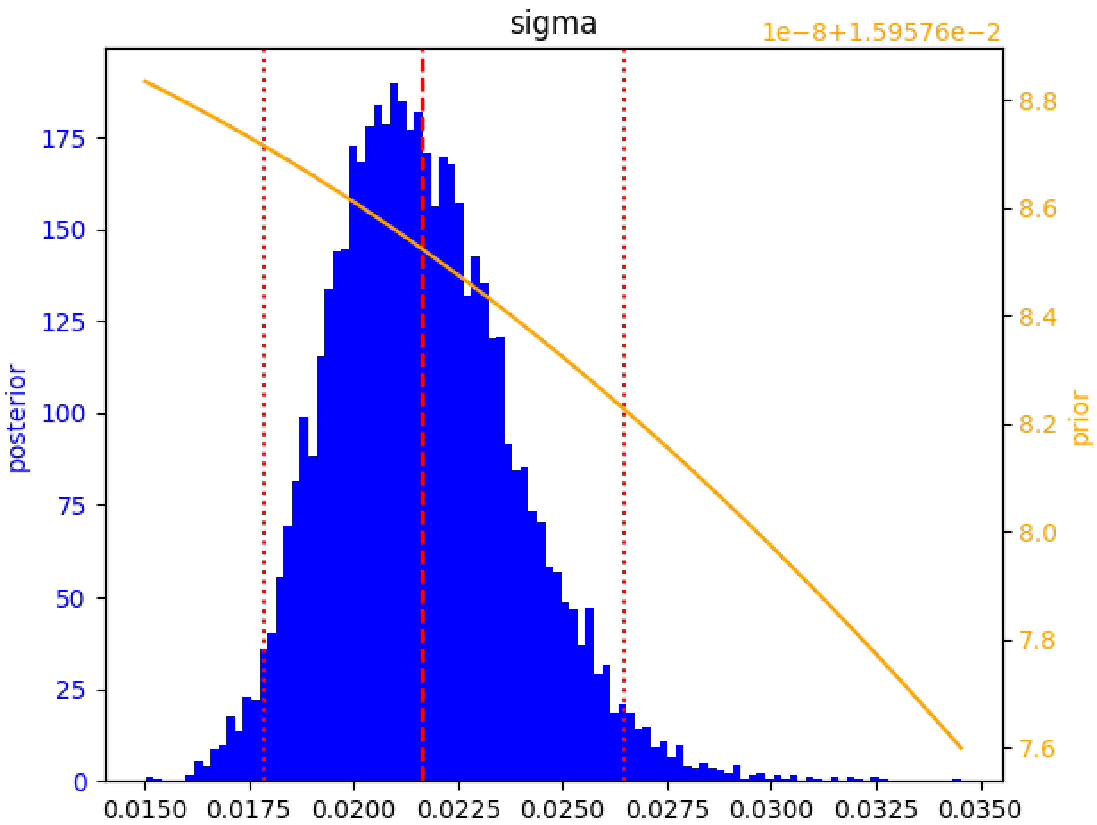

sigma
0.0350
0.0325
0.0300
0.0275
0.0250
0.0225
0.0200
0.0175
0.0150
0
2000
4000
6000
8000
10000


a0
posterior
prior
0
10
20
30
40
50
60
0.07938
0.07940
0.07942
0.07944
0.46
0.47
0.48
0.49
0.50
0.51

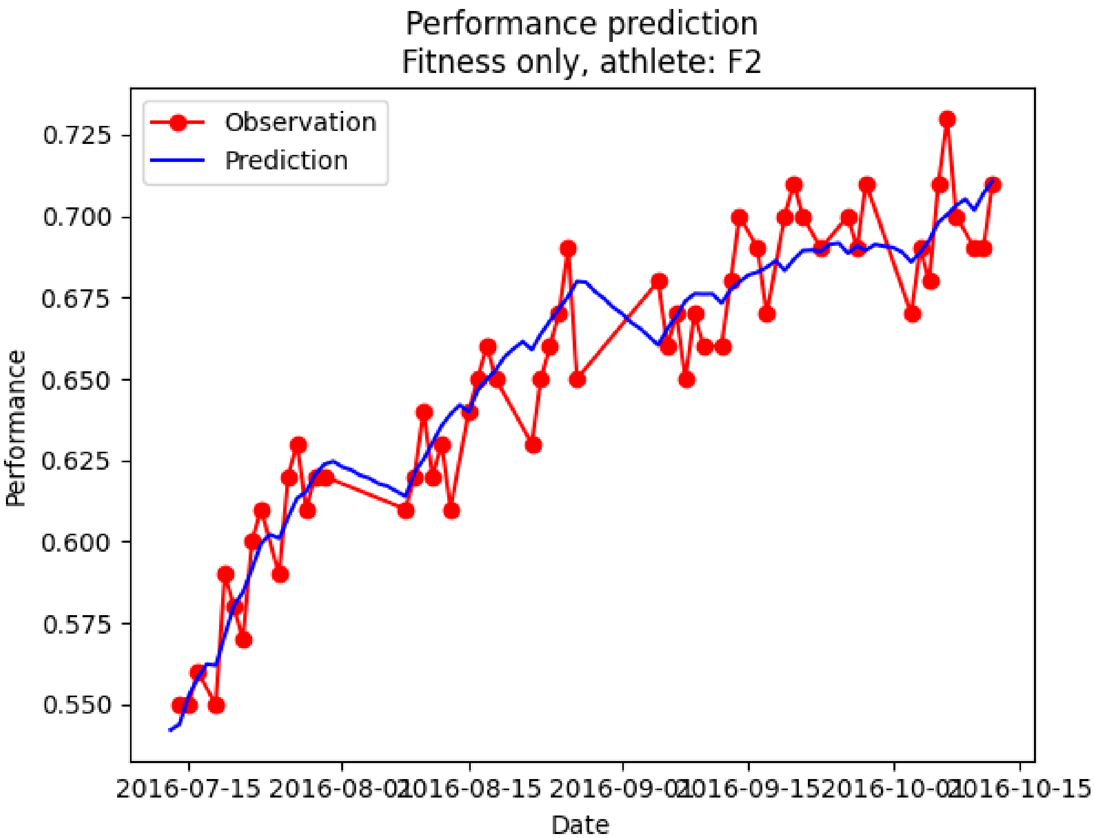


kG
1e6
1e−13+7.978845608e−2
posterior
prior
0
1
2
3
4
5
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1e−6

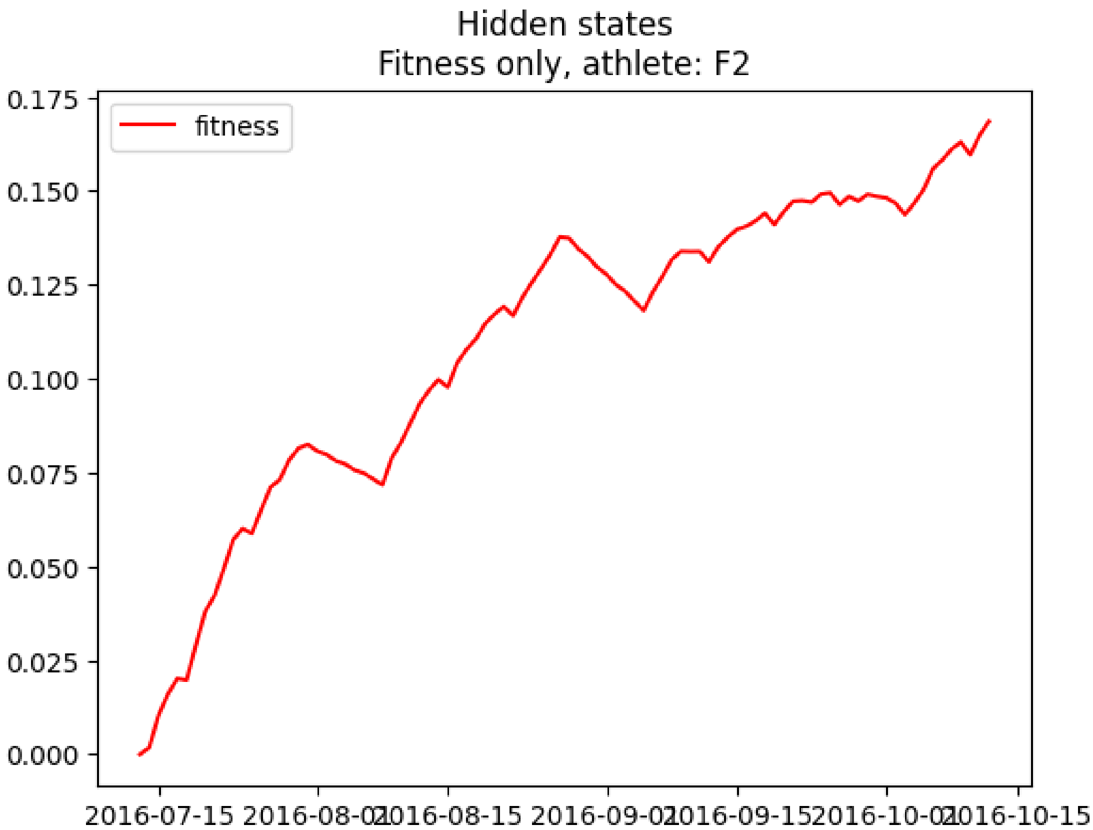

tauG
posterior
prior
0.00
0.02
0.04
0.06
0.08
30
35
40
45
50
55
60
65

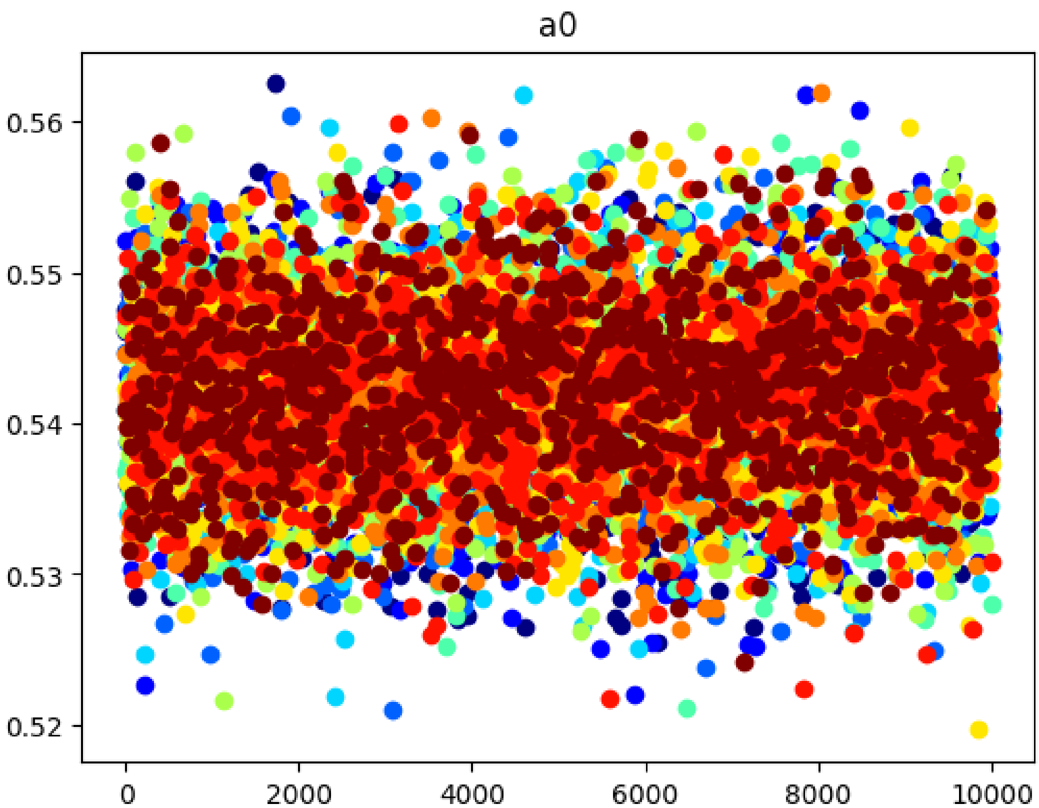


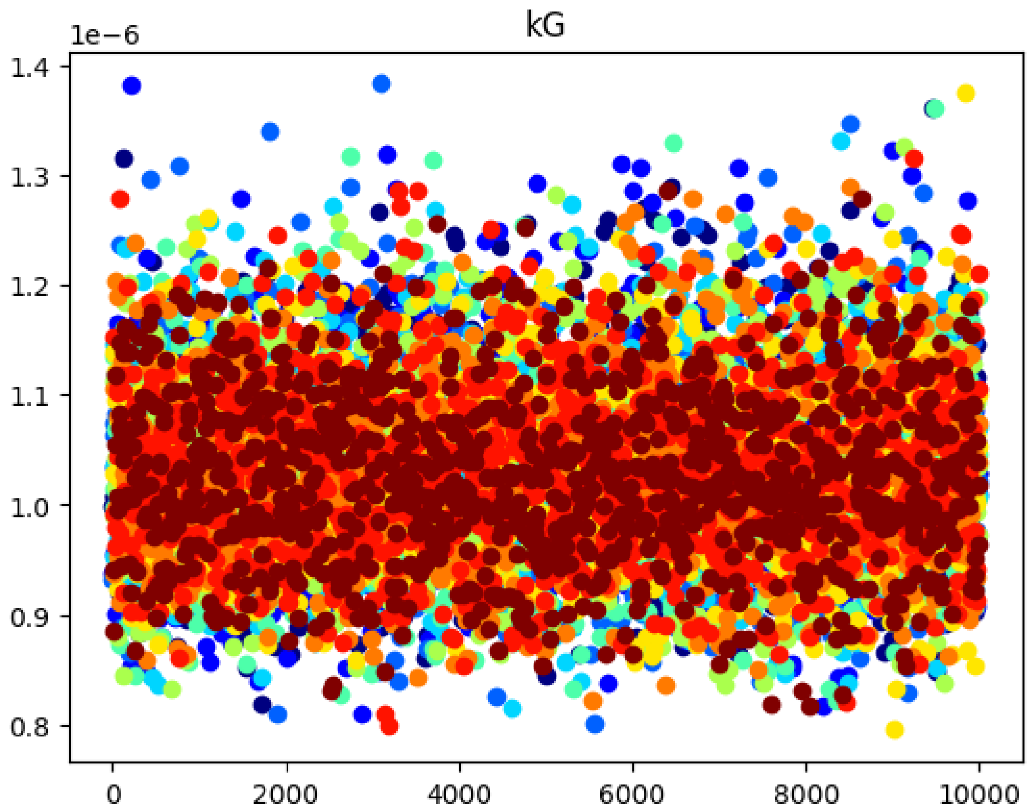
sigma
1e−8+1.59576e−2
posterior
prior
0
25
50
75
100
125
150
175
7.6
7.8
8.0
8.2
8.4
8.6
8.8
0.0150
0.0175
0.0200
0.0225
0.0250
0.0275
0.0300
0.0325
0.0350

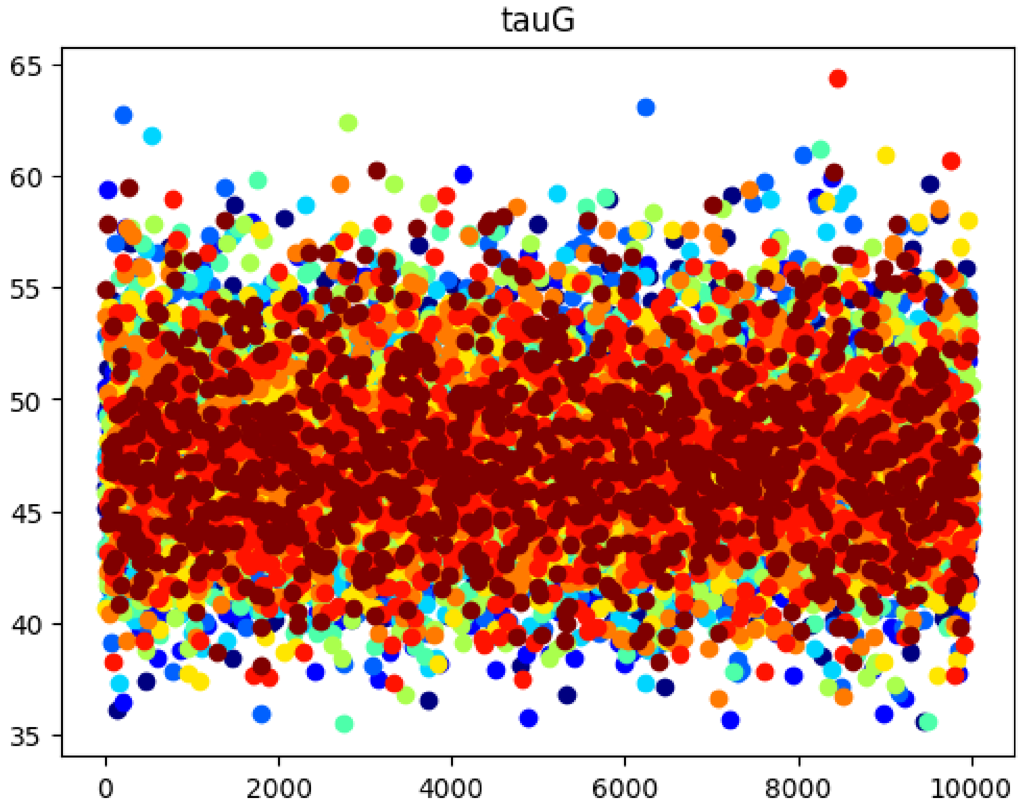


Performance prediction
Fitness only, athlete: F2
Observation
Prediction
Performance
0.725
0.700
0.675
0.650
0.625
0.600
0.575
0.550
Date
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

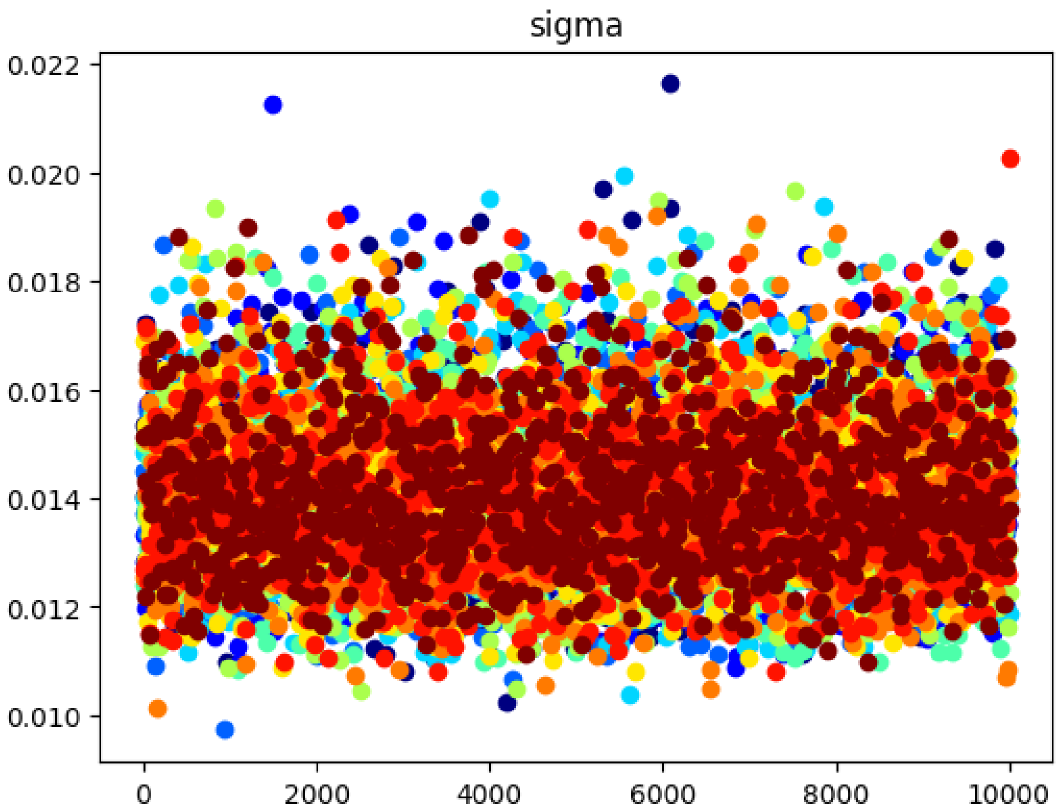

Hidden states
Fitness only, athlete: F2
fitness
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

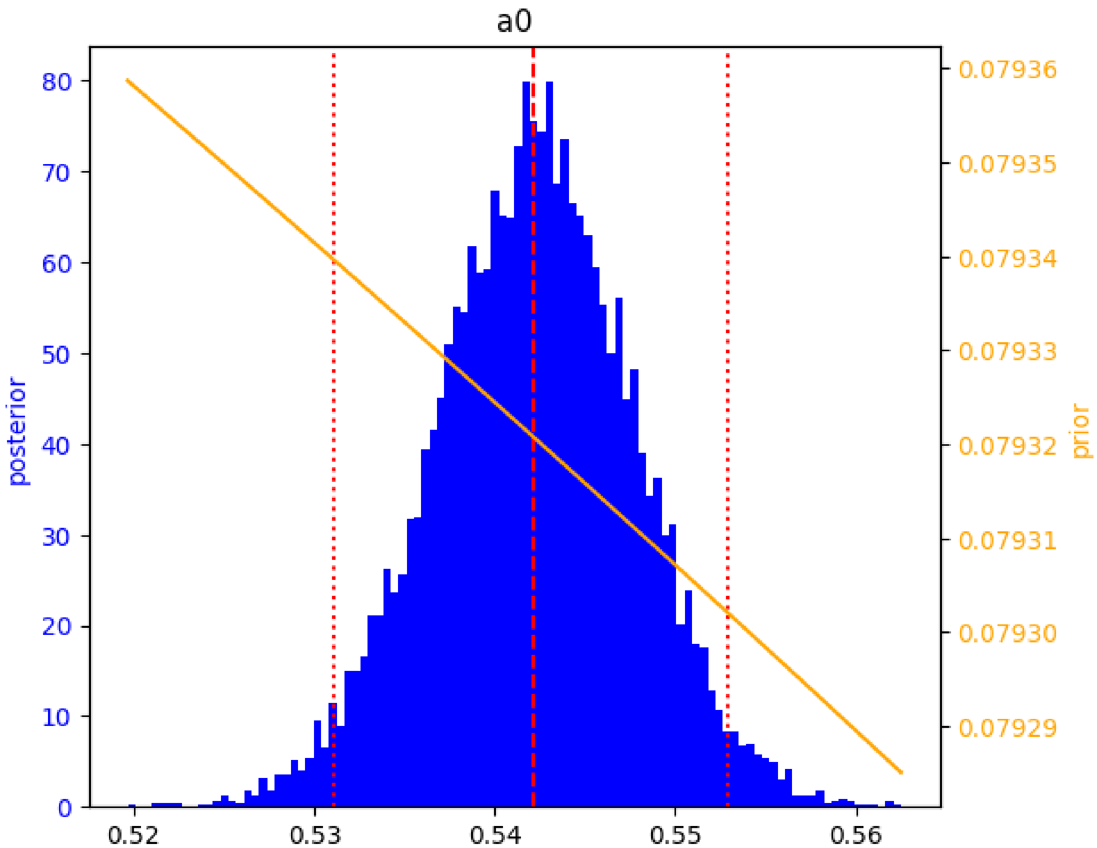

a0
0.56
0.55
0.54
0.53
0.52
0
2000
4000
6000
8000
10000

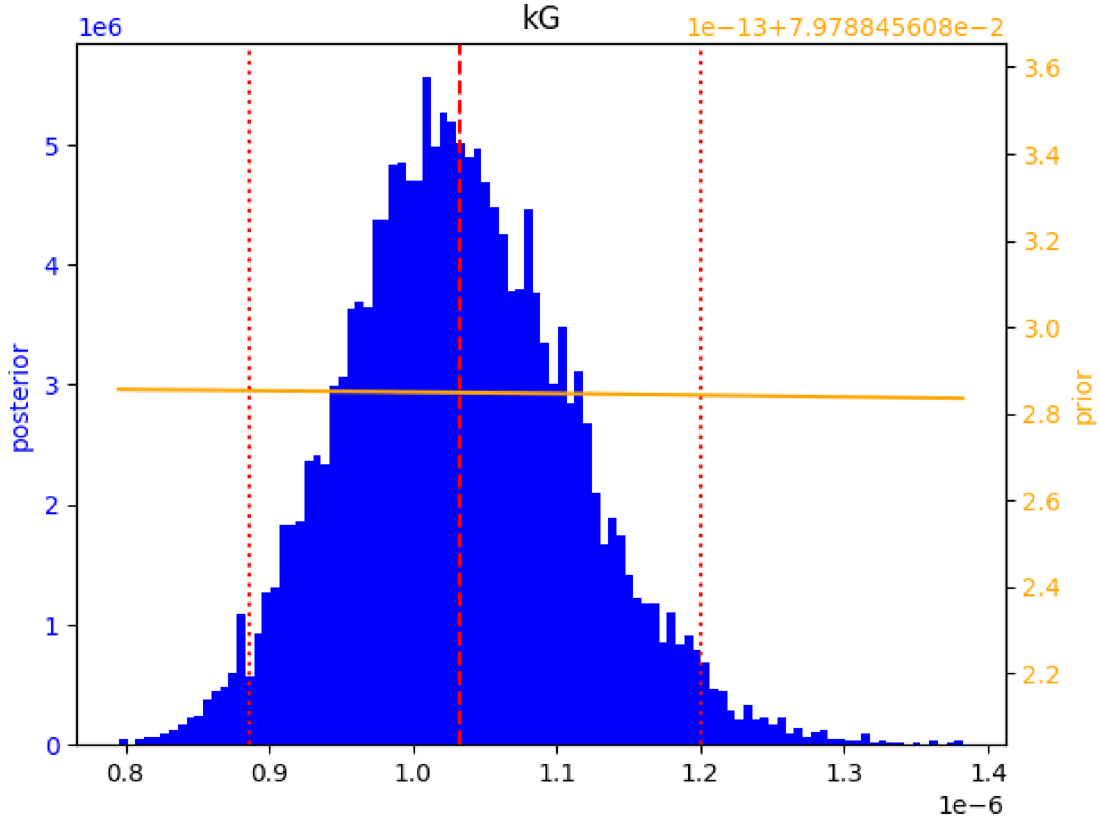

kG
1e−6
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0
2000
4000
6000
8000
10000

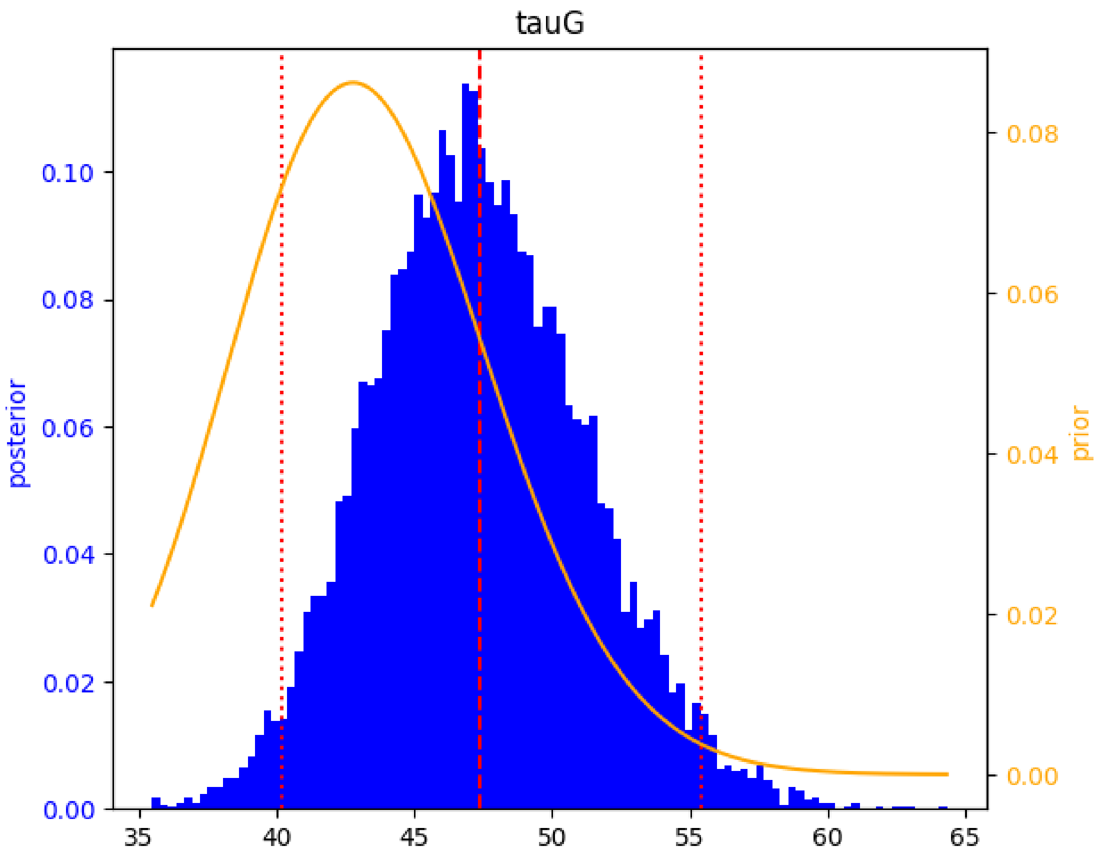


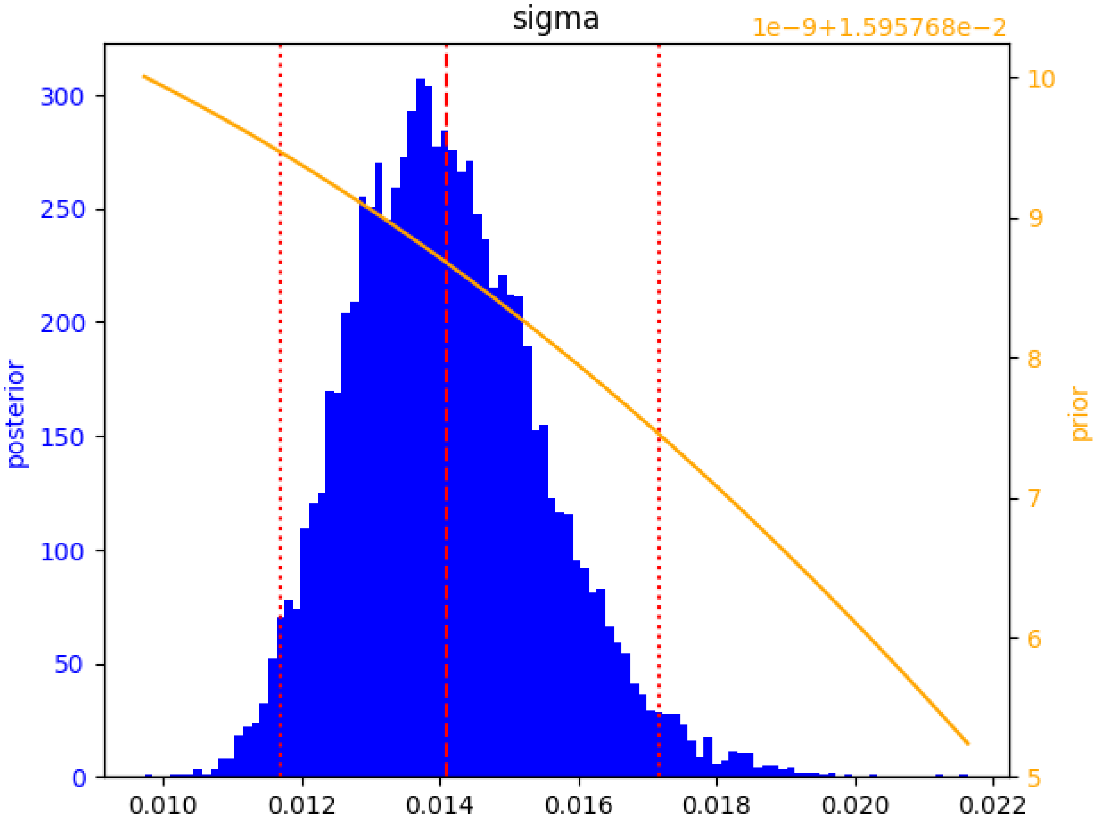
tauG
65
60
55
50
45
40
35
0
2000
4000
6000
8000
10000

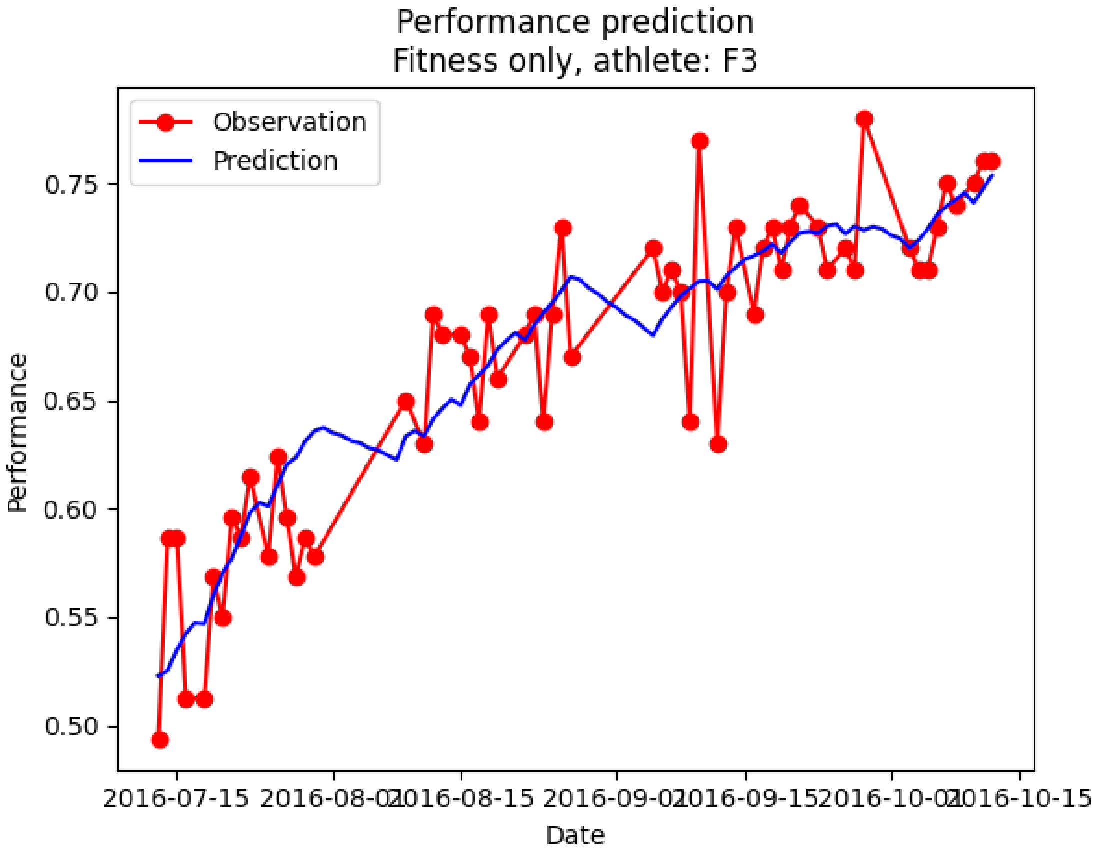

sigma
0.022
0.020
0.018
0.016
0.014
0.012
0.010
0
2000
4000
6000
8000
10000

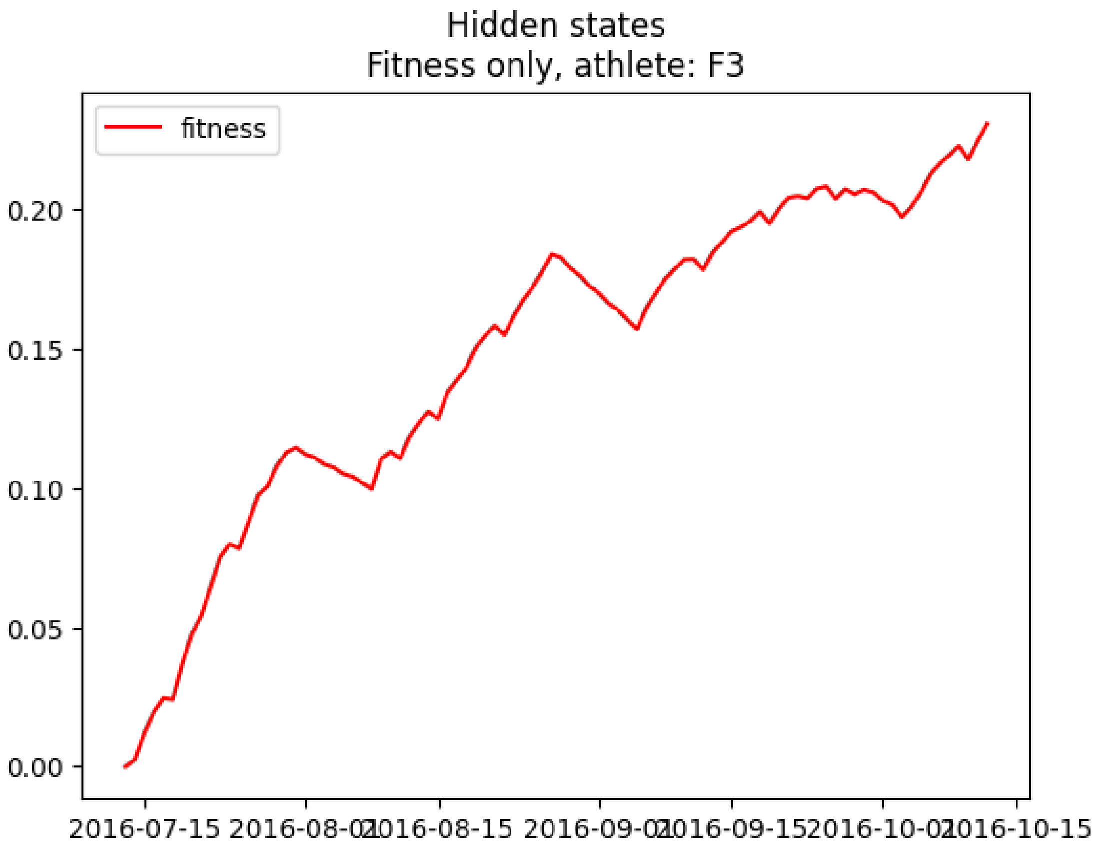

a0
posterior
prior
80
70
60
50
40
30
20
10
0
0.07936
0.07935
0.07934
0.07933
0.07932
0.07931
0.07930
0.07929
0.52
0.53
0.54
0.55
0.56

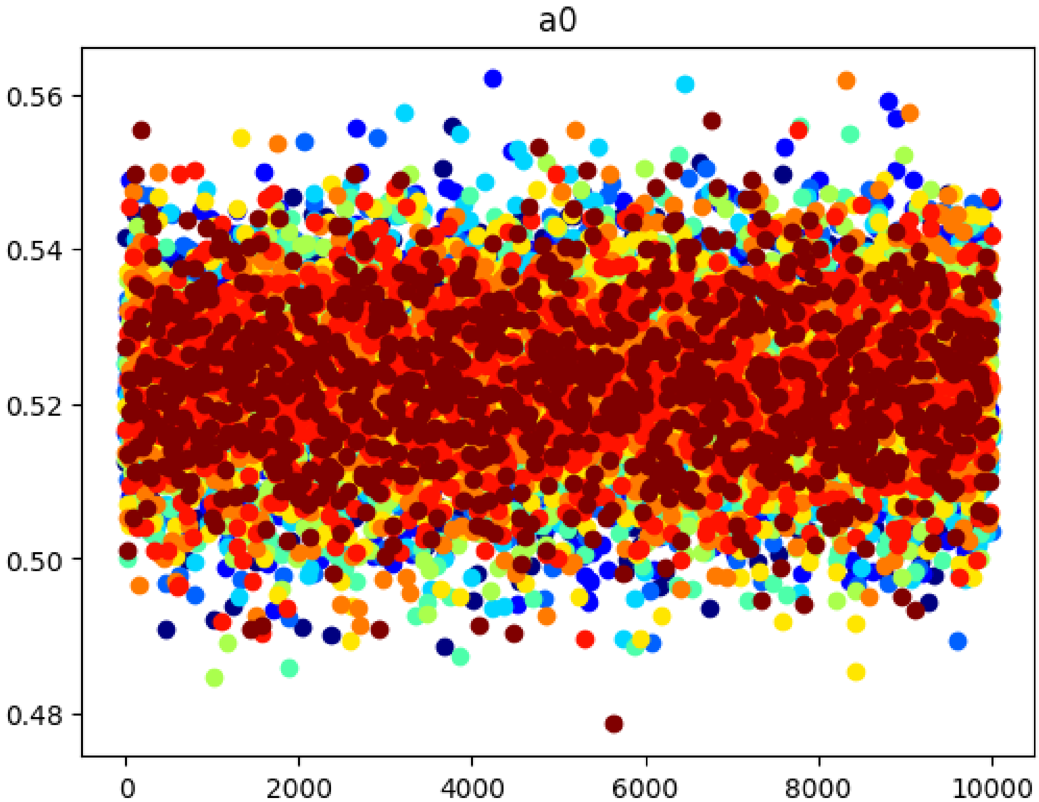

kG
1e6
1e−13+7.978845608e−2
posterior
prior
0
1
2
3
4
5
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1e−6

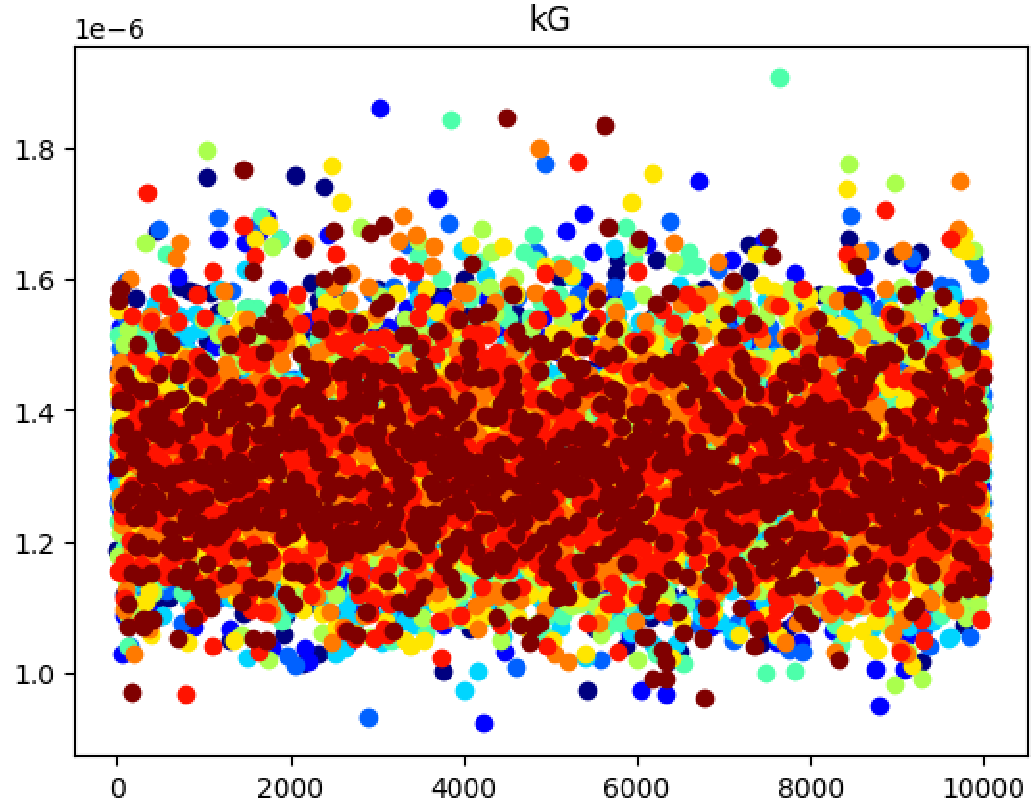

tauG
posterior
prior
0.00
0.02
0.04
0.06
0.08
0.10
0.00
0.02
0.04
0.06
0.08
35
40
45
50
55
60
65

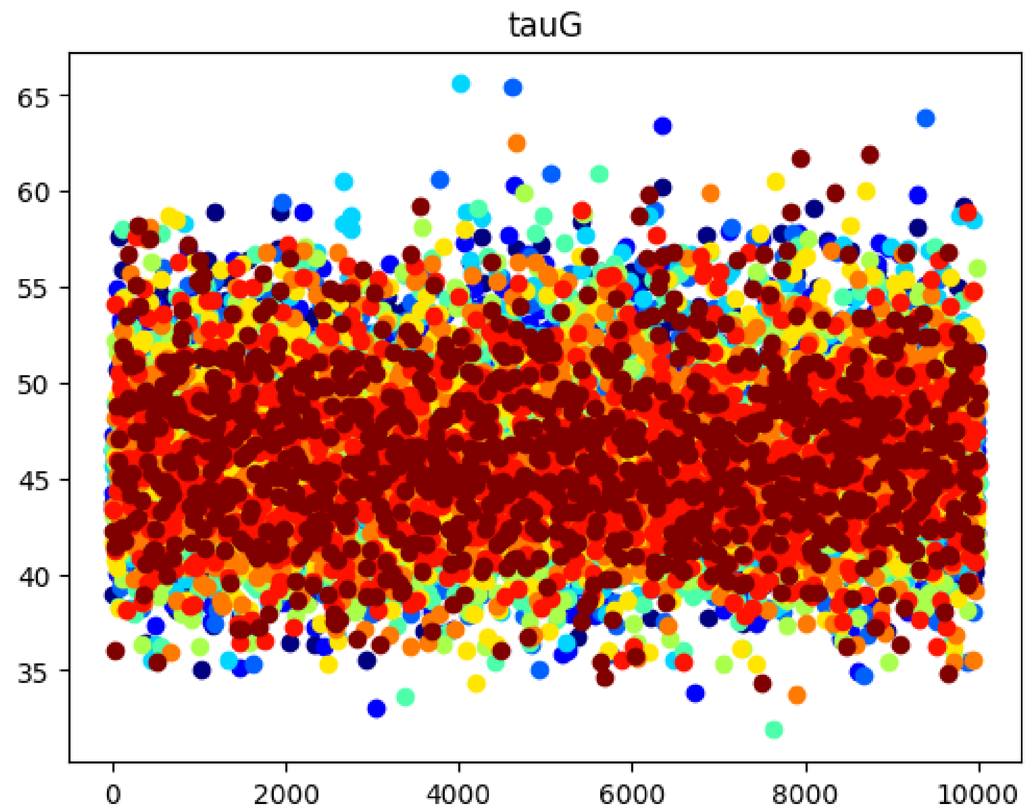

sigma
1e−9+1.595768e−2
posterior
prior
0 50 100 150 200 250 300
5 6 7 8 9 10
0.010 0.012 0.014 0.016 0.018 0.020 0.022


Performance prediction
Fitness only, athlete: F3
Observation
Prediction
Performance
0.75
0.70
0.65
0.60
0.55
0.50
Date
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

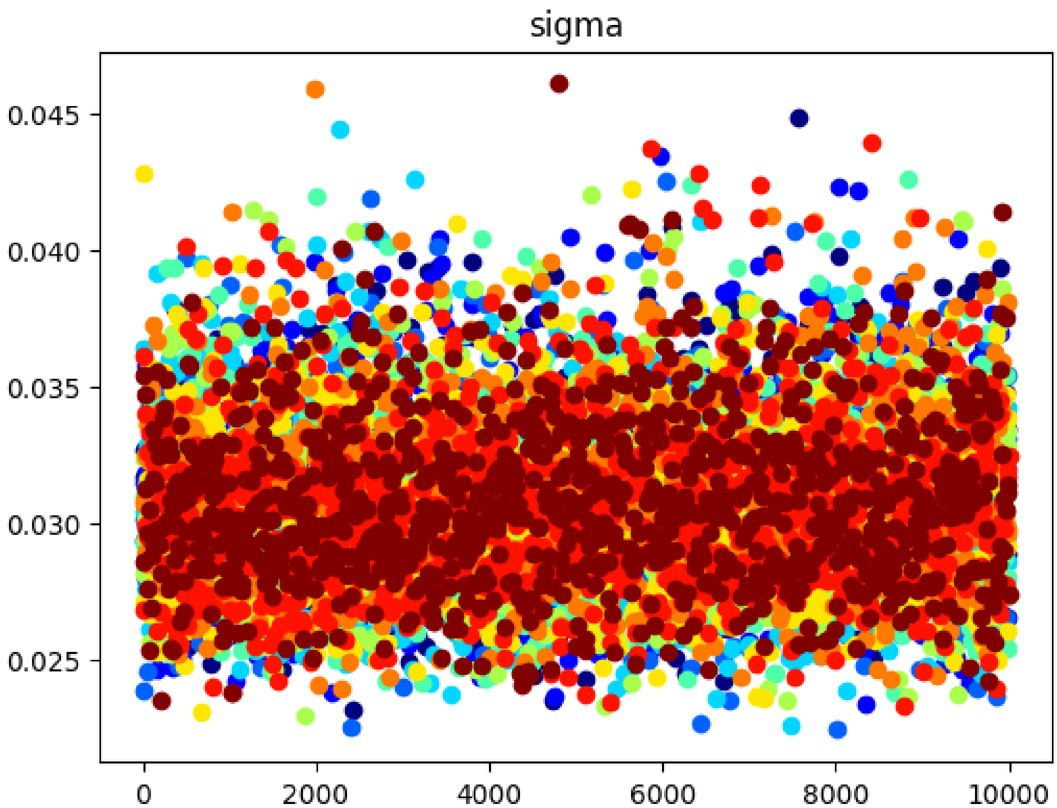

Hidden states
Fitness only, athlete: F3
fitness
0.20
0.15
0.10
0.05
0.00
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

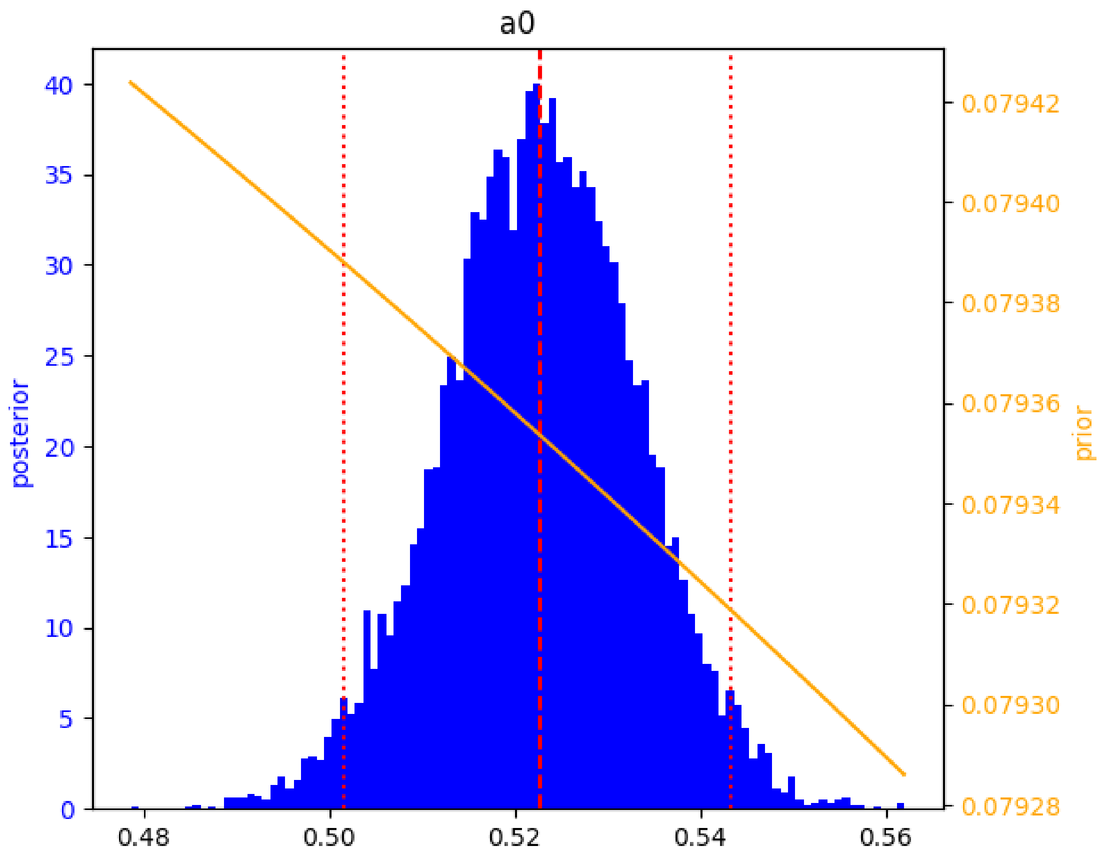

a0
0.56
0.54
0.52
0.50
0.48
0
2000
4000
6000
8000
10000


kG
1e−6
1.8
1.6
1.4
1.2
1.0
0
2000
4000
6000
8000
10000

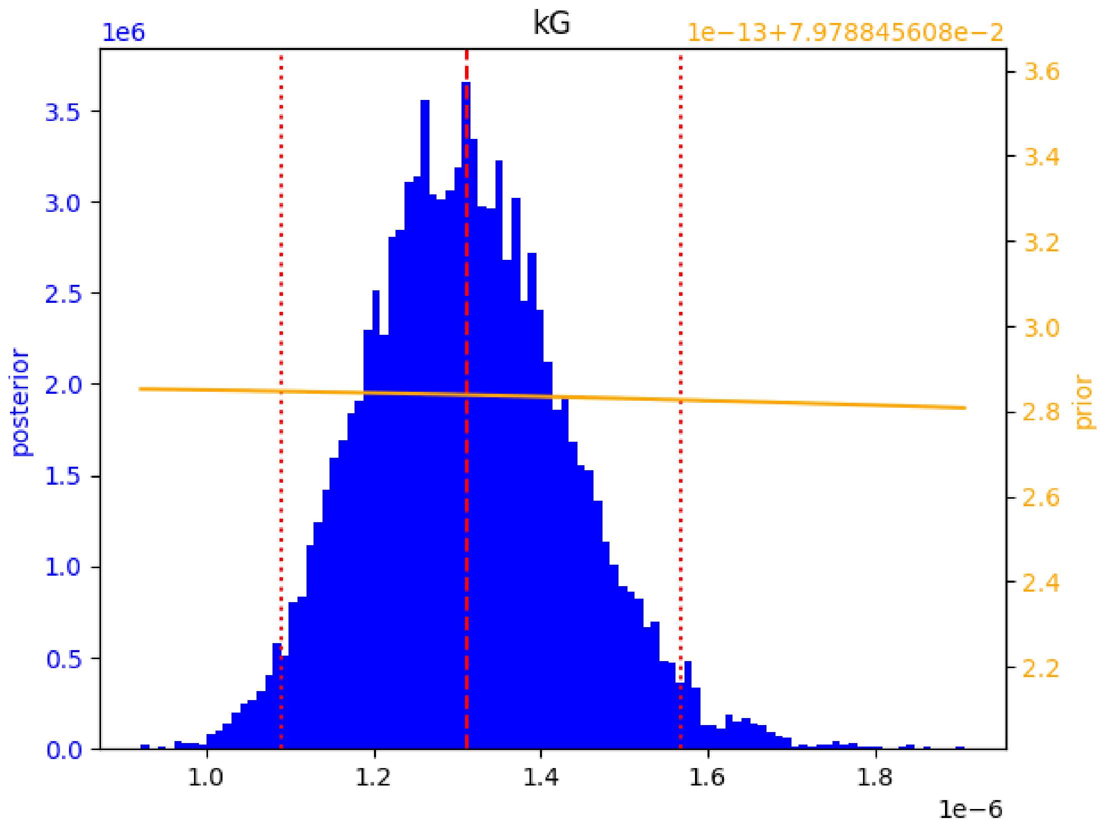


tauG
65
60
55
50
45
40
35
0
2000
4000
6000
8000
10000

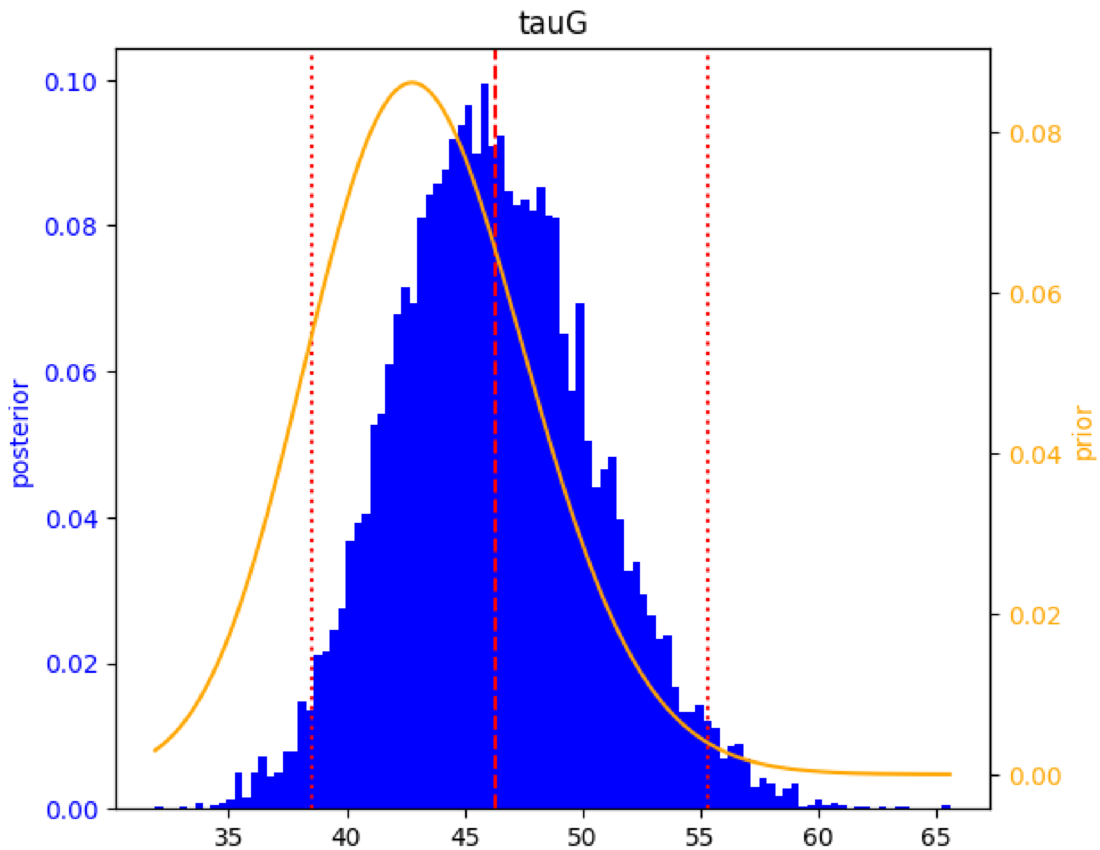

sigma
0.045
0.040
0.035
0.030
0.025
0
2000
4000
6000
8000
10000

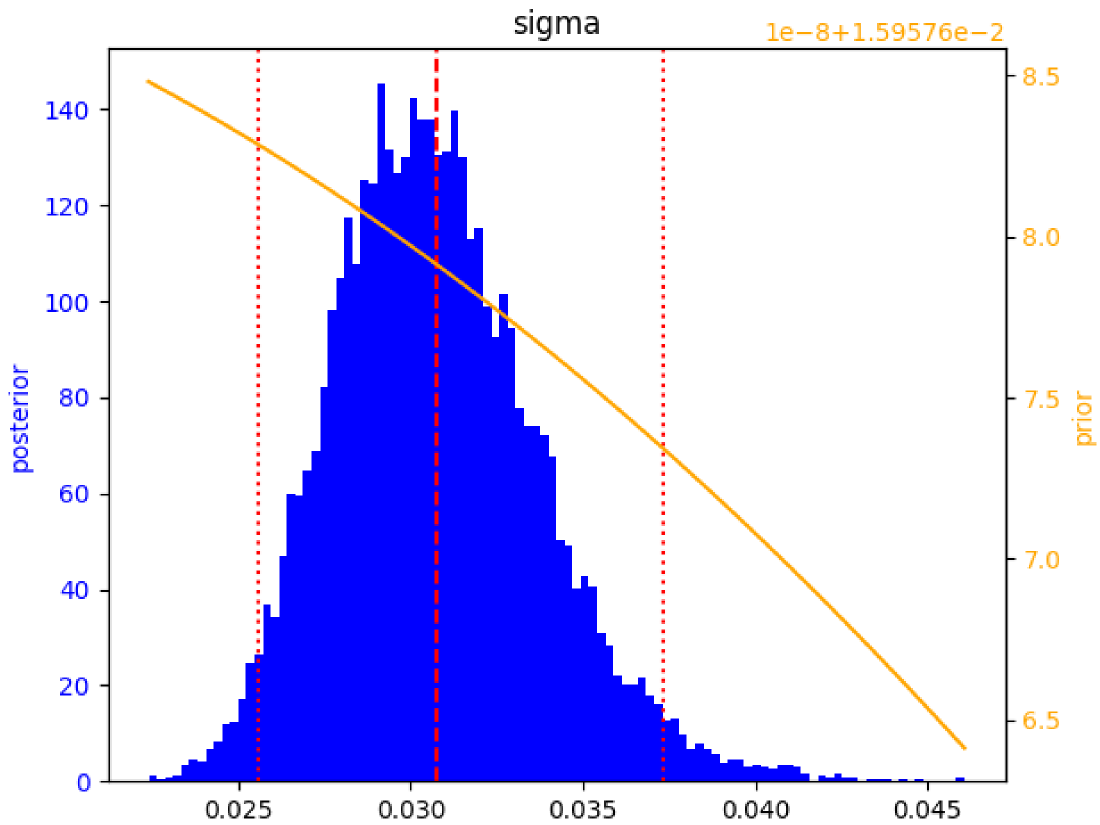


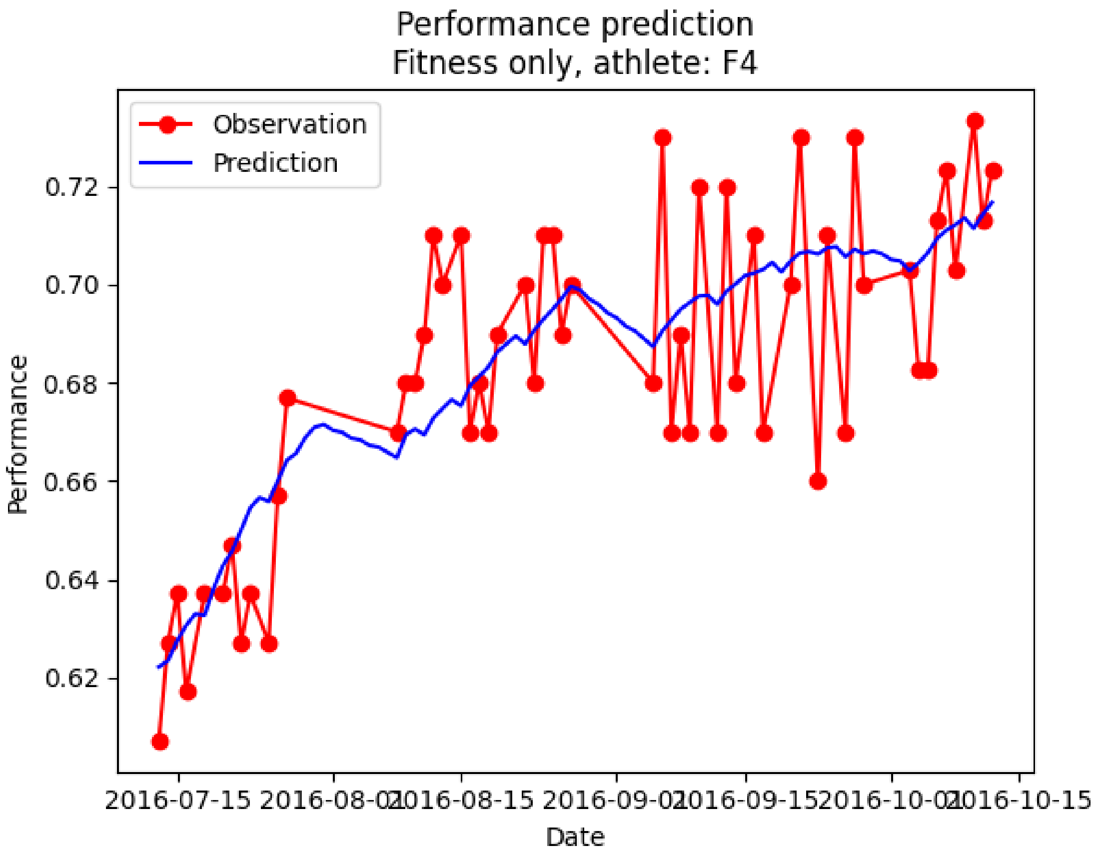
a0
posterior
prior
40
35
30
25
20
15
10
5
0
0.07942
0.07940
0.07938
0.07936
0.07934
0.07932
0.07930
0.07928
0.48
0.50
0.52
0.54
0.56

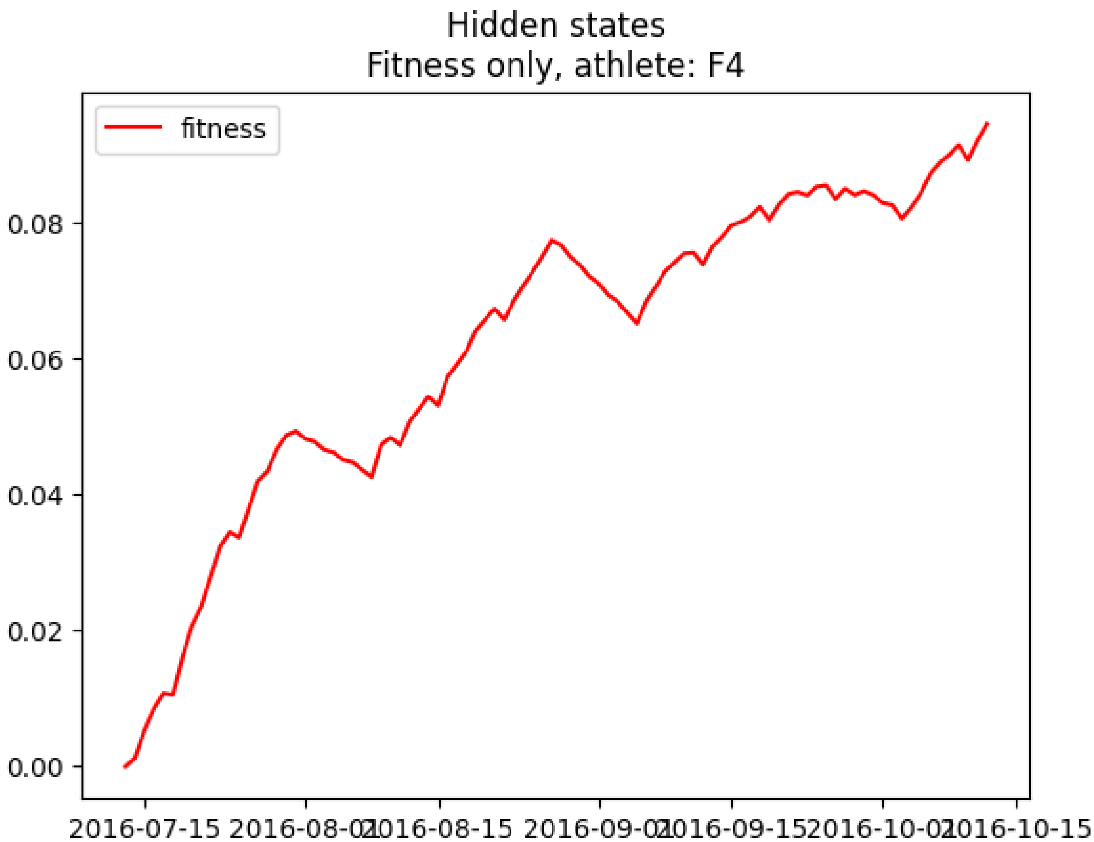


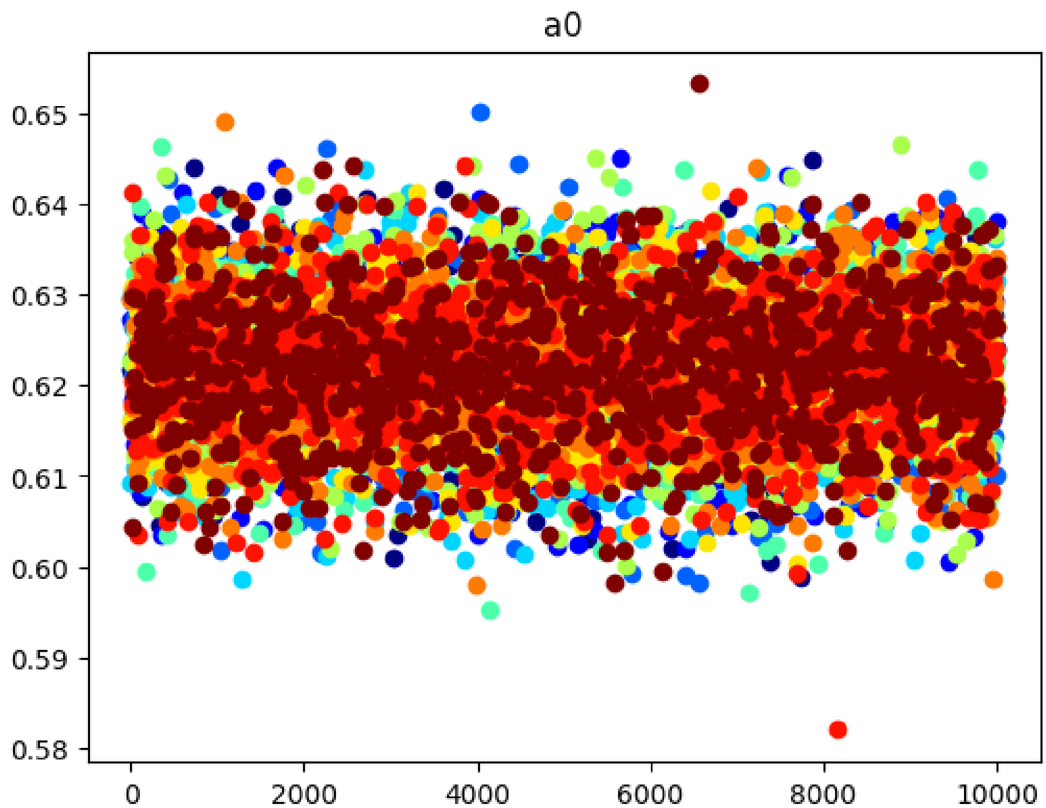
kG
1e6
1e−13+7.978845608e−2
posterior
prior
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
1.0
1.2
1.4
1.6
1.8
1e−6

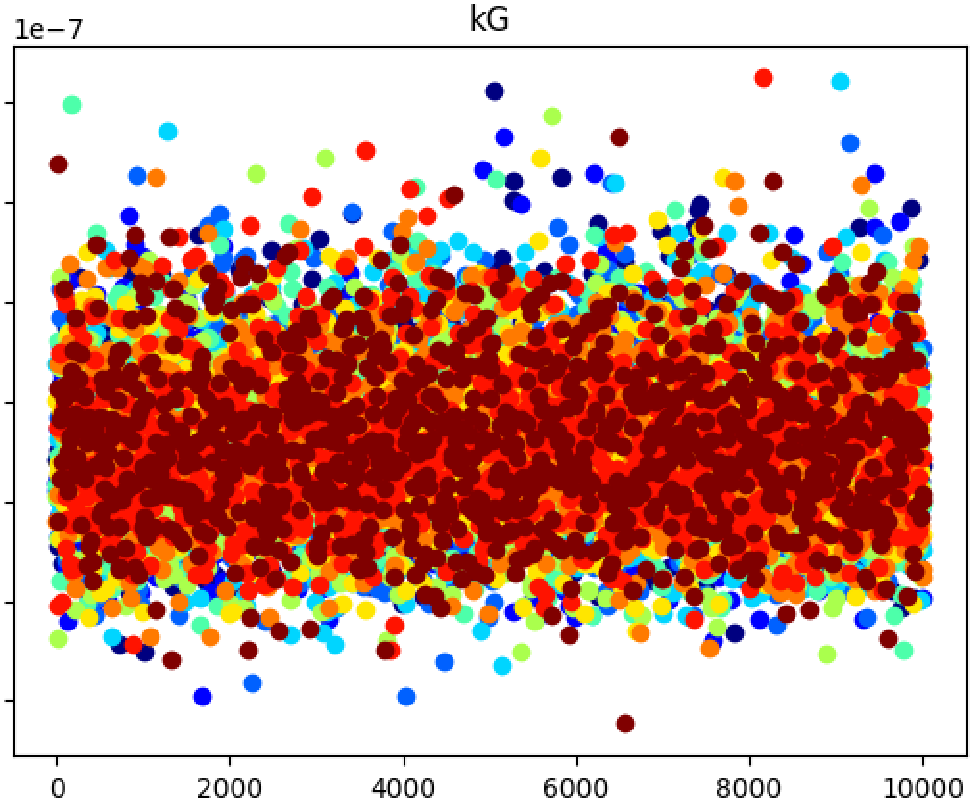

tauG
posterior
prior
0.00
0.02
0.04
0.06
0.08
0.10
0.00
0.02
0.04
0.06
0.08
35
40
45
50
55
60
65

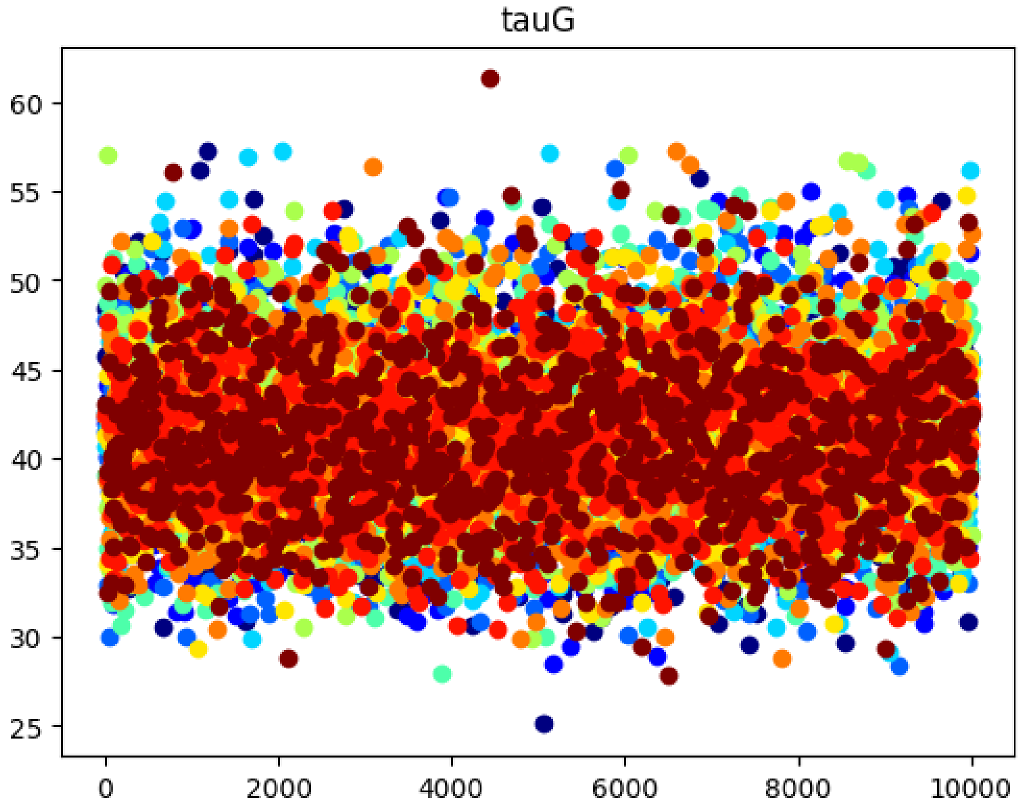

sigma
1e−8+1.59576e−2
posterior
prior
0
20
40
60
80
100
120
140
6.5
7.0
7.5
8.0
8.5
0.025
0.030
0.035
0.040
0.045

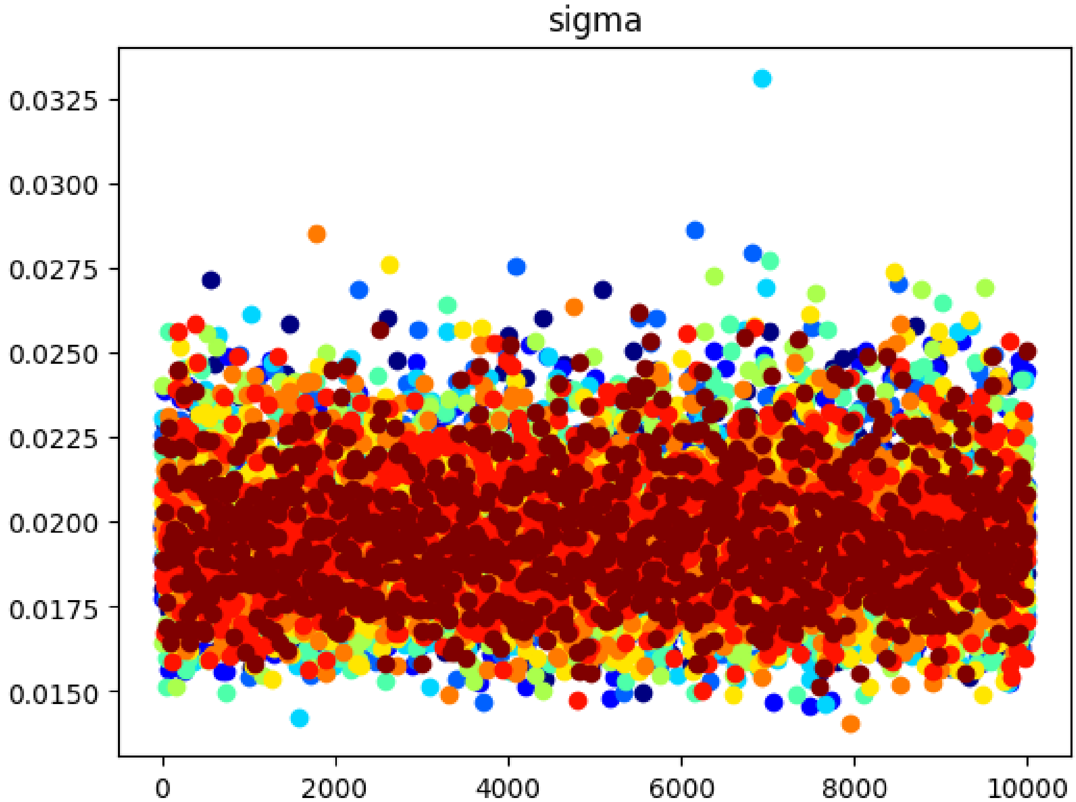

Performance prediction
Fitness only, athlete: F4
Observation
Prediction
Performance
0.72
0.70
0.68
0.66
0.64
0.62
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

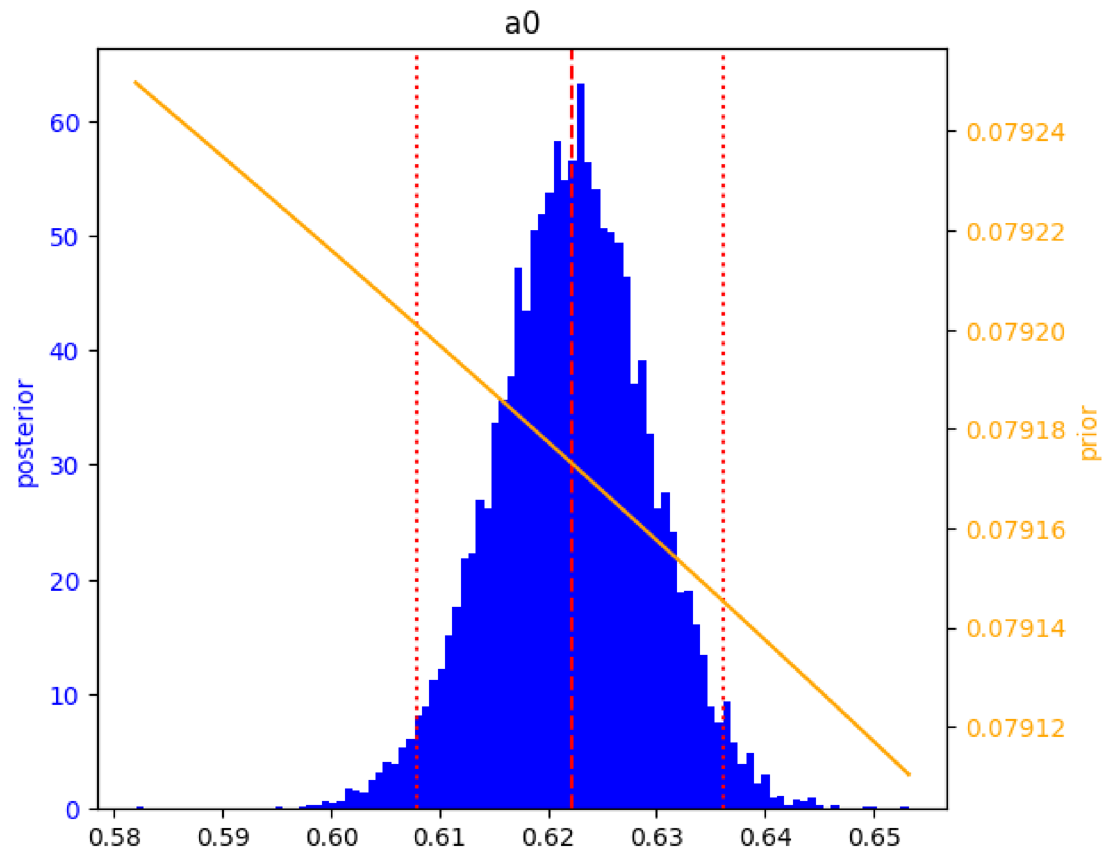

Hidden states
Fitness only, athlete: F4
fitness
0.08
0.06
0.04
0.02
0.00
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

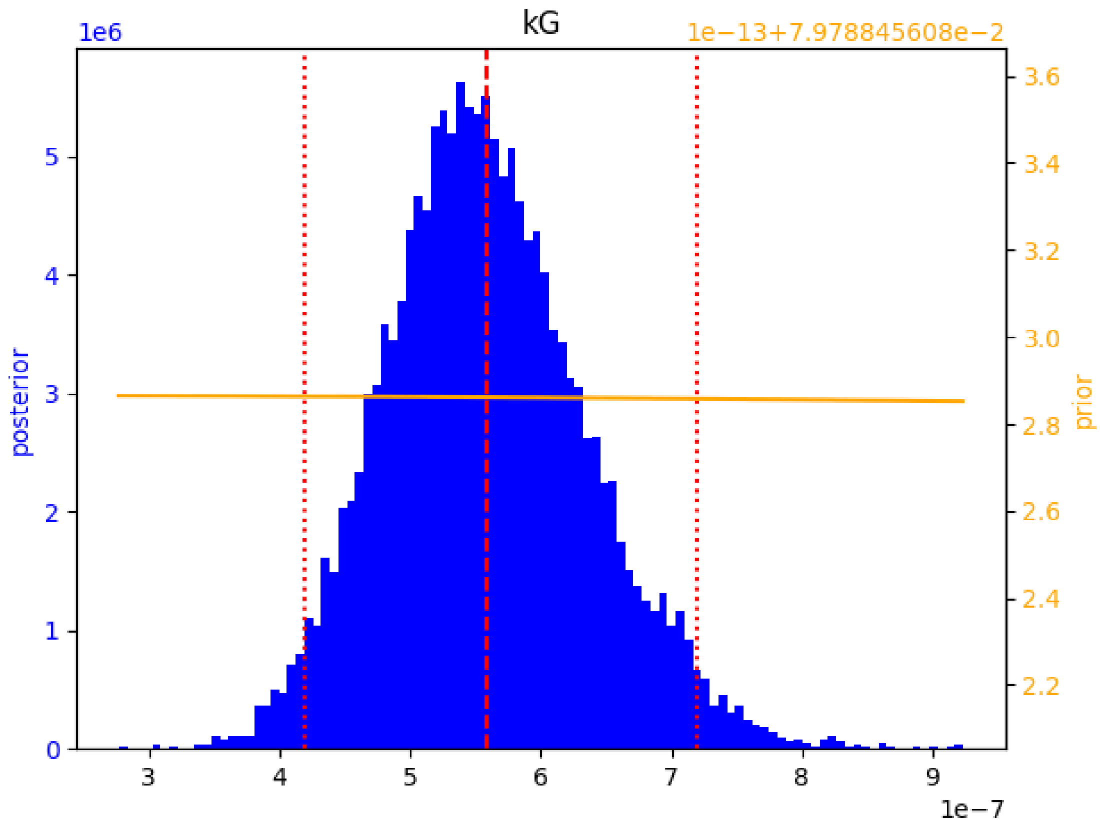

a0
0.65
0.64
0.63
0.62
0.61
0.60
0.59
0.58
0
2000
4000
6000
8000
10000

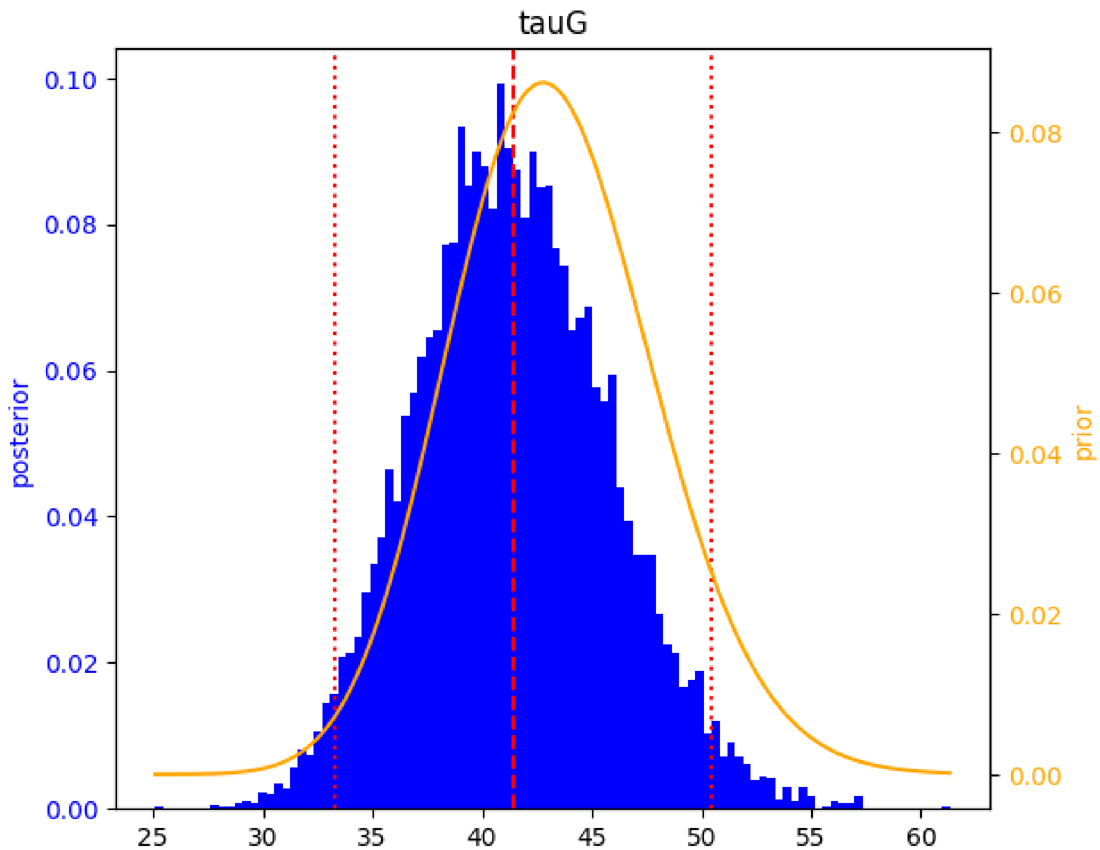

kG
1e−7
9
8
7
6
5
4
3
0
2000
4000
6000
8000
10000


tauG
60
55
50
45
40
35
30
25
0
2000
4000
6000
8000
10000

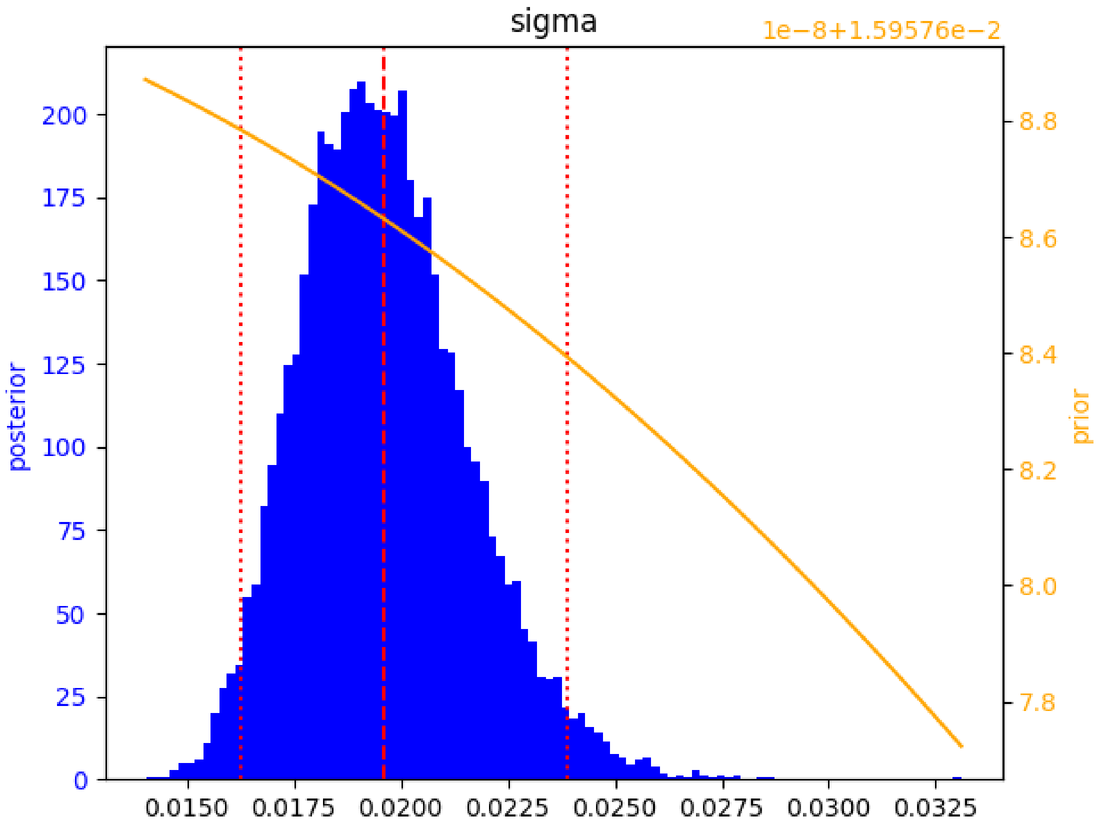

sigma
0.0325
0.0300
0.0275
0.0250
0.0225
0.0200
0.0175
0.0150
0
2000
4000
6000
8000
10000


a0
posterior
prior
0
10
20
30
40
50
60
0.07912
0.07914
0.07916
0.07918
0.07920
0.07922
0.07924
0.58
0.59
0.60
0.61
0.62
0.63
0.64
0.65

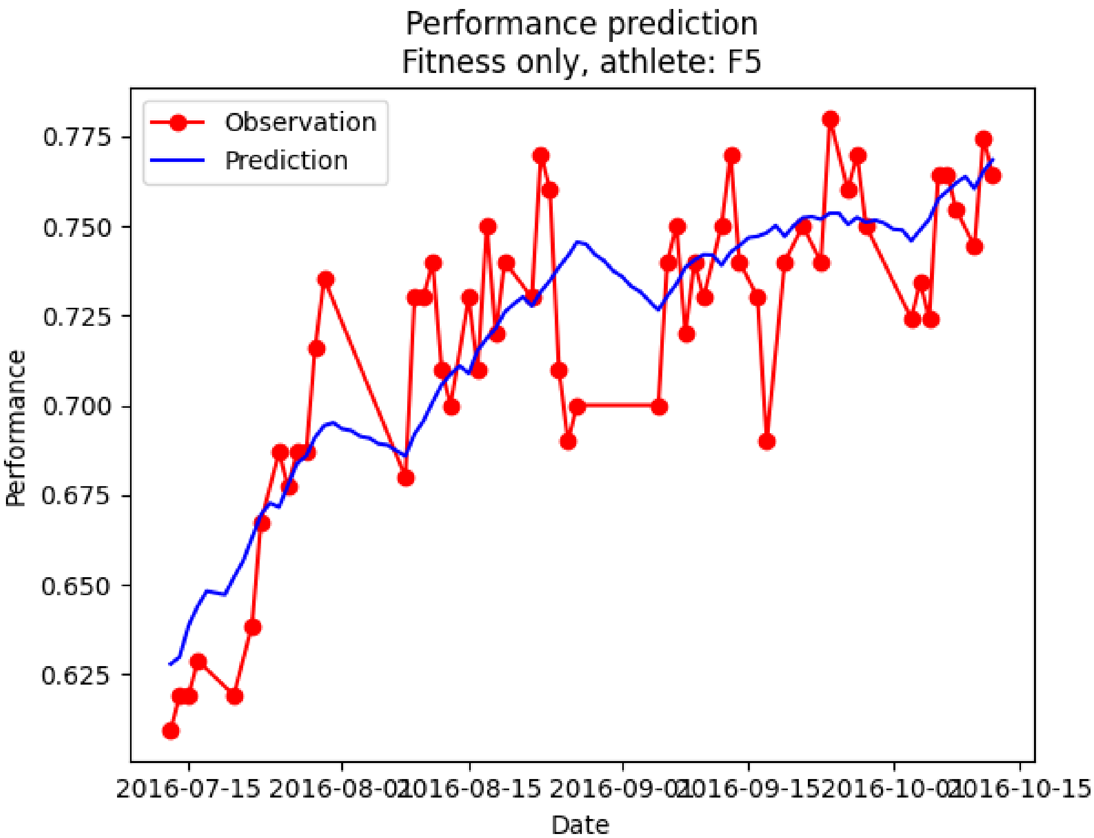

kG
1e6
1e−13+7.978845608e−2
posterior
prior
0
1
2
3
4
5
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3
4
5
6
7
8
9
1e−7

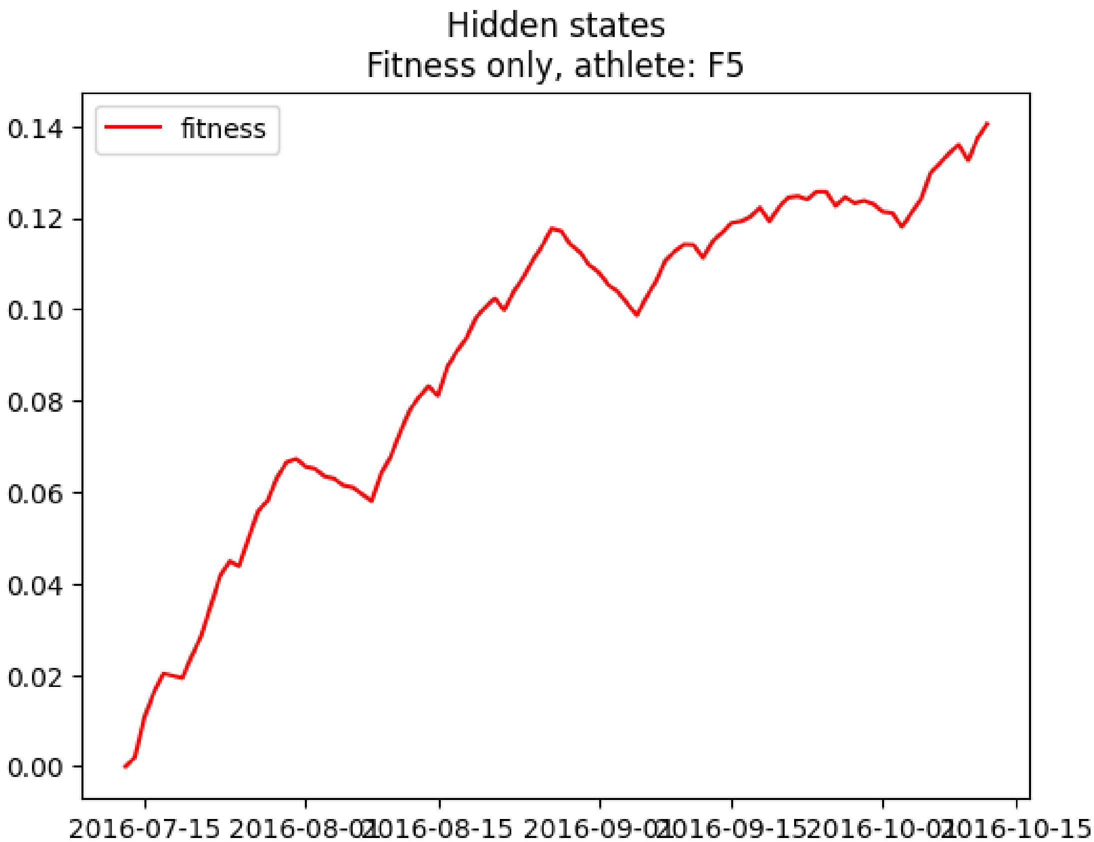


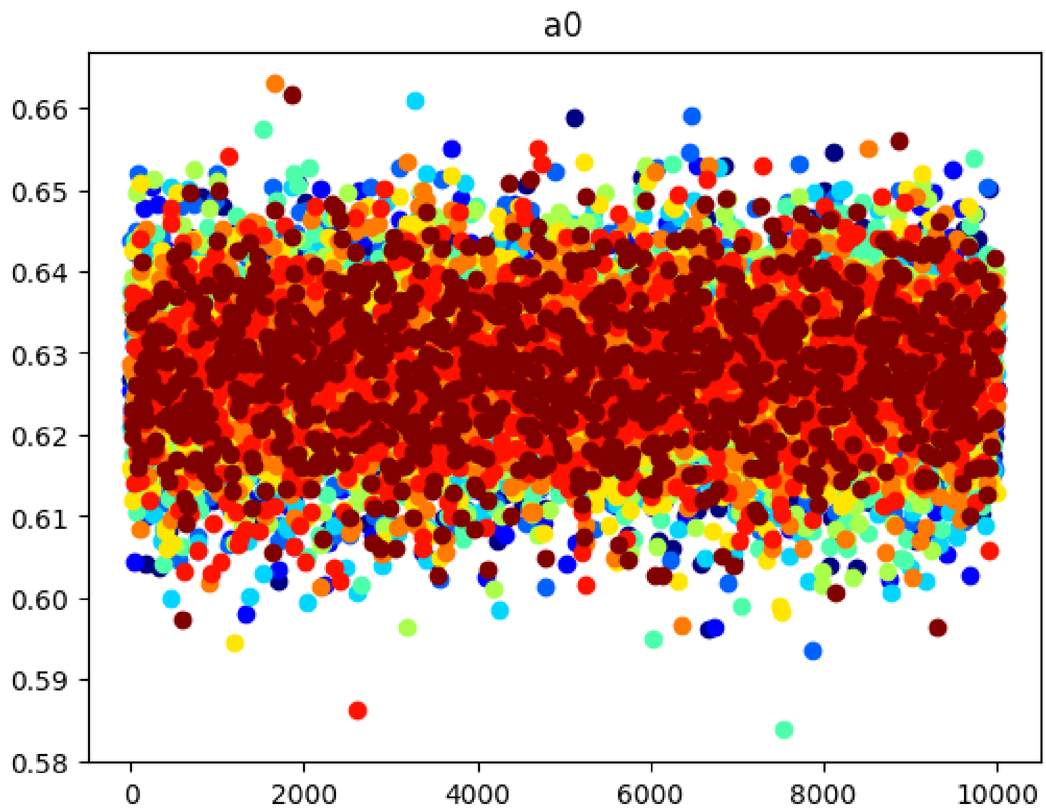
tauG
posterior
prior
0.00
0.02
0.04
0.06
0.08
0.10
0.00
0.02
0.04
0.06
0.08
25
30
35
40
45
50
55
60

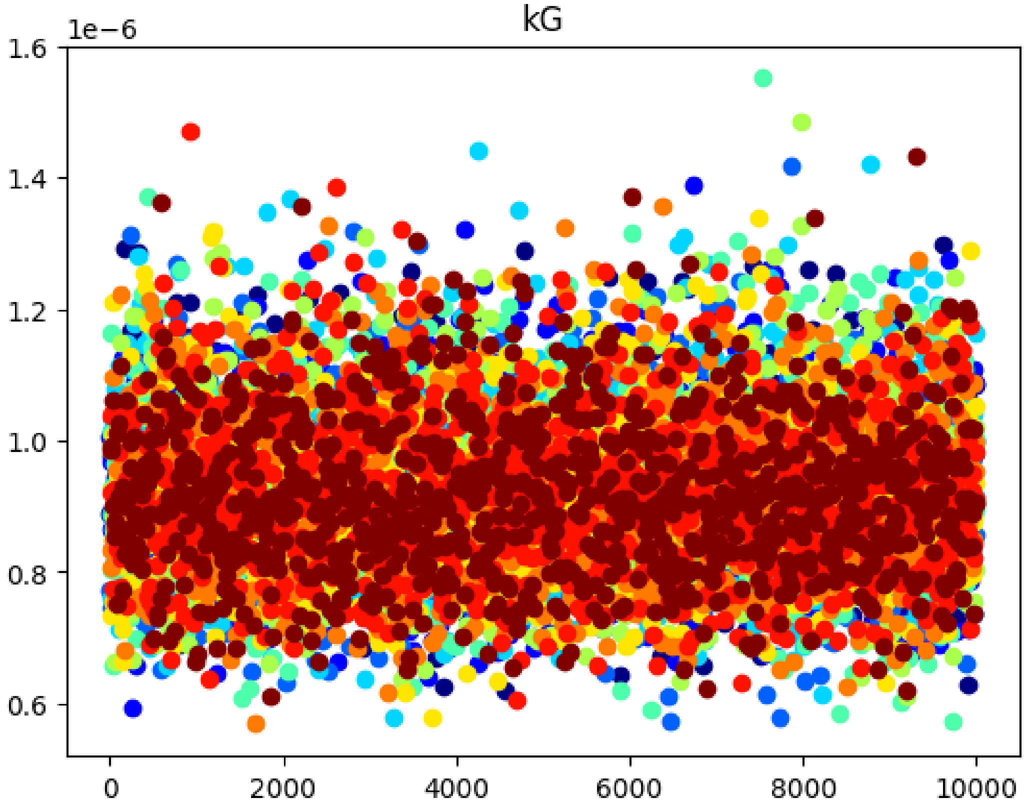


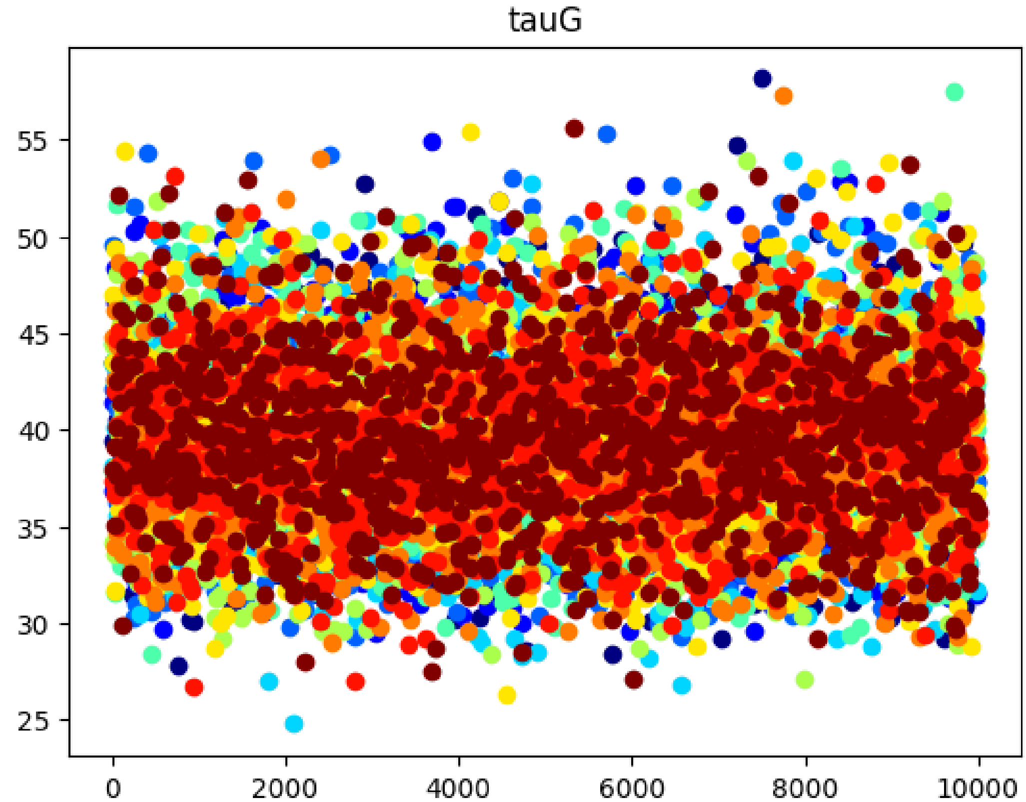
sigma
1e−8+1.59576e−2
posterior
prior
200
175
150
125
100
75
50
25
0
8.8
8.6
8.4
8.2
8.0
7.8
0.0150
0.0175
0.0200
0.0225
0.0250
0.0275
0.0300
0.0325

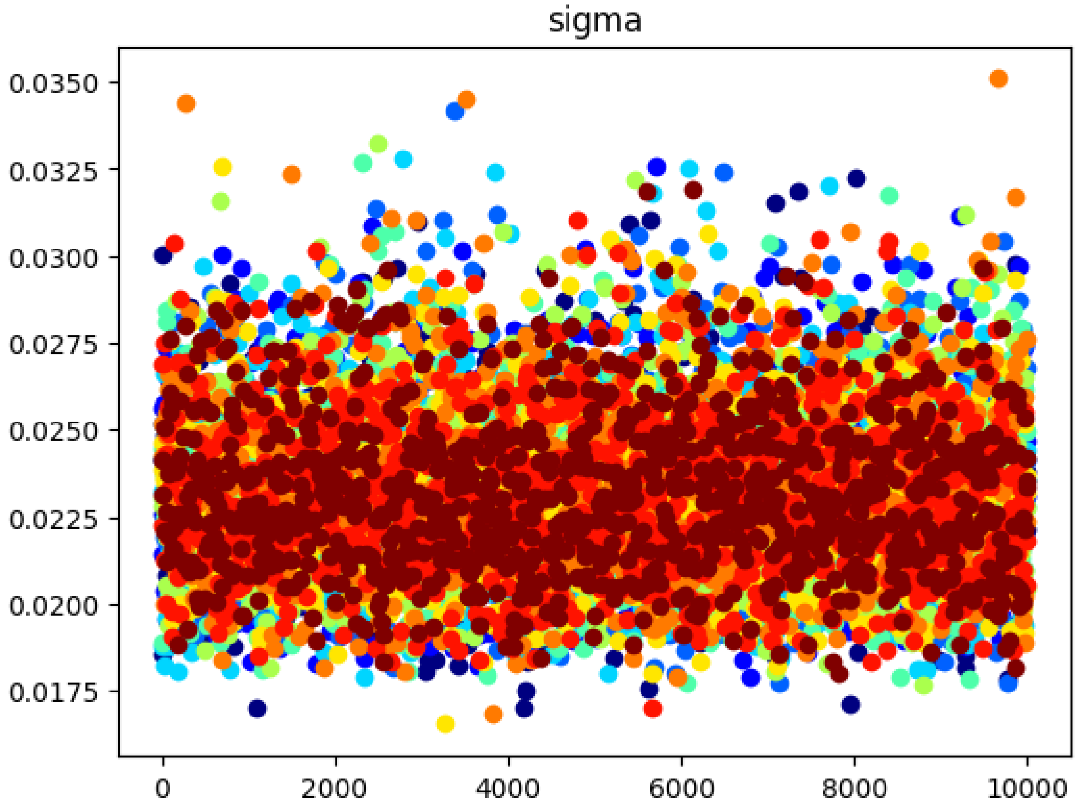

Performance prediction
Fitness only, athlete: F5
Observation
Prediction
0.775
0.750
0.725
0.700
0.675
0.650
0.625
Performance
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

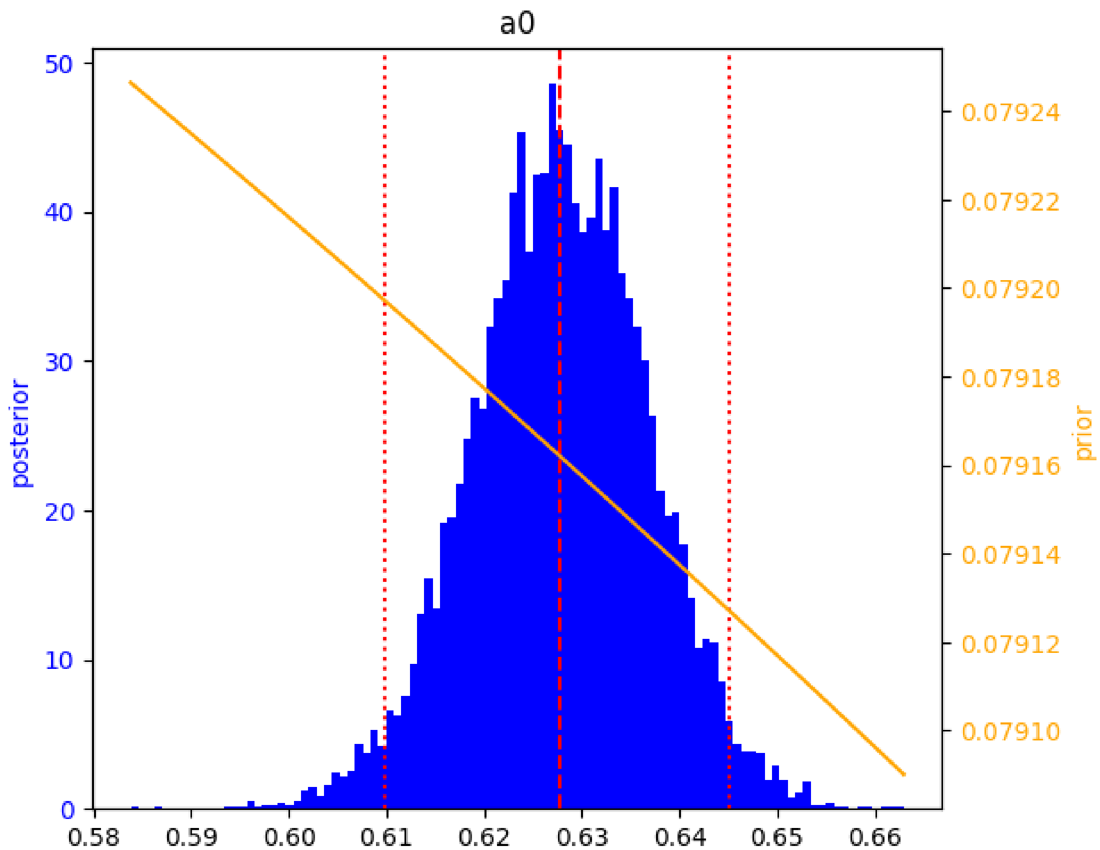

Hidden states
Fitness only, athlete: F5
fitness
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

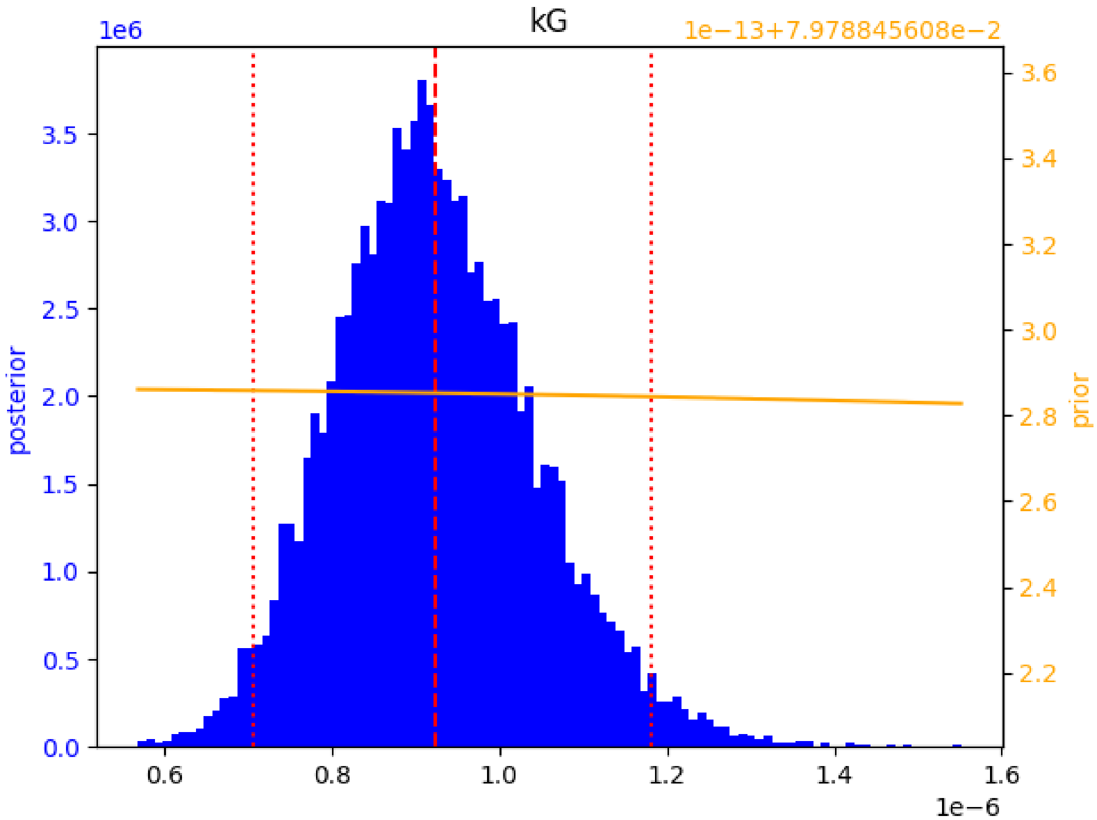

a0
0.66
0.65
0.64
0.63
0.62
0.61
0.60
0.59
0.58
0
2000
4000
6000
8000
10000

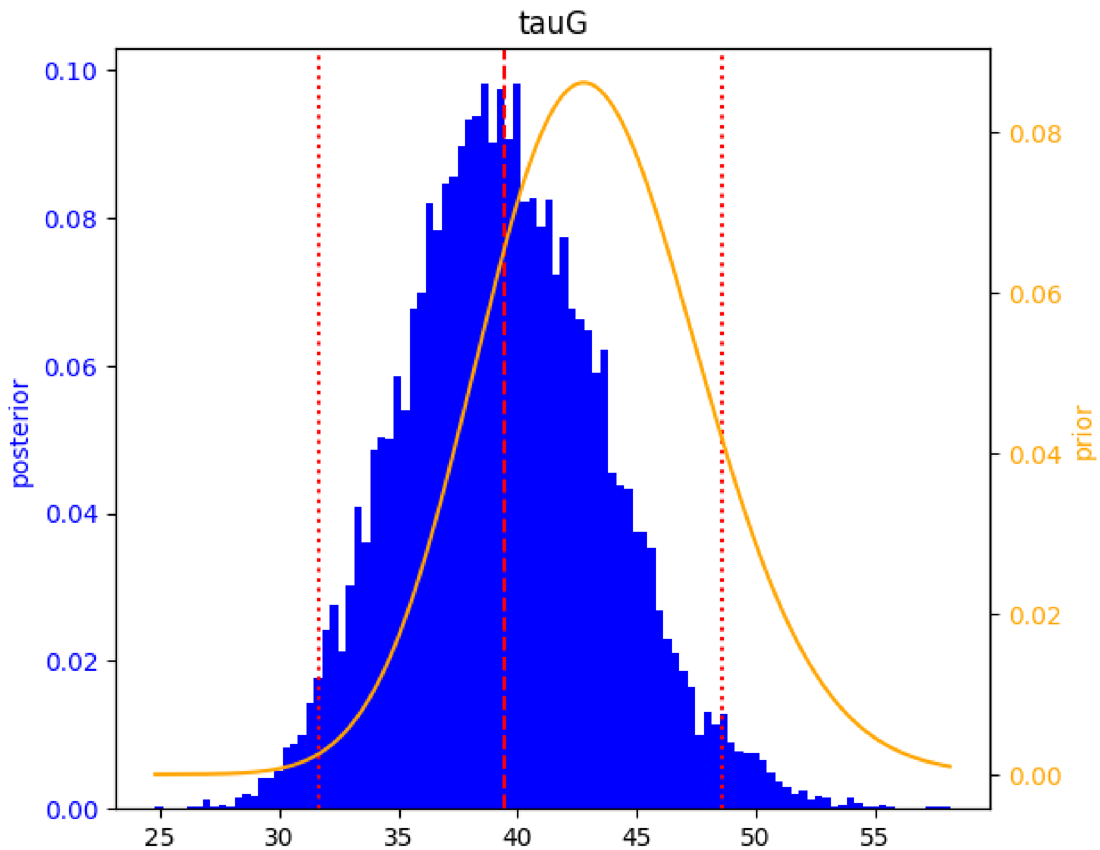

kG
1e−6
1.6
1.4
1.2
1.0
0.8
0.6
0
2000
4000
6000
8000
10000

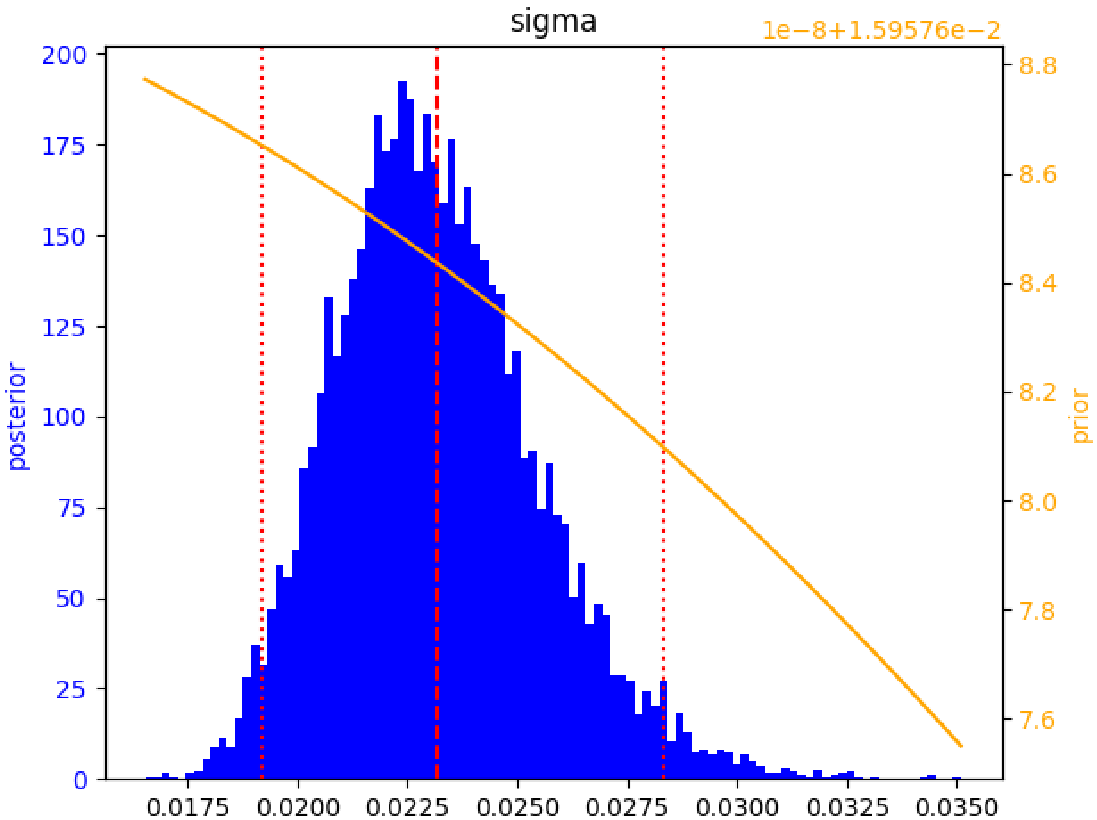

tauG
55
50
45
40
35
30
25
0
2000
4000
6000
8000
10000


sigma
0.0350
0.0325
0.0300
0.0275
0.0250
0.0225
0.0200
0.0175
0
2000
4000
6000
8000
10000

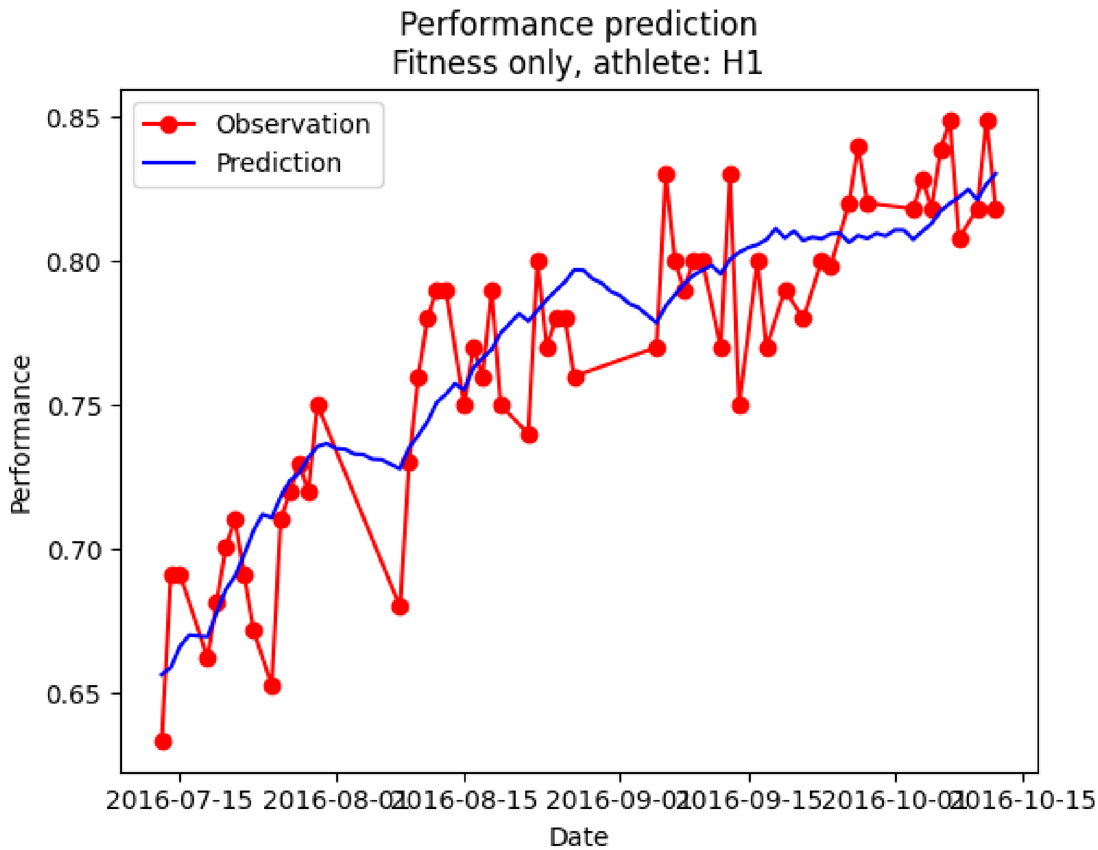

a0
posterior
prior
0.07924
0.07922
0.07920
0.07918
0.07916
0.07914
0.07912
0.07910
0
10
20
30
40
50
0.58
0.59
0.60
0.61
0.62
0.63
0.64
0.65
0.66

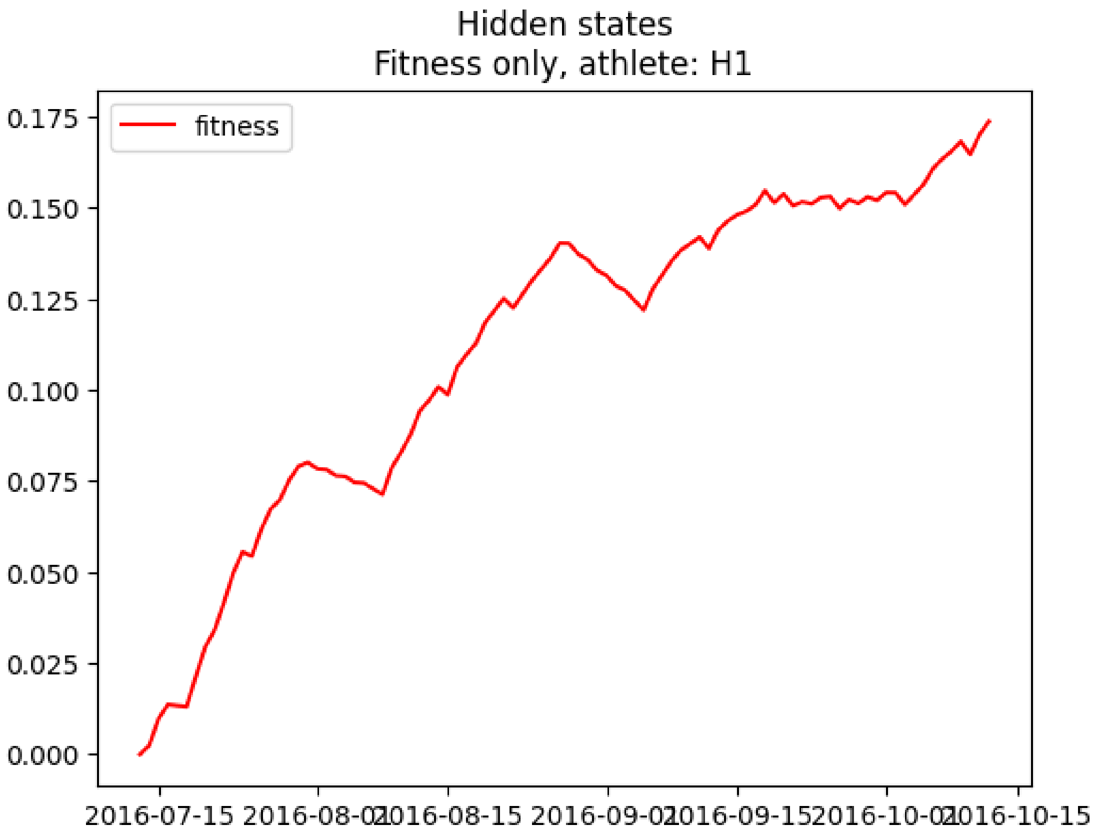

kG
1e6
1e−13+7.978845608e−2
posterior
prior
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
0.6
0.8
1.0
1.2
1.4
1.6
1e−6

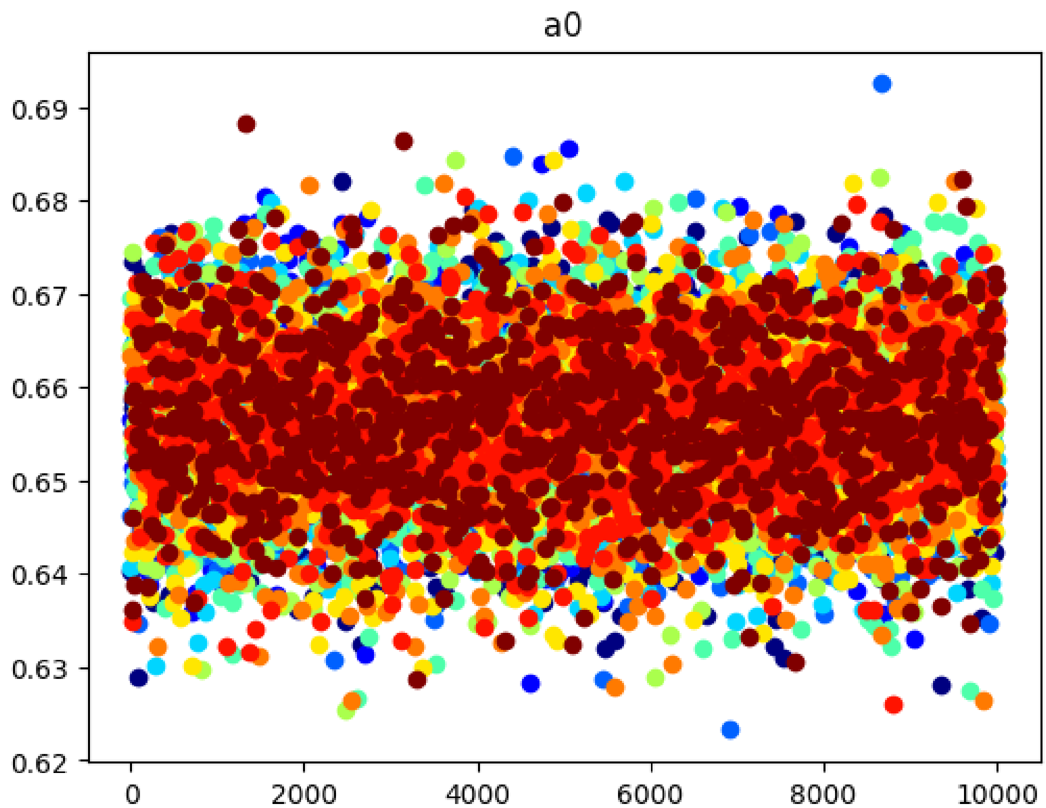

tauG
posterior
prior
0.00
0.02
0.04
0.06
0.08
0.10
25
30
35
40
45
50
55

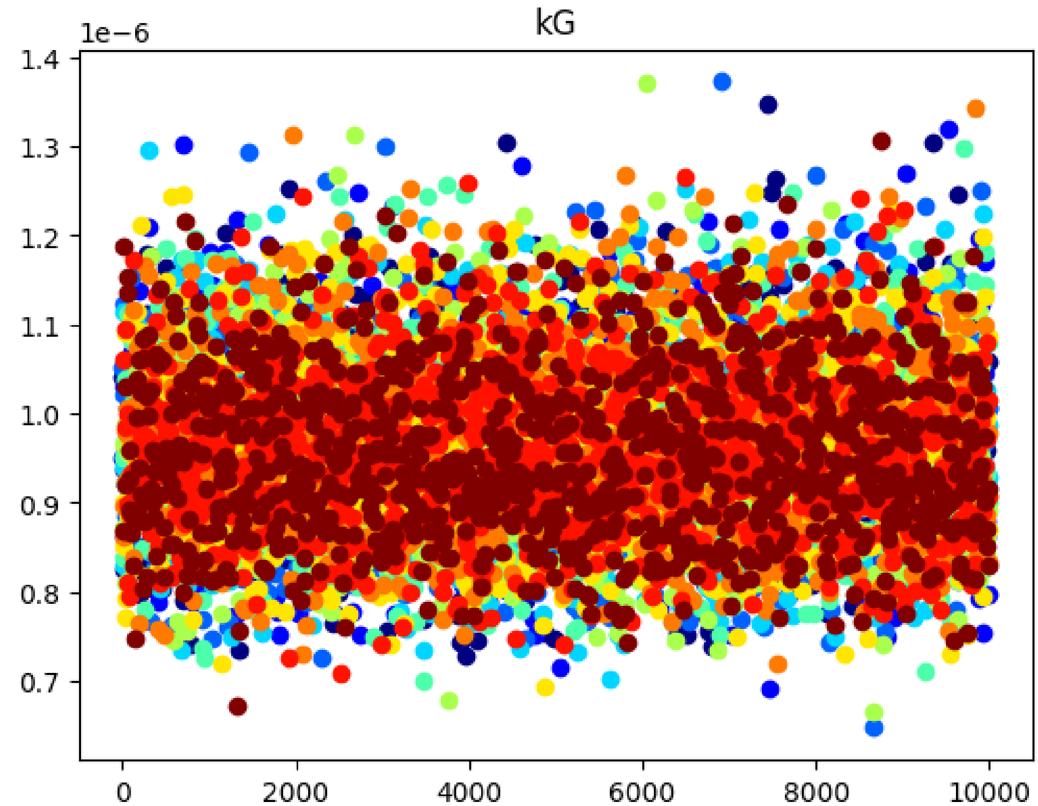


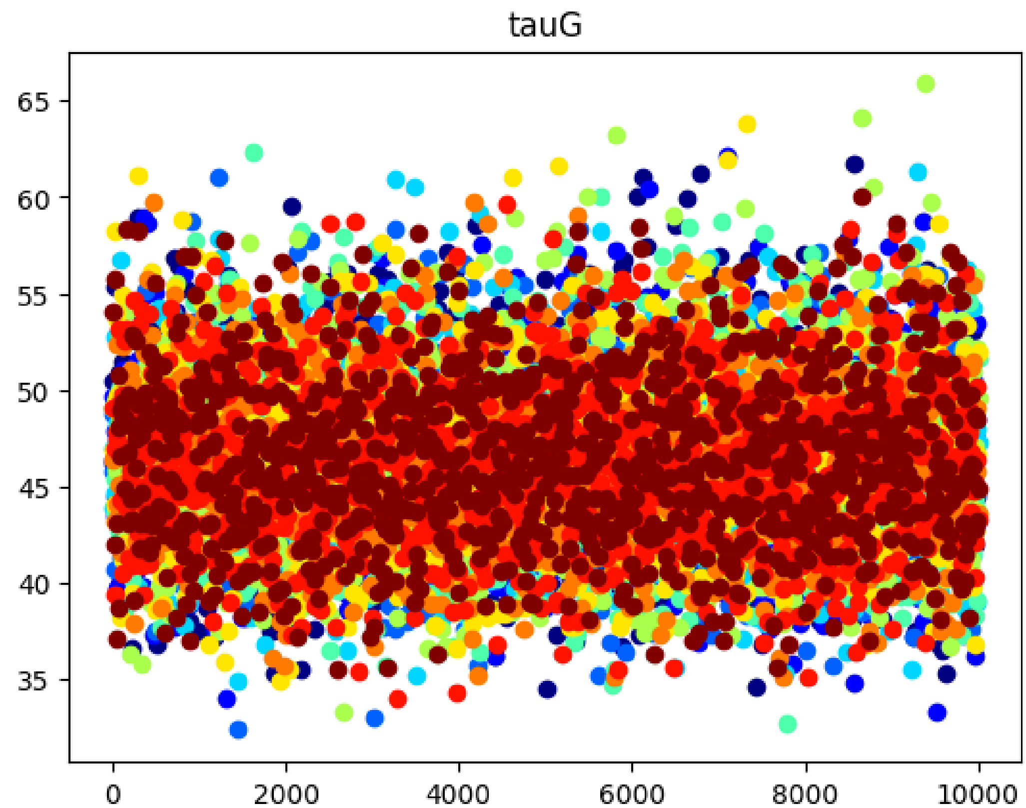
sigma
1e−8+1.59576e−2
posterior
prior
200
175
150
125
100
75
50
25
0
8.8
8.6
8.4
8.2
8.0
7.8
7.6
0.0175
0.0200
0.0225
0.0250
0.0275
0.0300
0.0325
0.0350

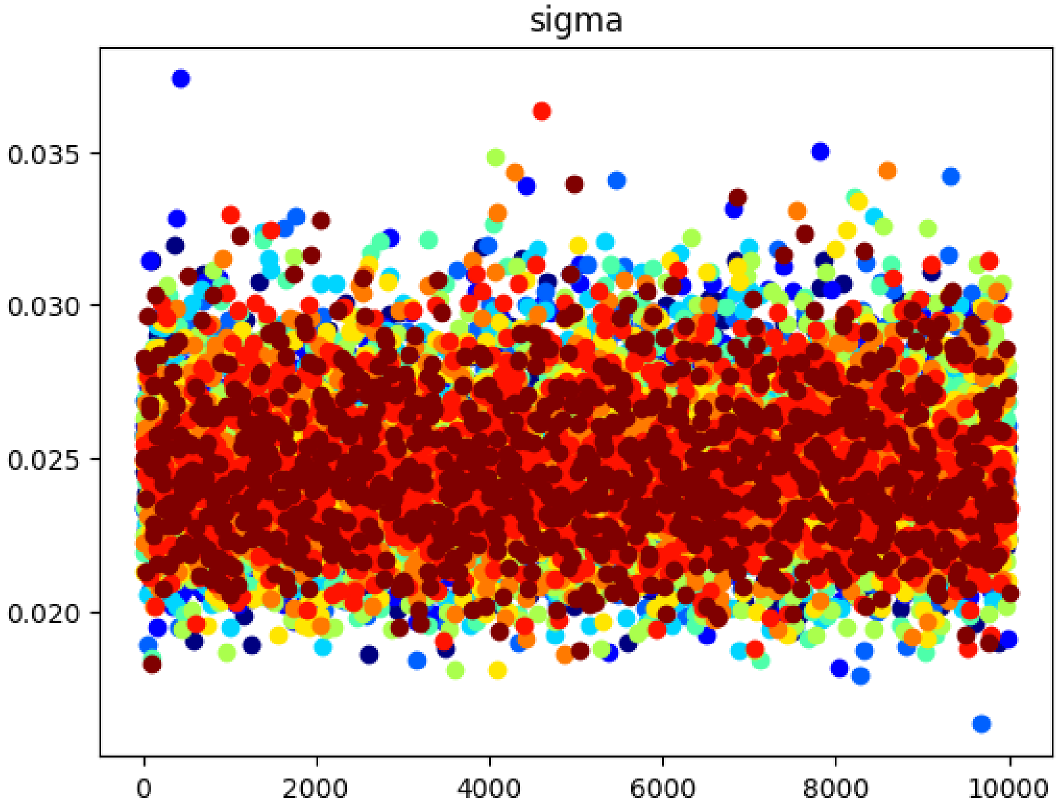

Performance prediction
Fitness only, athlete: H1
Observation
Prediction
0.85
0.80
0.75
0.70
0.65
Performance
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

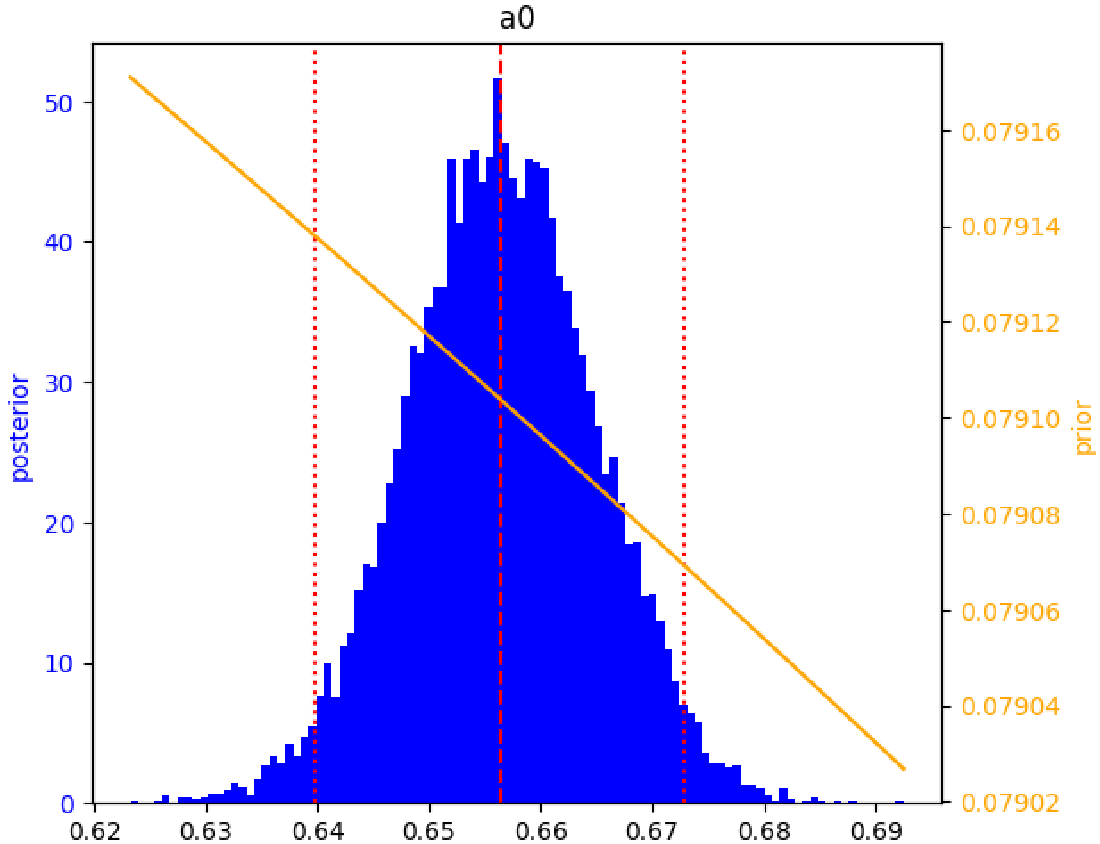

Hidden states
Fitness only, athlete: H1
fitness
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

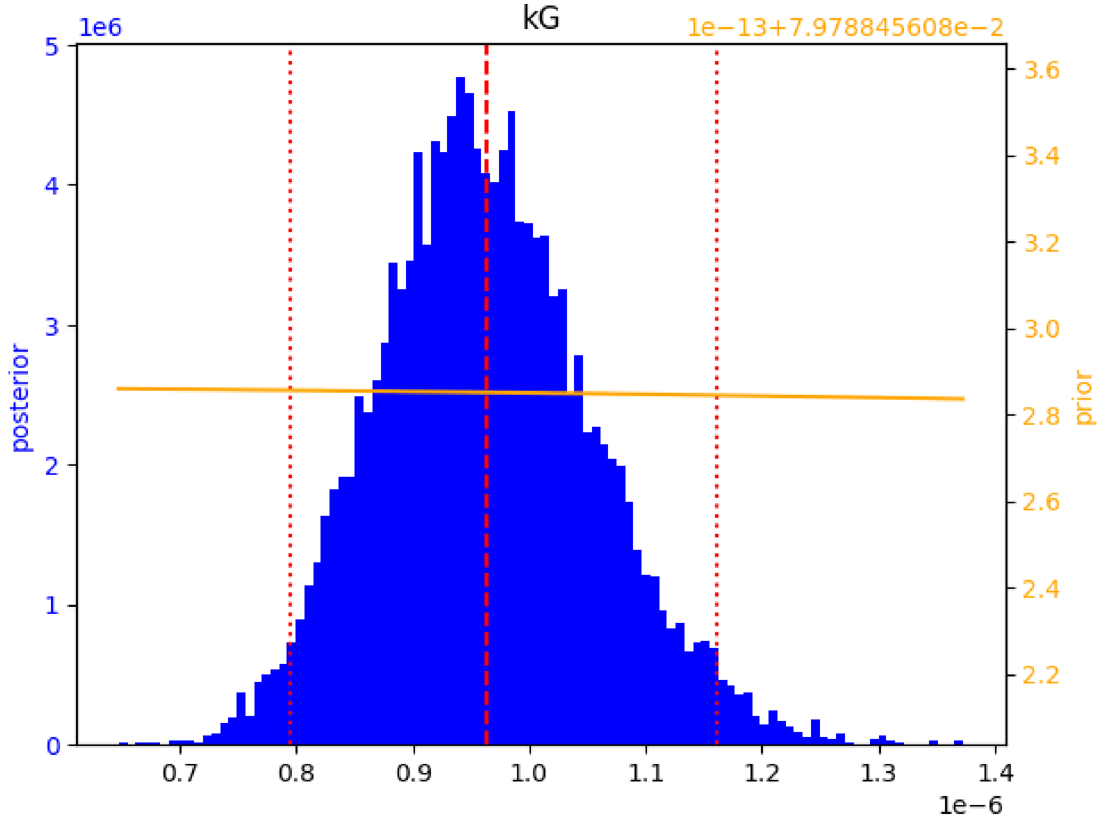

a0
0.69
0.68
0.67
0.66
0.65
0.64
0.63
0.62
0
2000
4000
6000
8000
10000

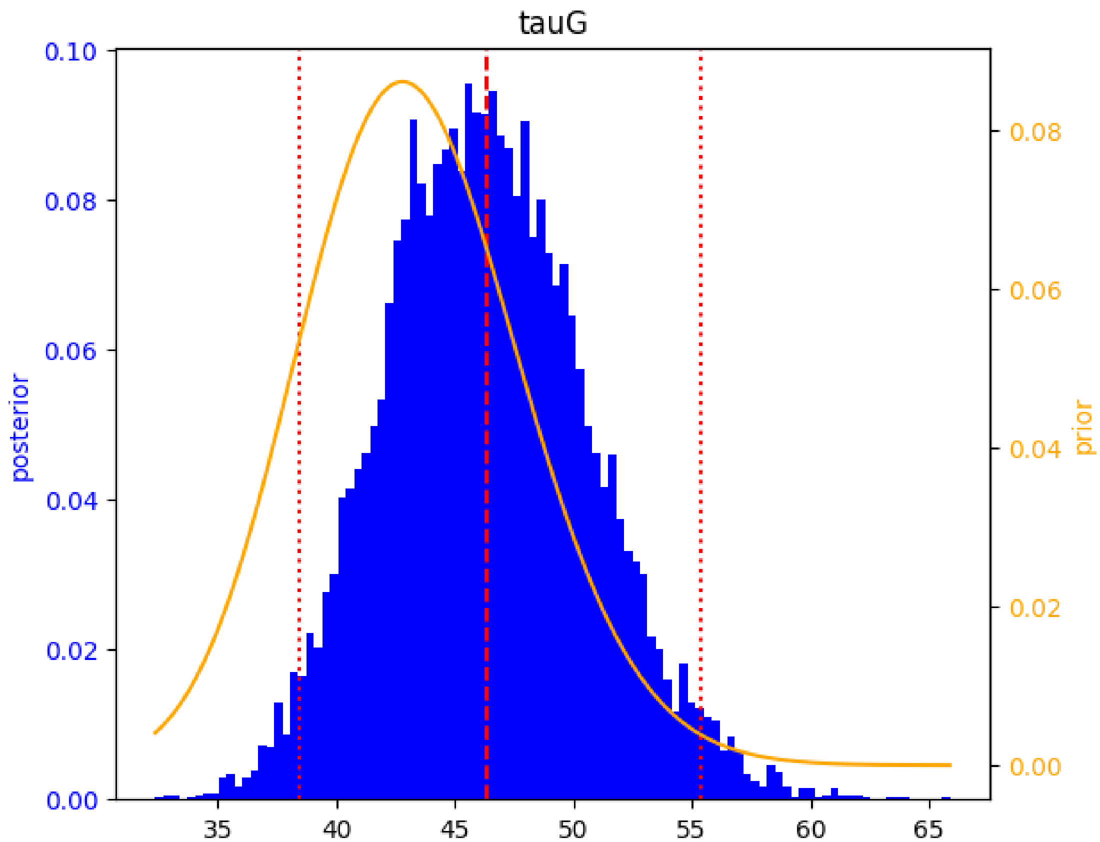

kG
1e−6
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0
2000
4000
6000
8000
10000


tauG
65
60
55
50
45
40
35
0
2000
4000
6000
8000
10000

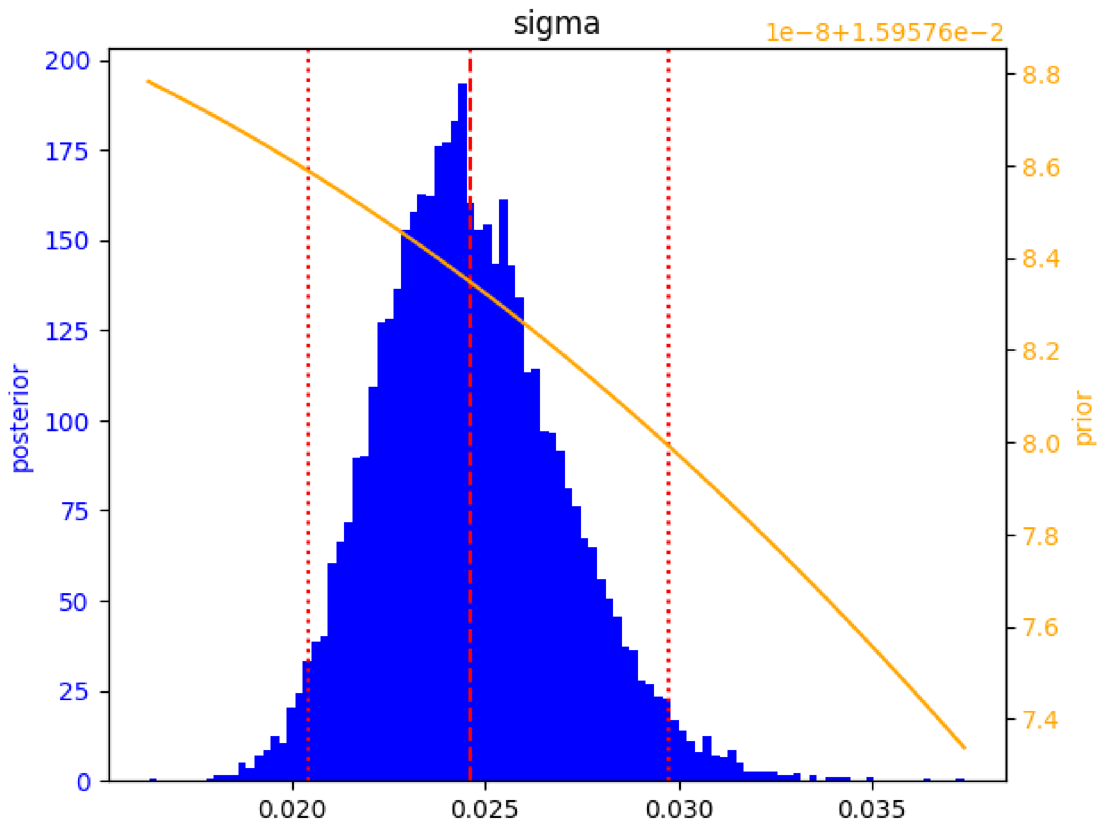

sigma
0.035
0.030
0.025
0.020
0
2000
4000
6000
8000
10000

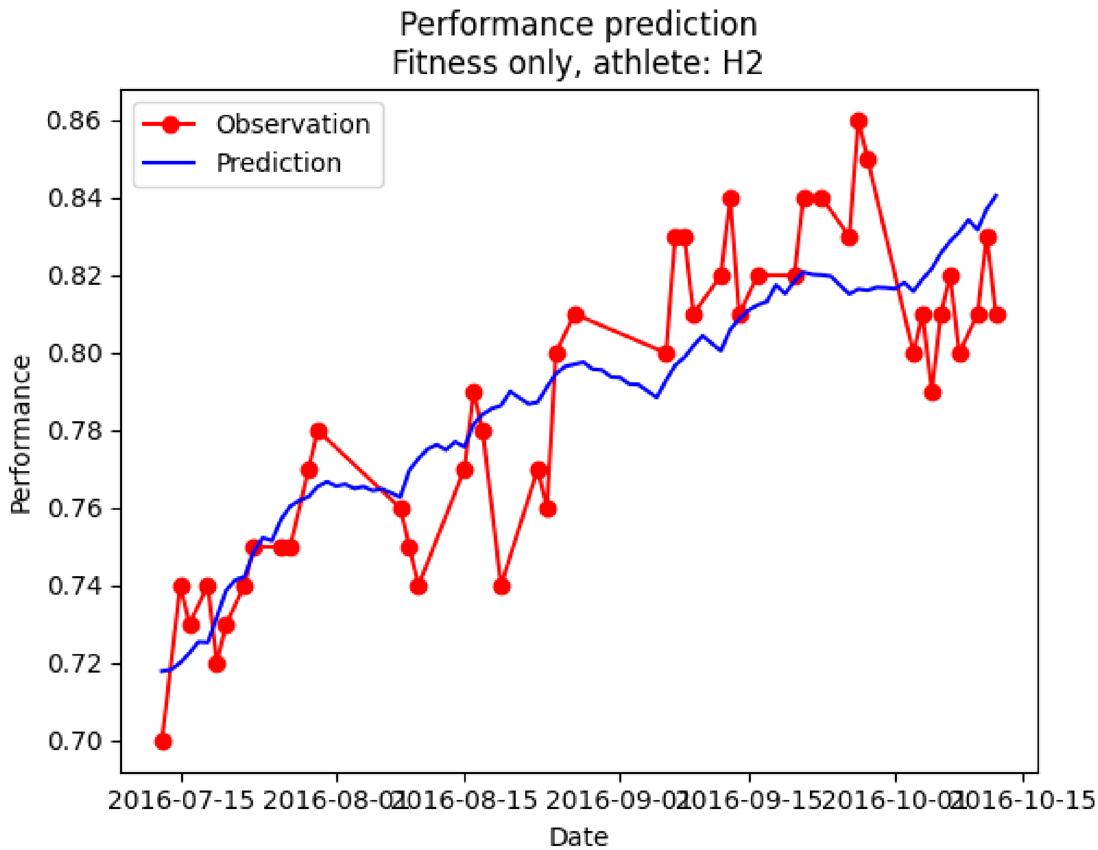

a0
posterior
prior
0
10
20
30
40
50
0.62
0.63
0.64
0.65
0.66
0.67
0.68
0.69
0.07902
0.07904
0.07906
0.07908
0.07910
0.07912
0.07914
0.07916

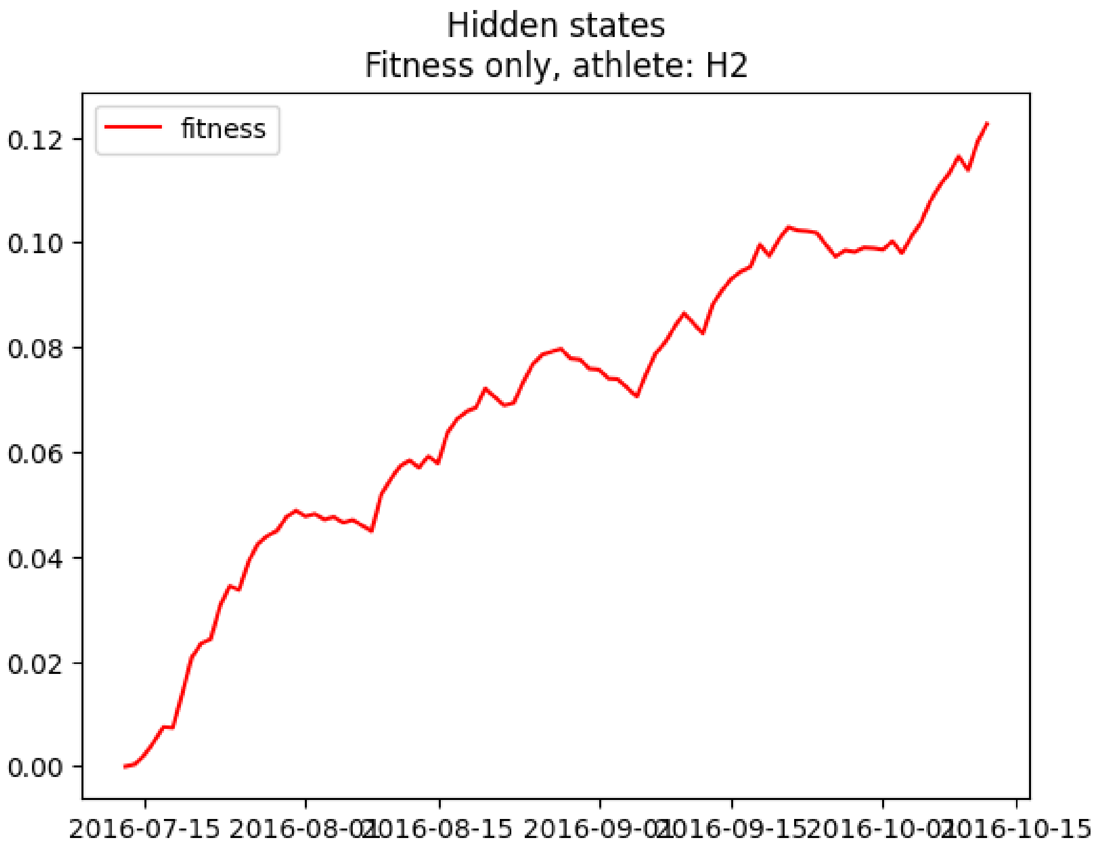

kG
1e6
1e−13+7.978845608e−2
posterior
prior
0
1
2
3
4
5
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1e−6

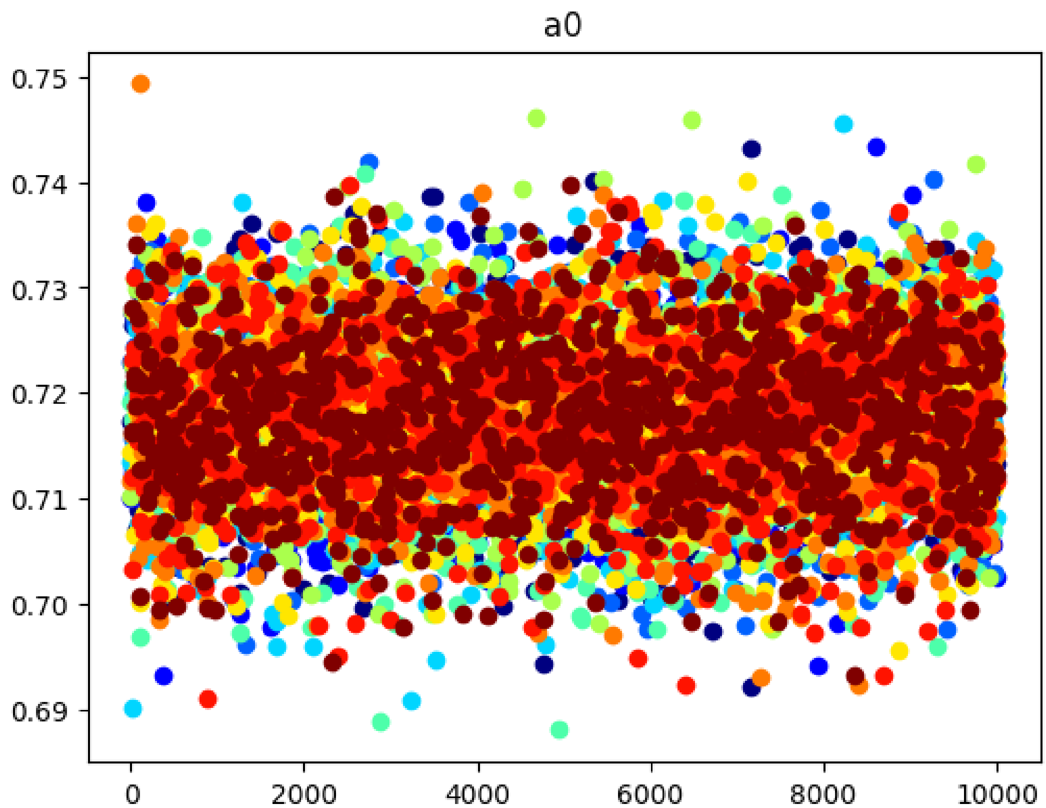


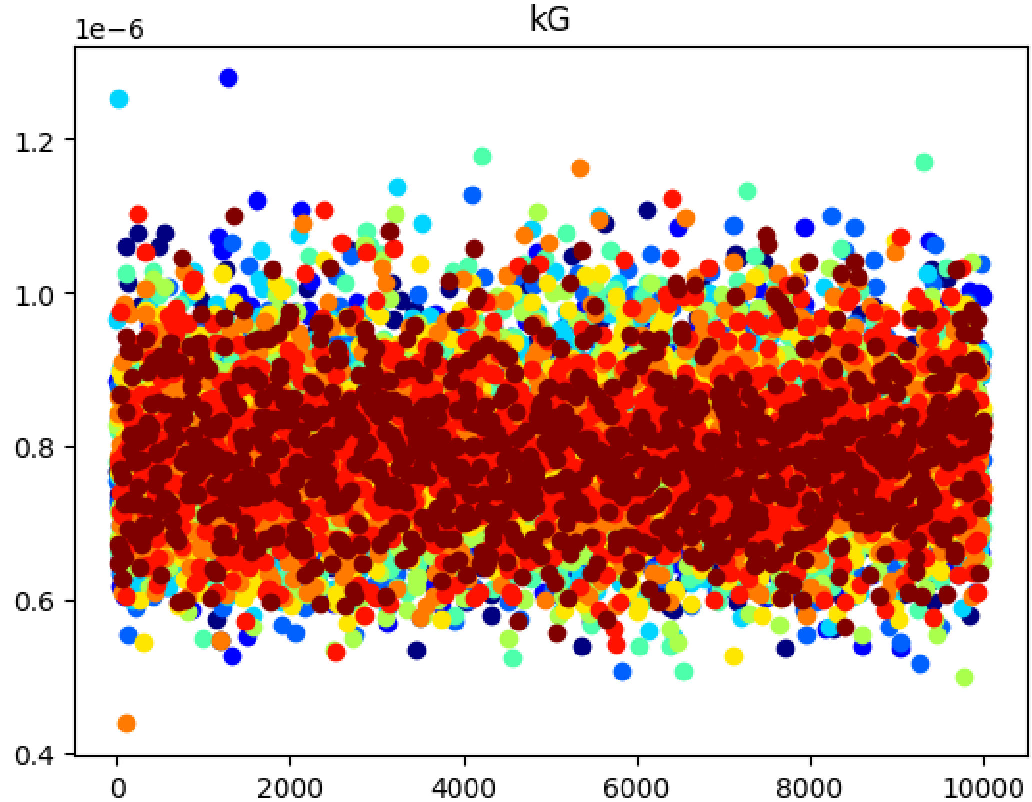
tauG
posterior
prior
0.00
0.02
0.04
0.06
0.08
0.10
35
40
45
50
55
60
65

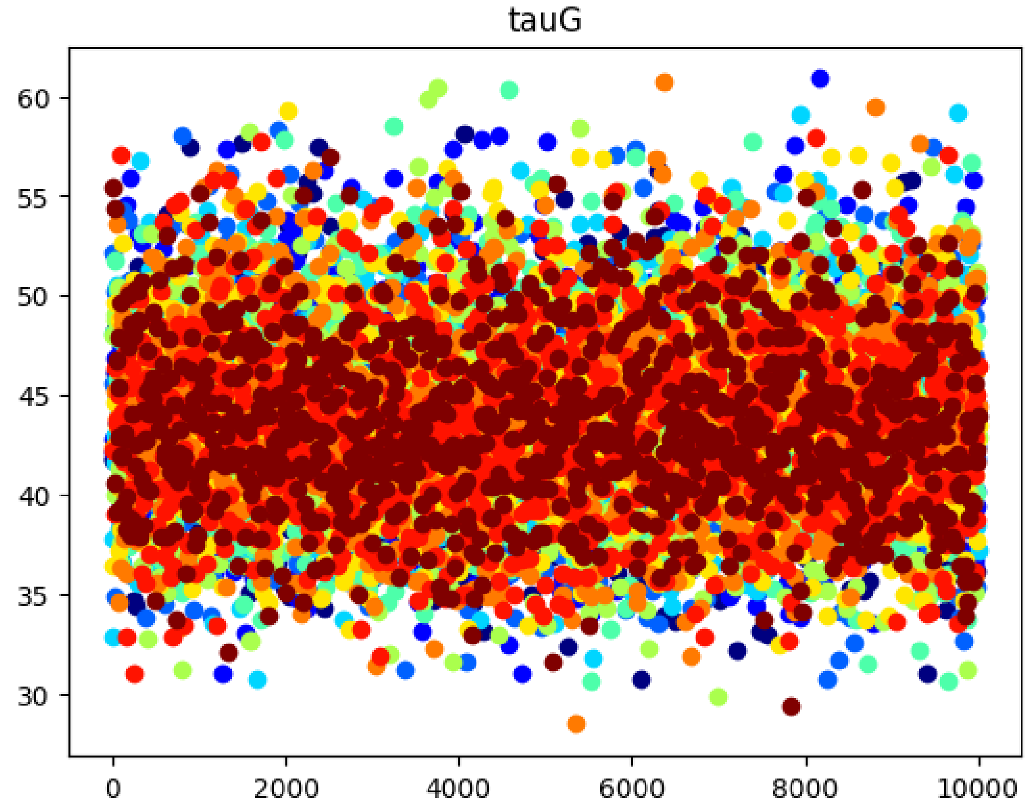

sigma
1e−8+1.59576e−2
posterior
prior
200
175
150
125
100
75
50
25
0
8.8
8.6
8.4
8.2
8.0
7.8
7.6
7.4
0.020
0.025
0.030
0.035

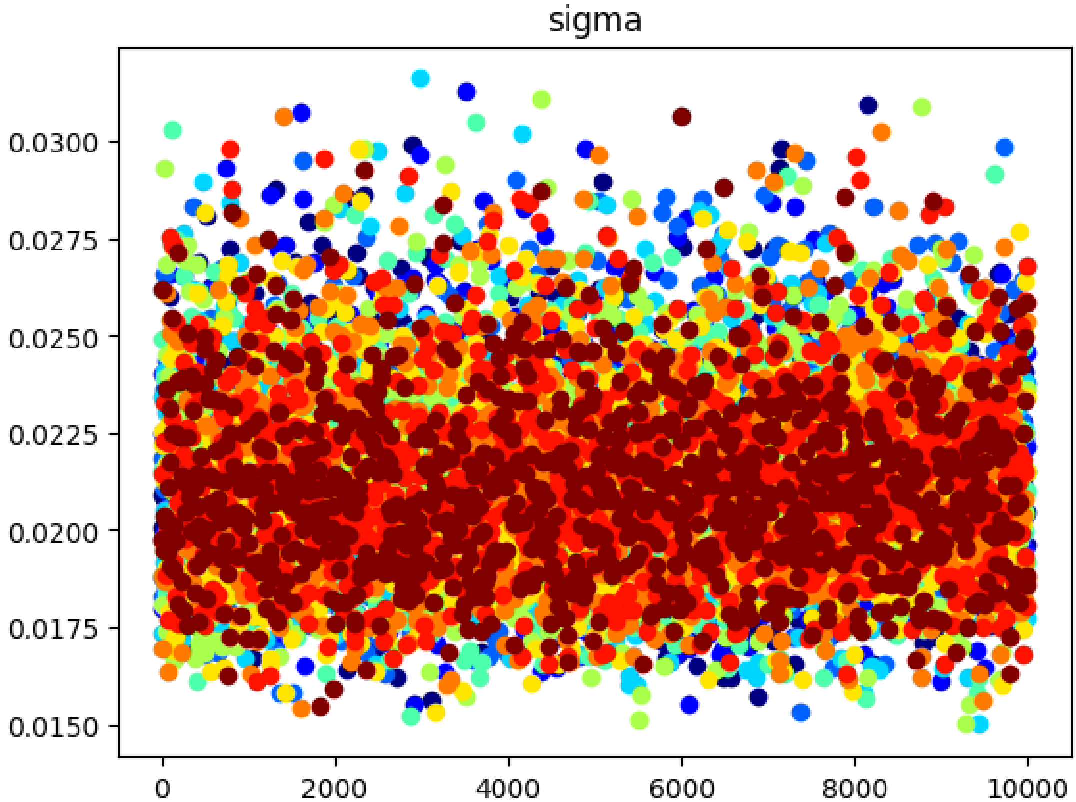

Performance prediction
Fitness only, athlete: H2
Observation
Prediction
Performance
0.86
0.84
0.82
0.80
0.78
0.76
0.74
0.72
0.70
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

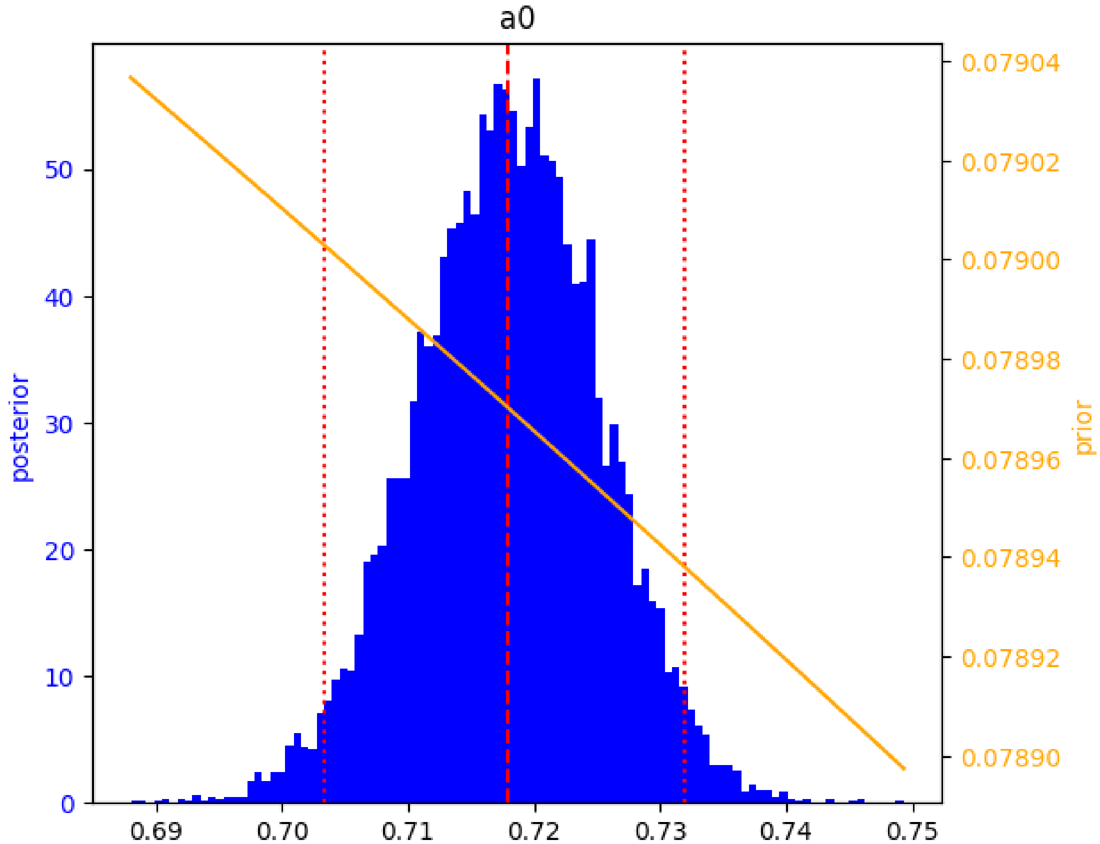

Hidden states
Fitness only, athlete: H2
fitness
0.12
0.10
0.08
0.06
0.04
0.02
0.00
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15


a0
0.75
0.74
0.73
0.72
0.71
0.70
0.69
0
2000
4000
6000
8000
10000

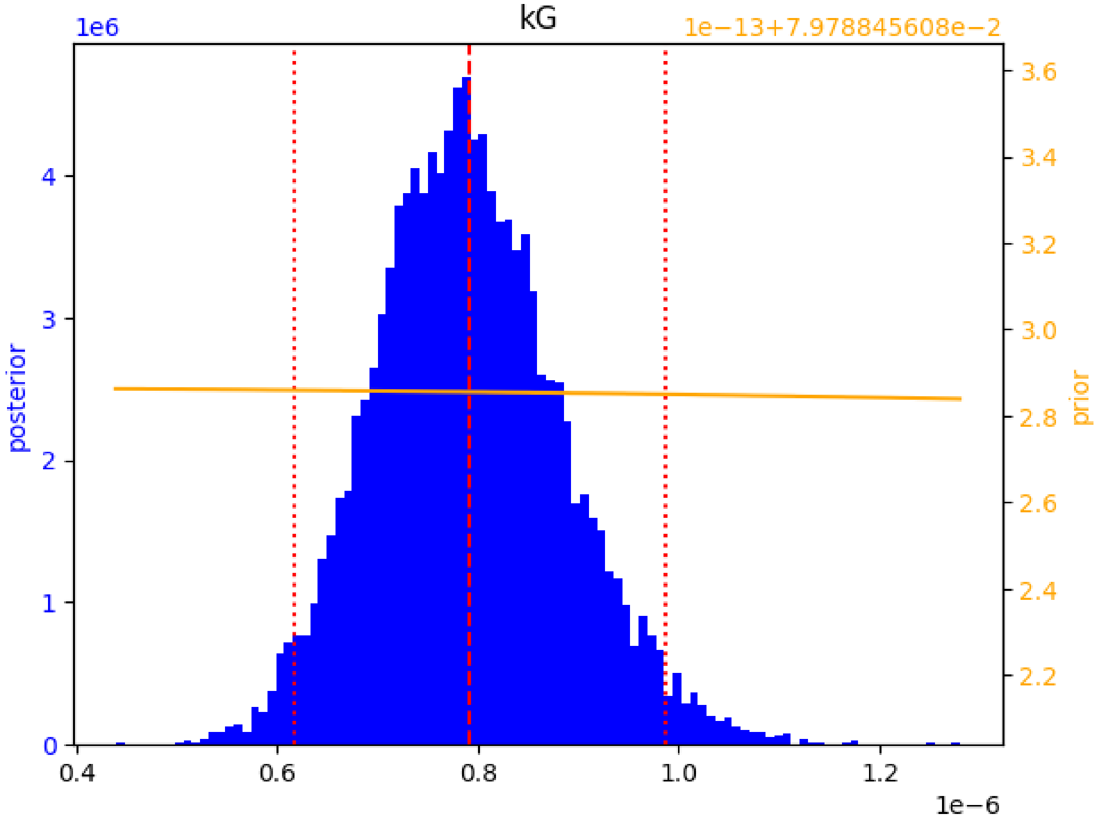

kG
1e−6
1.2
1.0
0.8
0.6
0.4
0
2000
4000
6000
8000
10000

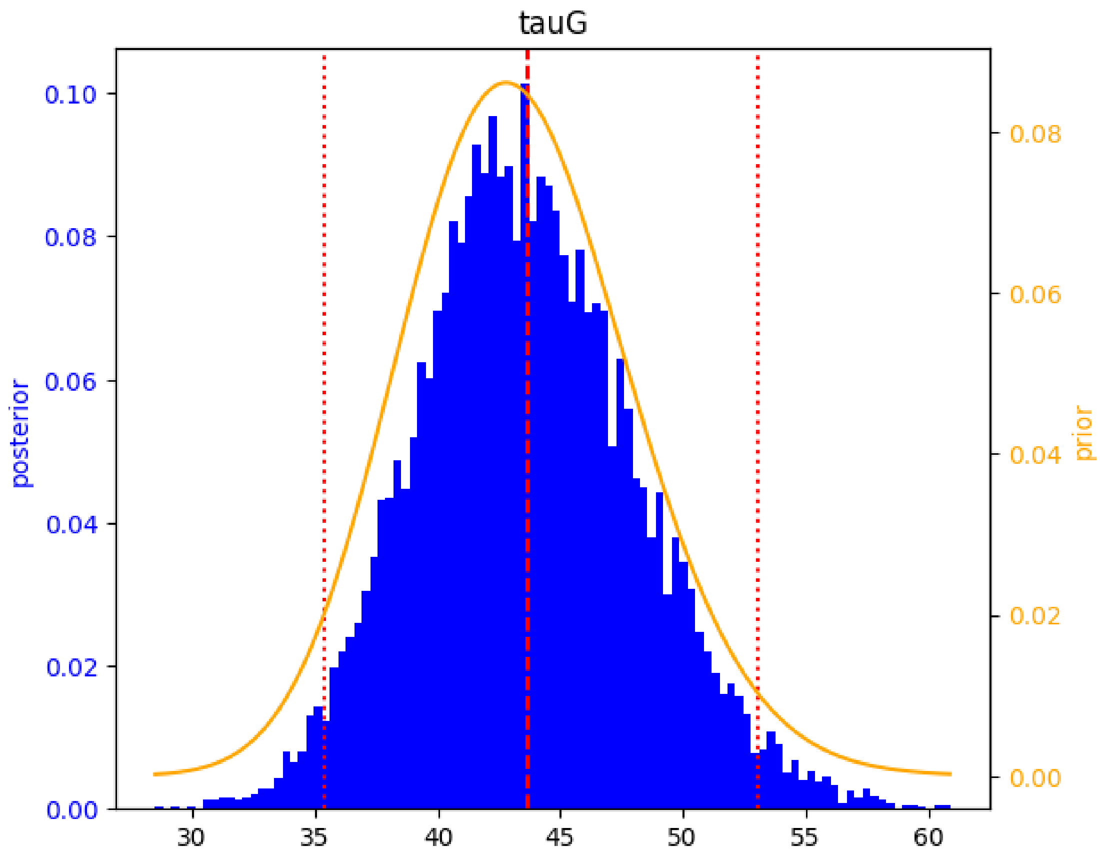

tauG
60
55
50
45
40
35
30
0
2000
4000
6000
8000
10000

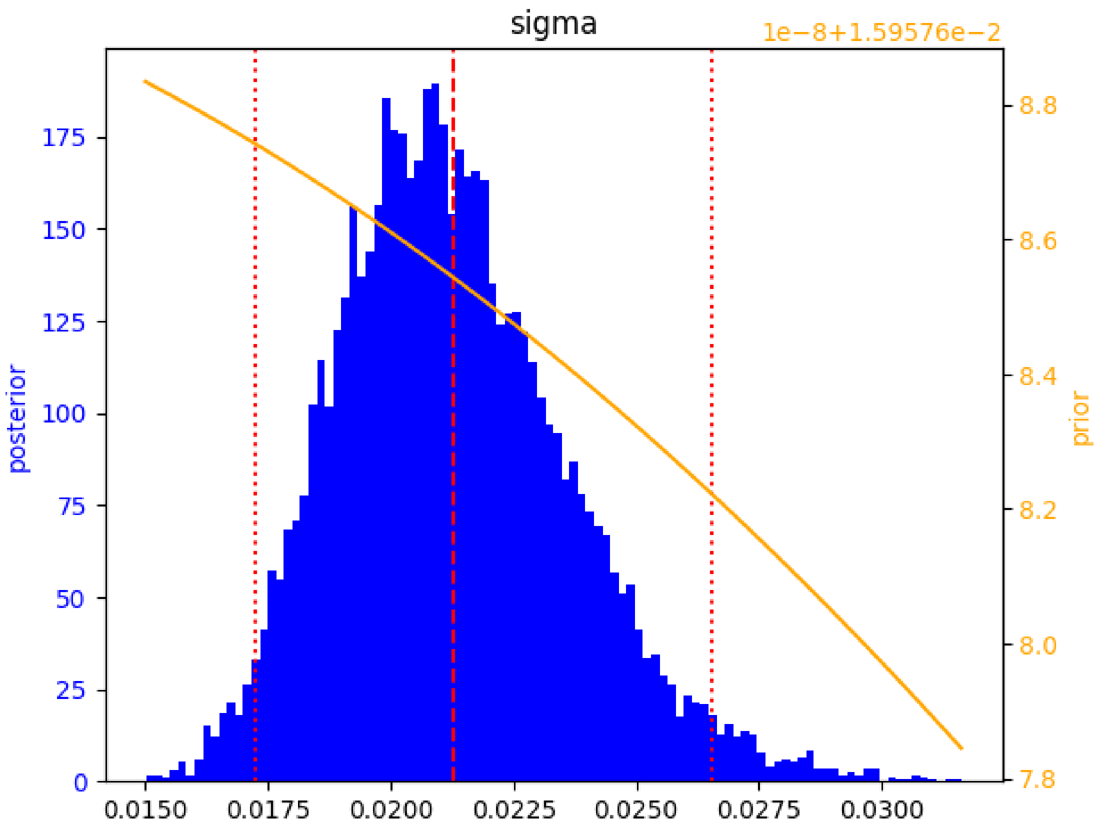

sigma
0.0300
0.0275
0.0250
0.0225
0.0200
0.0175
0.0150
0
2000
4000
6000
8000
10000

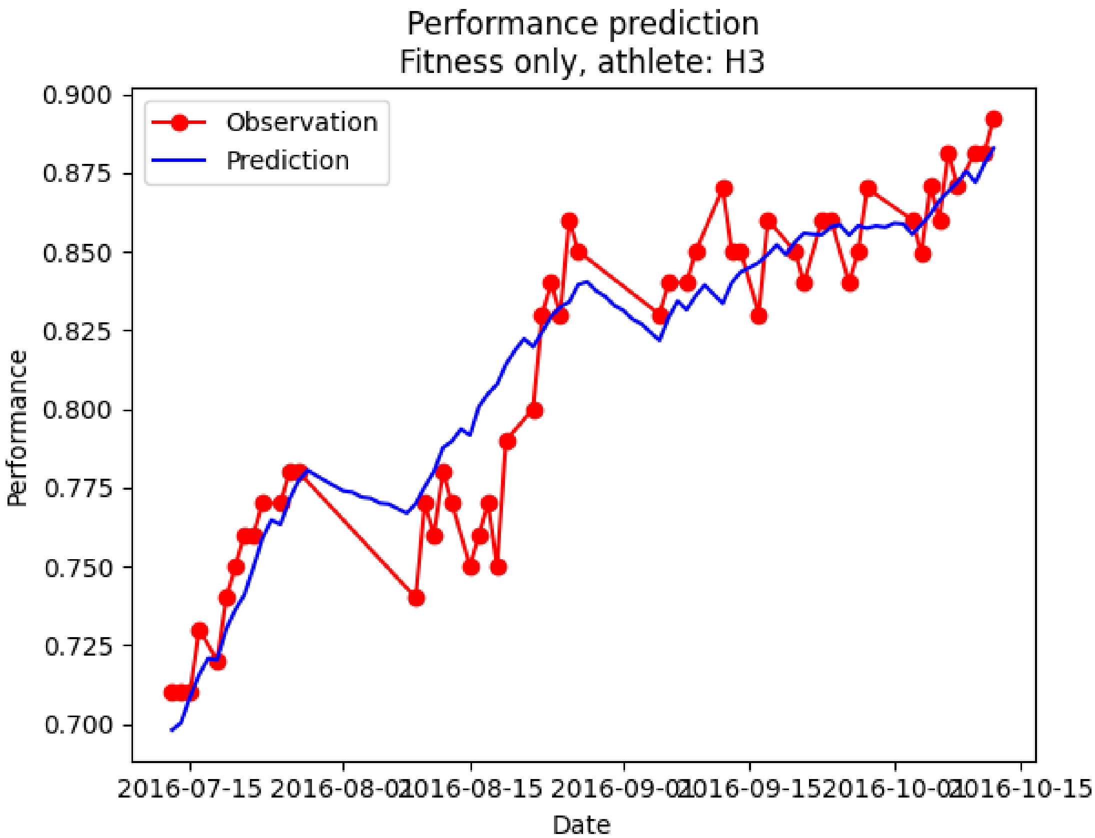


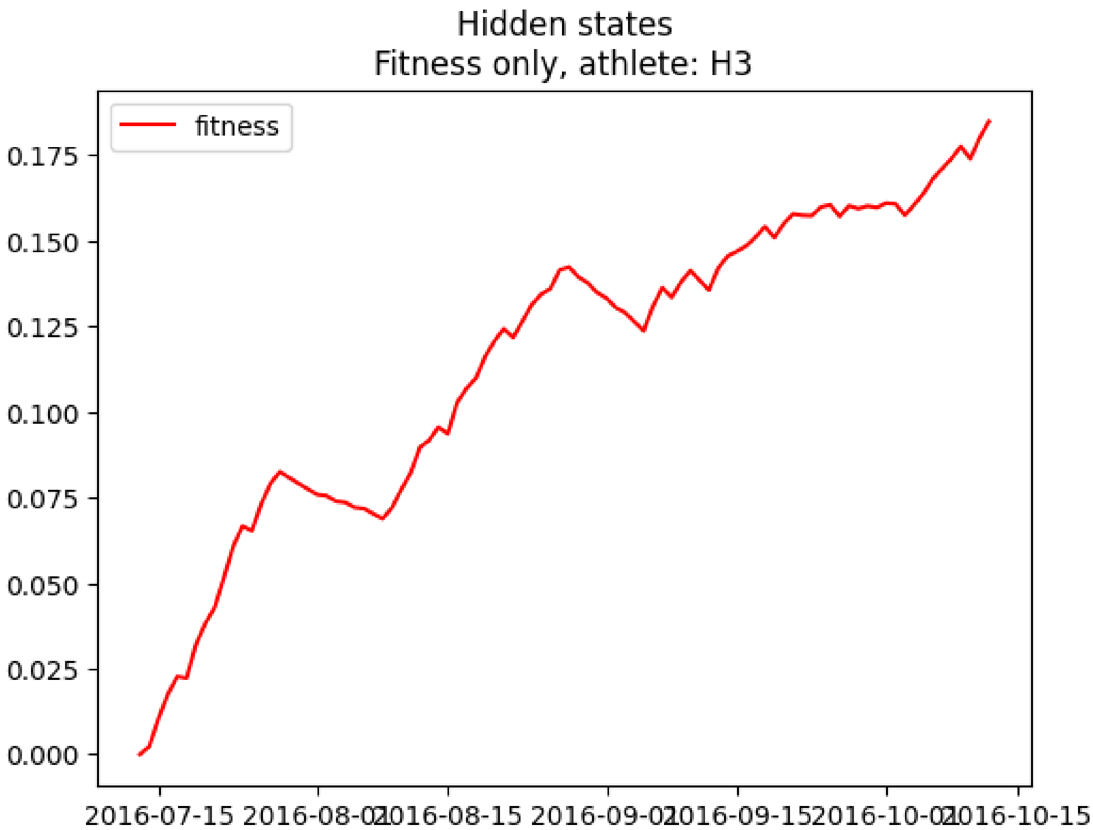
a0
posterior
prior
0
10
20
30
40
50
0.07890
0.07892
0.07894
0.07896
0.07898
0.07900
0.07902
0.07904
0.69
0.70
0.71
0.72
0.73
0.74
0.75

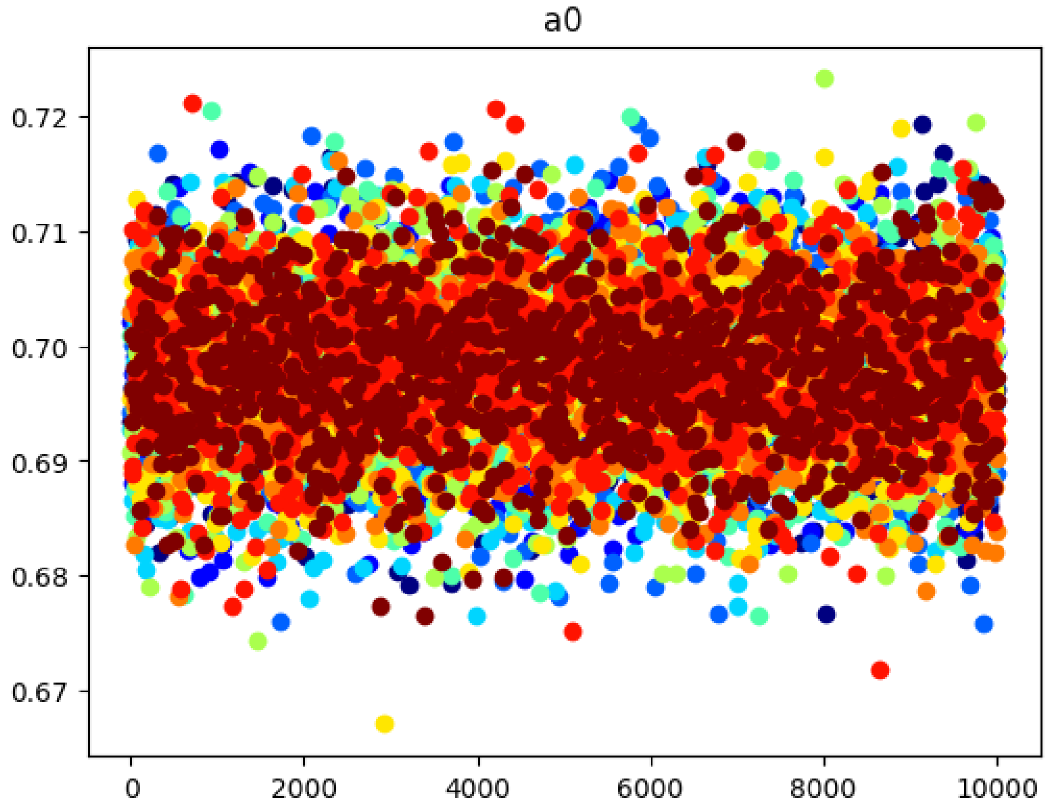

kG
1e6
1e−13+7.978845608e−2
posterior
prior
0
1
2
3
4
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
0.4
0.6
0.8
1.0
1.2
1e−6

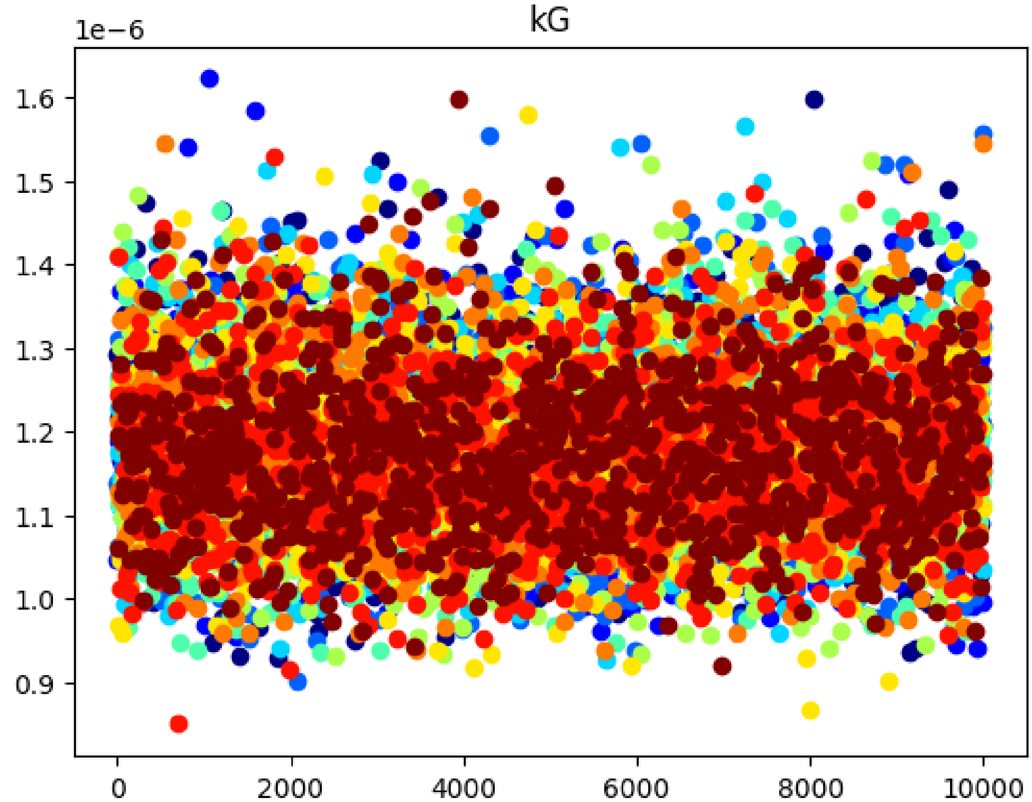

tauG
posterior
prior
0.00
0.02
0.04
0.06
0.08
0.10
0.00
0.02
0.04
0.06
0.08
30
35
40
45
50
55
60

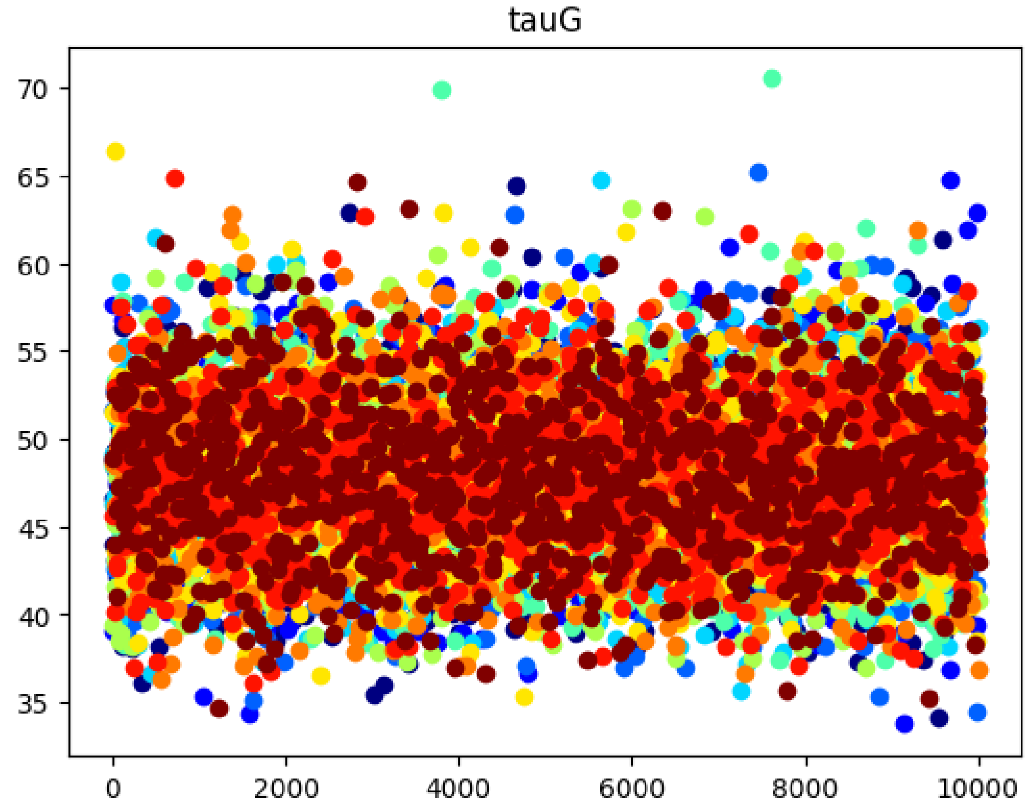

sigma
1e−8+1.59576e−2
posterior
prior
175
150
125
100
75
50
25
0
8.8
8.6
8.4
8.2
8.0
7.8
0.0150
0.0175
0.0200
0.0225
0.0250
0.0275
0.0300

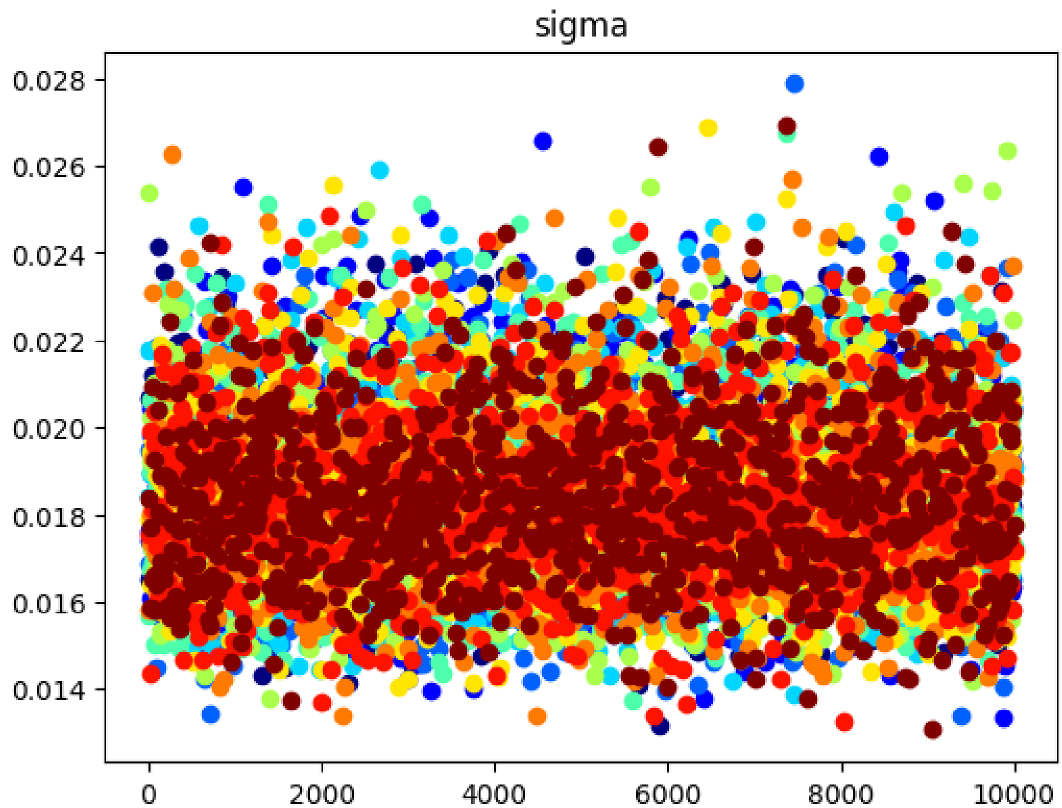

Performance prediction
Fitness only, athlete: H3
Observation
Prediction
0.900
0.875
0.850
0.825
0.800
0.775
0.750
0.725
0.700
Performance
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

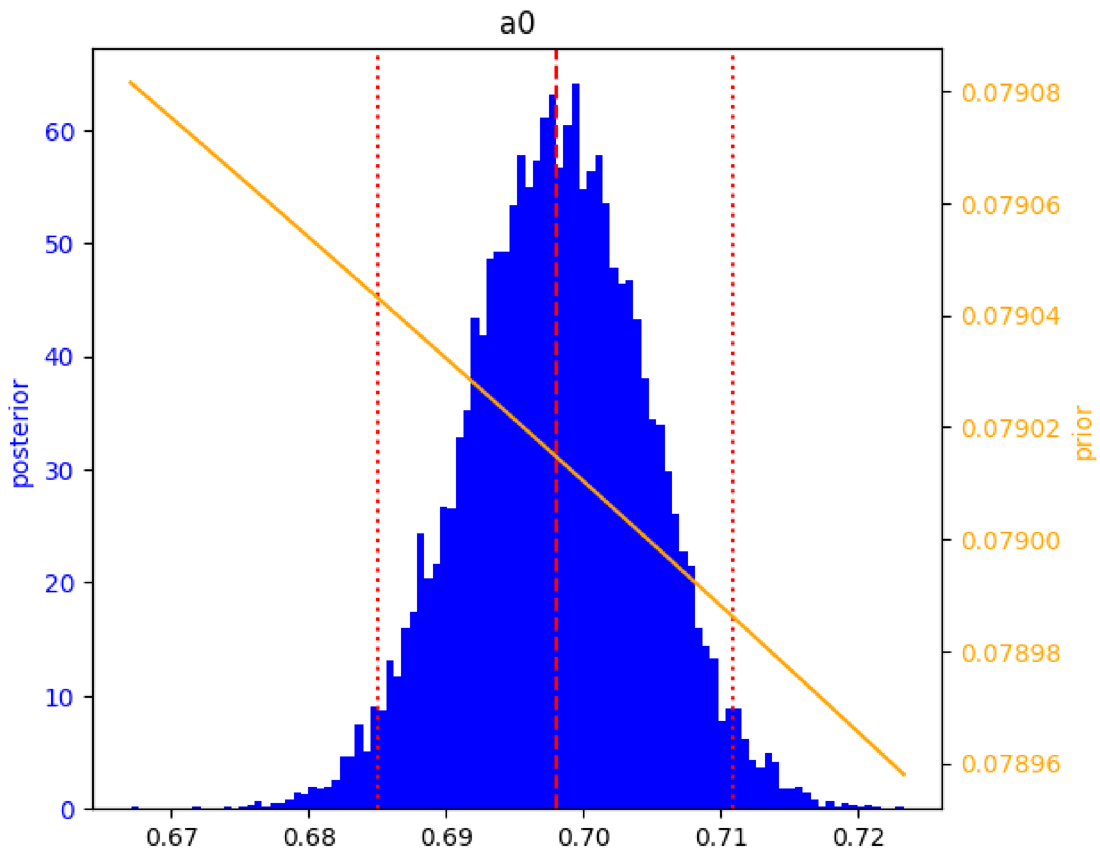

Hidden states
Fitness only, athlete: H3
fitness
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

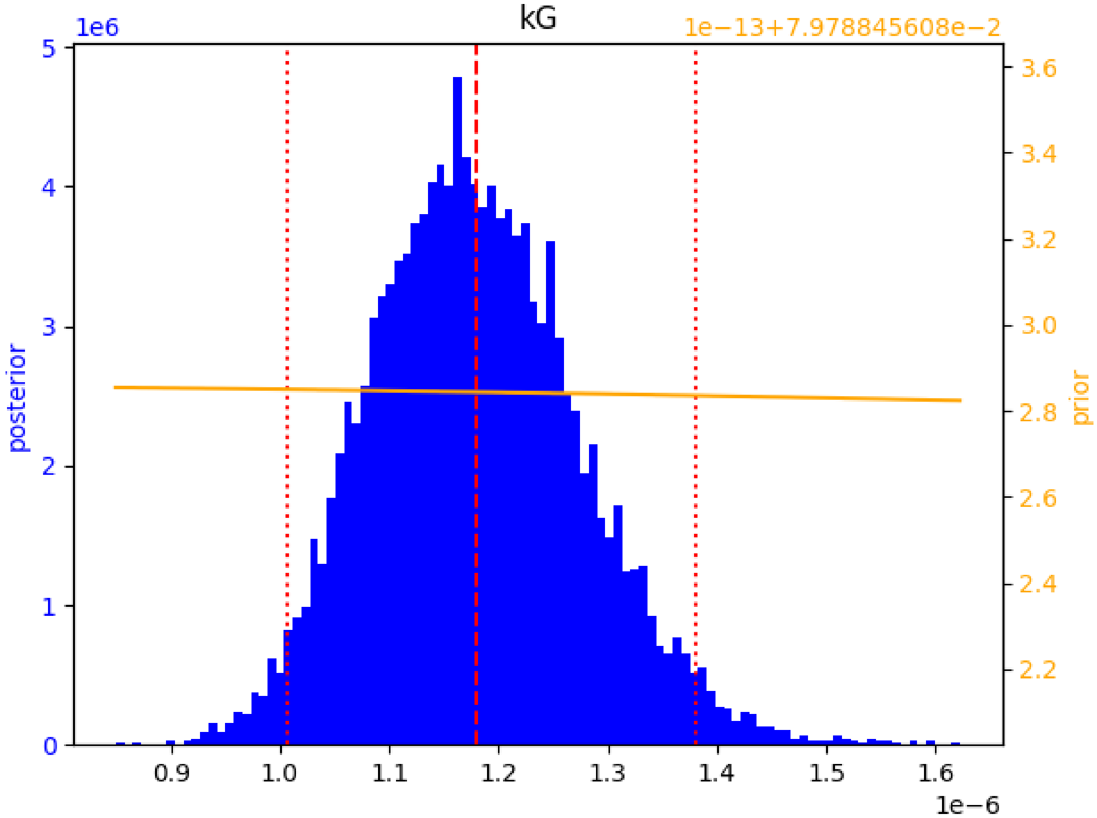

a0
0.72
0.71
0.70
0.69
0.68
0.67
0
2000
4000
6000
8000
10000

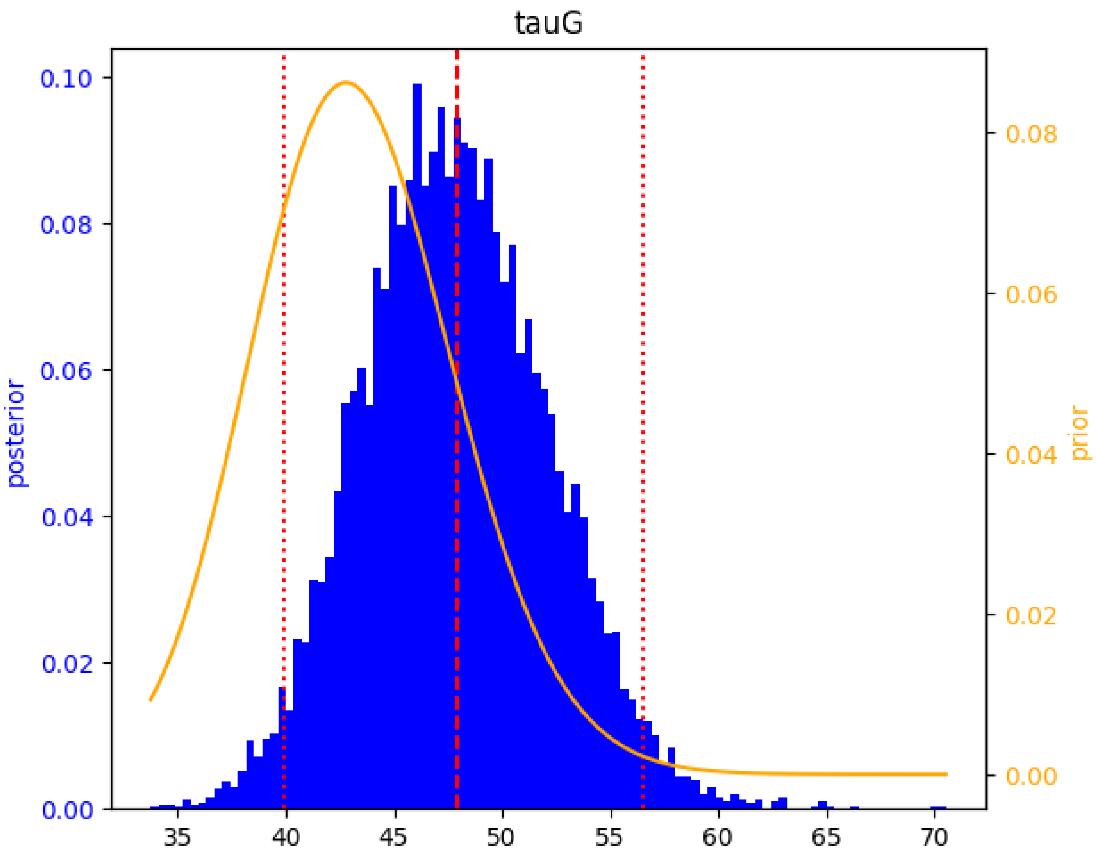

kG
1e−6
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0
2000
4000
6000
8000
10000


tauG
70
65
60
55
50
45
40
35
0
2000
4000
6000
8000
10000

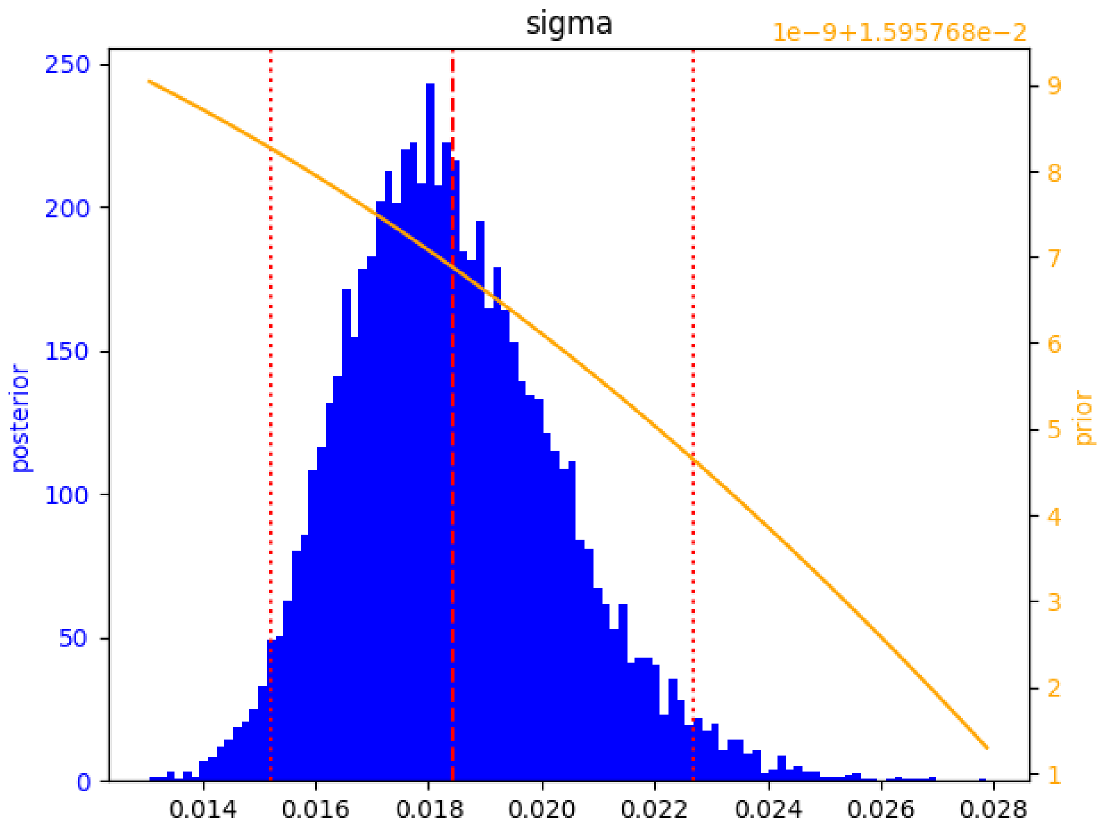

sigma
0.028
0.026
0.024
0.022
0.020
0.018
0.016
0.014
0
2000
4000
6000
8000
10000


a0
posterior
prior
0
10
20
30
40
50
60
0.07896
0.07898
0.07900
0.07902
0.07904
0.07906
0.07908
0.67
0.68
0.69
0.70
0.71
0.72

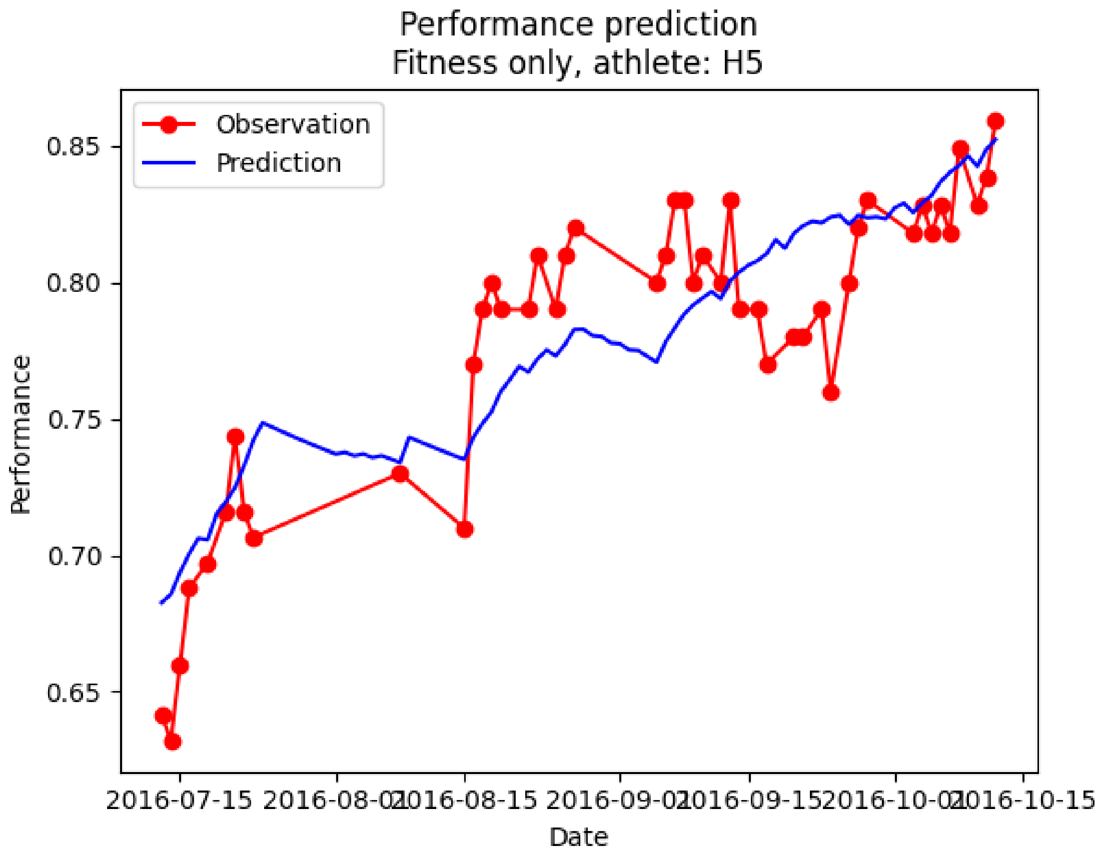

kG
1e6
1e−13+7.978845608e−2
5
4
3
2
1
0
posterior
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
prior
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1e−6



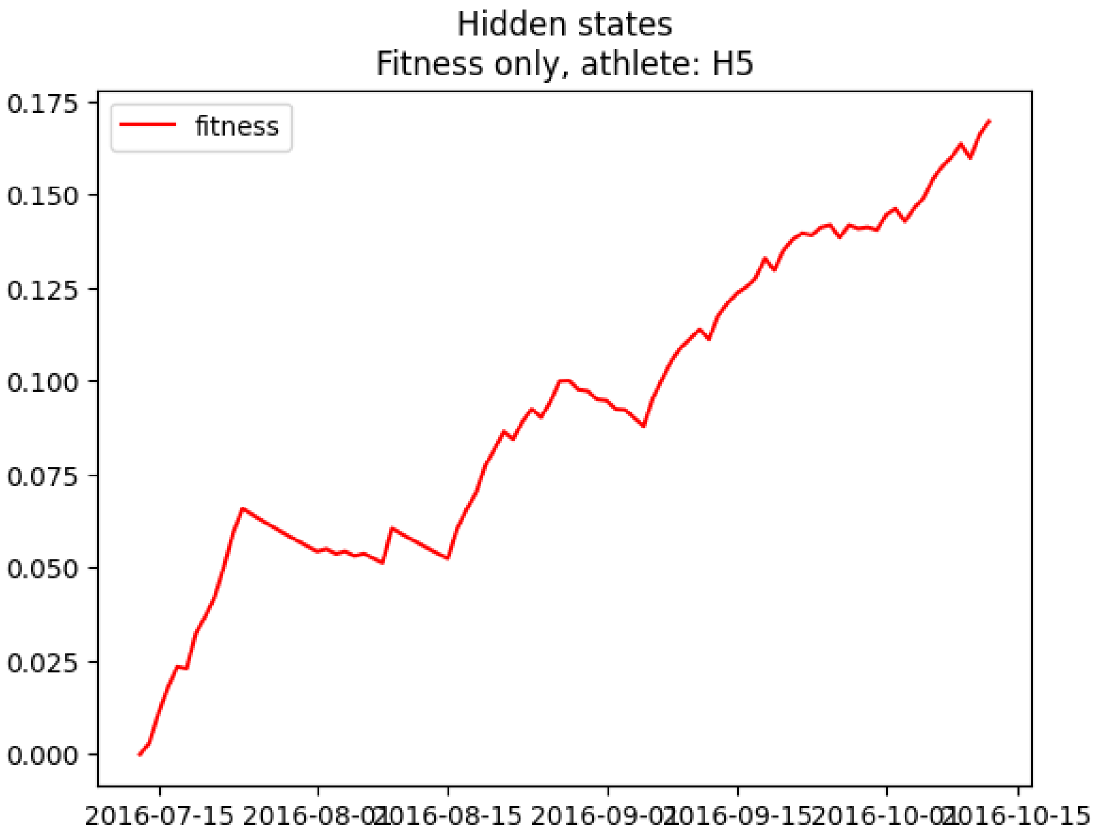
tauG
posterior
prior
0.10
0.08
0.06
0.04
0.02
0.00
0.08
0.06
0.04
0.02
0.00
35
40
45
50
55
60
65
70

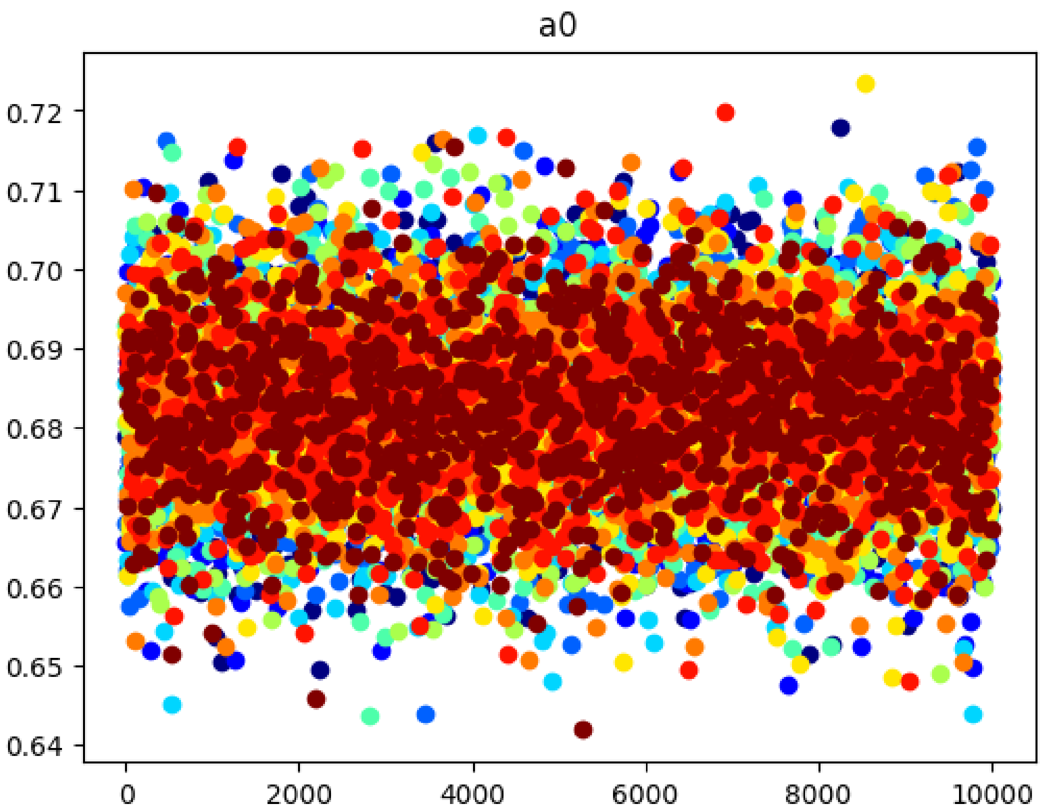


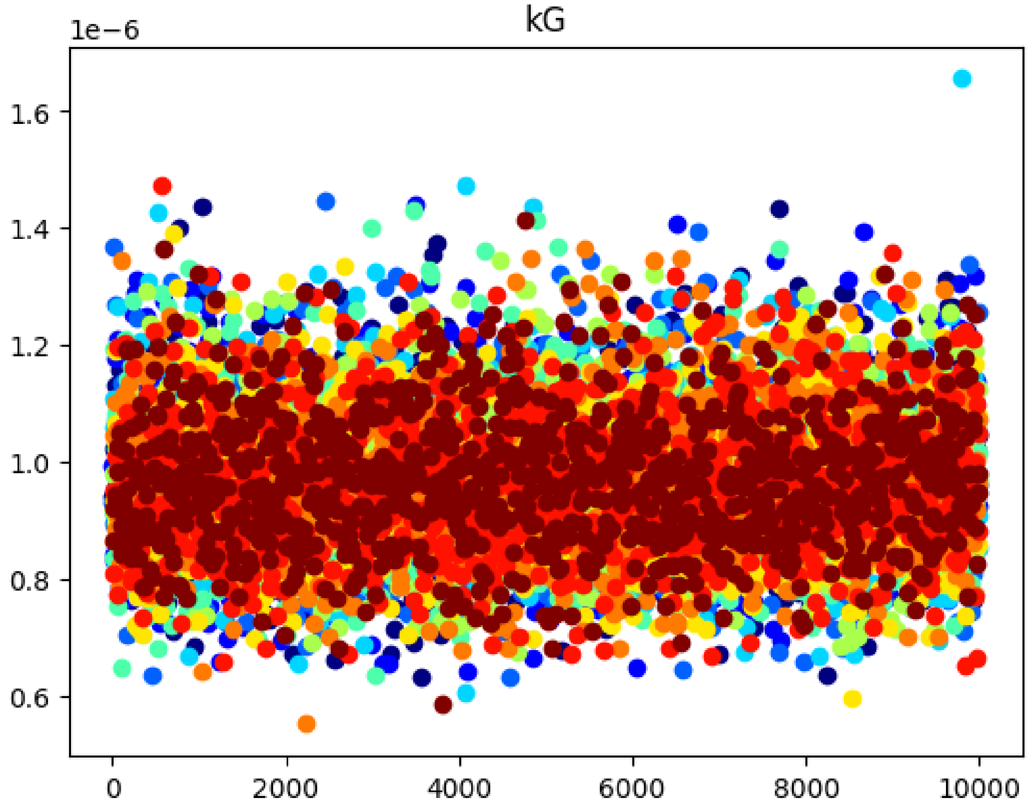
sigma
1e−9+1.595768e−2
posterior
prior
250
200
150
100
50
0
9
8
7
6
5
4
3
2
1
0.014
0.016
0.018
0.020
0.022
0.024
0.026
0.028



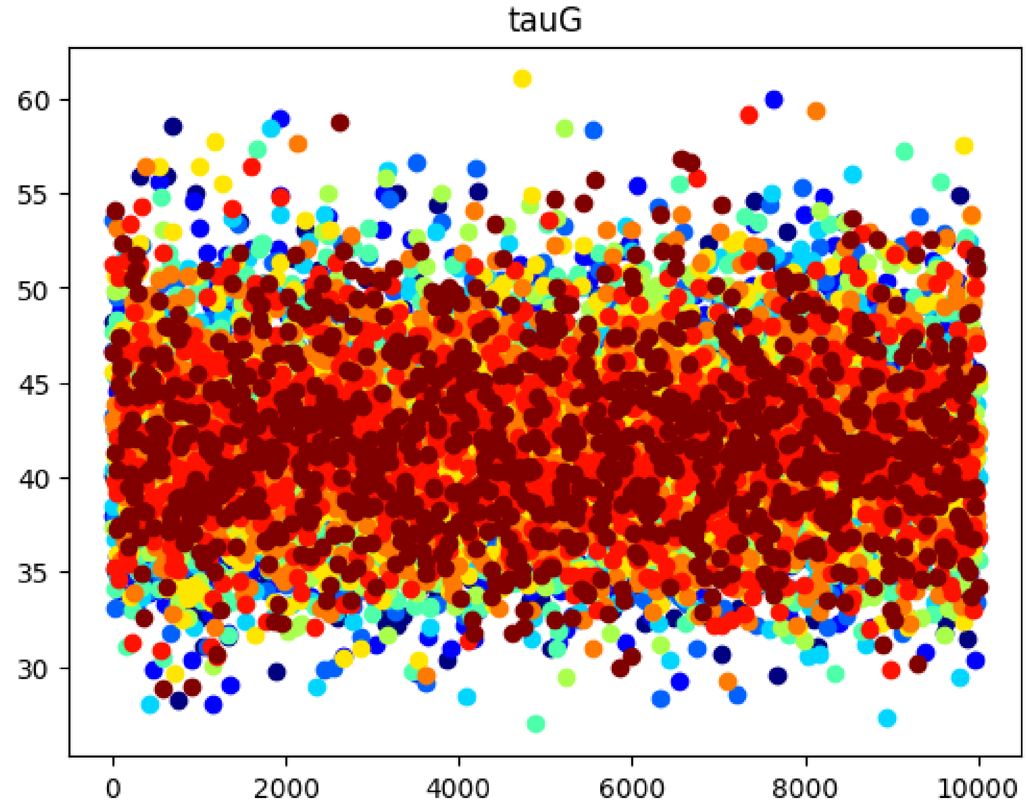
Performance prediction
Fitness only, athlete: H5
Observation
Prediction
Performance
0.85
0.80
0.75
0.70
0.65
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

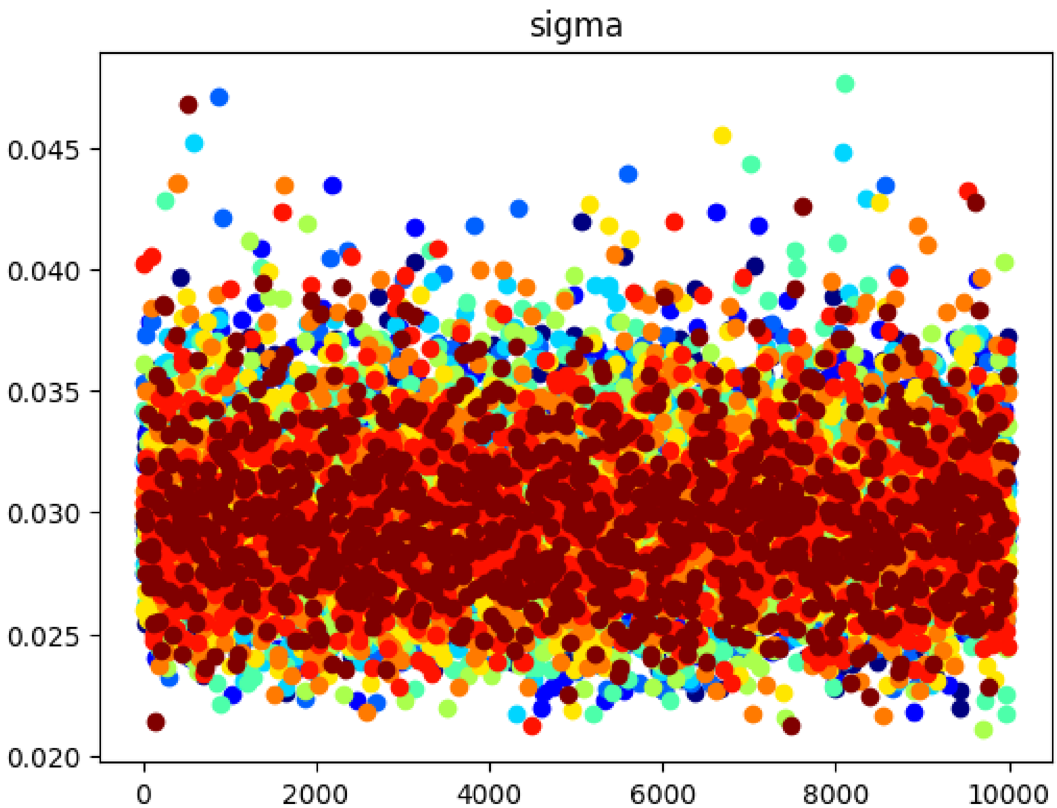

Hidden states
Fitness only, athlete: H5
fitness
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15


a0
0.72
0.71
0.70
0.69
0.68
0.67
0.66
0.65
0.64
0
2000
4000
6000
8000
10000

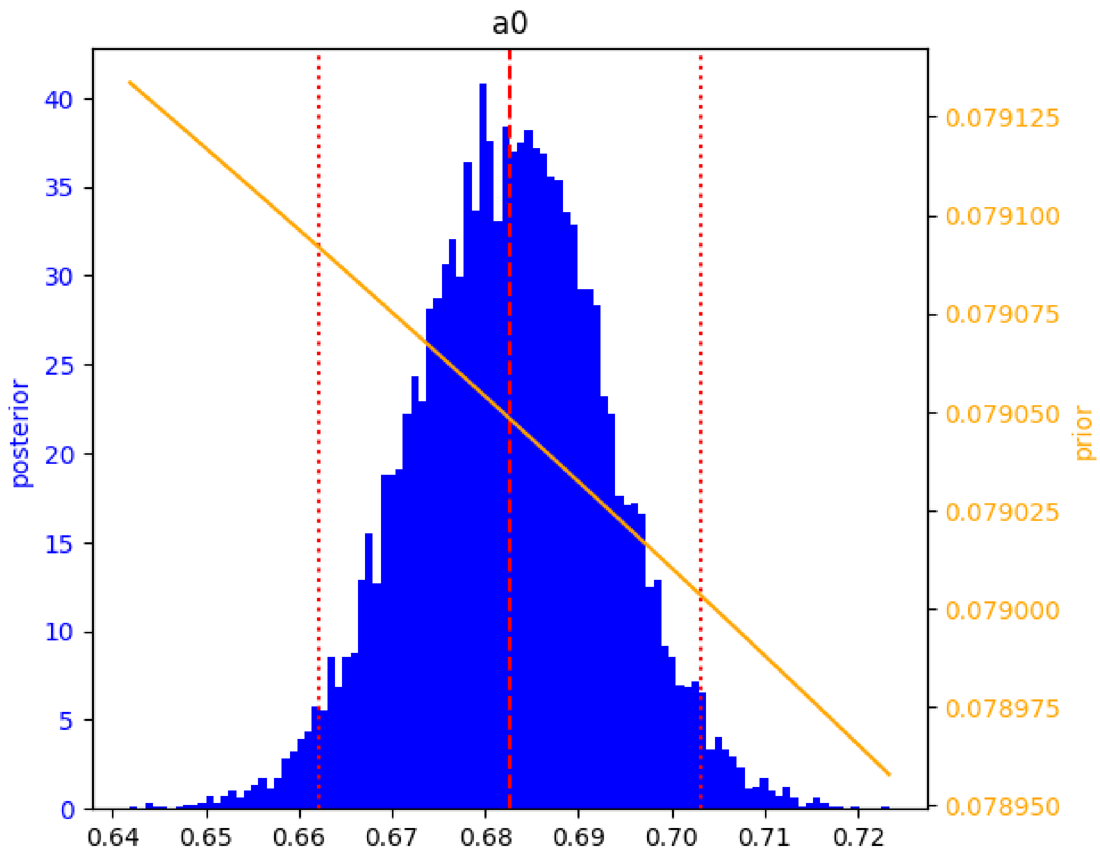


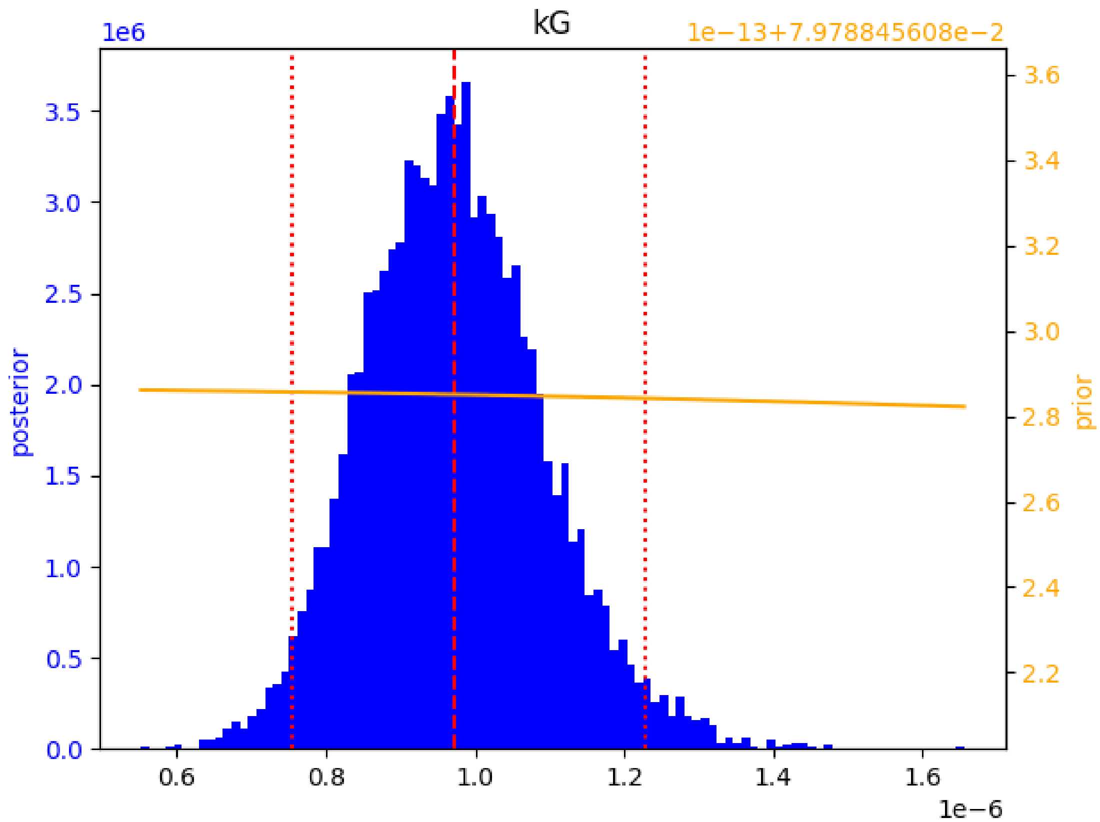
kG
1e−6
1.6
1.4
1.2
1.0
0.8
0.6
0
2000
4000
6000
8000
10000

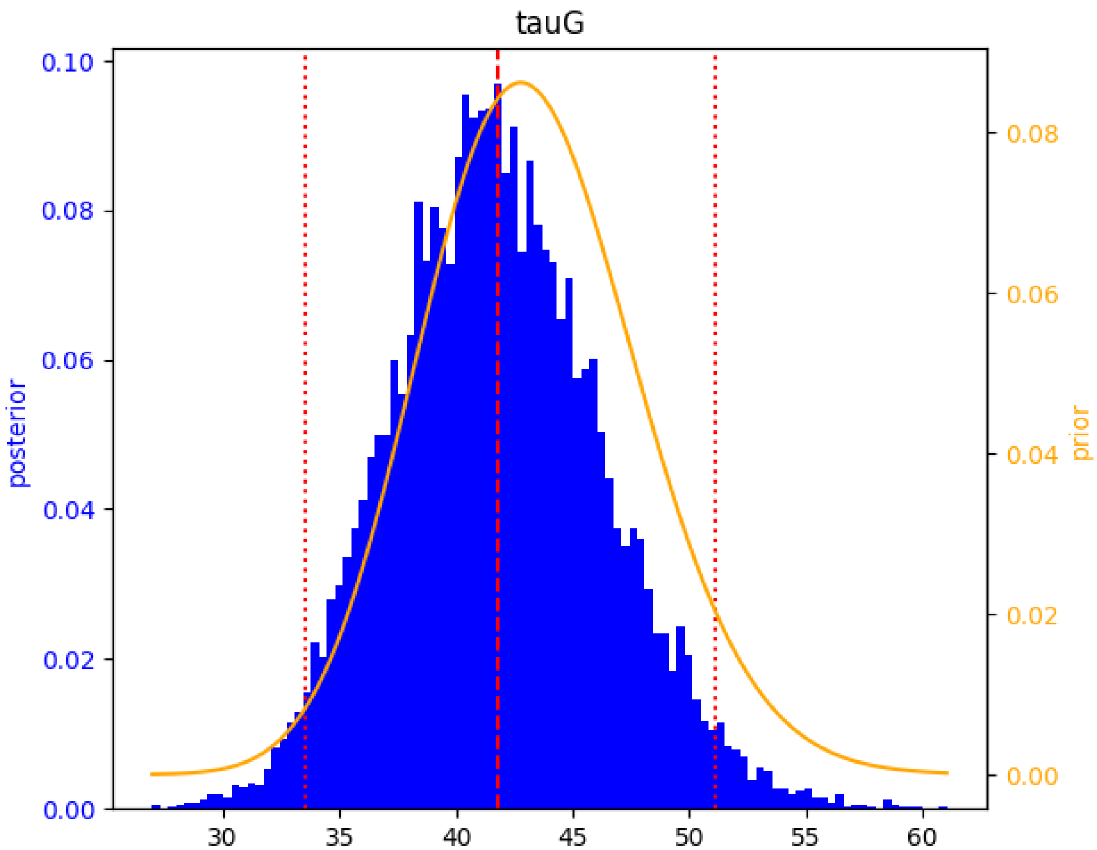

tauG
60
55
50
45
40
35
30
0
2000
4000
6000
8000
10000



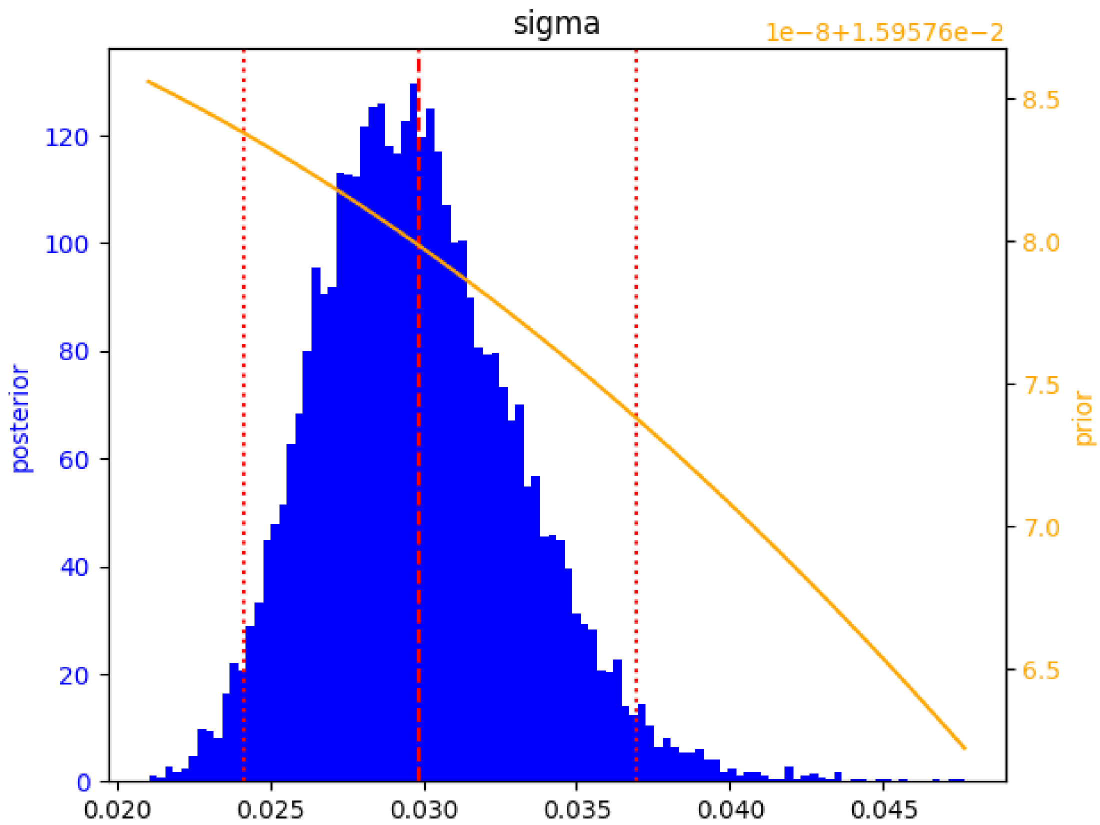
sigma
0.045
0.040
0.035
0.030
0.025
0.020
0
2000
4000
6000
8000
10000


a0
posterior
prior
0
5
10
15
20
25
30
35
40
0.64
0.65
0.66
0.67
0.68
0.69
0.70
0.71
0.72
0.078950
0.078975
0.079000
0.079025
0.079050
0.079075
0.079100
0.079125

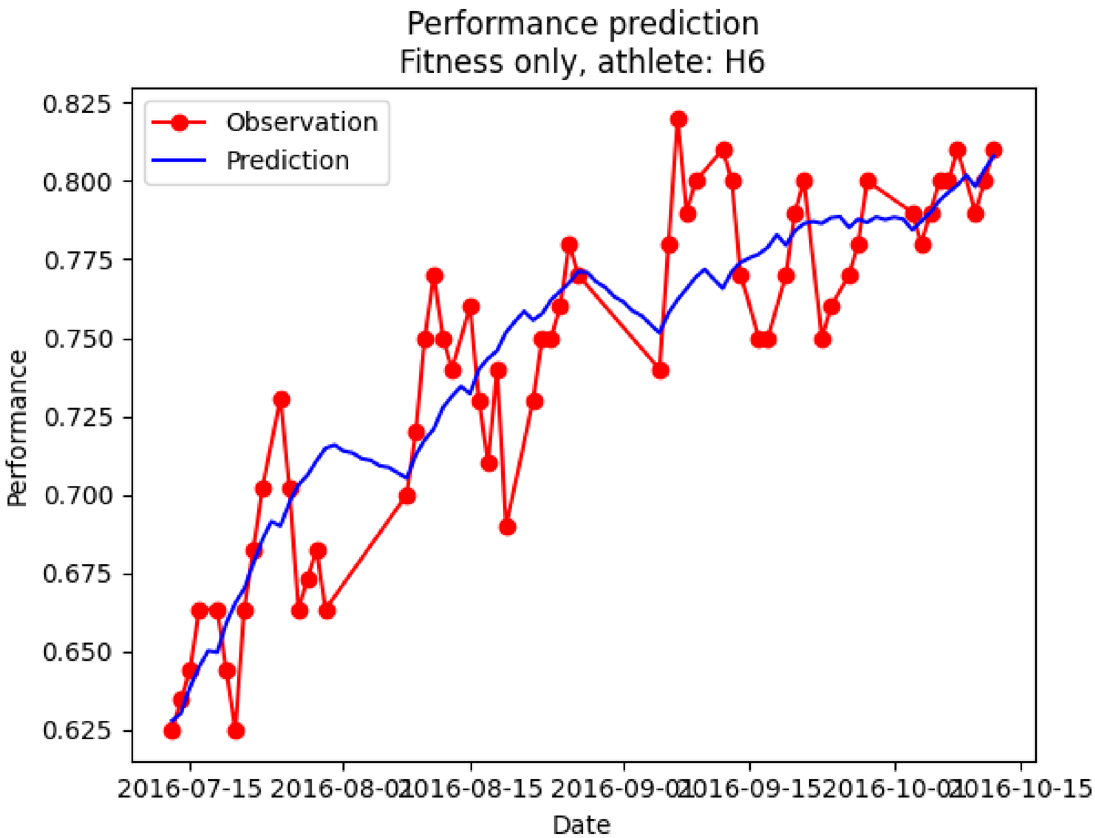

kG
1e6
1e−13+7.978845608e−2
posterior
prior
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
0.6
0.8
1.0
1.2
1.4
1.6
1e−6

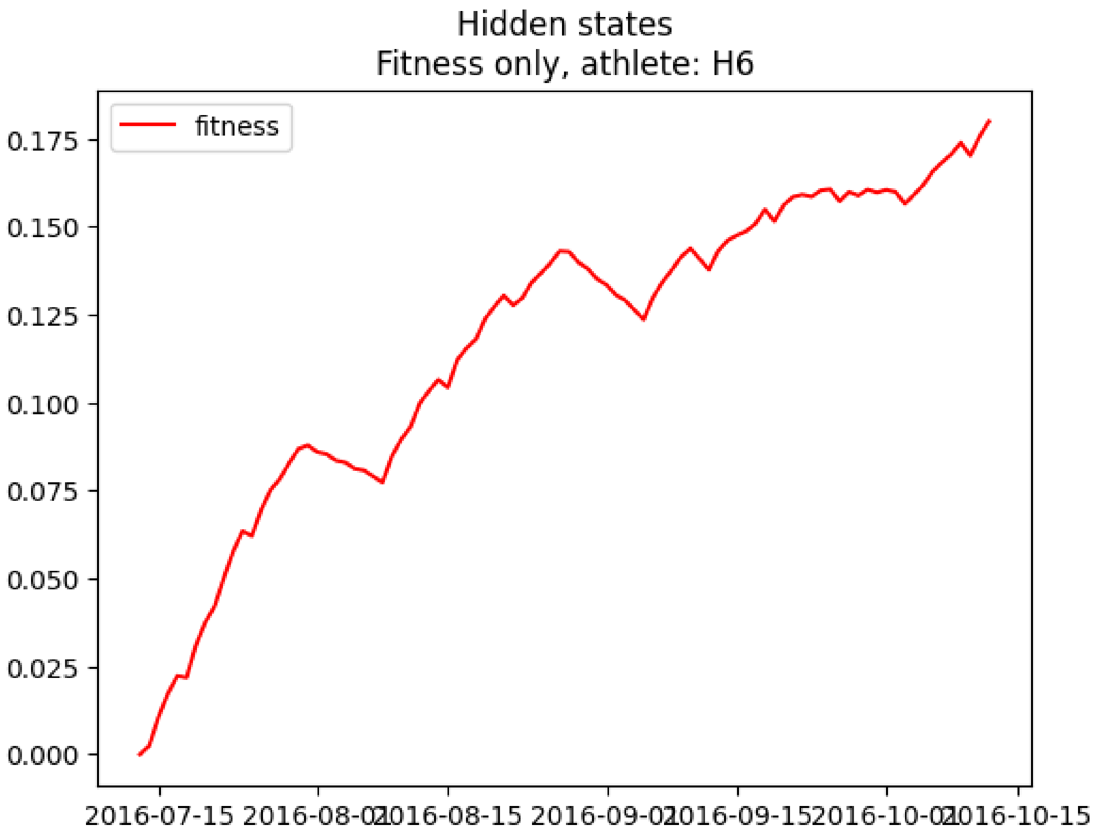


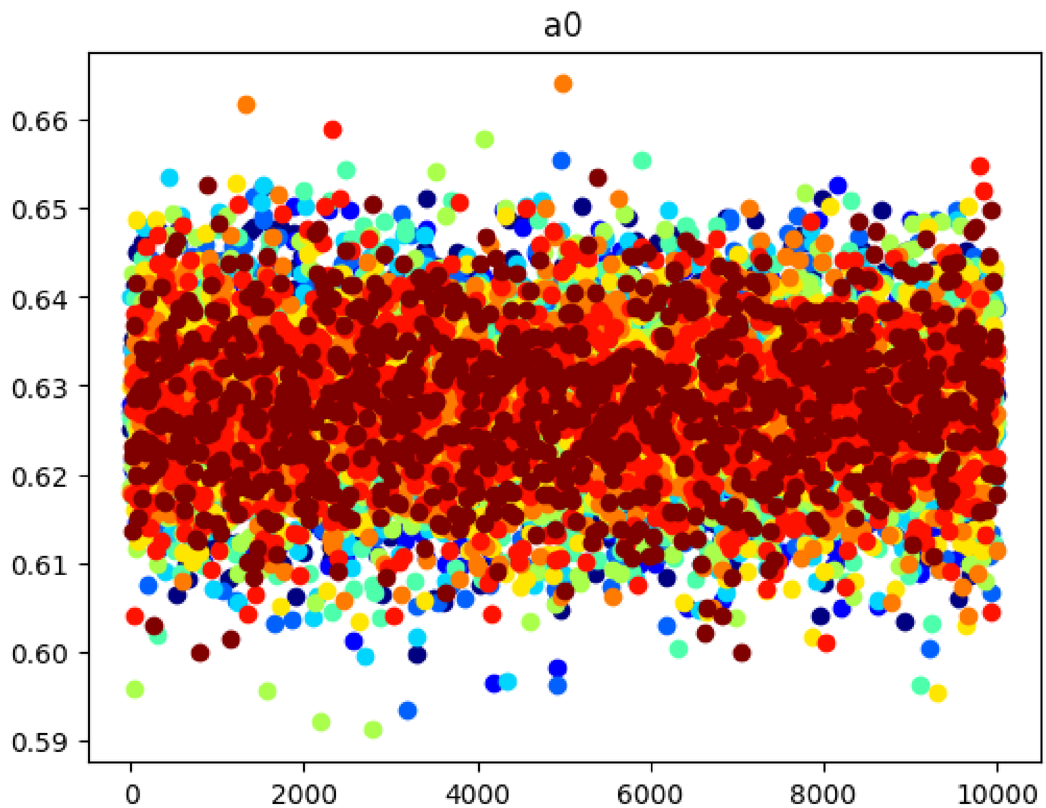
tauG
posterior
prior
0.00
0.02
0.04
0.06
0.08
0.10
0.00
0.02
0.04
0.06
0.08
30
35
40
45
50
55
60

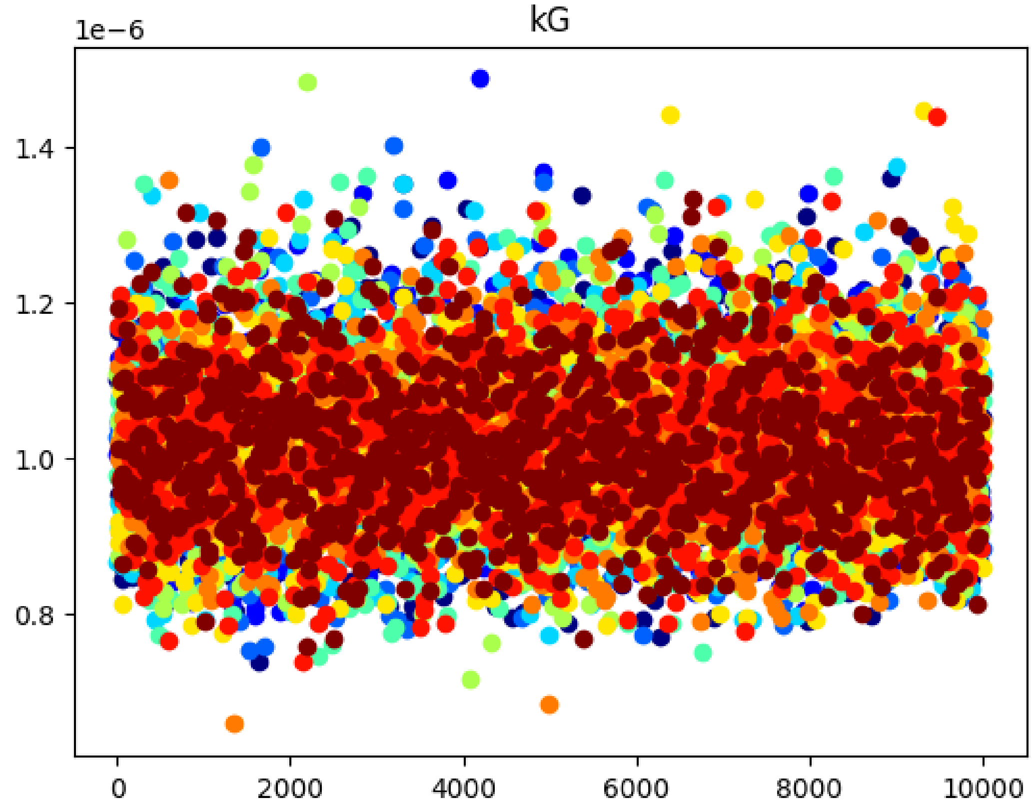


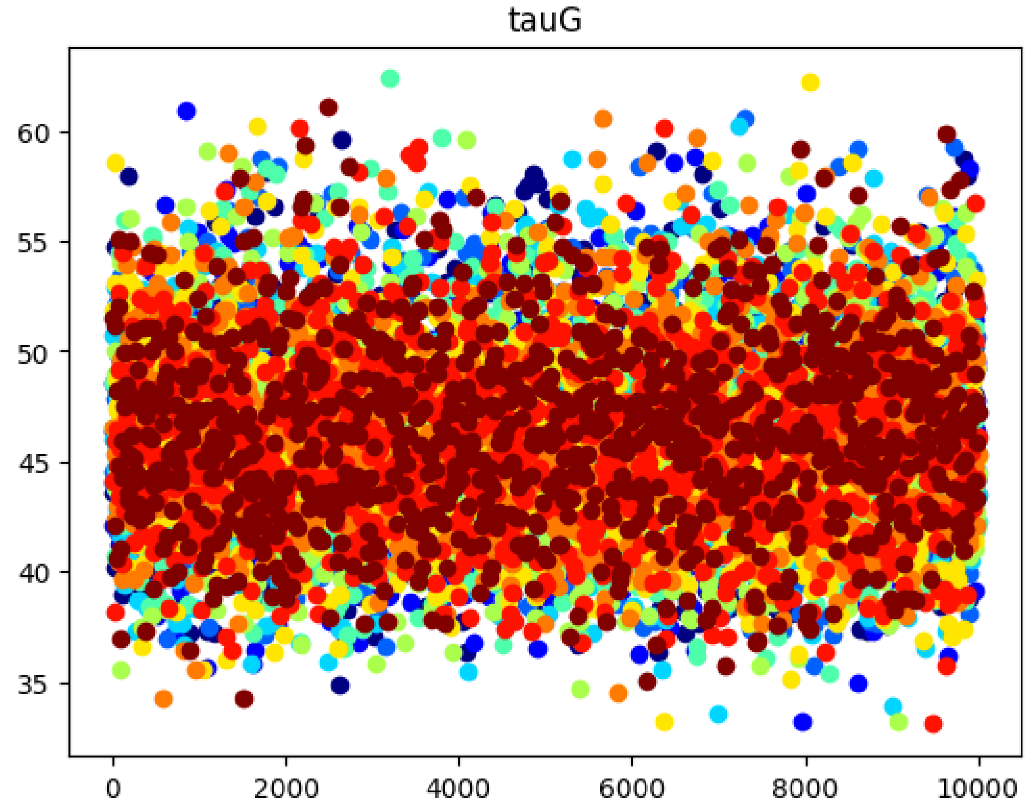
sigma
1e−8+1.59576e−2
posterior
prior
0
20
40
60
80
100
120
6.5
7.0
7.5
8.0
8.5
0.020
0.025
0.030
0.035
0.040
0.045

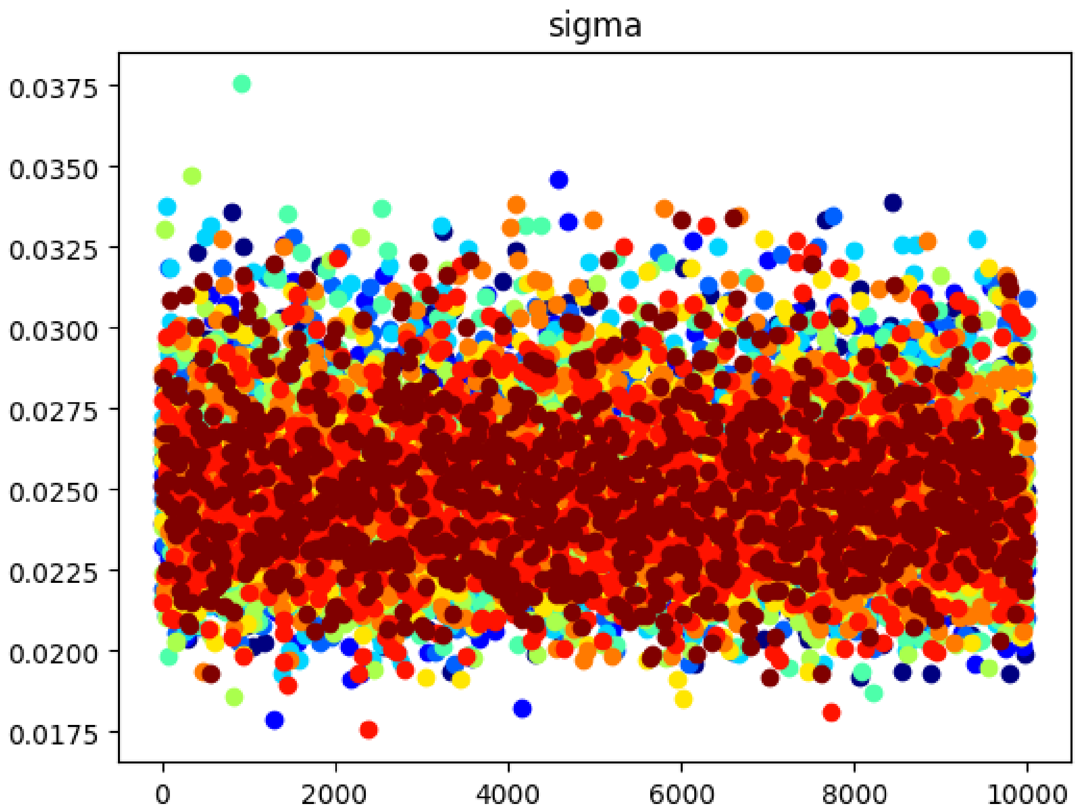

Performance prediction
Fitness only, athlete: H6
Observation
Prediction
Performance
Date
0.825
0.800
0.775
0.750
0.725
0.700
0.675
0.650
0.625
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

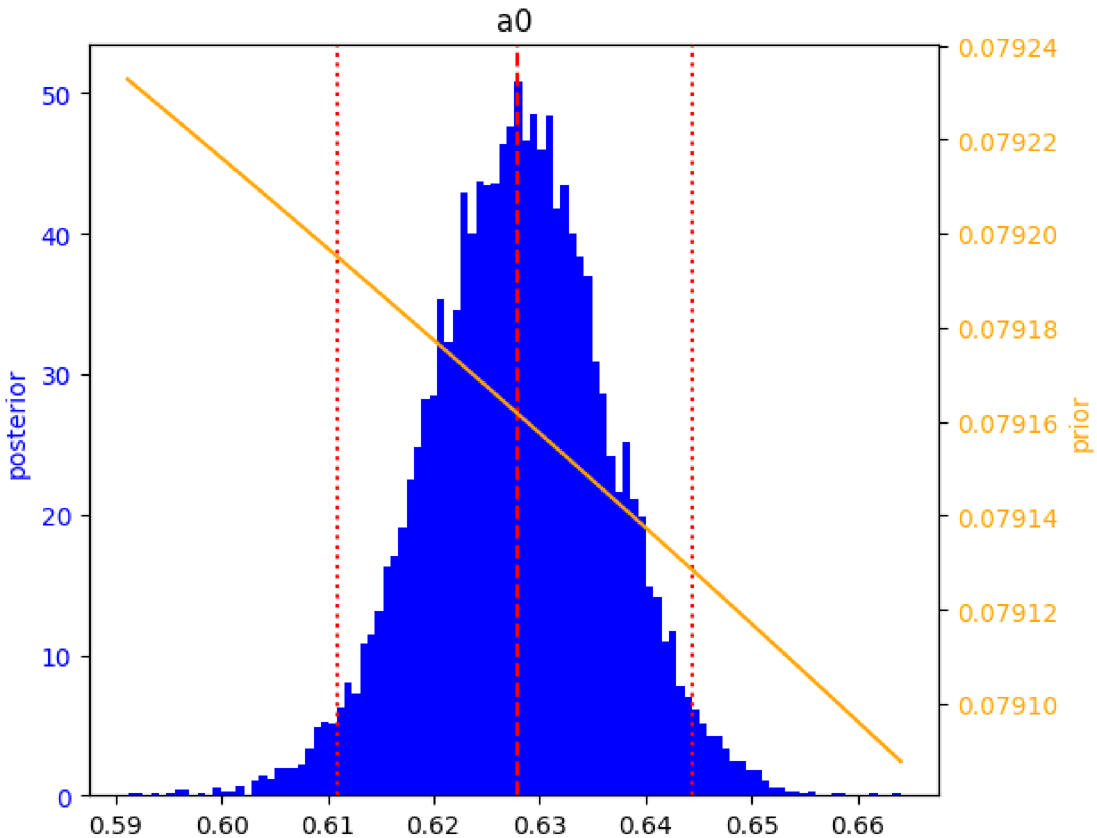

Hidden states
Fitness only, athlete: H6
fitness
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

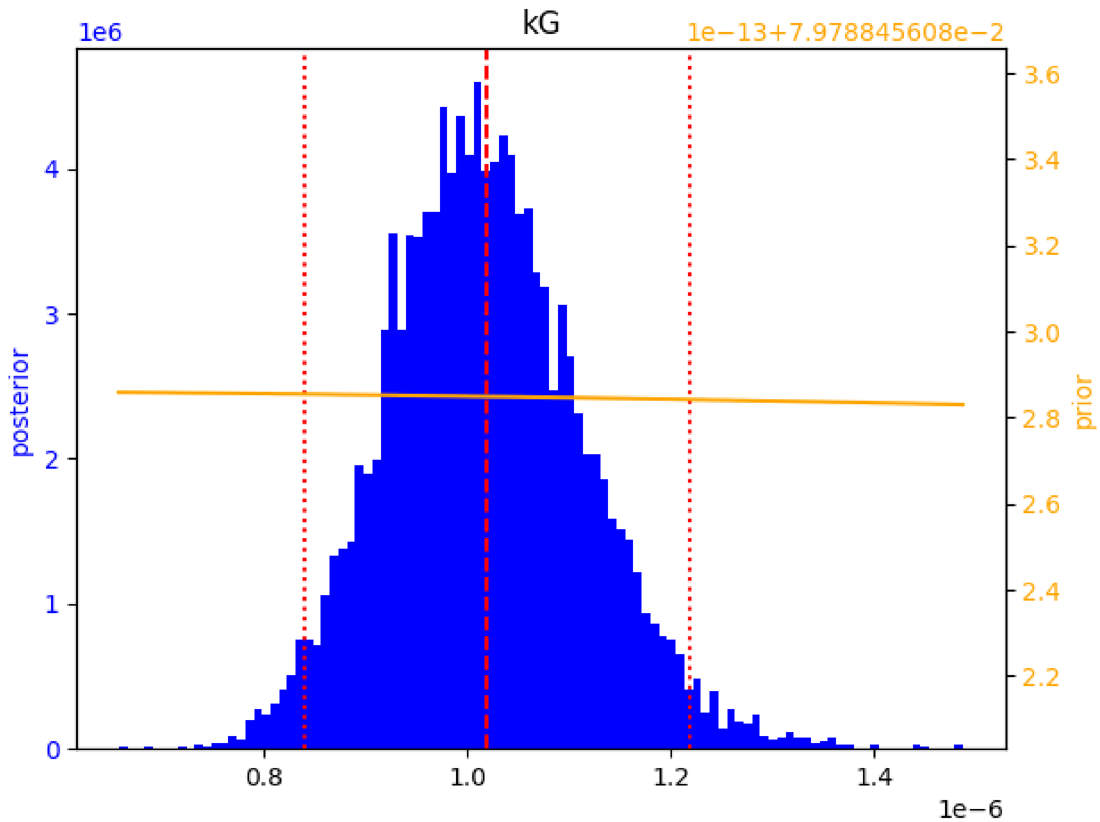

a0
0.66
0.65
0.64
0.63
0.62
0.61
0.60
0.59
0
2000
4000
6000
8000
10000

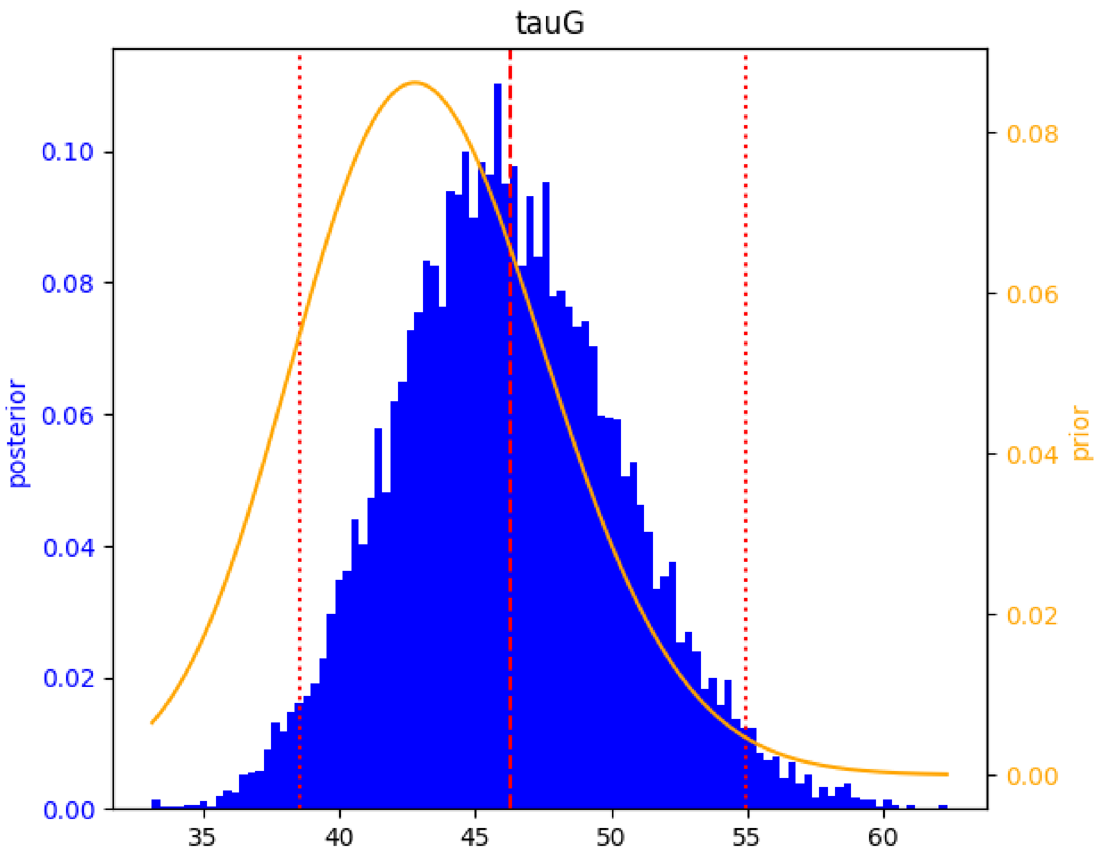

kG
1e−6
1.4
1.2
1.0
0.8
0
2000
4000
6000
8000
10000

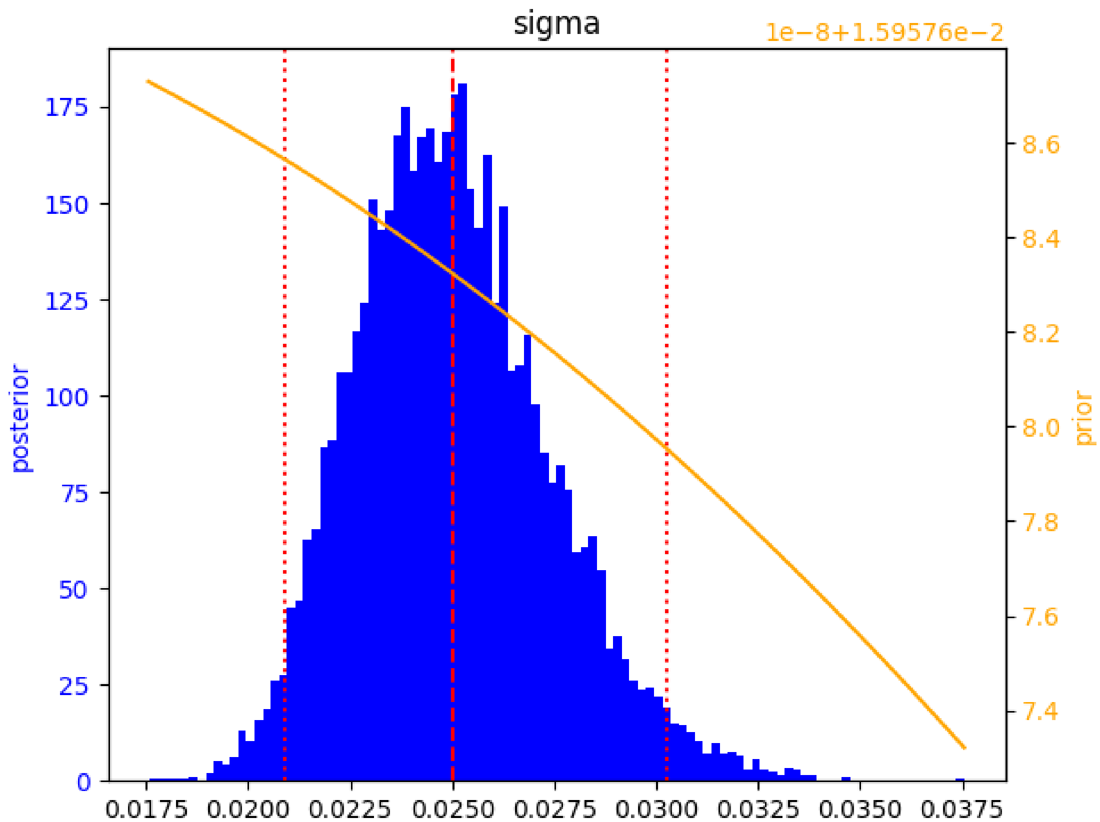

tauG
60
55
50
45
40
35
0
2000
4000
6000
8000
10000

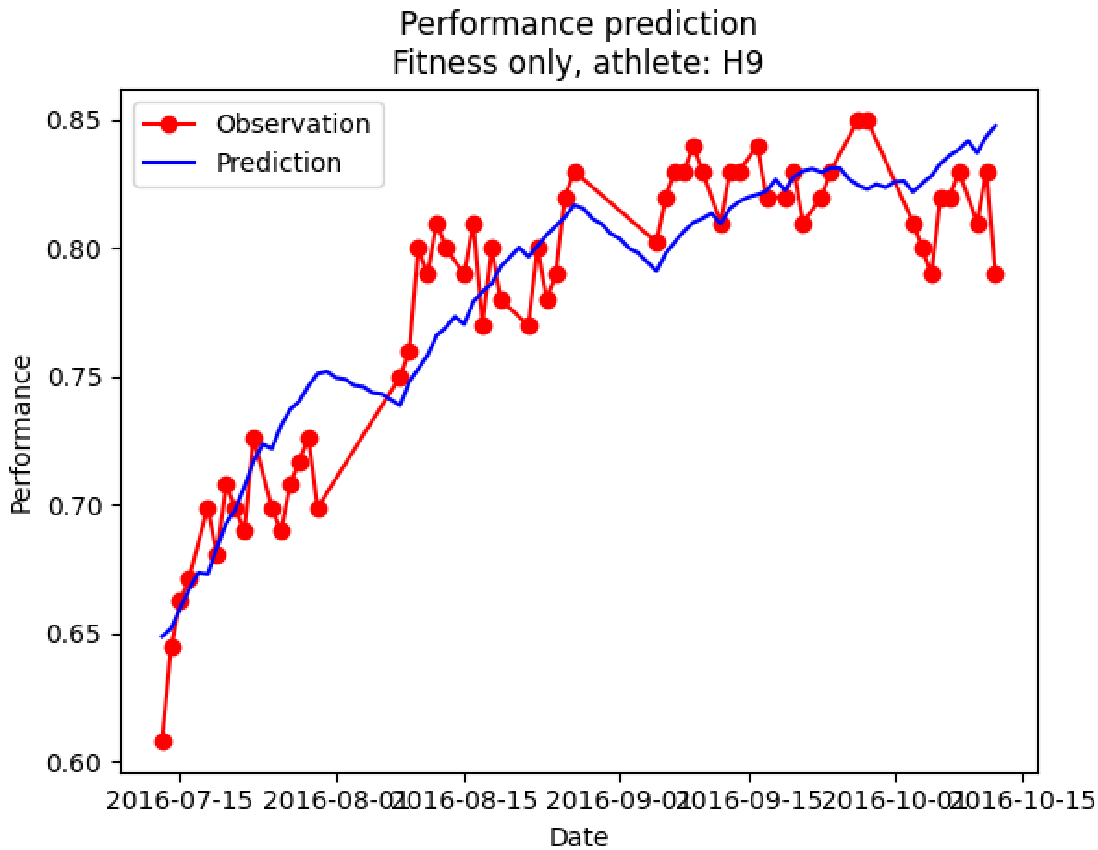

sigma
0.0375
0.0350
0.0325
0.0300
0.0275
0.0250
0.0225
0.0200
0.0175
0
2000
4000
6000
8000
10000

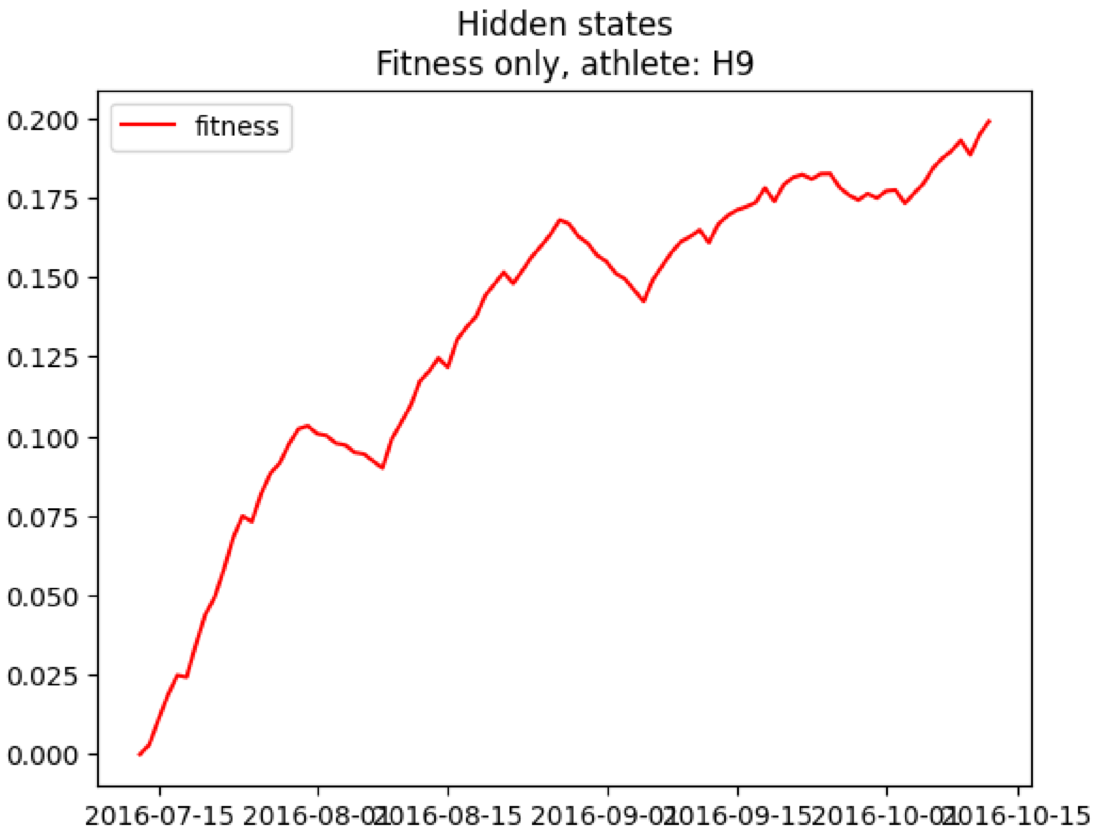

a0
posterior
prior
0
10
20
30
40
50
0.07910
0.07912
0.07914
0.07916
0.07918
0.07920
0.07922
0.07924
0.59
0.60
0.61
0.62
0.63
0.64
0.65
0.66

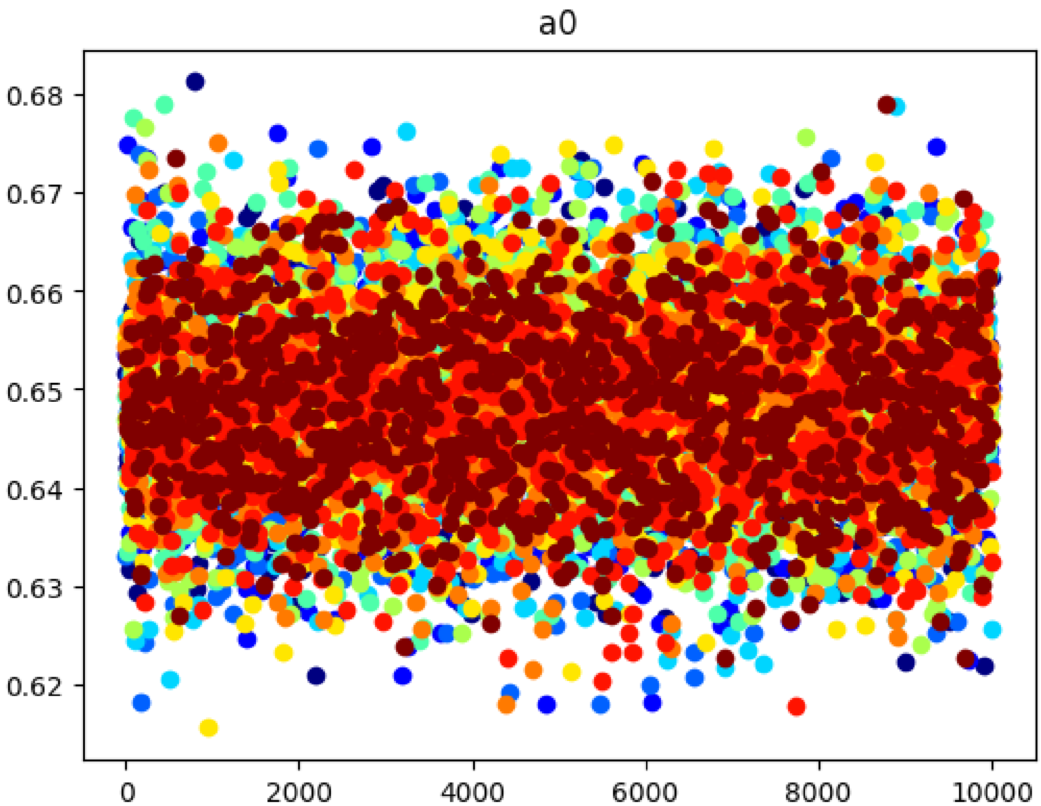

kG
1e6
1e−13+7.978845608e−2
posterior
prior
0
1
2
3
4
0.8
1.0
1.2
1.4
1e−6
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6

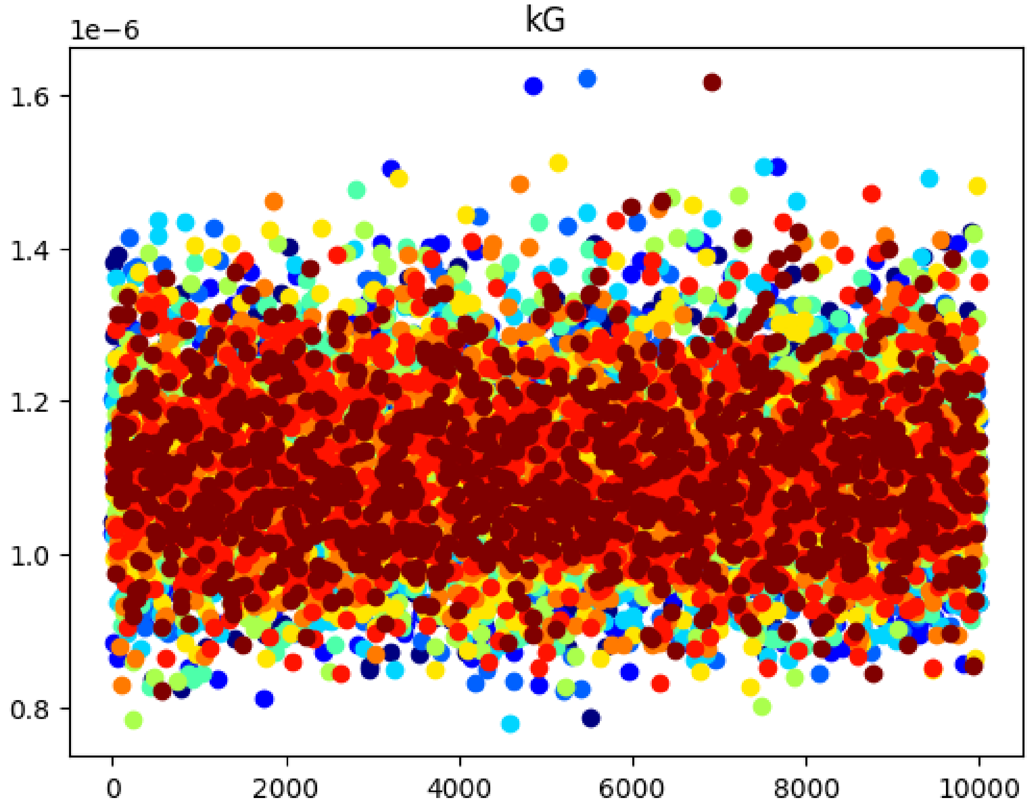

tauG
posterior
prior
0.00
0.02
0.04
0.06
0.08
0.10
35
40
45
50
55
60


sigma
1e−8+1.59576e−2
posterior
prior
175
150
125
100
75
50
25
0
8.6
8.4
8.2
8.0
7.8
7.6
7.4
0.0175
0.0200
0.0225
0.0250
0.0275
0.0300
0.0325
0.0350
0.0375

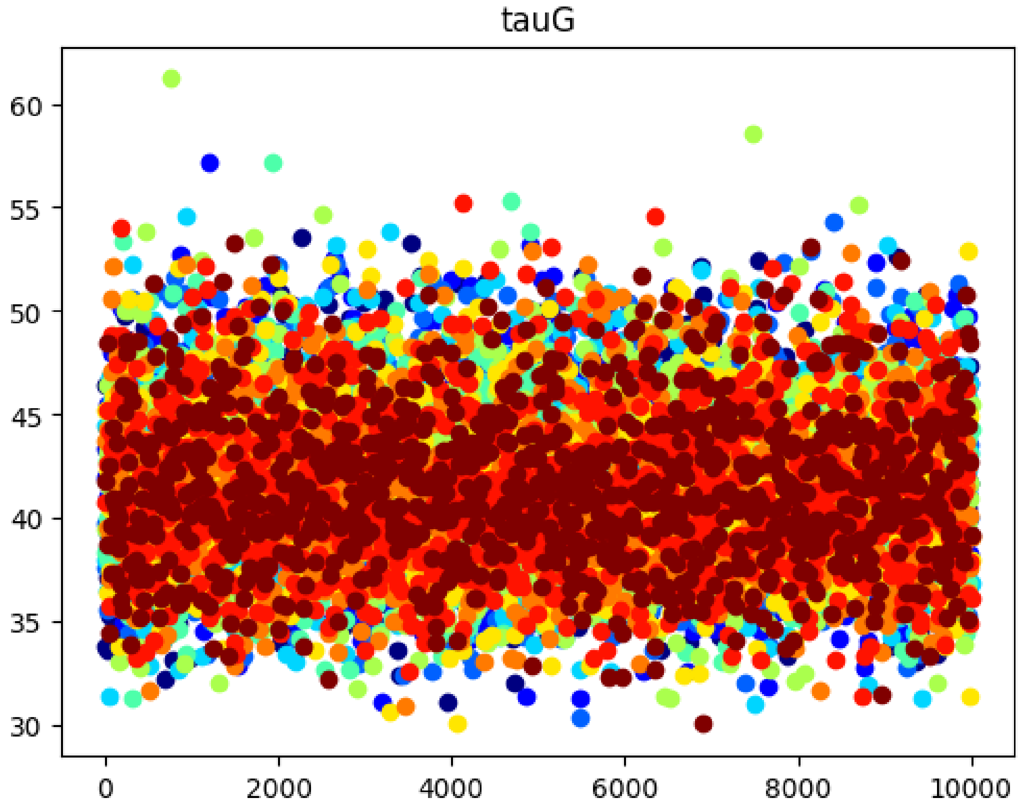

Performance prediction
Fitness only, athlete: H9
Observation
Prediction
Performance
Date
0.85
0.80
0.75
0.70
0.65
0.60
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

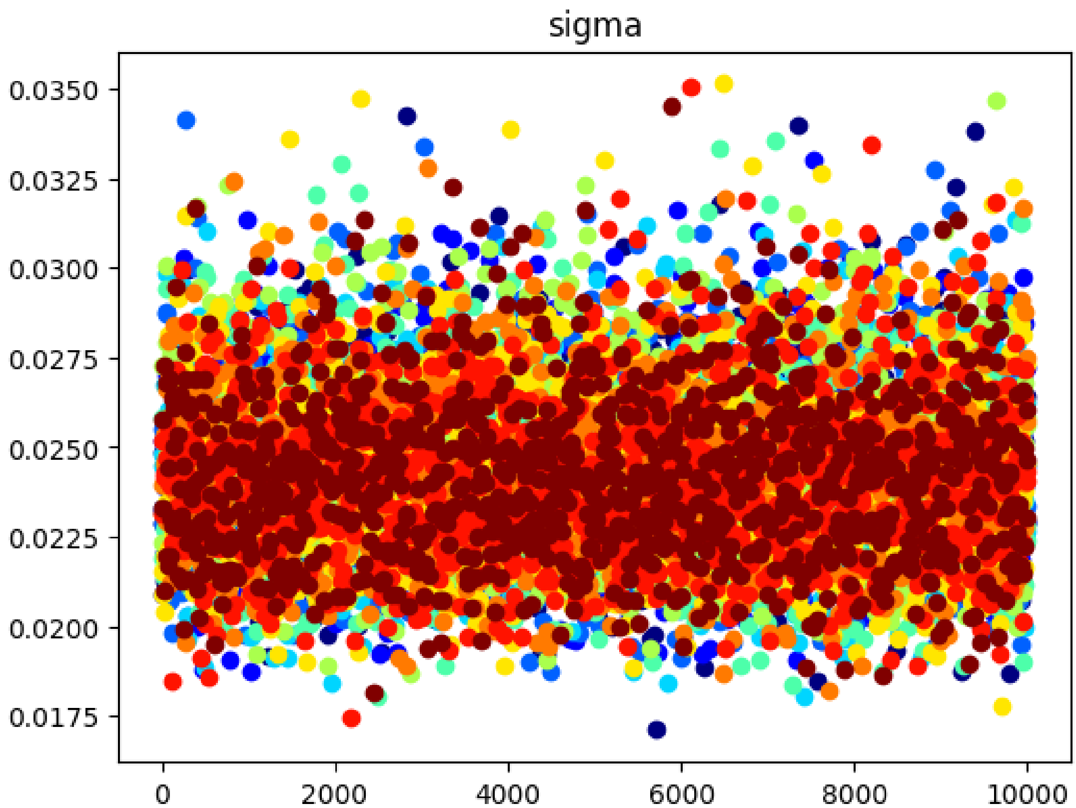

Hidden states
Fitness only, athlete: H9
fitness
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

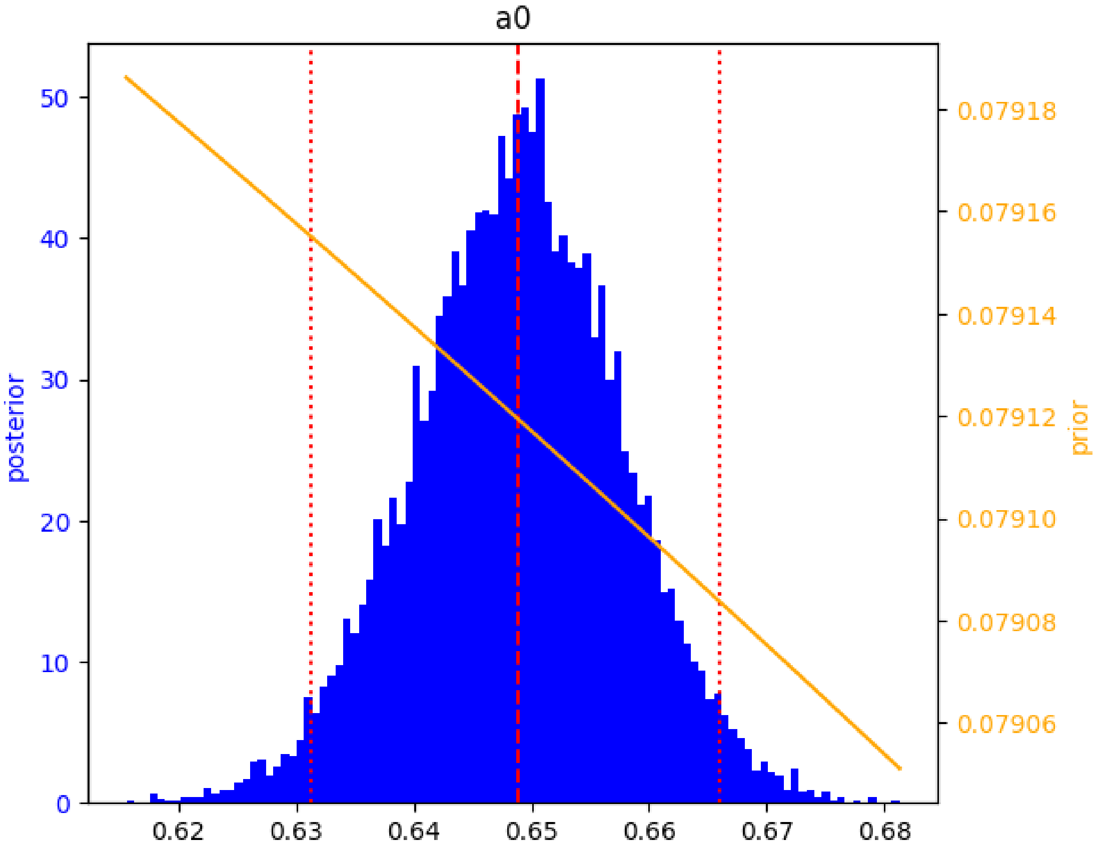

a0
0.68
0.67
0.66
0.65
0.64
0.63
0.62
0
2000
4000
6000
8000
10000



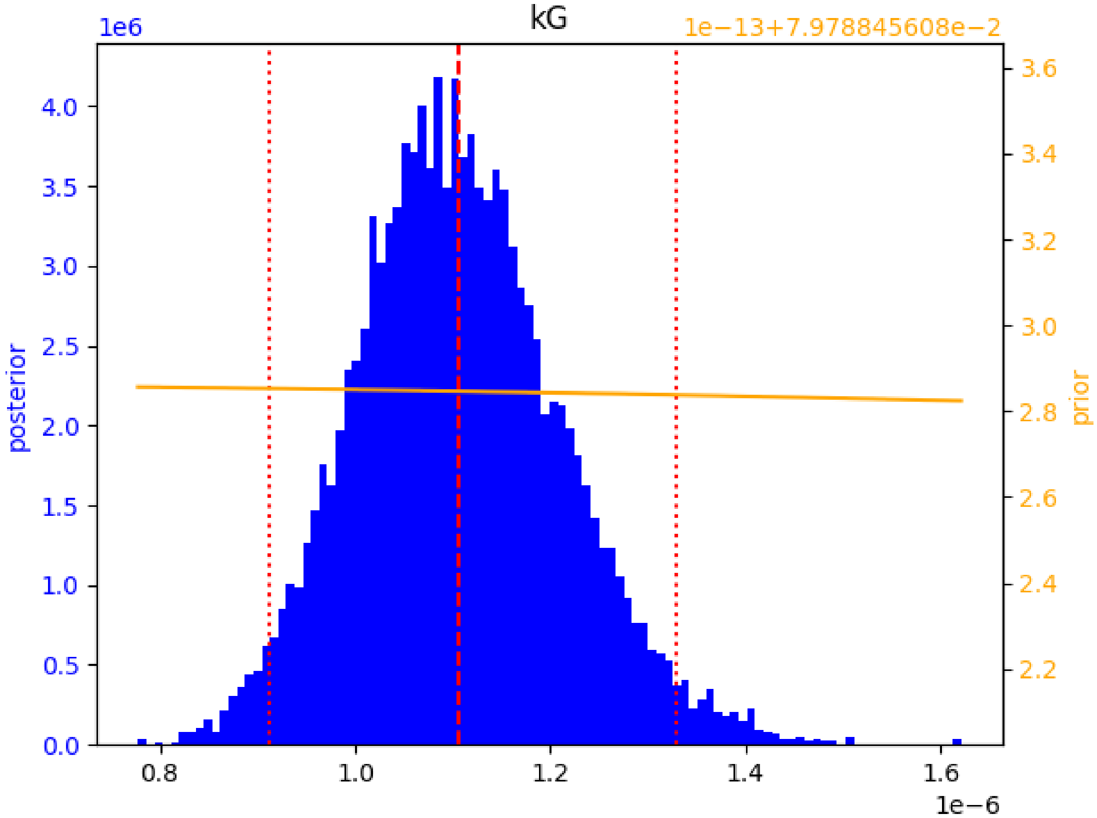
kG
1e−6
1.6
1.4
1.2
1.0
0.8
0
2000
4000
6000
8000
10000


tauG
60
55
50
45
40
35
30
0
2000
4000
6000
8000
10000

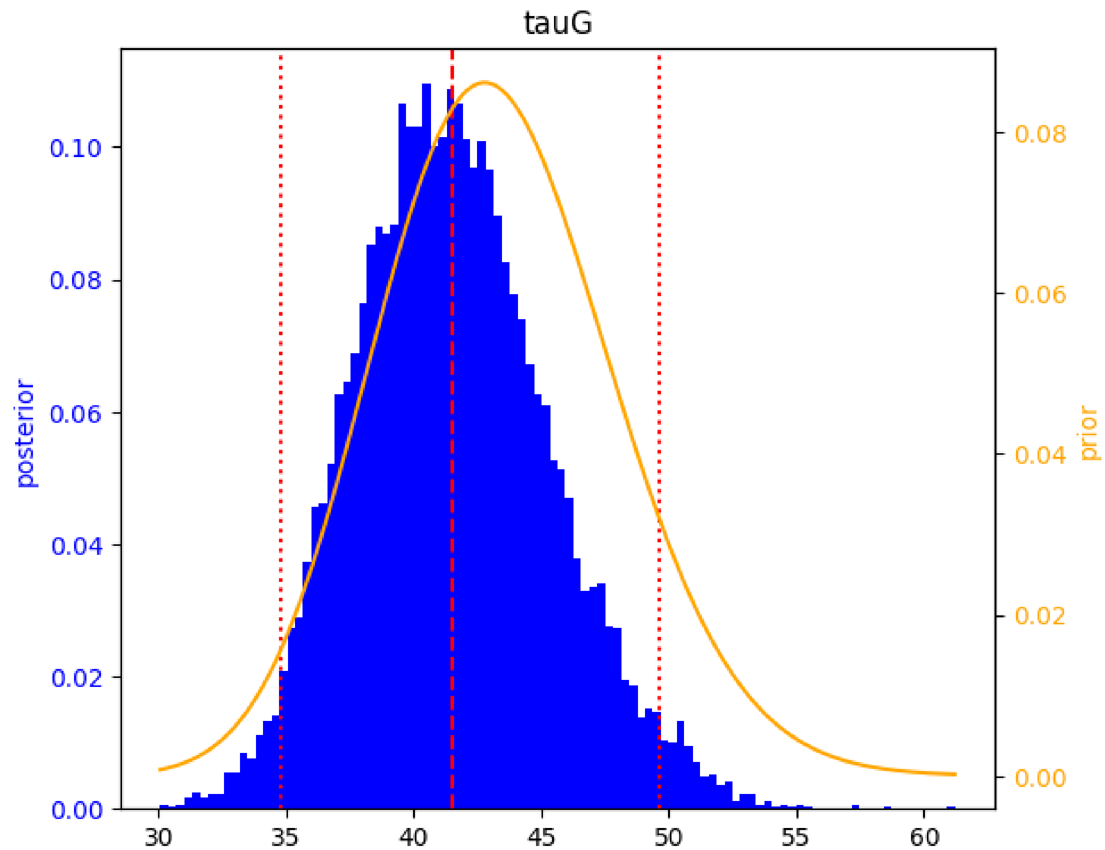

sigma
0.0350
0.0325
0.0300
0.0275
0.0250
0.0225
0.0200
0.0175
0
2000
4000
6000
8000
10000



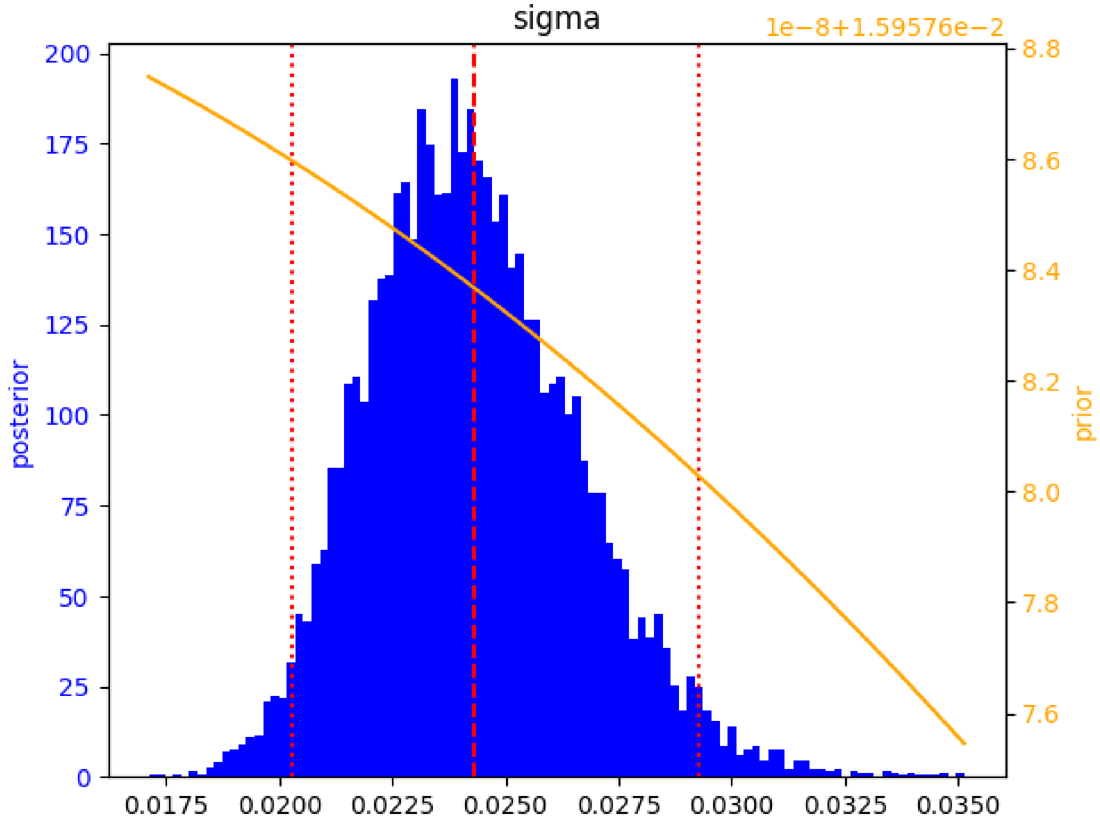
a0
posterior
prior
50
40
30
20
10
0
0.07918
0.07916
0.07914
0.07912
0.07910
0.07908
0.07906
0.62
0.63
0.64
0.65
0.66
0.67
0.68



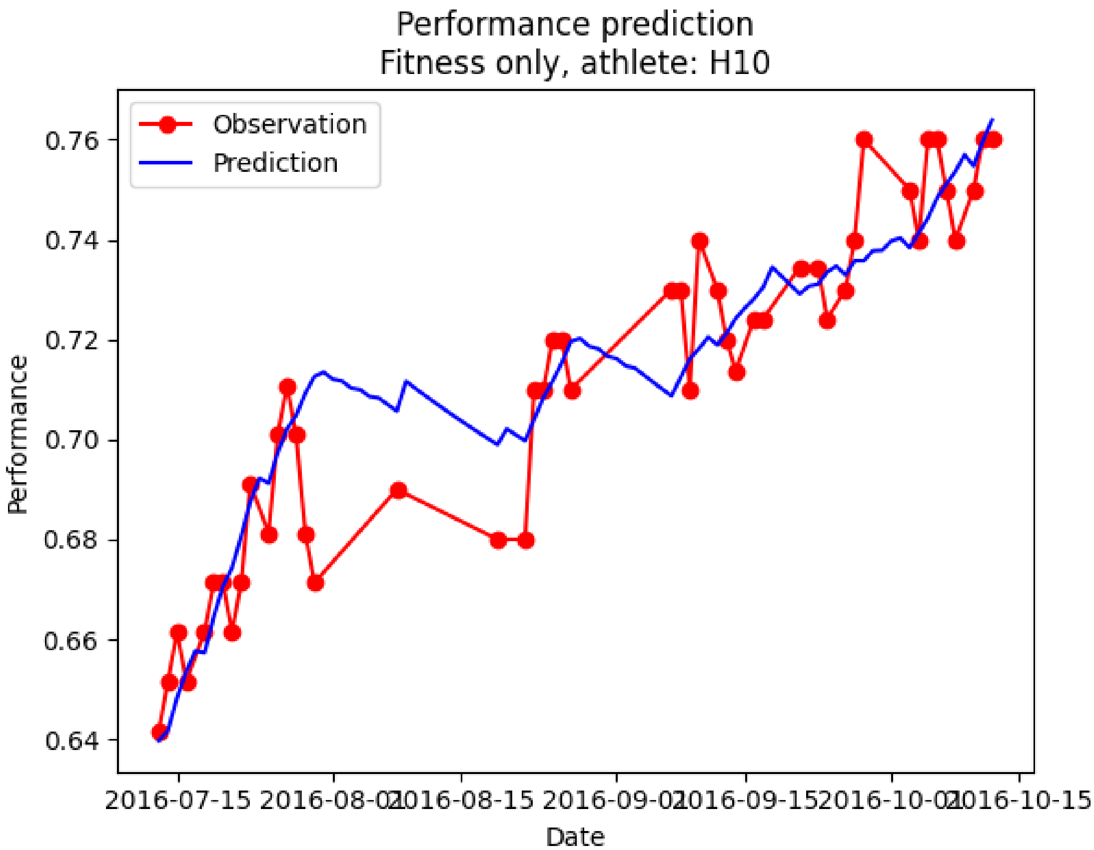
kG
1e6
1e−13+7.978845608e−2
posterior
prior
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
0.8
1.0
1.2
1.4
1.6
1e−6

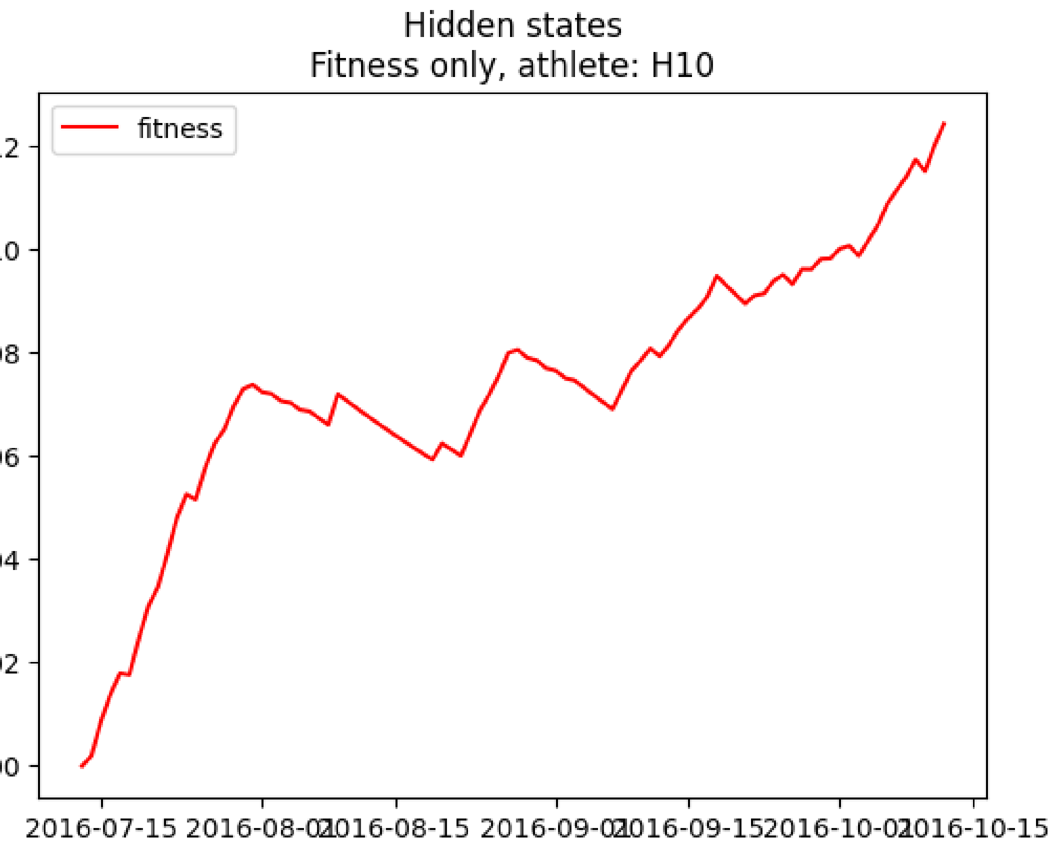


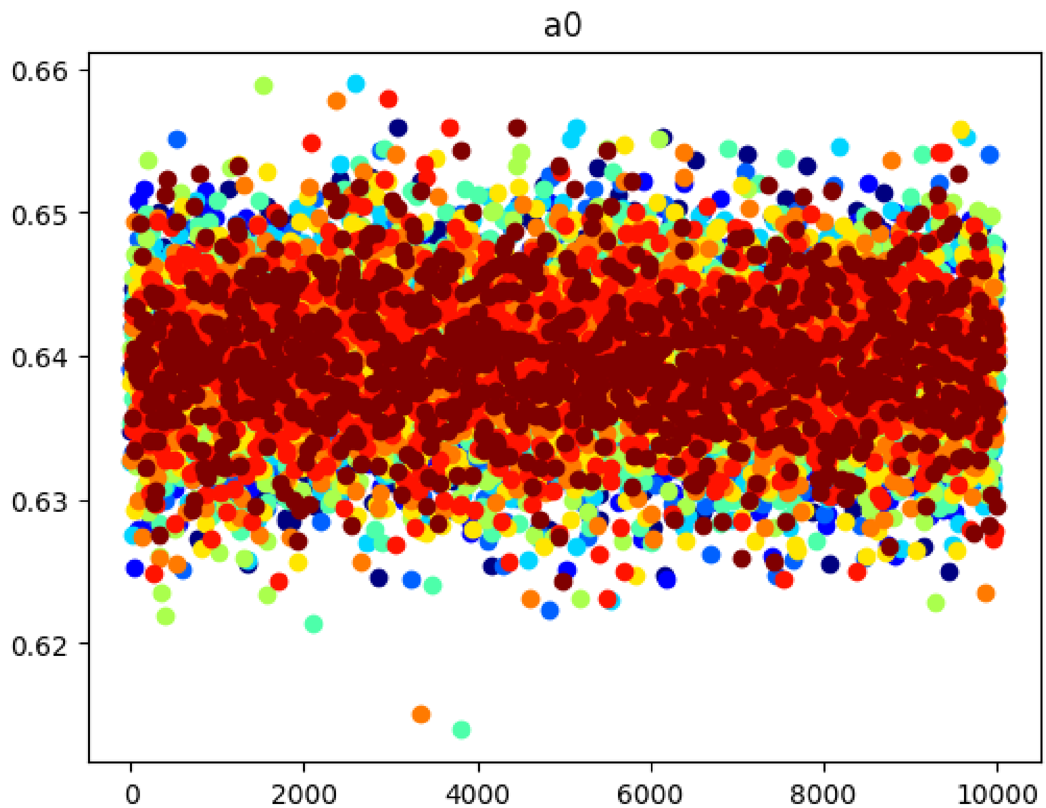
tauG
posterior
prior
0.00
0.02
0.04
0.06
0.08
0.10
0.00
0.02
0.04
0.06
0.08
30
35
40
45
50
55
60

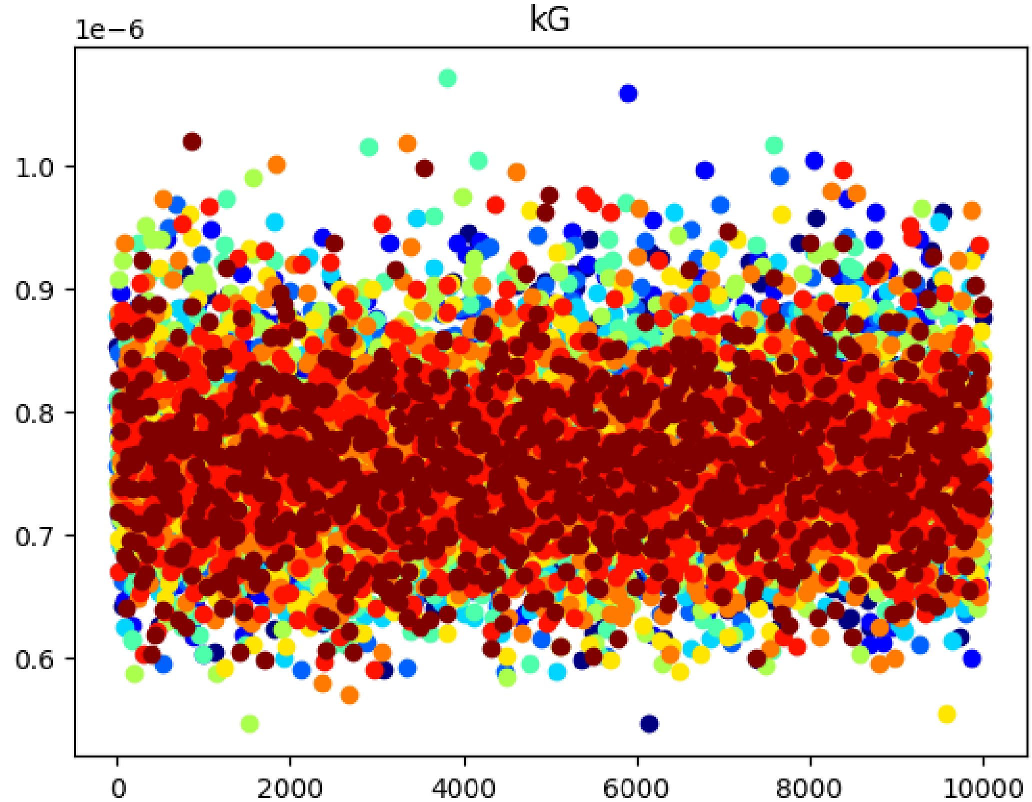


sigma
1e−8+1.59576e−2
posterior
prior
0
25
50
75
100
125
150
175
200
7.6
7.8
8.0
8.2
8.4
8.6
8.8
0.0175
0.0200
0.0225
0.0250
0.0275
0.0300
0.0325
0.0350

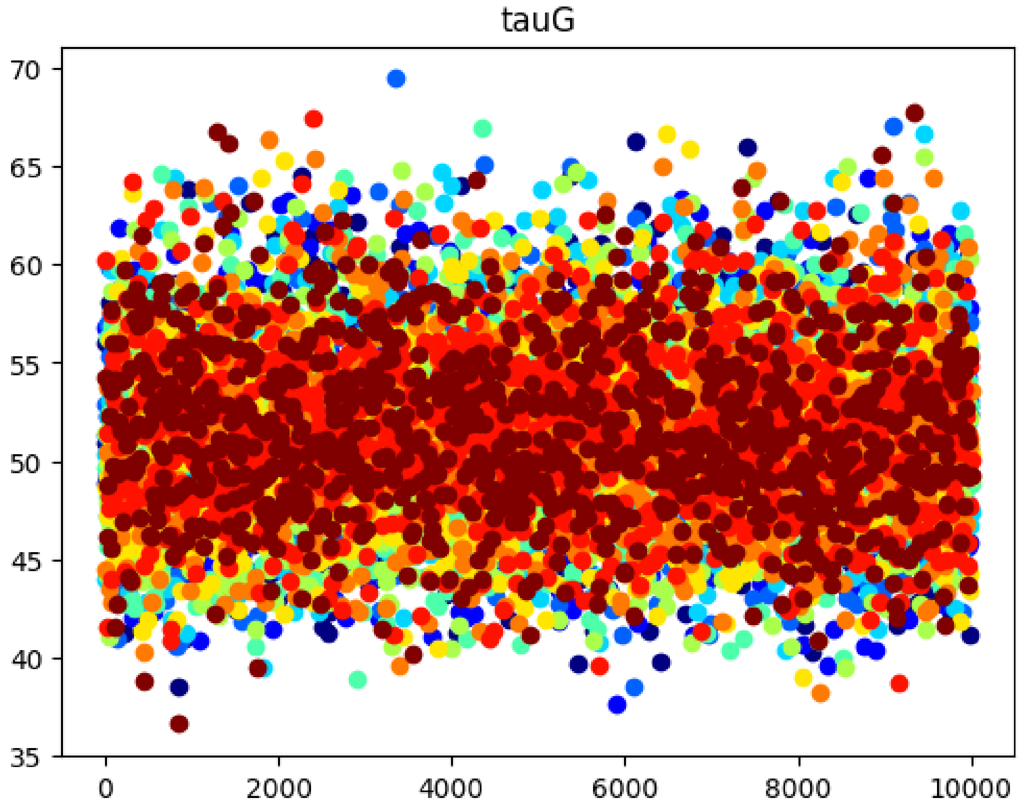

Performance prediction
Fitness only, athlete: H10
Observation
Prediction
Performance
0.76
0.74
0.72
0.70
0.68
0.66
0.64
Date
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

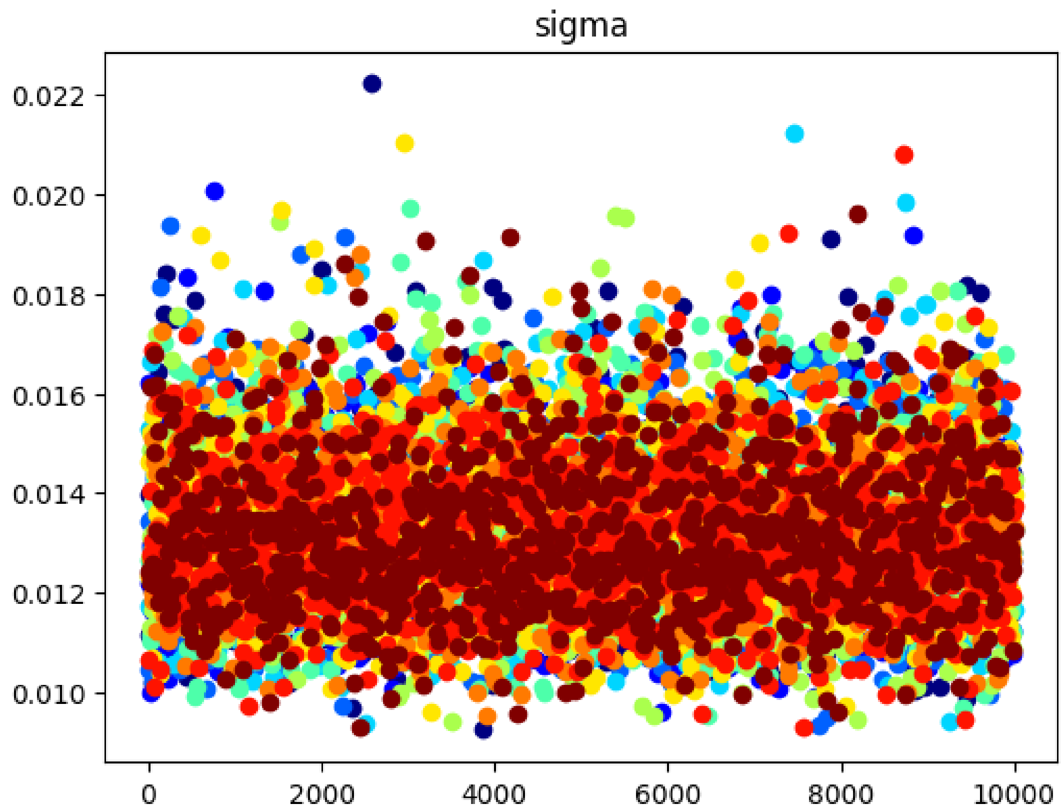

Hidden states
Fitness only, athlete: H10
fitness
0.12
0.10
0.08
0.06
0.04
0.02
0.00
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

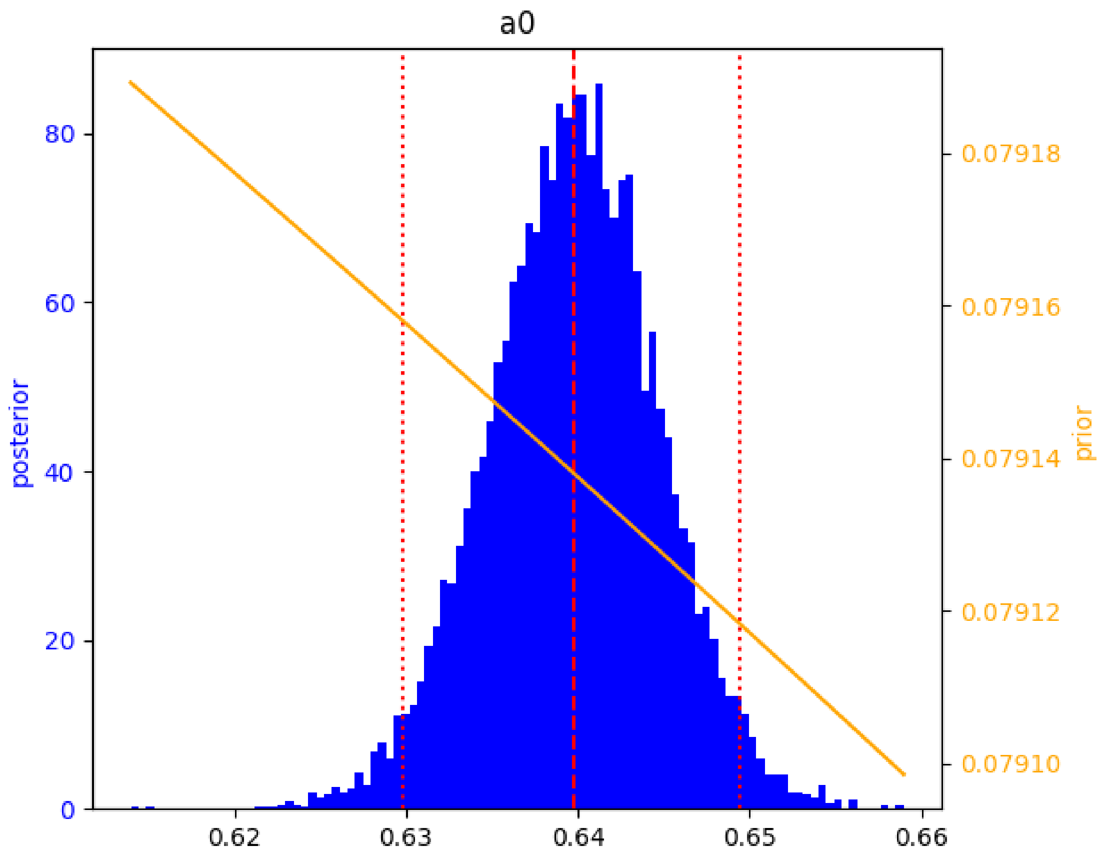

a0
0.66
0.65
0.64
0.63
0.62
0
2000
4000
6000
8000
10000

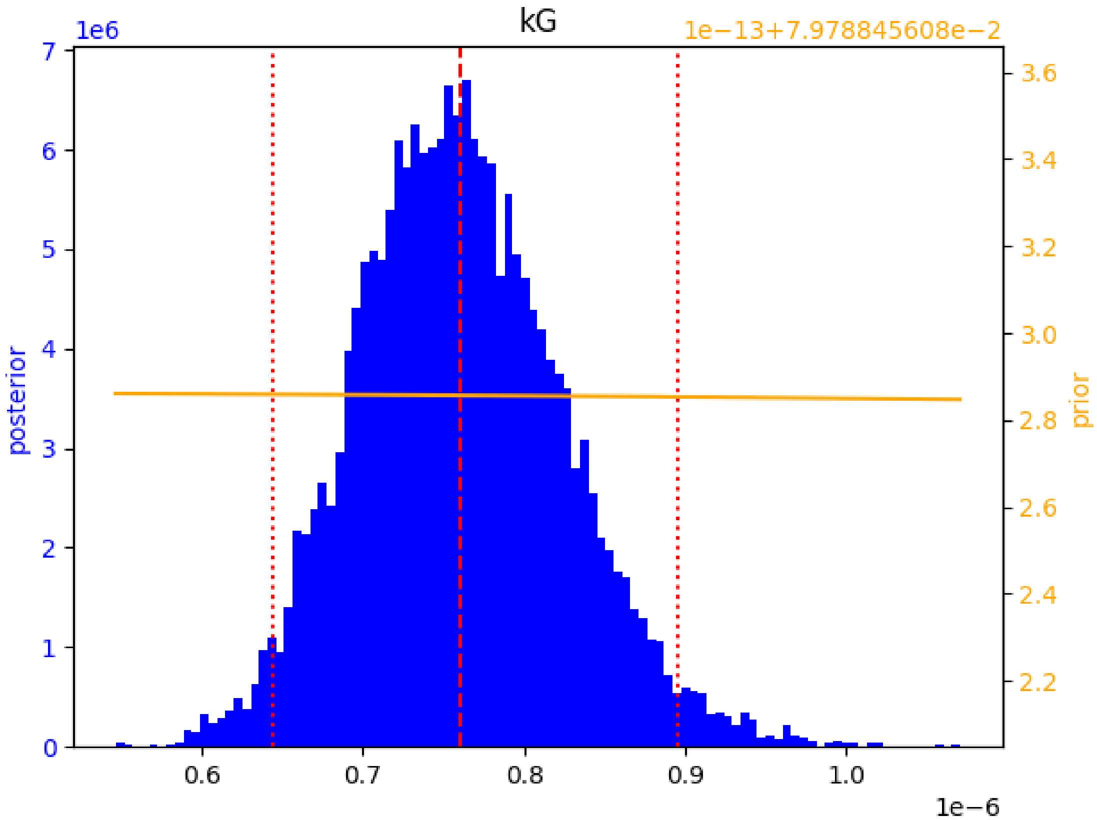


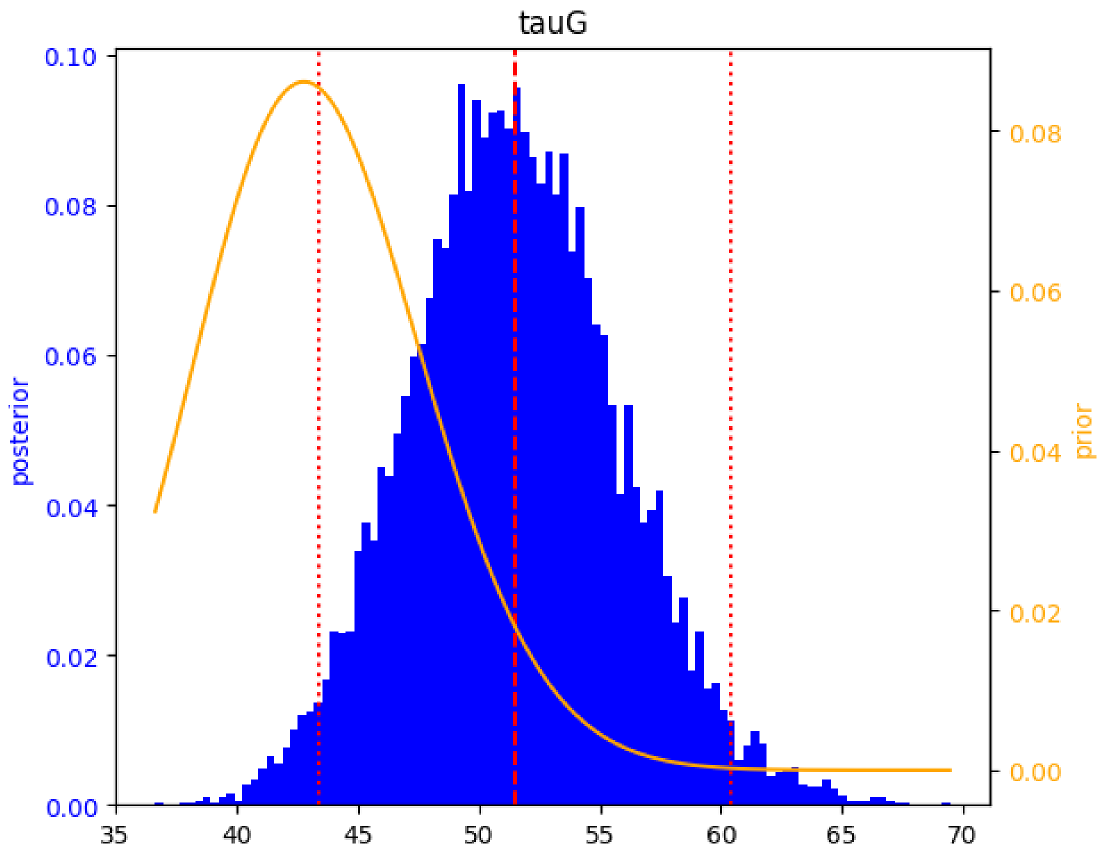
kG
1e−6
1.0
0.9
0.8
0.7
0.6
0
2000
4000
6000
8000
10000

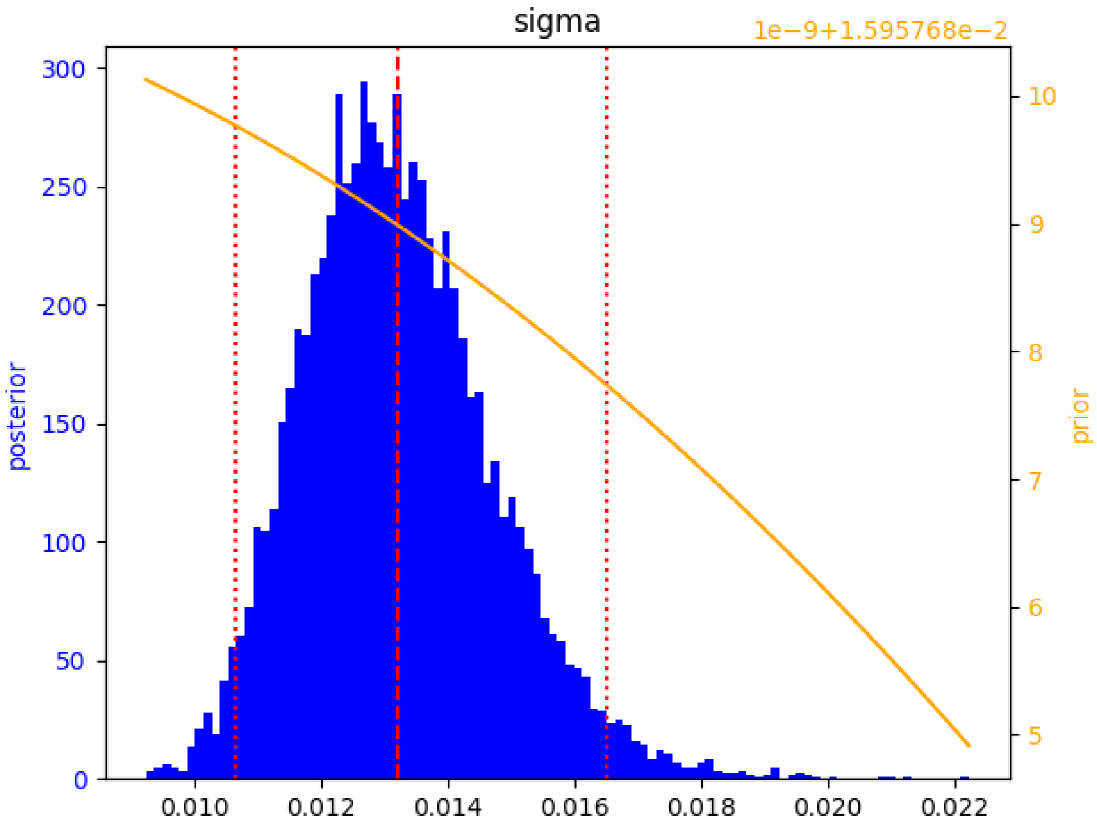

tauG
70
65
60
55
50
45
40
35
0
2000
4000
6000
8000
10000


sigma
0.022
0.020
0.018
0.016
0.014
0.012
0.010
0
2000
4000
6000
8000
10000

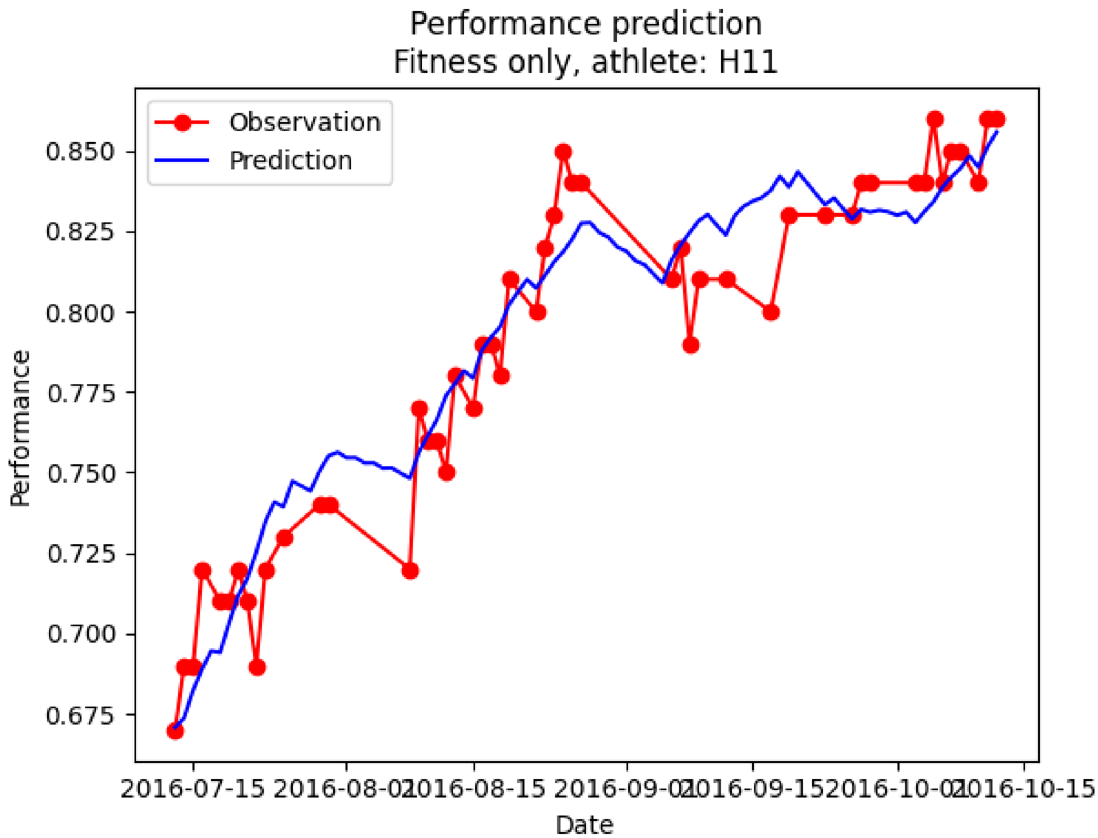

a0
posterior
prior
80
60
40
20
0
0.07918
0.07916
0.07914
0.07912
0.07910
0.62
0.63
0.64
0.65
0.66


kG
1e6
1e−13+7.978845608e−2
posterior
prior
0
1
2
3
4
5
6
7
0.6
0.7
0.8
0.9
1.0
1e−6
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6

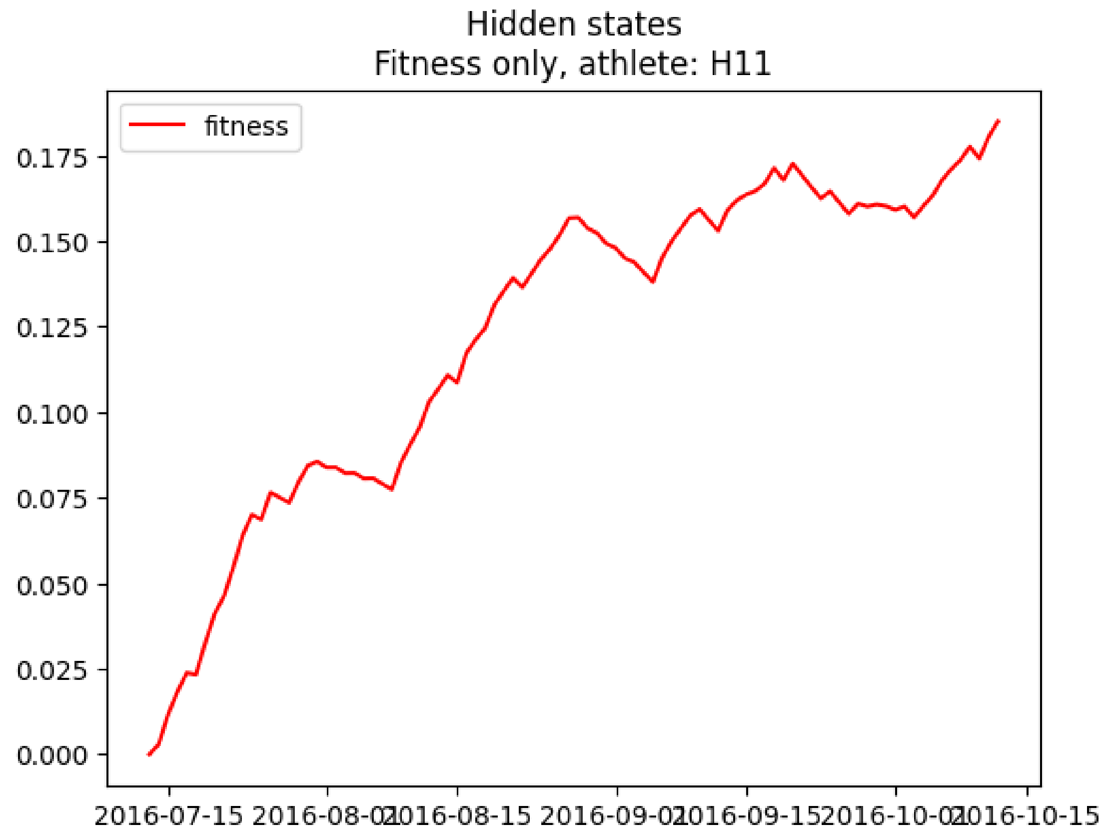

tauG
posterior
prior
0.00
0.02
0.04
0.06
0.08
0.10
0.00
0.02
0.04
0.06
0.08
35
40
45
50
55
60
65
70

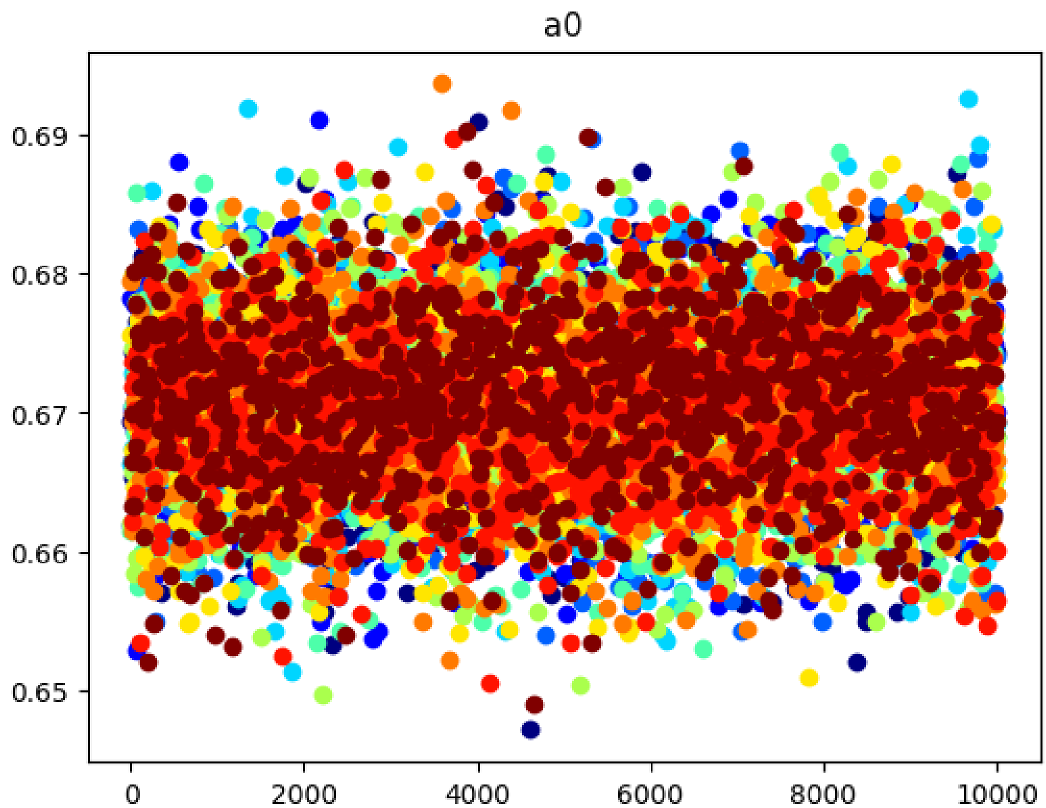


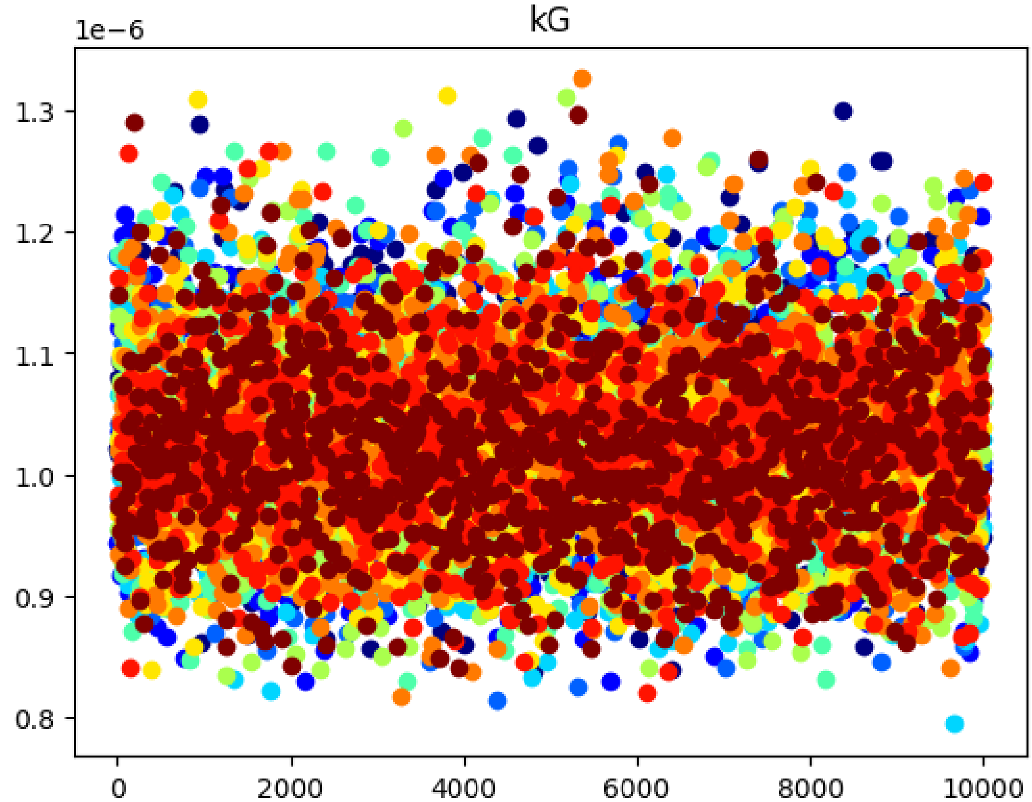
sigma
1e−9+1.595768e−2
posterior
prior
300
250
200
150
100
50
0
10
9
8
7
6
5
0.010
0.012
0.014
0.016
0.018
0.020
0.022

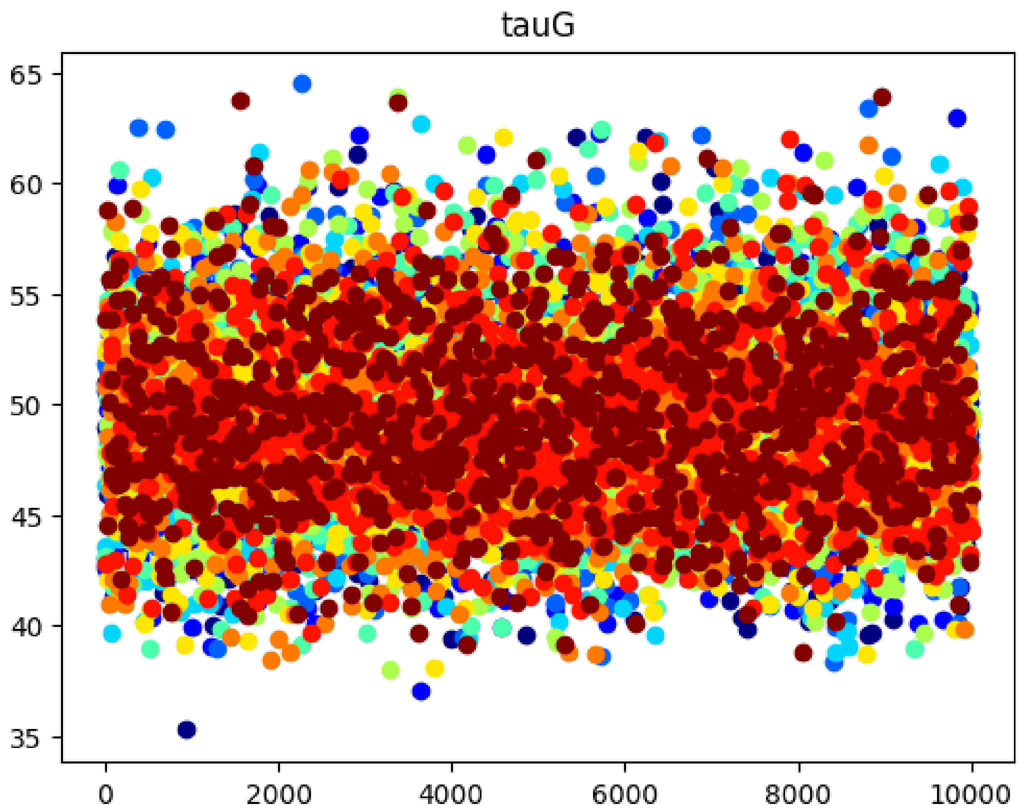


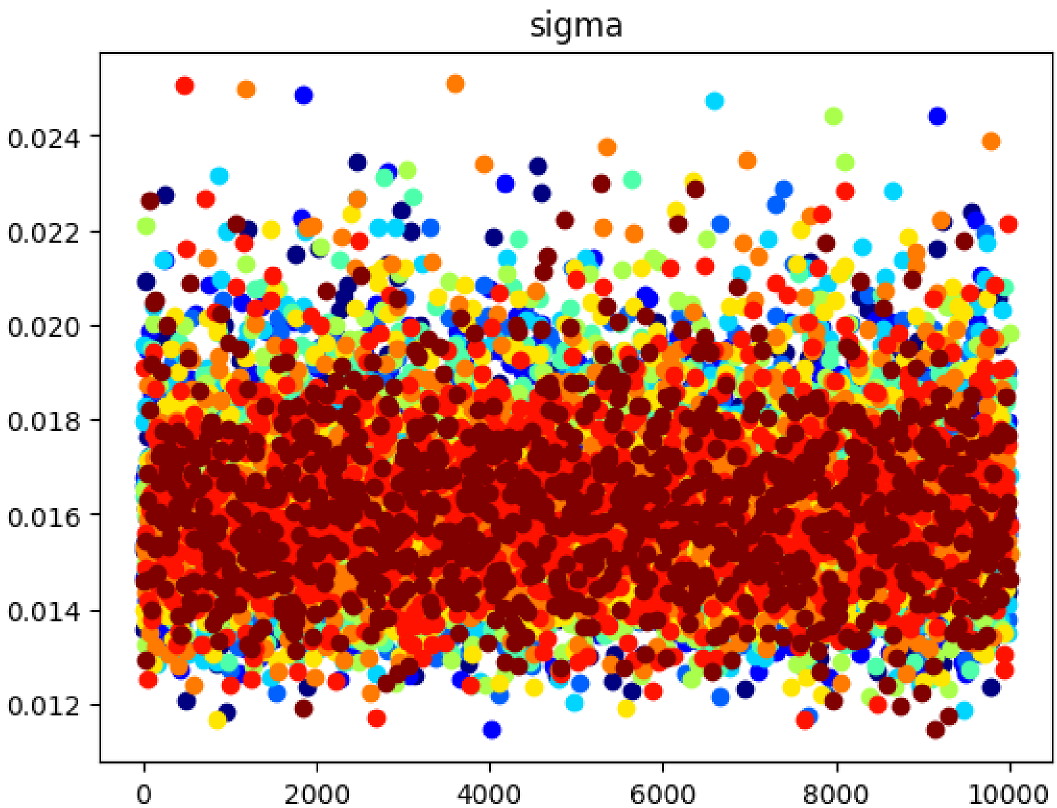
Performance prediction
Fitness only, athlete: H11
Observation
Prediction
0.850
0.825
0.800
0.775
0.750
0.725
0.700
0.675
Performance
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

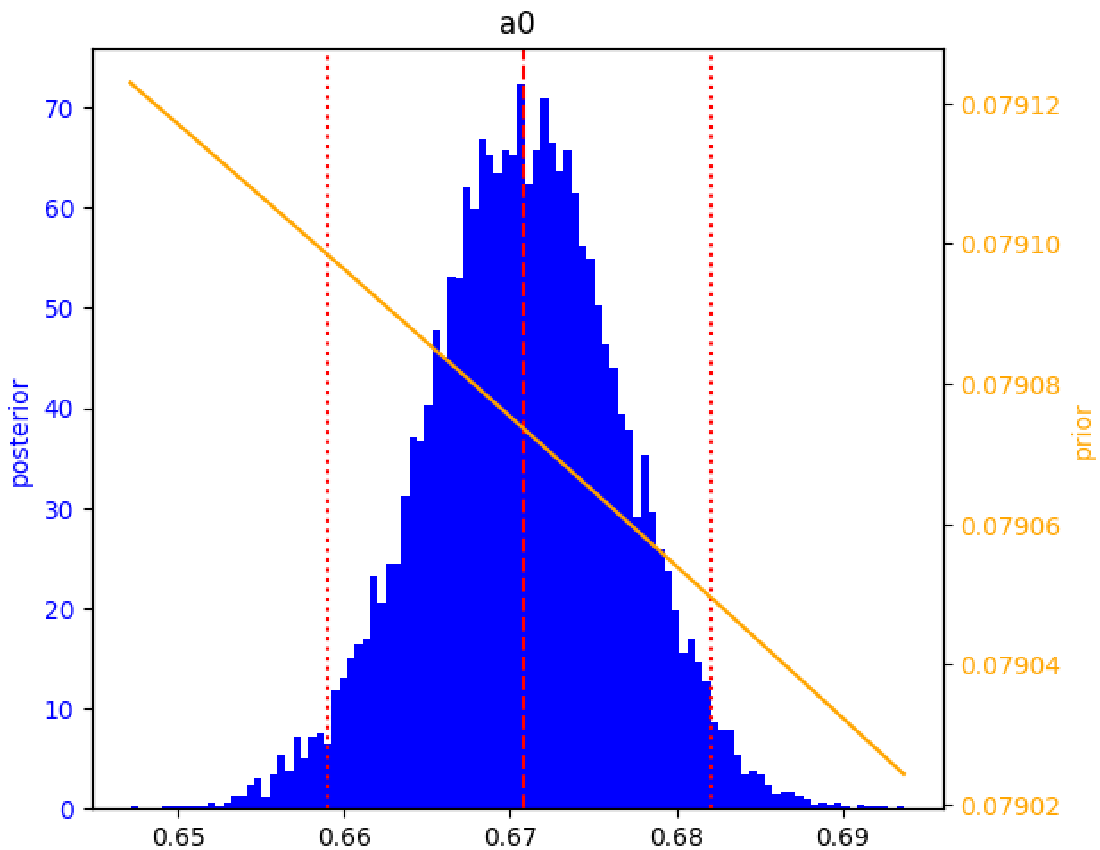

Hidden states
Fitness only, athlete: H11
fitness
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

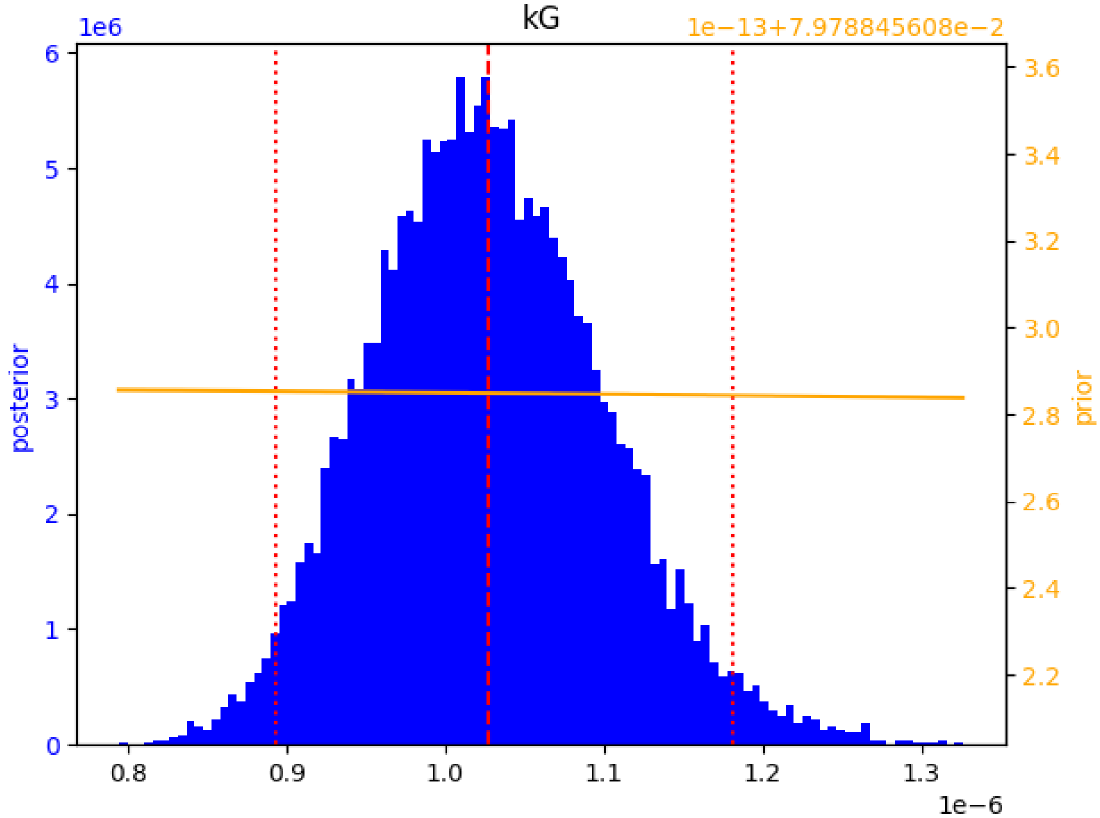

a0
0.69
0.68
0.67
0.66
0.65
0
2000
4000
6000
8000
10000


kG
1e−6
1.3
1.2
1.1
1.0
0.9
0.8
0
2000
4000
6000
8000
10000

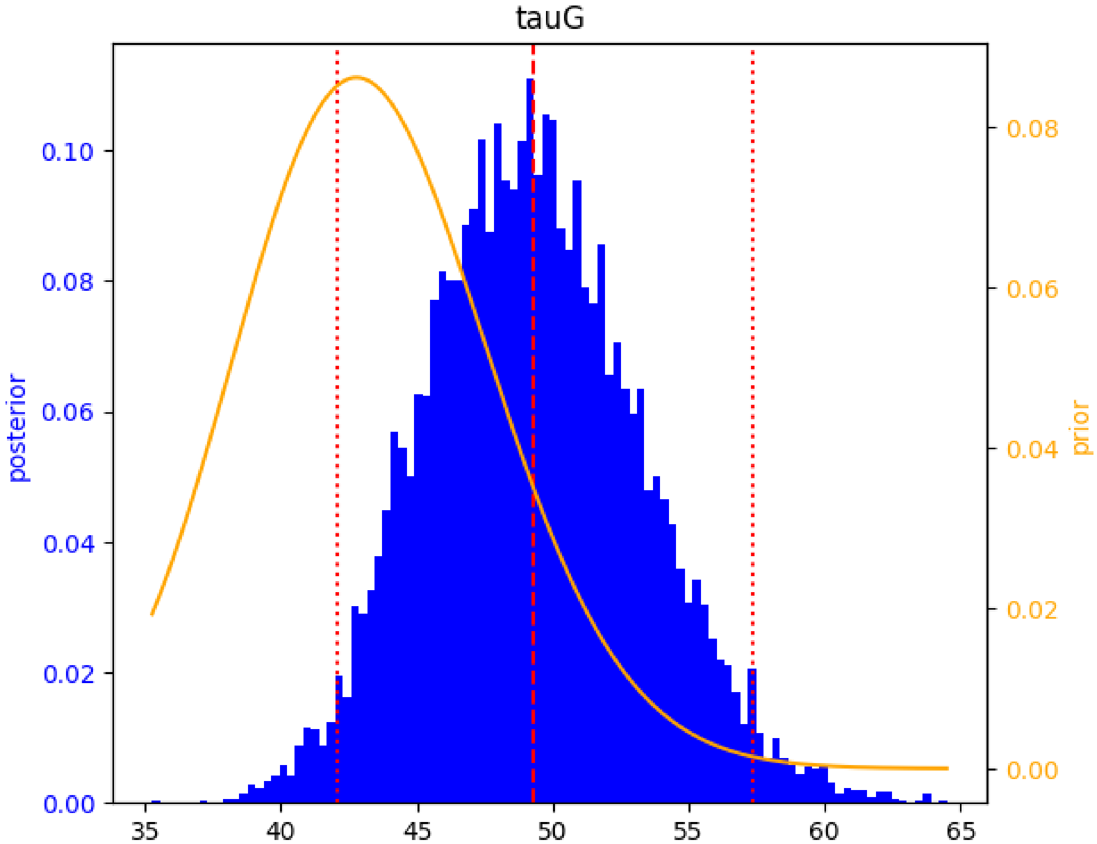

tauG
65
60
55
50
45
40
35
0
2000
4000
6000
8000
10000

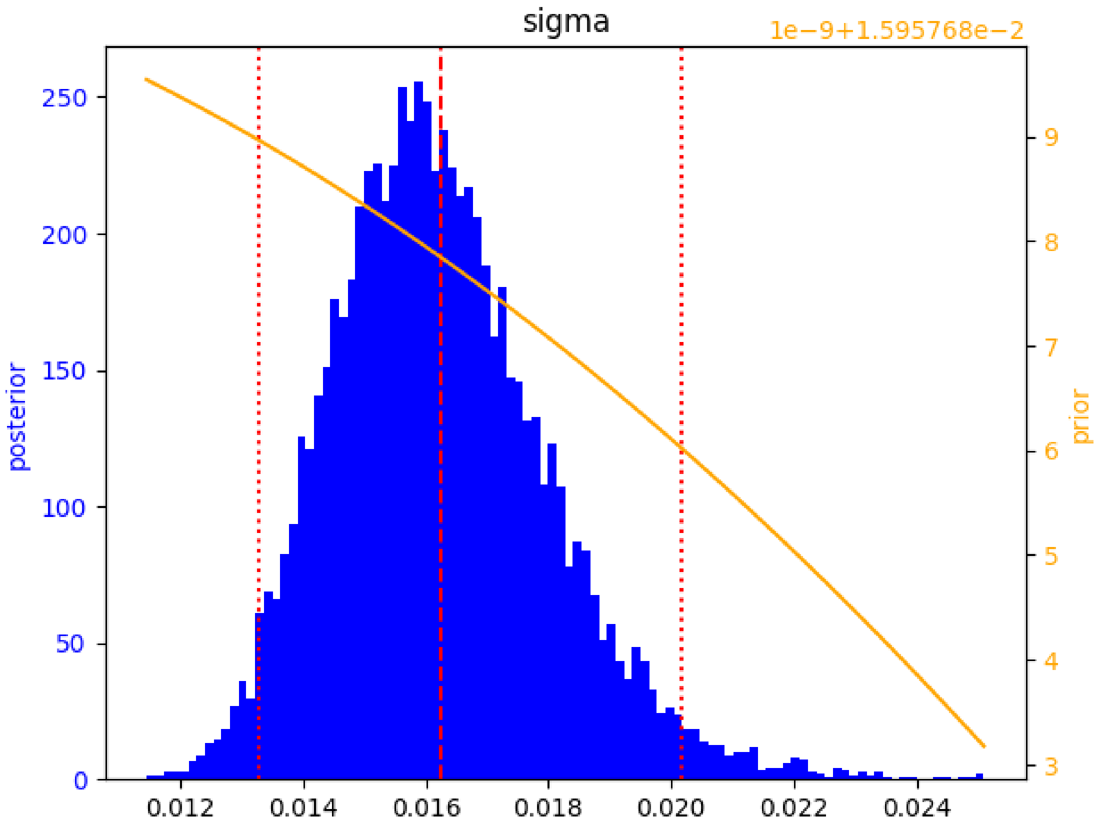

sigma
0.024
0.022
0.020
0.018
0.016
0.014
0.012
0
2000
4000
6000
8000
10000

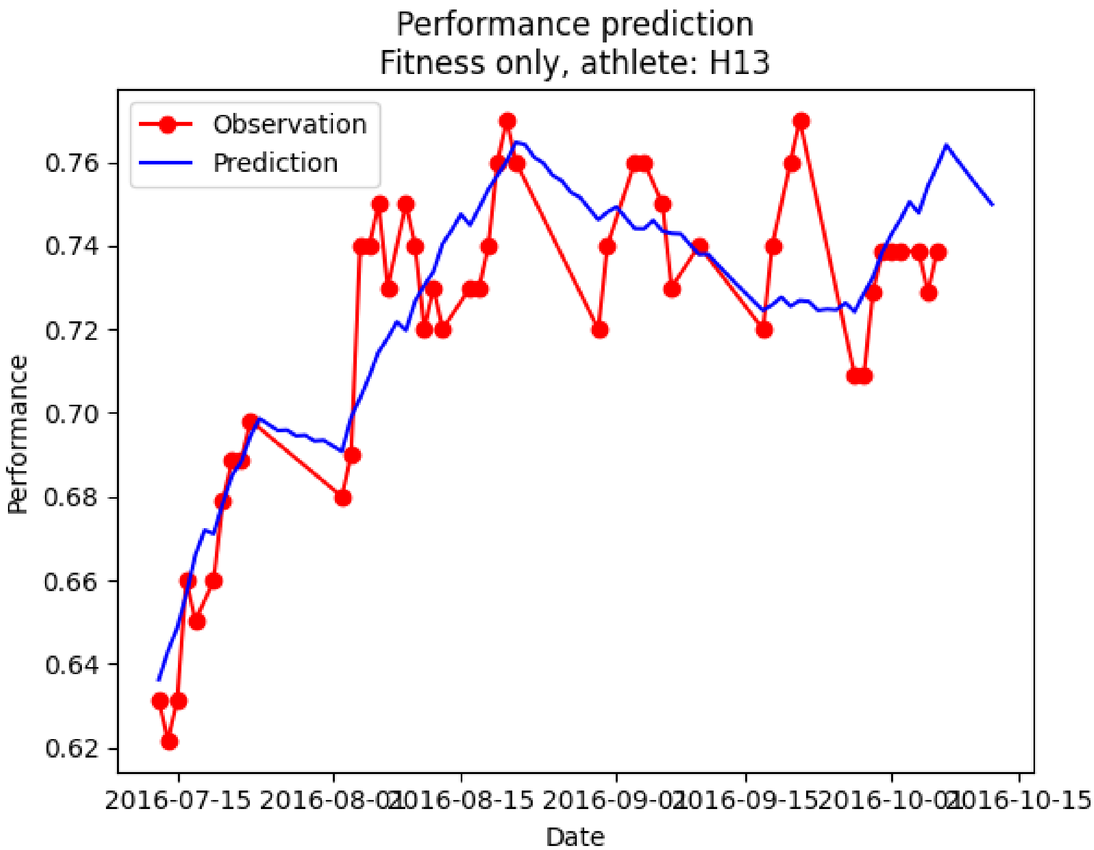

a0
posterior
prior
0
10
20
30
40
50
60
70
0.07902
0.07904
0.07906
0.07908
0.07910
0.07912
0.65
0.66
0.67
0.68
0.69



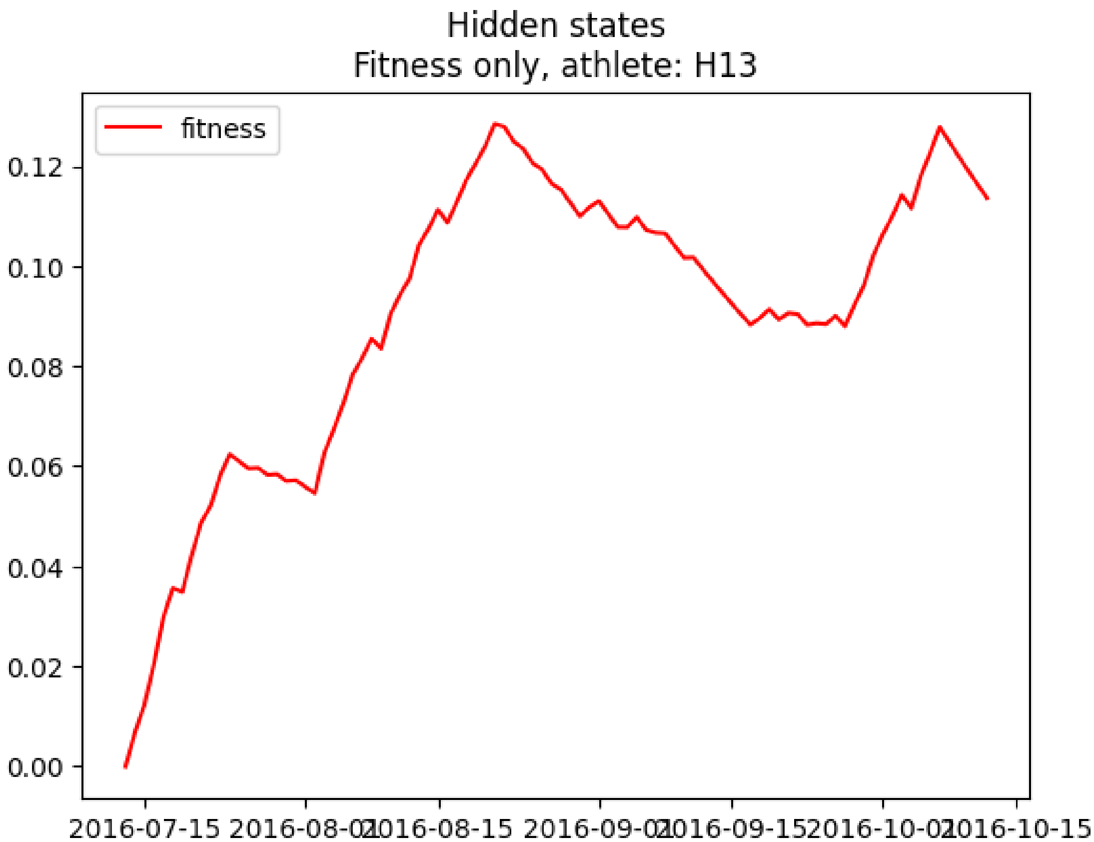
kG
1e6
1e−13+7.978845608e−2
posterior
prior
0
1
2
3
4
5
6
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
0.8
0.9
1.0
1.1
1.2
1.3
1e−6

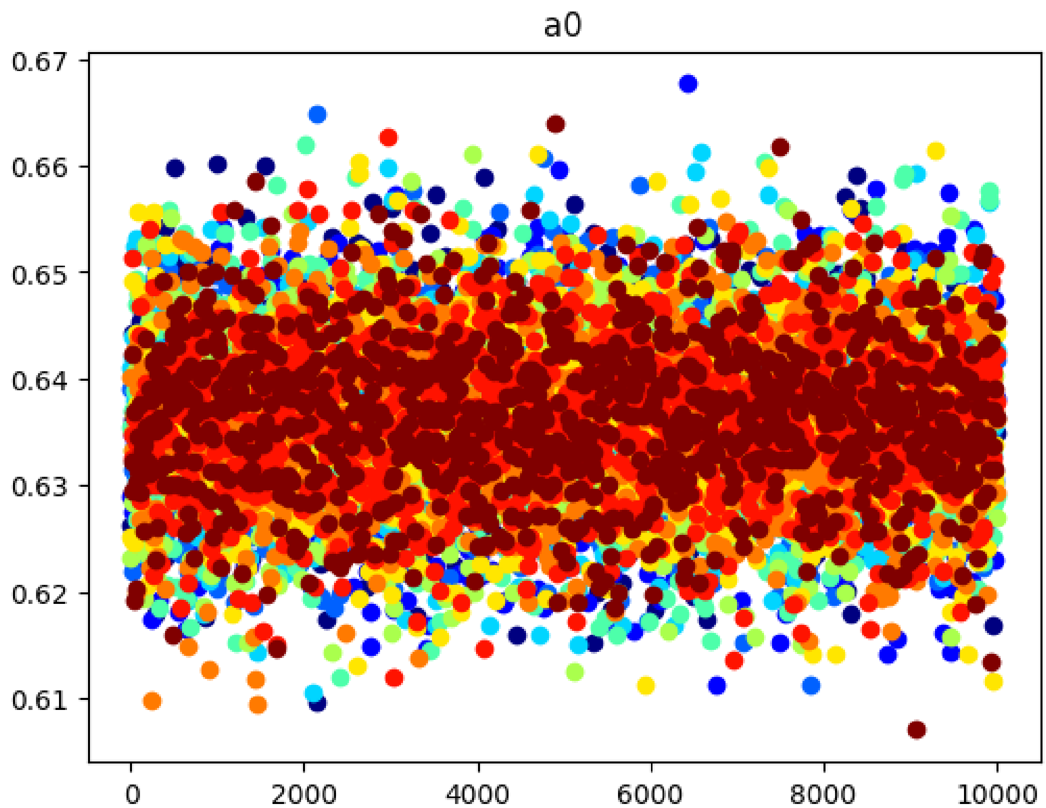

tauG
posterior
prior
0.00
0.02
0.04
0.06
0.08
0.10
35
40
45
50
55
60
65

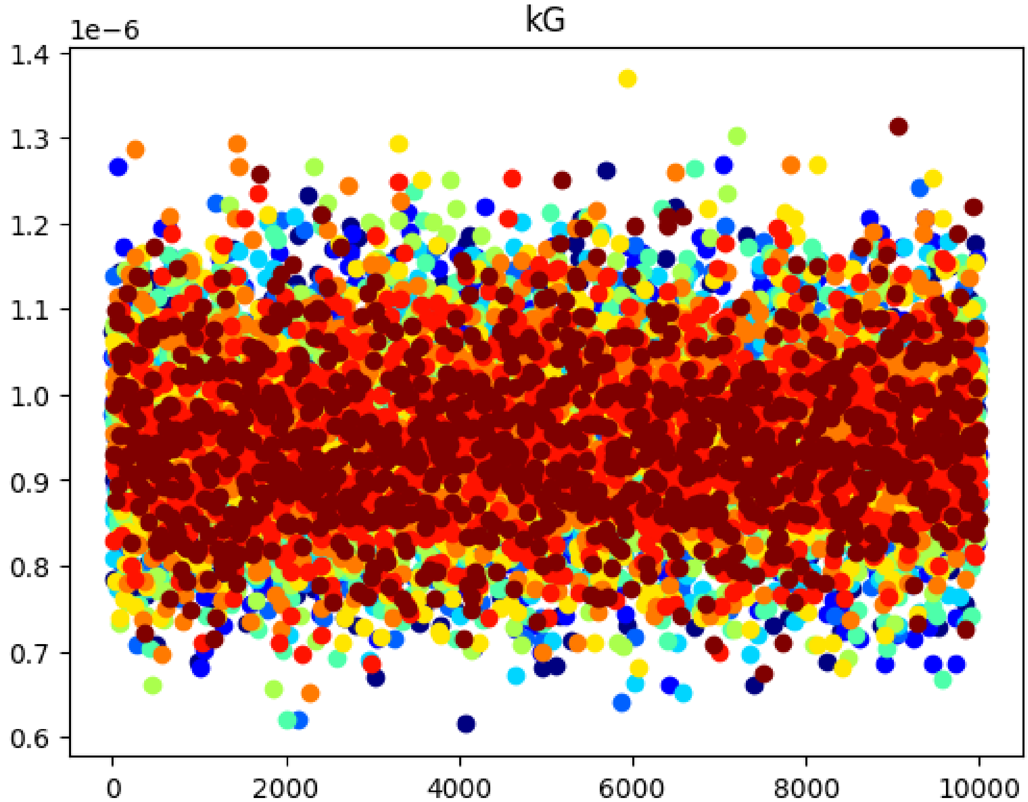

sigma
1e−9+1.595768e−2
posterior
prior
0
50
100
150
200
250
3
4
5
6
7
8
9
0.012
0.014
0.016
0.018
0.020
0.022
0.024

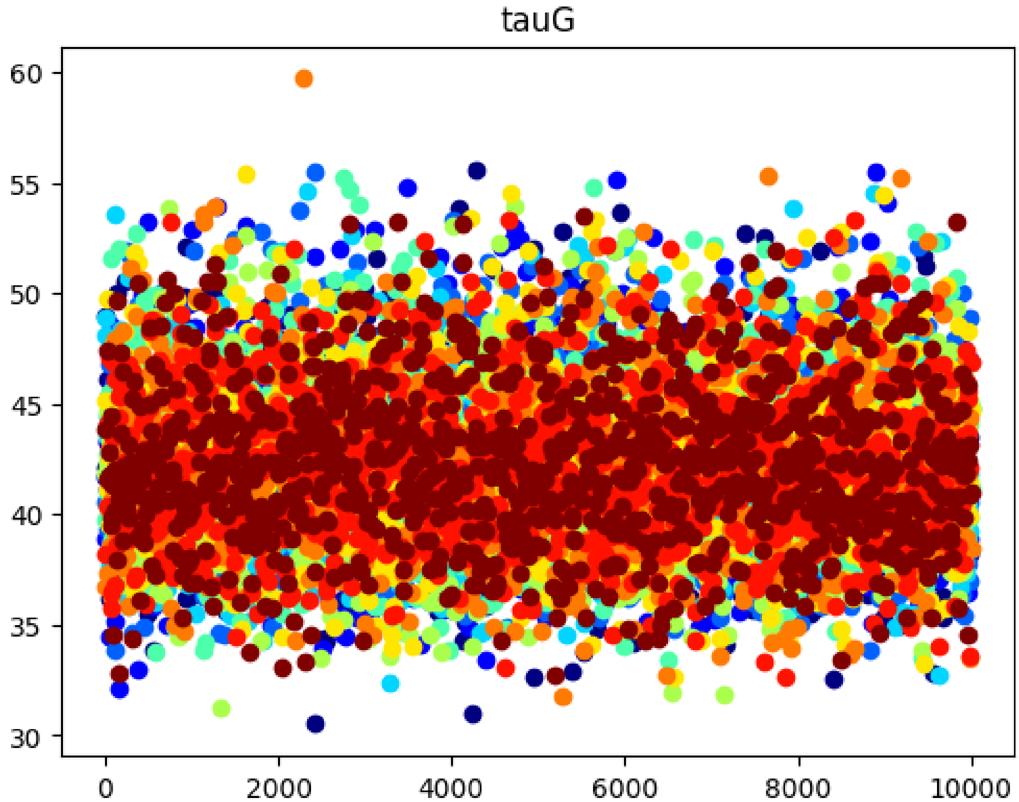


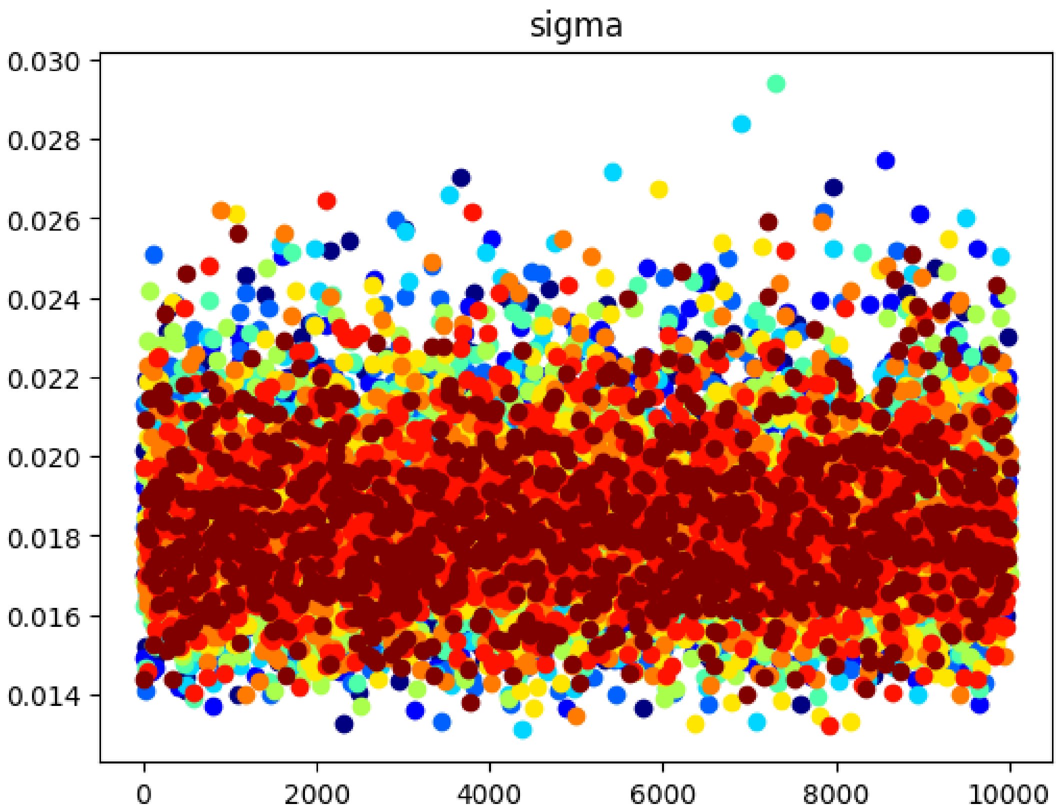
Performance prediction
Fitness only, athlete: H13
Observation
Prediction
Performance
0.62
0.64
0.66
0.68
0.70
0.72
0.74
0.76
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date


Hidden states
Fitness only, athlete: H13
fitness
0.12
0.10
0.08
0.06
0.04
0.02
0.00
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

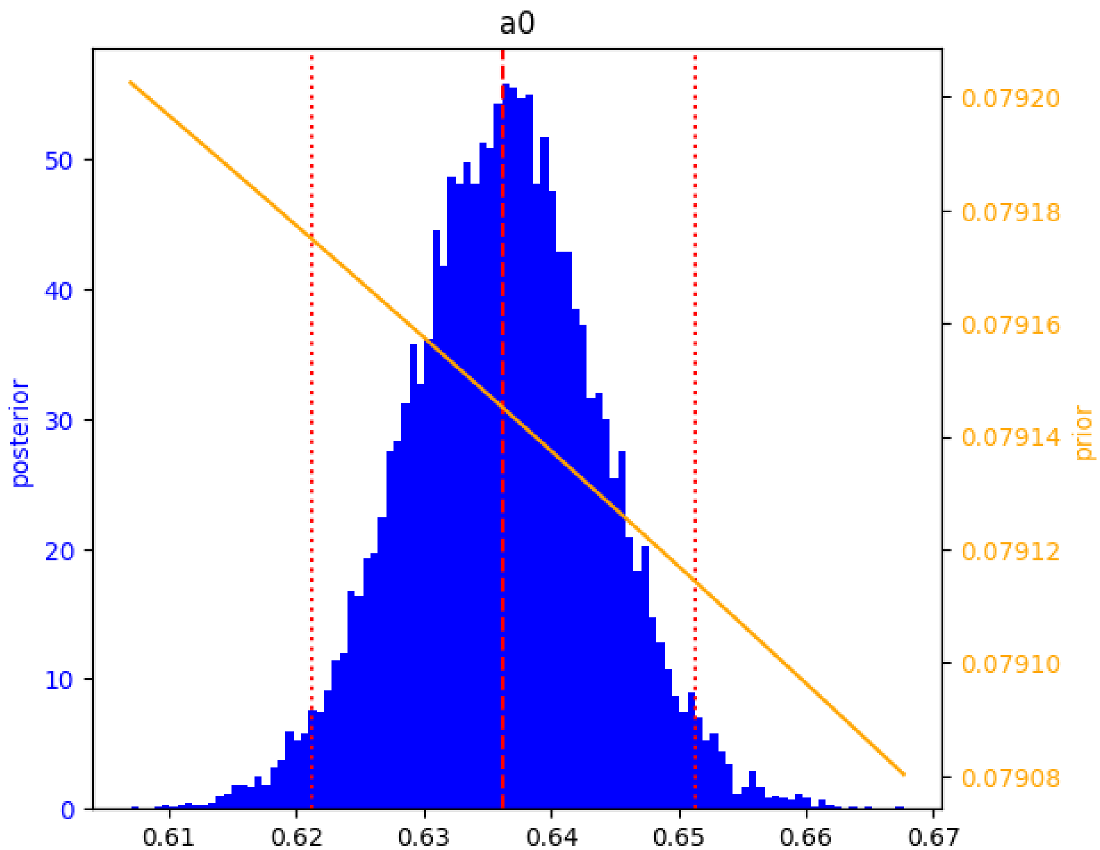

a0
0.67
0.66
0.65
0.64
0.63
0.62
0.61
0
2000
4000
6000
8000
10000


kG
1e−6
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0
2000
4000
6000
8000
10000

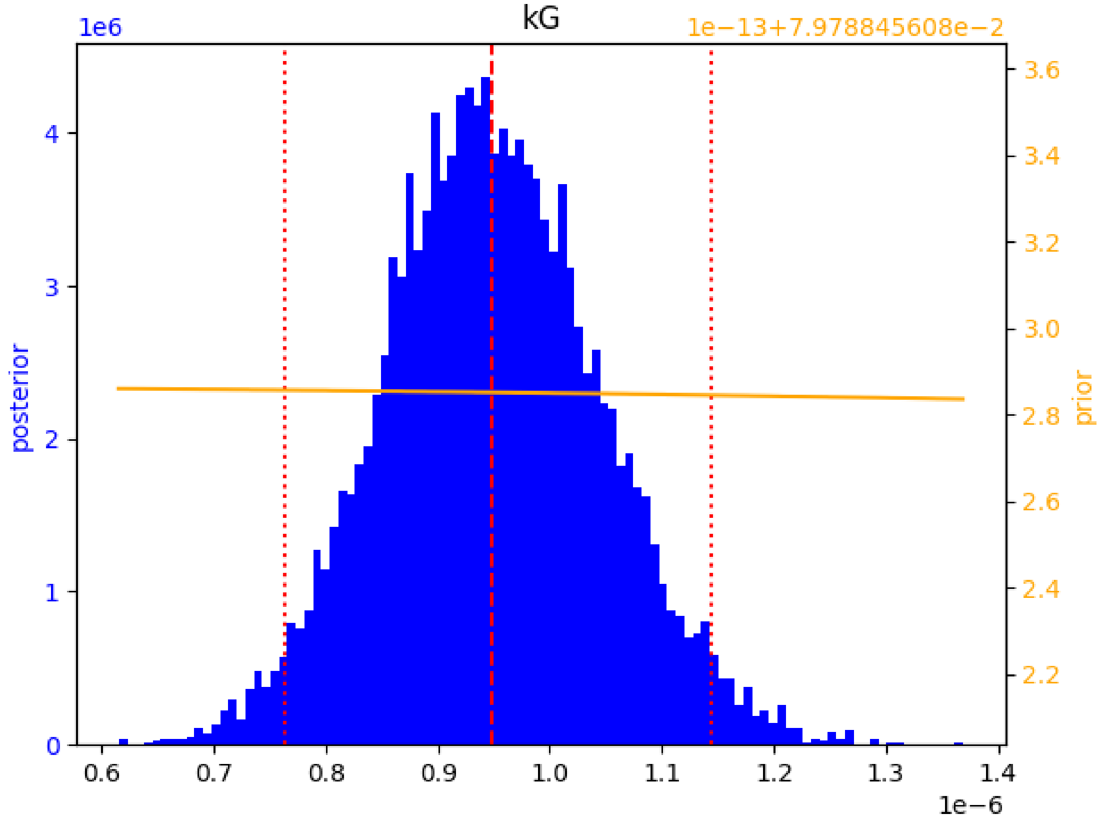

tauG
60
55
50
45
40
35
30
0
2000
4000
6000
8000
10000

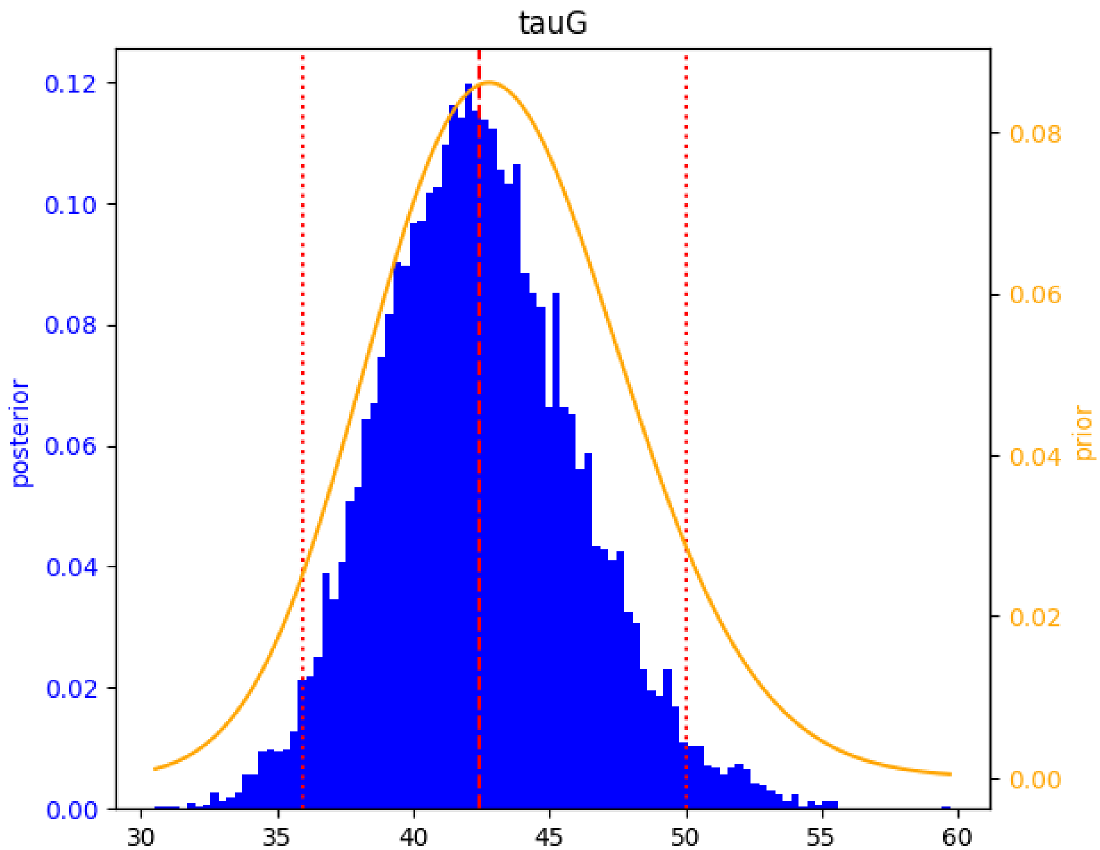


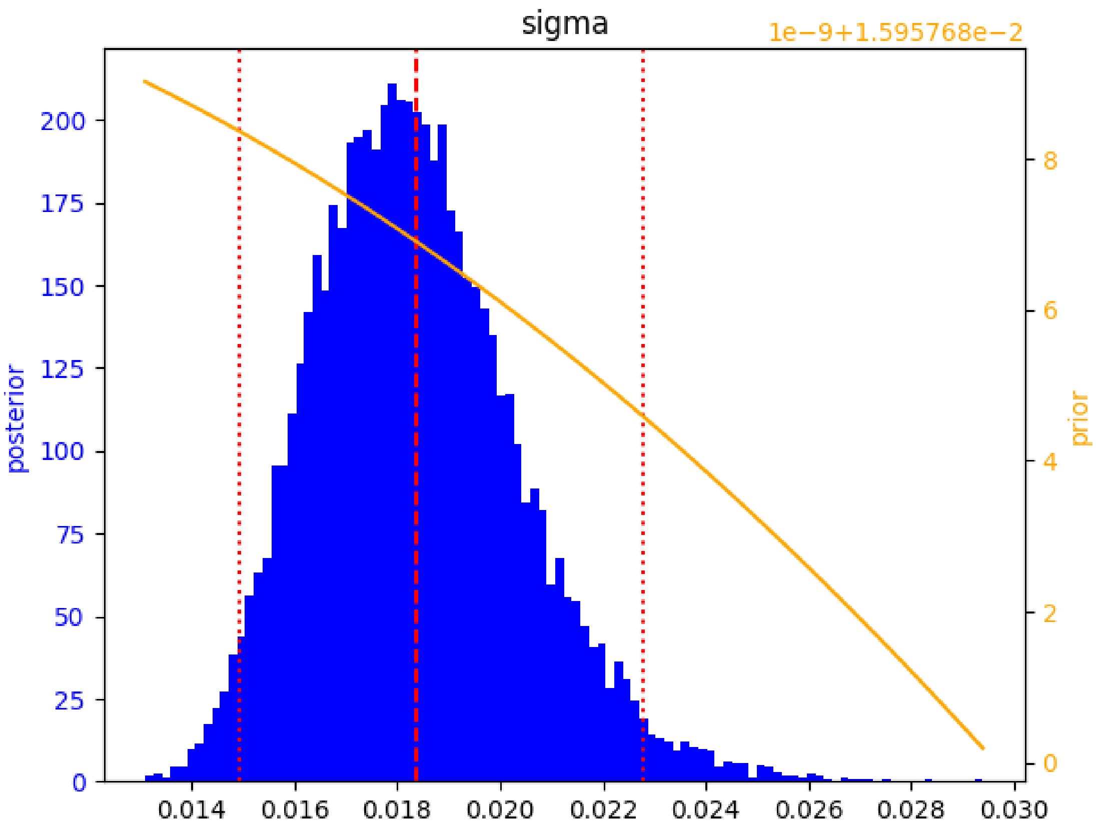
sigma
0.030
0.028
0.026
0.024
0.022
0.020
0.018
0.016
0.014
0
2000
4000
6000
8000
10000



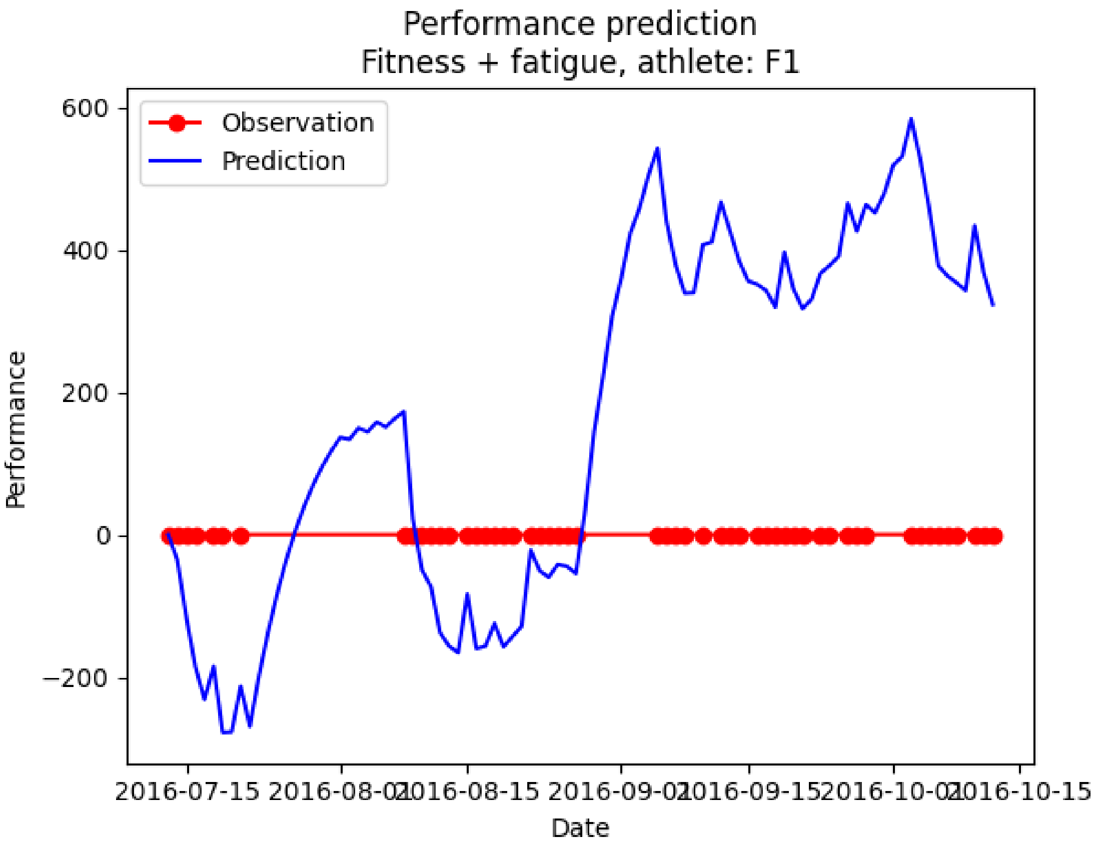
a0
posterior
prior
0
10
20
30
40
50
0.61
0.62
0.63
0.64
0.65
0.66
0.67
0.07908
0.07910
0.07912
0.07914
0.07916
0.07918
0.07920

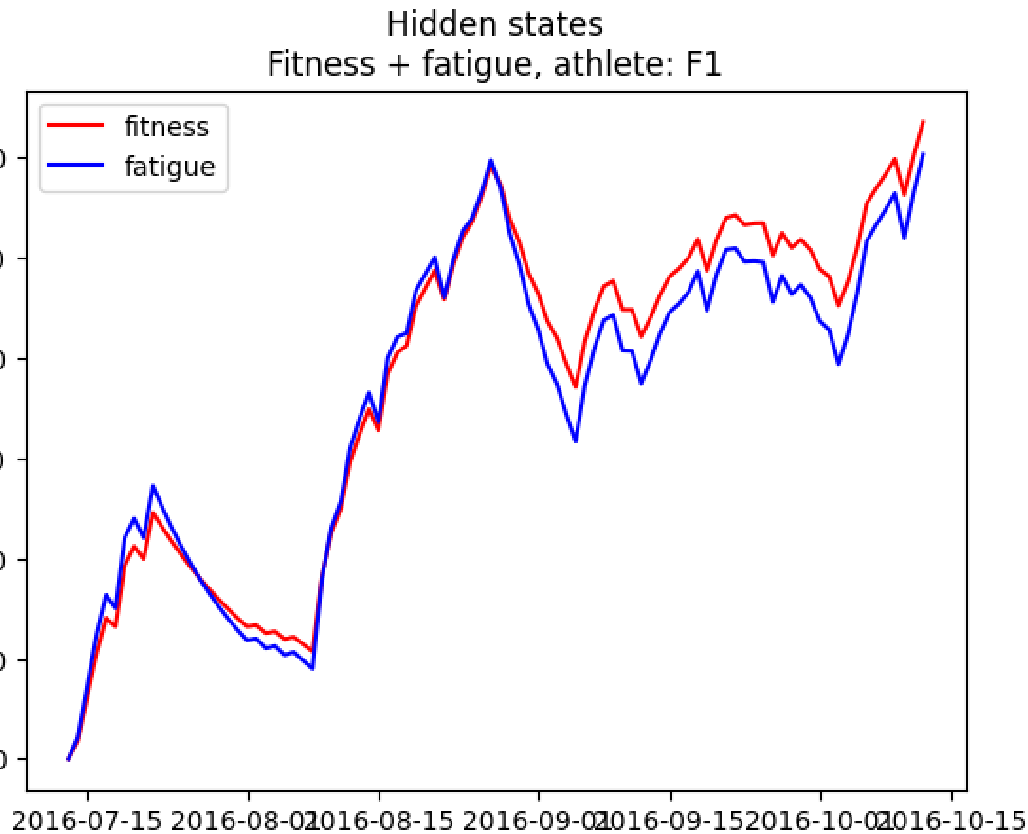

kG
1e6
1e−13+7.978845608e−2
posterior
prior
0
1
2
3
4
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1e−6


tauG
posterior
prior
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.00
0.02
0.04
0.06
0.08
30
35
40
45
50
55
60

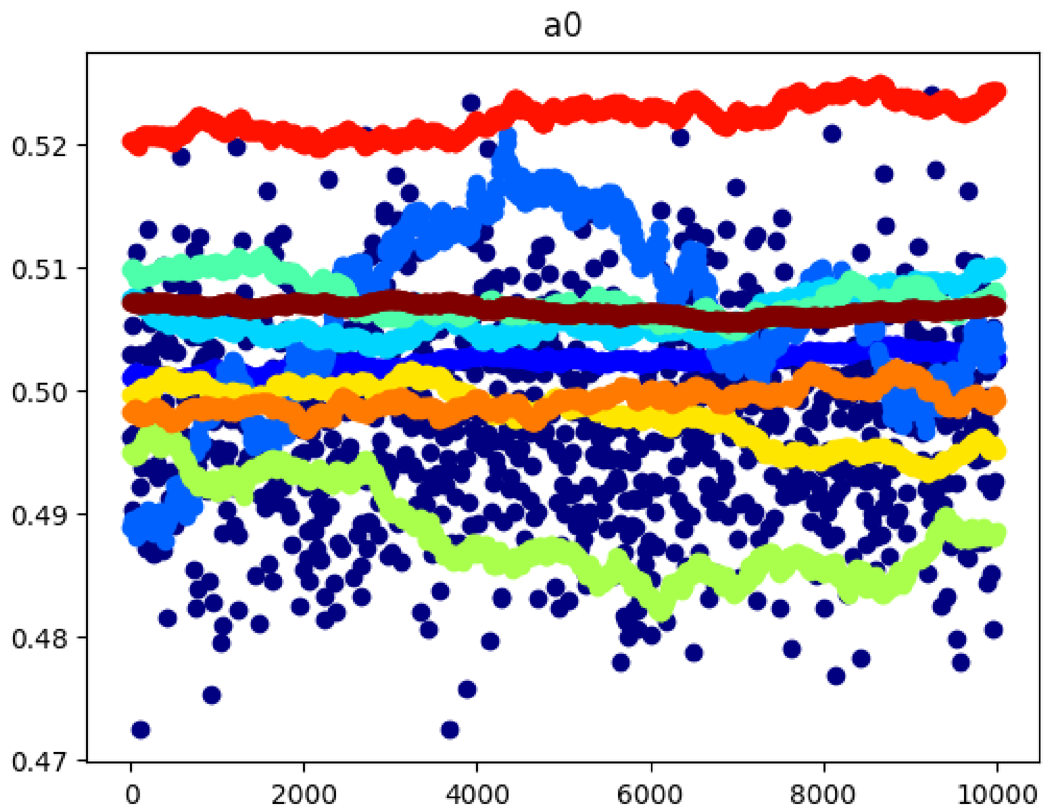


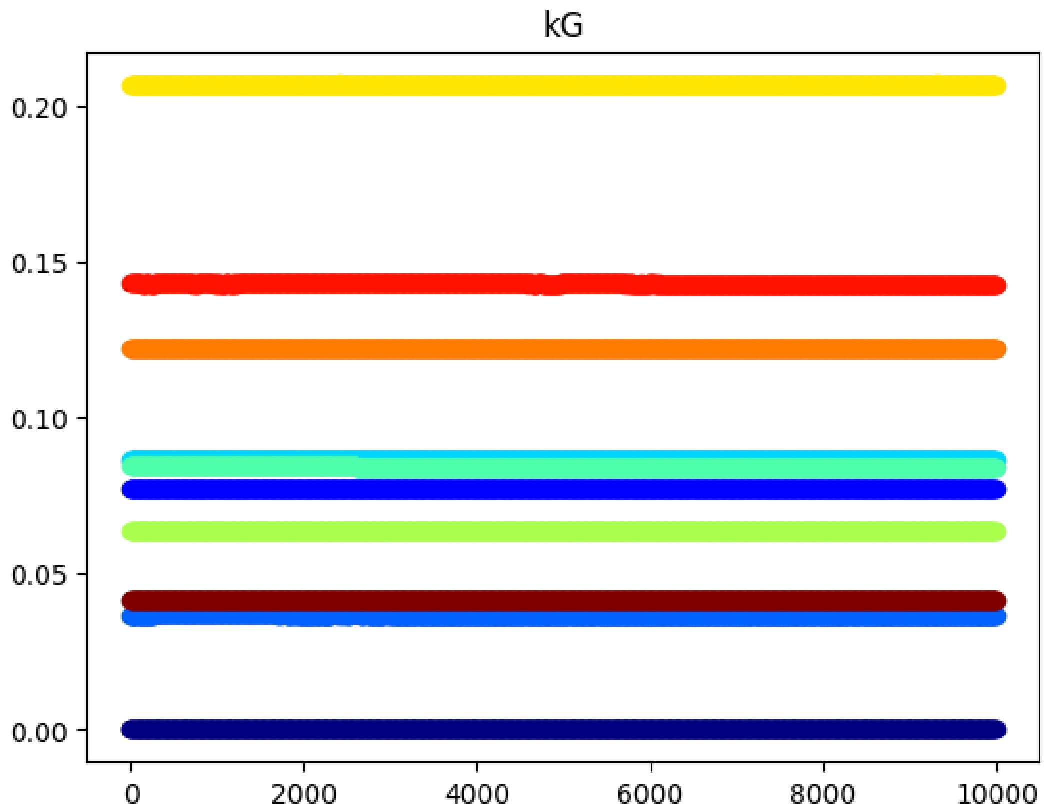
[5]:
```python
for ath in athletes_id:
    mods[ath]["Banister"].train.plot_perf(show = False)
    plt.title("Performance prediction\nFitness + fatigue, athlete: "+ath)
    plt.legend()
    plt.show()

    mods[ath]["Banister"].train.plot_state(show = False)
    plt.title("Hidden states\nFitness + fatigue, athlete: "+ath)
    plt.legend()
    plt.show()

    mods[ath]["Banister"].train.plot_rawchains()
    mods[ath]["Banister"].train.plot_posteriors()
```

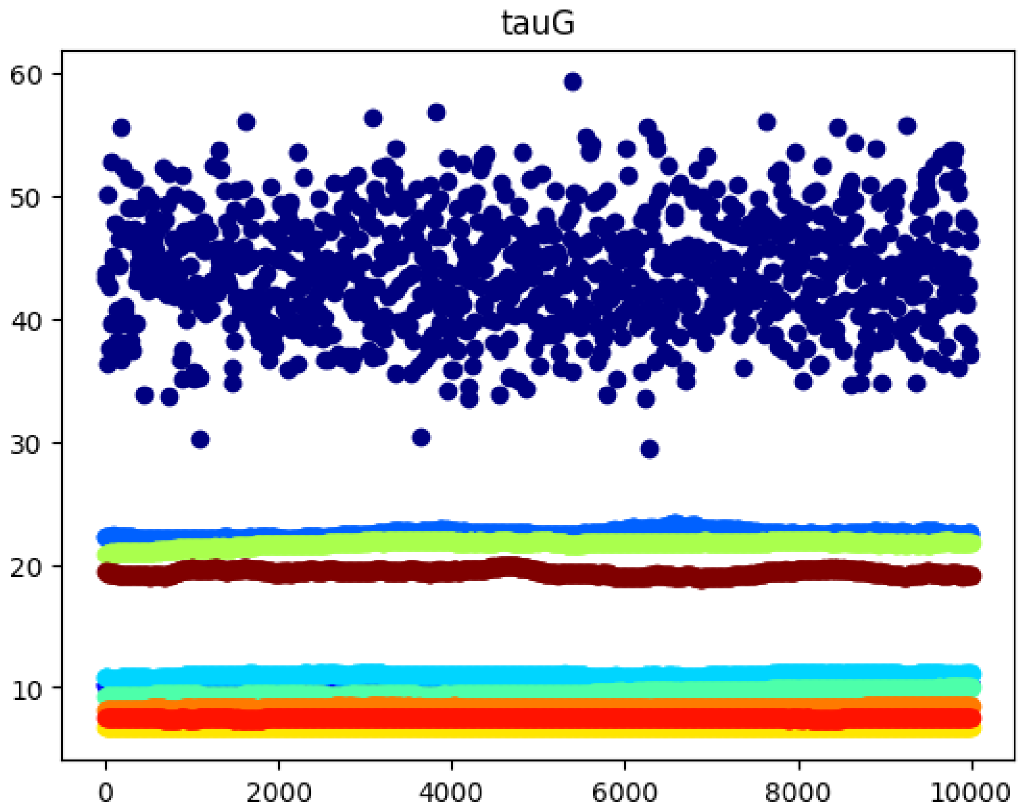

Performance prediction
Fitness + fatigue, athlete: F1
Observation
Prediction
600
400
200
0
−200
Performance
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

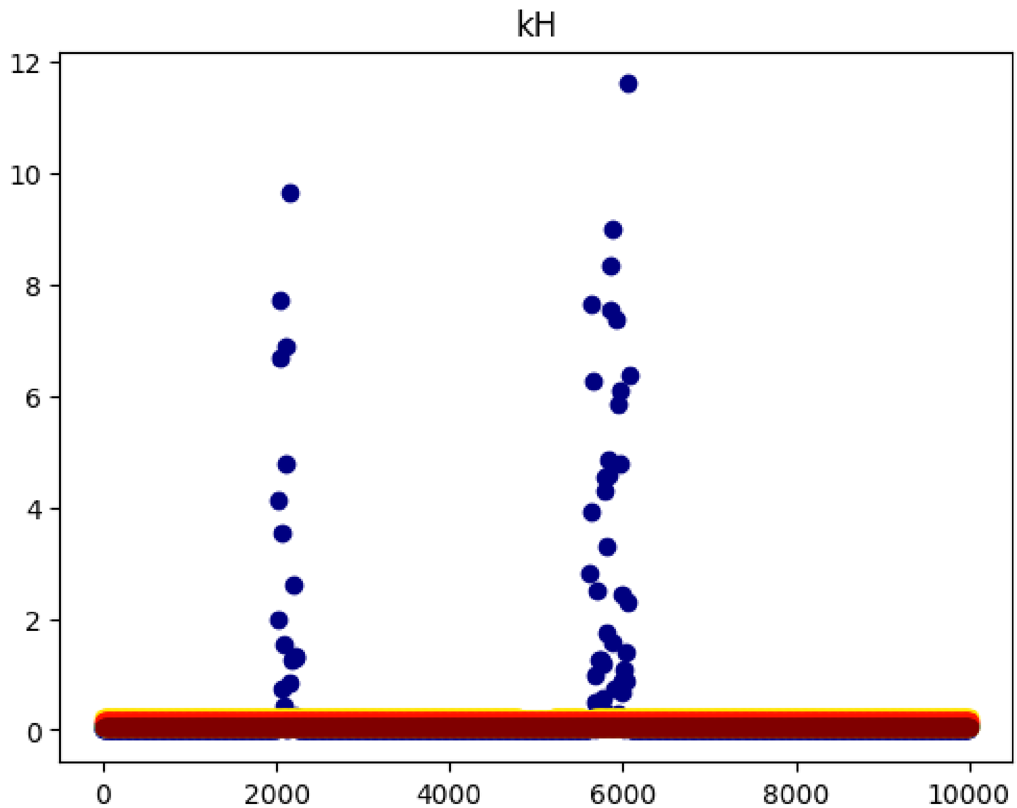


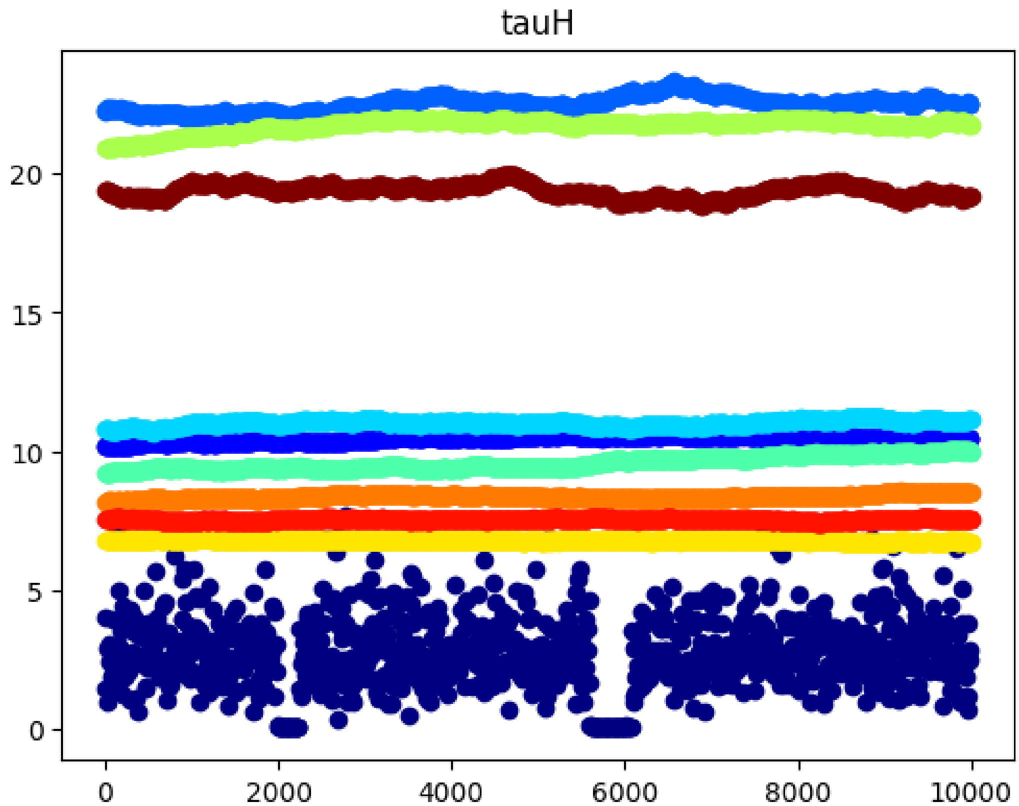
Hidden states
Fitness + fatigue, athlete: F1
fitness
fatigue
6000
5000
4000
3000
2000
1000
0
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

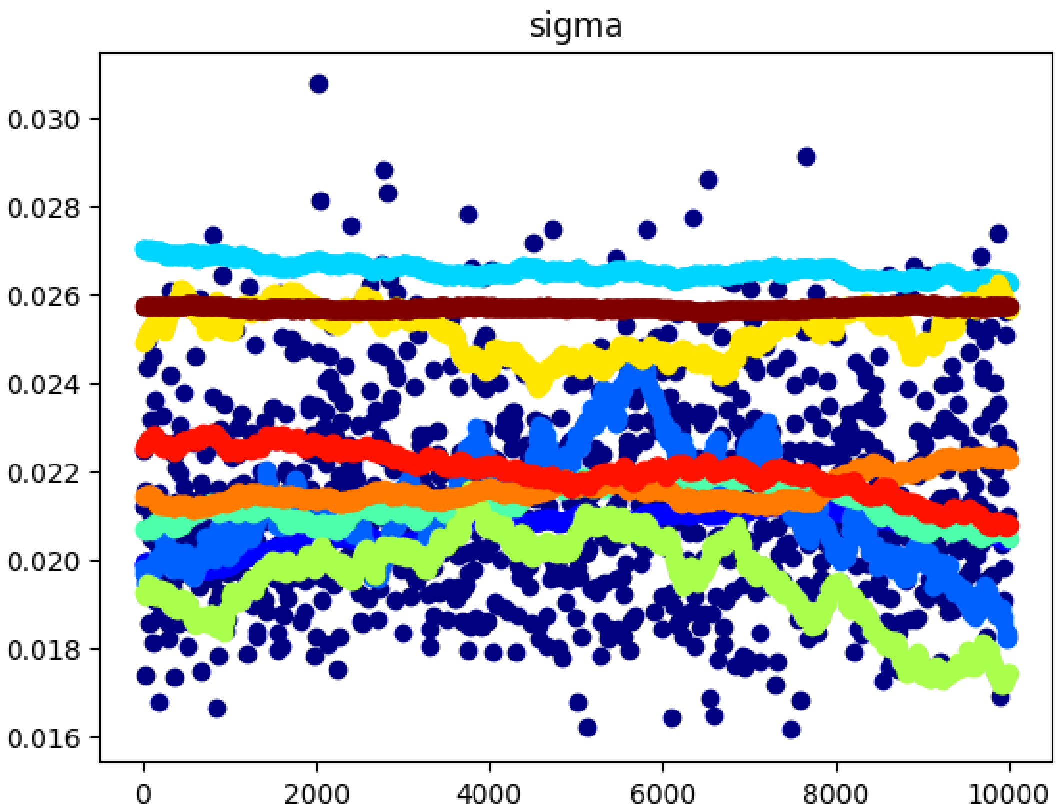

a0
0.52
0.51
0.50
0.49
0.48
0.47
0
2000
4000
6000
8000
10000


kG
0.20
0.15
0.10
0.05
0.00
0
2000
4000
6000
8000
10000

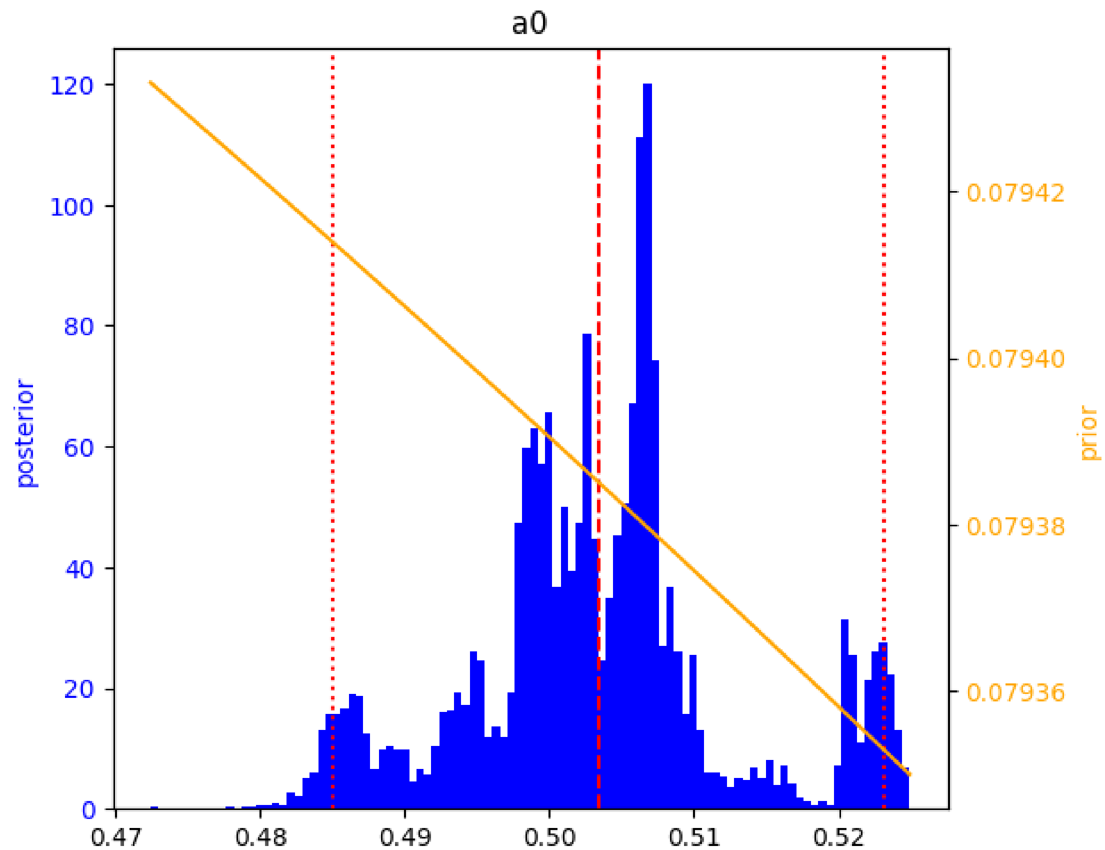

tauG
60
50
40
30
20
10
0
2000
4000
6000
8000
10000

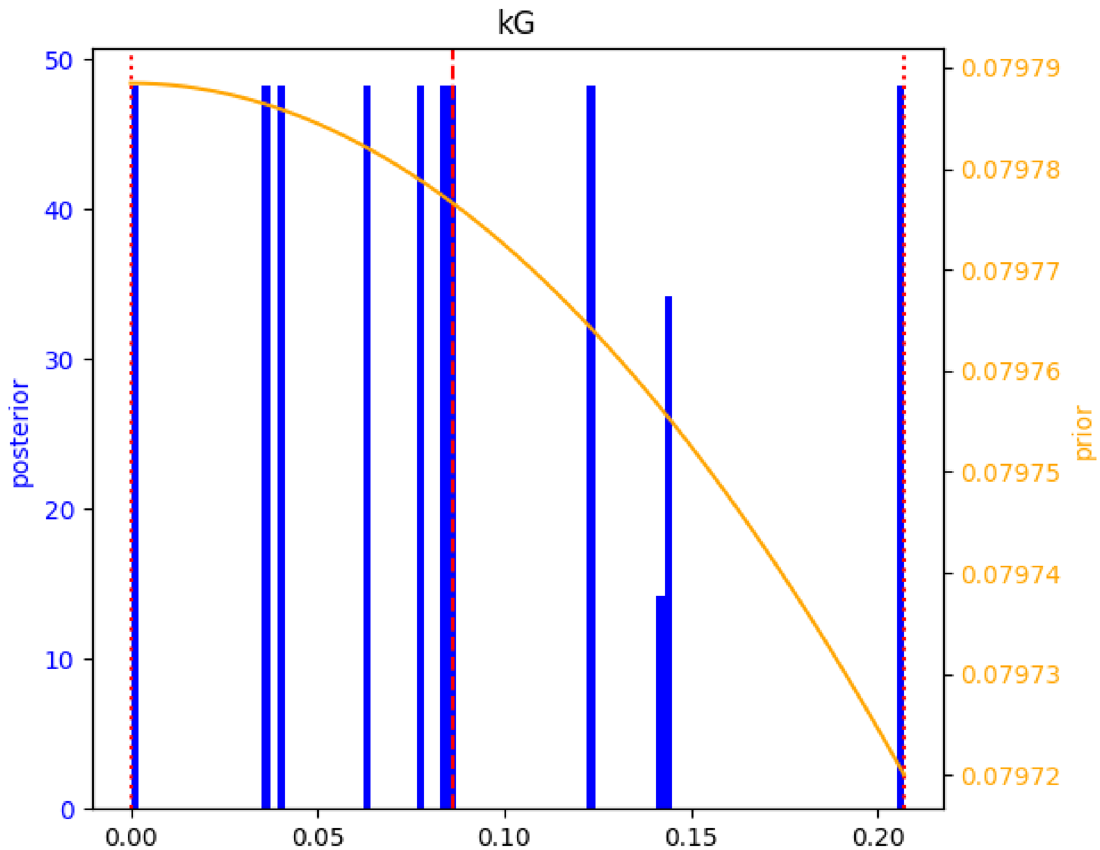

kH
12
10
8
6
4
2
0
0
2000
4000
6000
8000
10000


tauH
20
15
10
5
0
0
2000
4000
6000
8000
10000

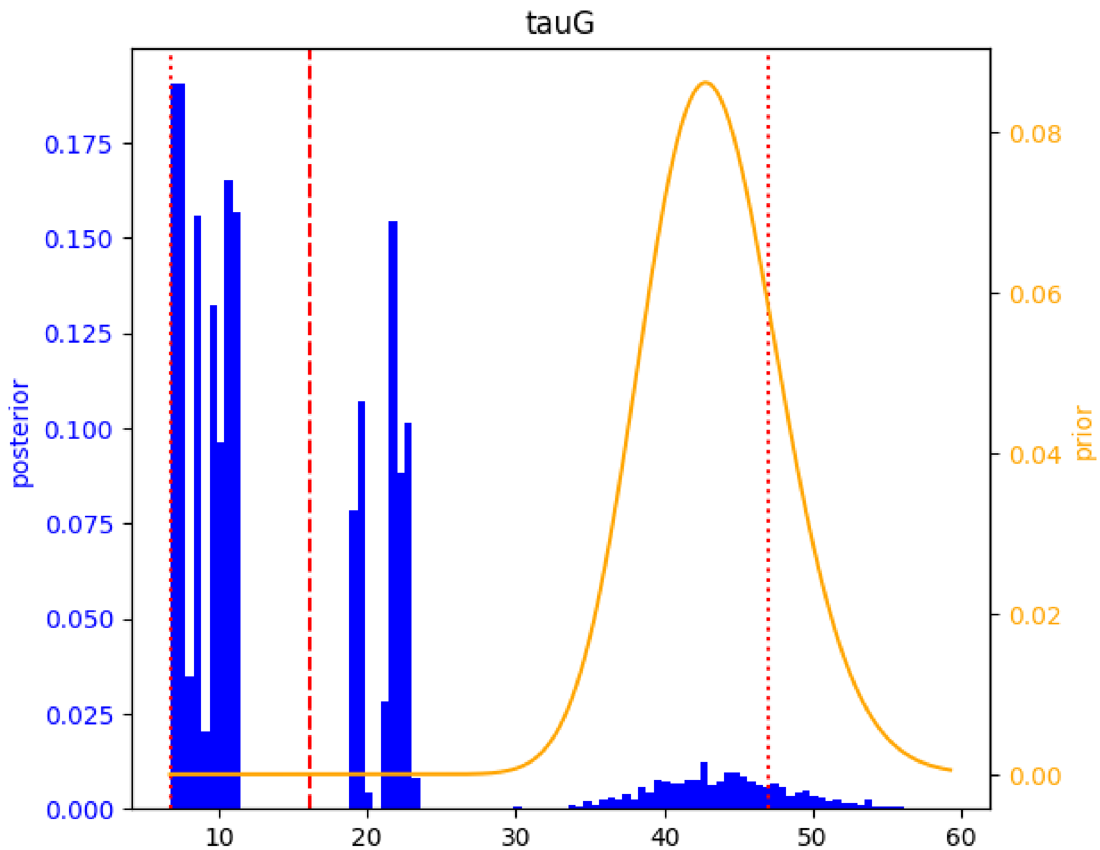


sigma
0.030
0.028
0.026
0.024
0.022
0.020
0.018
0.016
0
2000
4000
6000
8000
10000

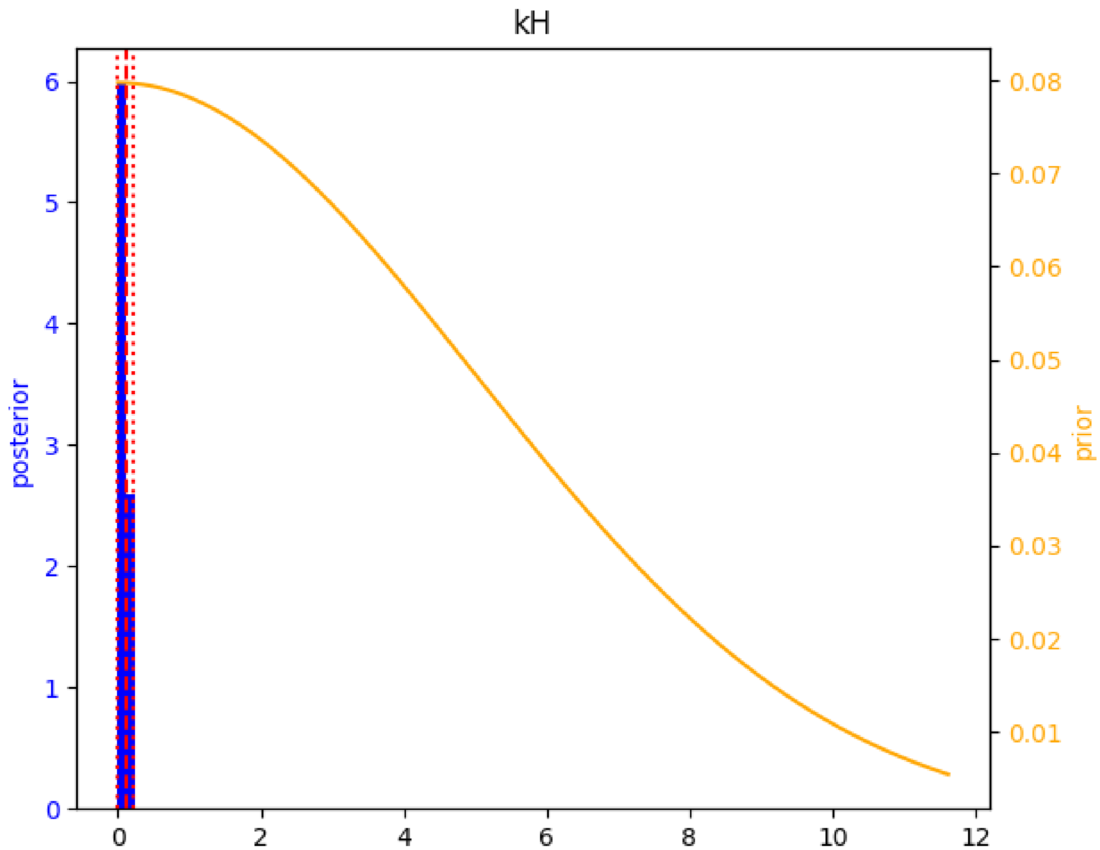

a0
posterior
prior
0
20
40
60
80
100
120
0.07936
0.07938
0.07940
0.07942
0.47
0.48
0.49
0.50
0.51
0.52

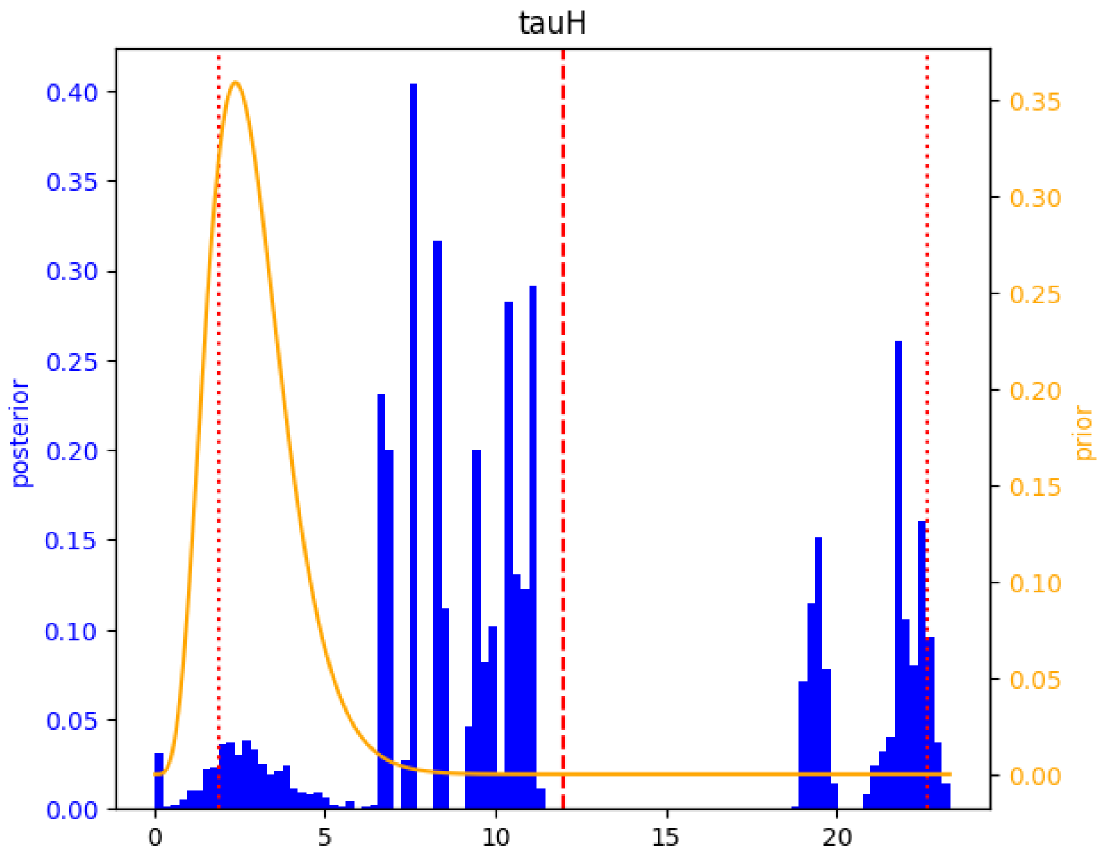


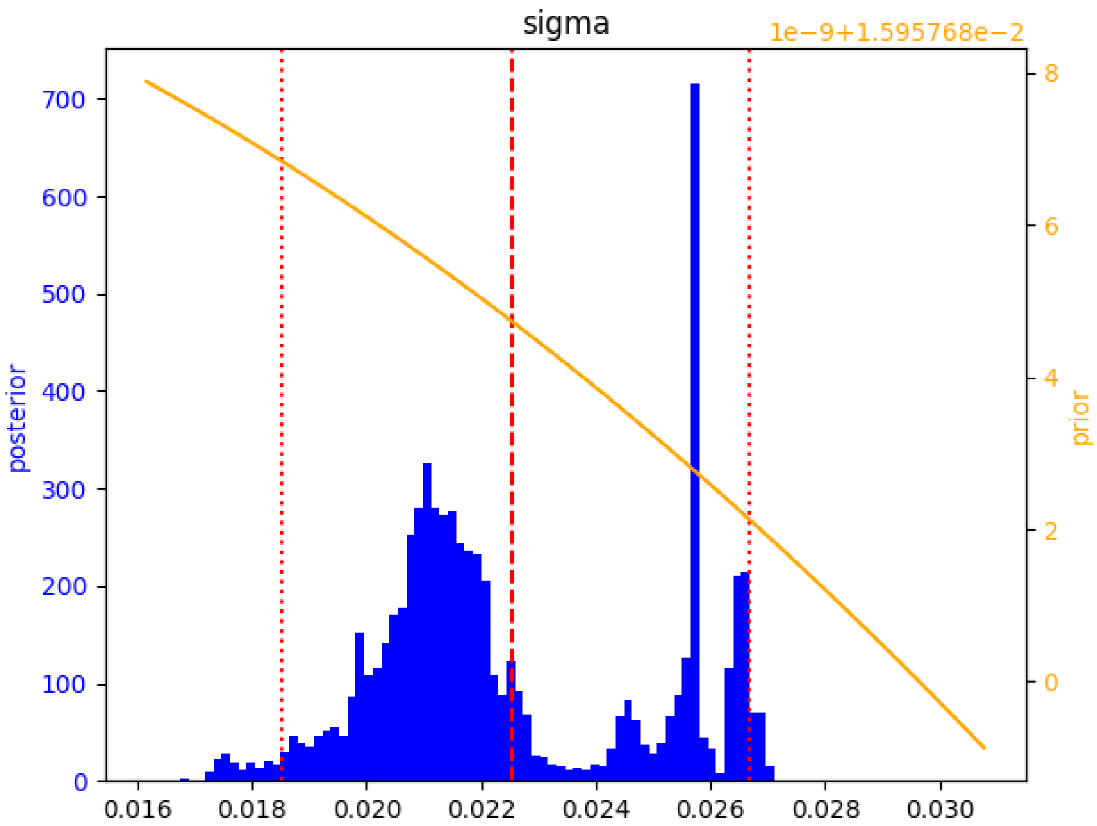
kG
posterior
prior
0
10
20
30
40
50
0.07972
0.07973
0.07974
0.07975
0.07976
0.07977
0.07978
0.07979
0.00
0.05
0.10
0.15
0.20



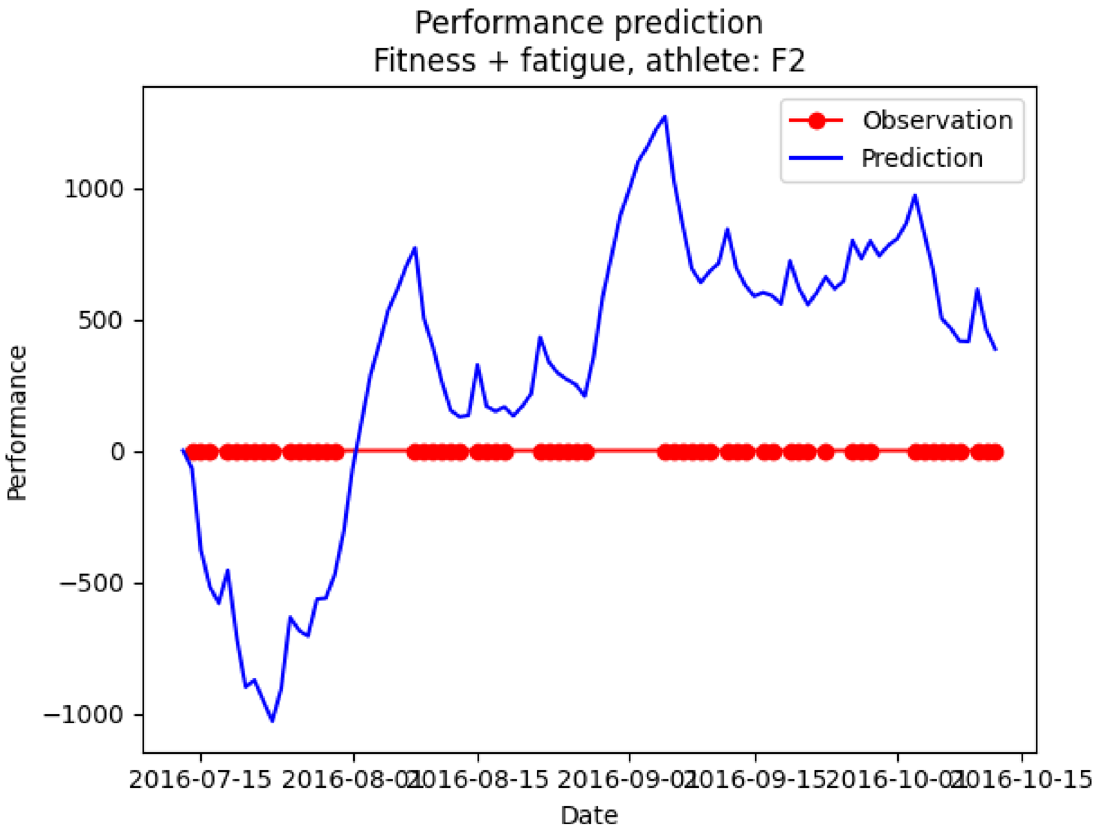
tauG
posterior
prior
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
0.08
0.06
0.04
0.02
0.00
10
20
30
40
50
60

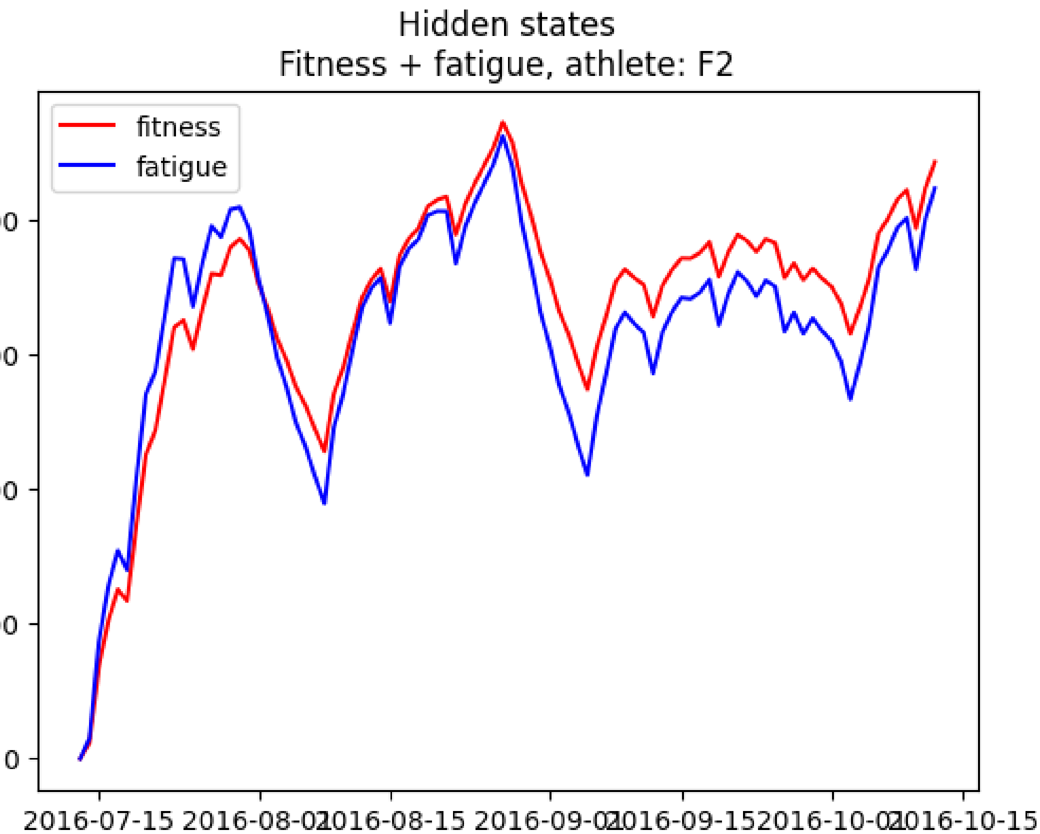

kH
posterior
prior
0
1
2
3
4
5
6
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0
2
4
6
8
10
12


tauH
posterior
prior
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0
5
10
15
20



sigma
1e−9+1.595768e−2
posterior
prior
0
100
200
300
400
500
600
700
0.016
0.018
0.020
0.022
0.024
0.026
0.028
0.030
8
6
4
2
0


Performance prediction
Fitness + fatigue, athlete: F2
Observation
Prediction
Performance
1000
500
0
−500
−1000
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date


Hidden states
Fitness + fatigue, athlete: F2
fitness
fatigue
8000
6000
4000
2000
0
2016-07-15
2016-08-01
2016-08-15
2016-09-01
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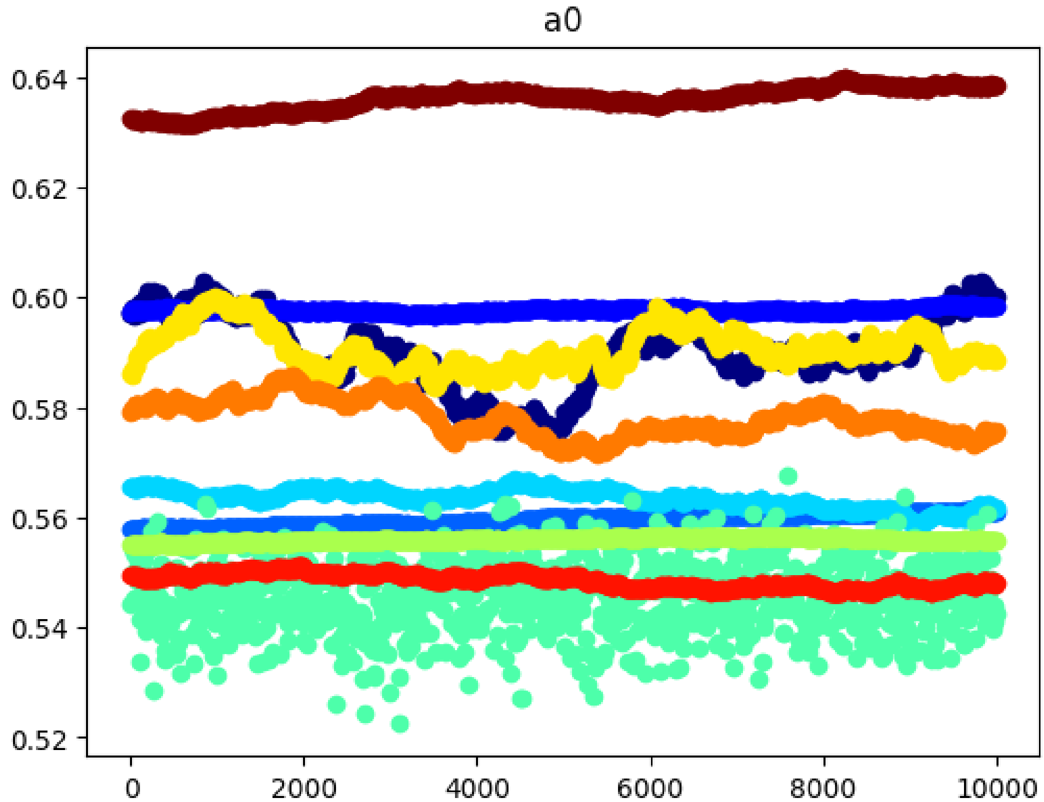
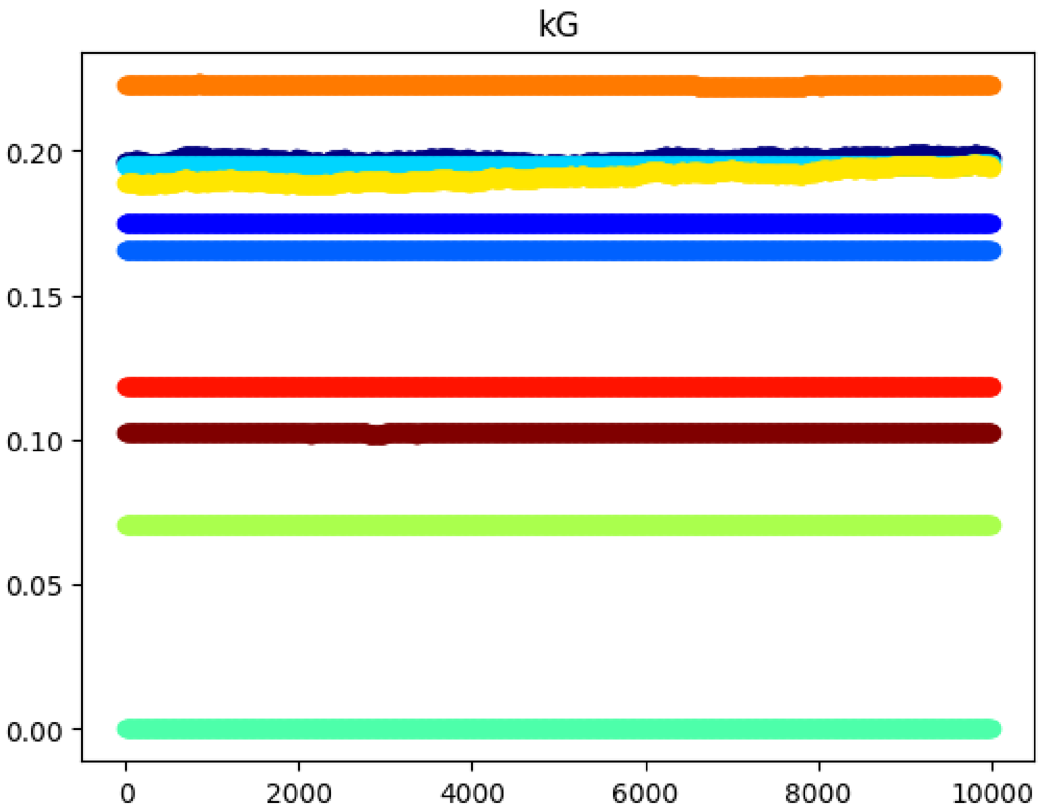
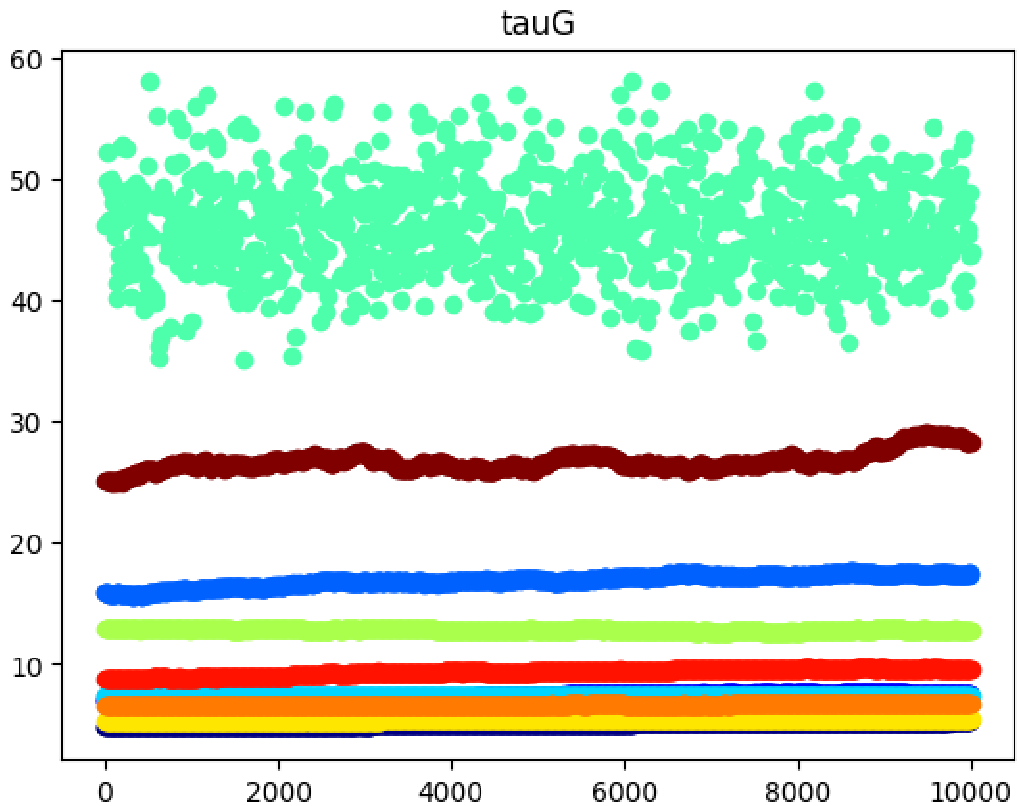
2016-10-01
2016-10-15

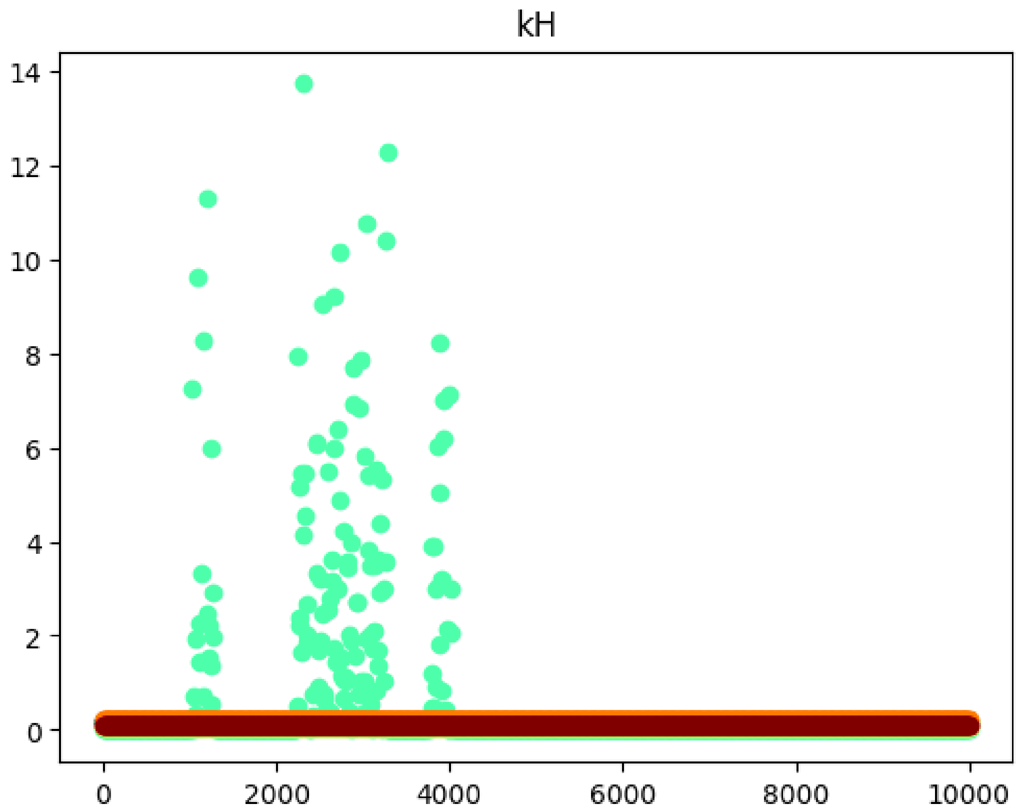


a0
0.64
0.62
0.60
0.58
0.56
0.54
0.52
0
2000
4000
6000
8000
10000


kG
0.20
0.15
0.10
0.05
0.00
0
2000
4000
6000
8000
10000



tauG
60
50
40
30
20
10
0
2000
4000
6000
8000
10000


kH
14
12
10
8
6
4
2
0
0
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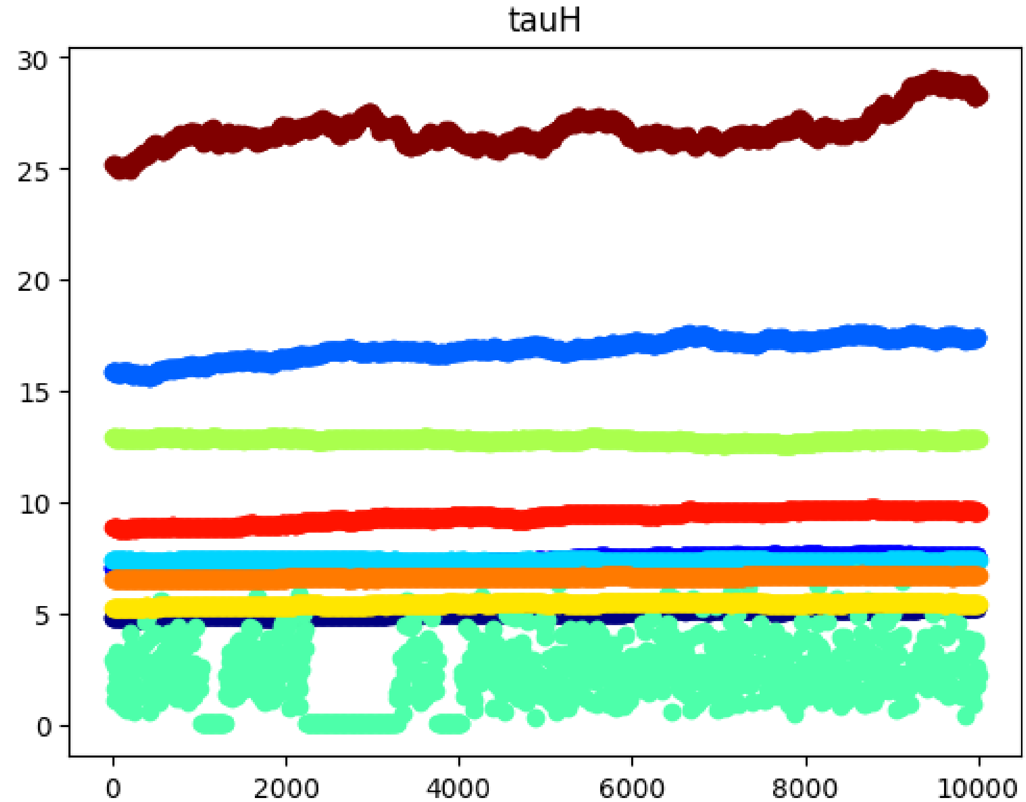
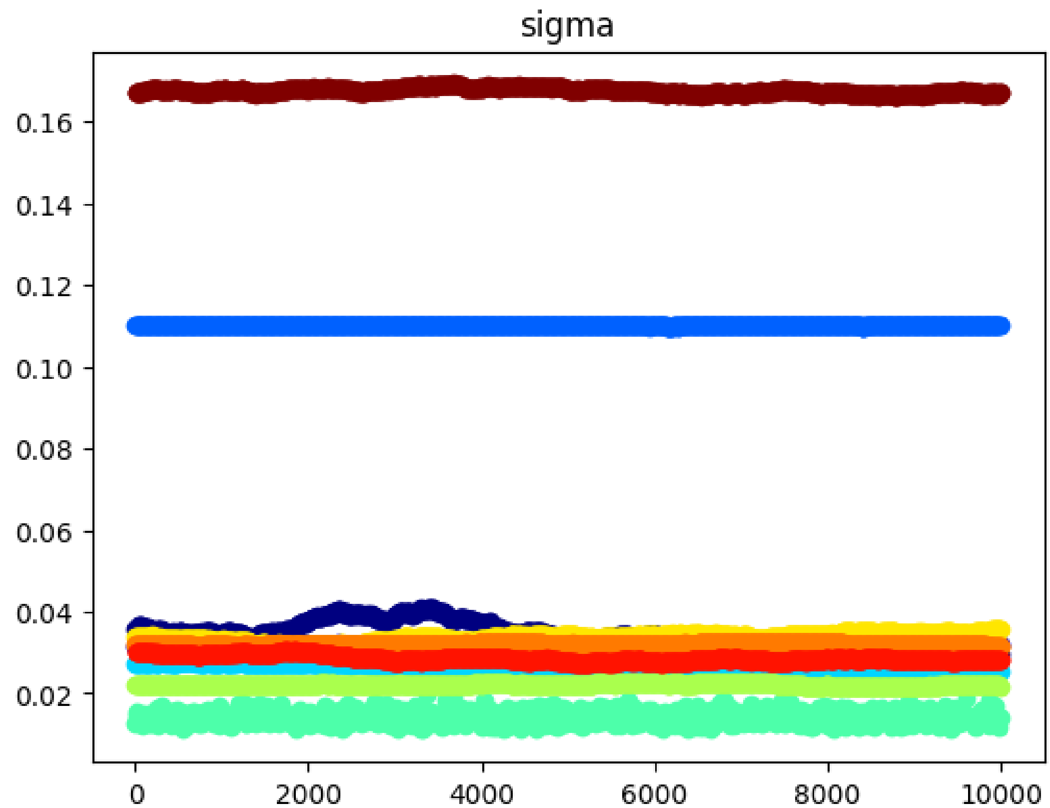
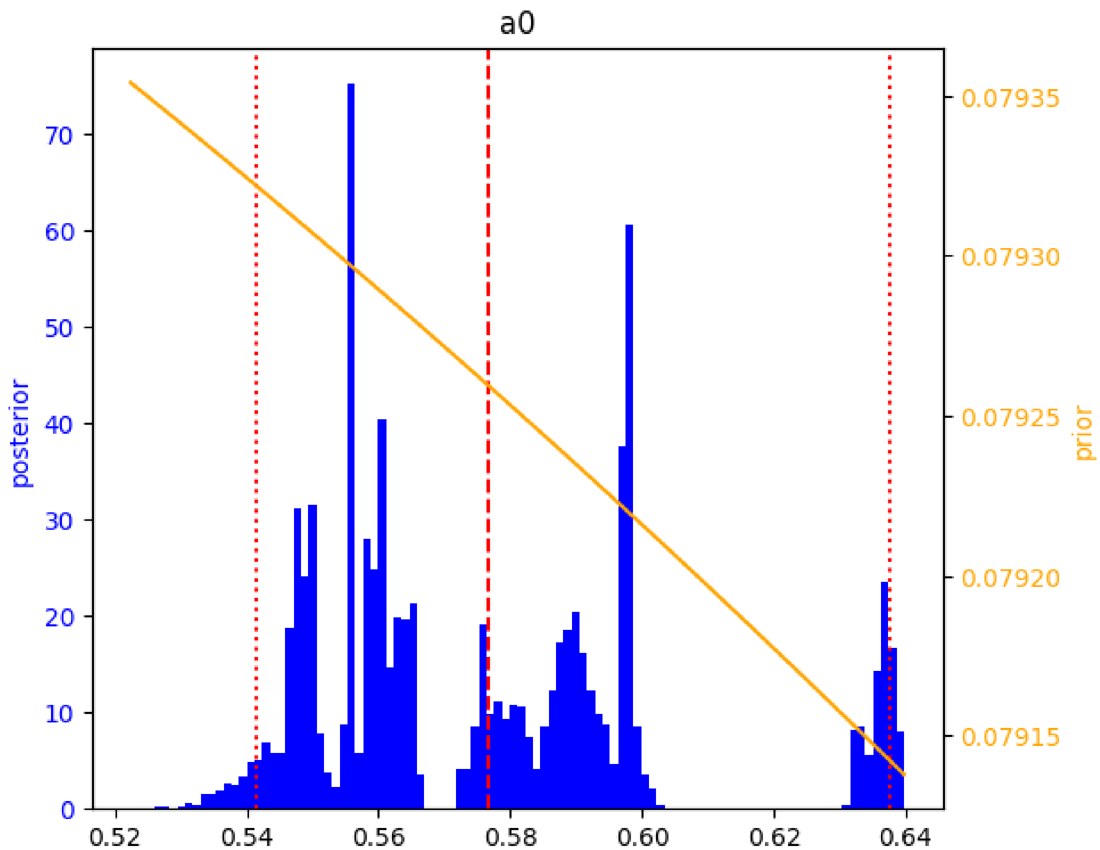
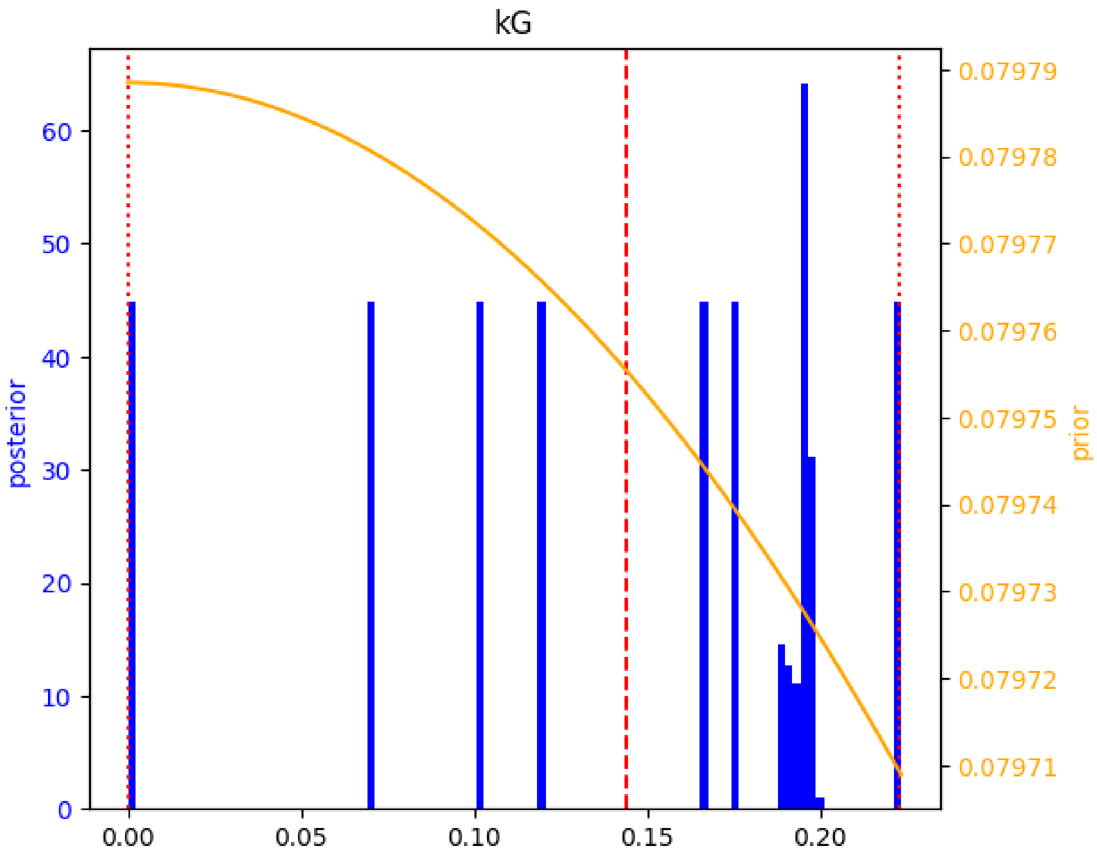
4000
6000
8000
10000


tauH
30
25
20
15
10
5
0
0
2000
4000
6000
8000
10000


sigma
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0
2000
4000
6000
8000
10000



a0
posterior
prior
0
10
20
30
40
50
60
70
0.07915
0.07920
0.07925
0.07930
0.07935
0.52
0.54
0.56
0.58
0.60
0.62
0.64


kG
posterior
prior
0
10
20
30
40
50
60
0.00
0.05
0.10
0.15
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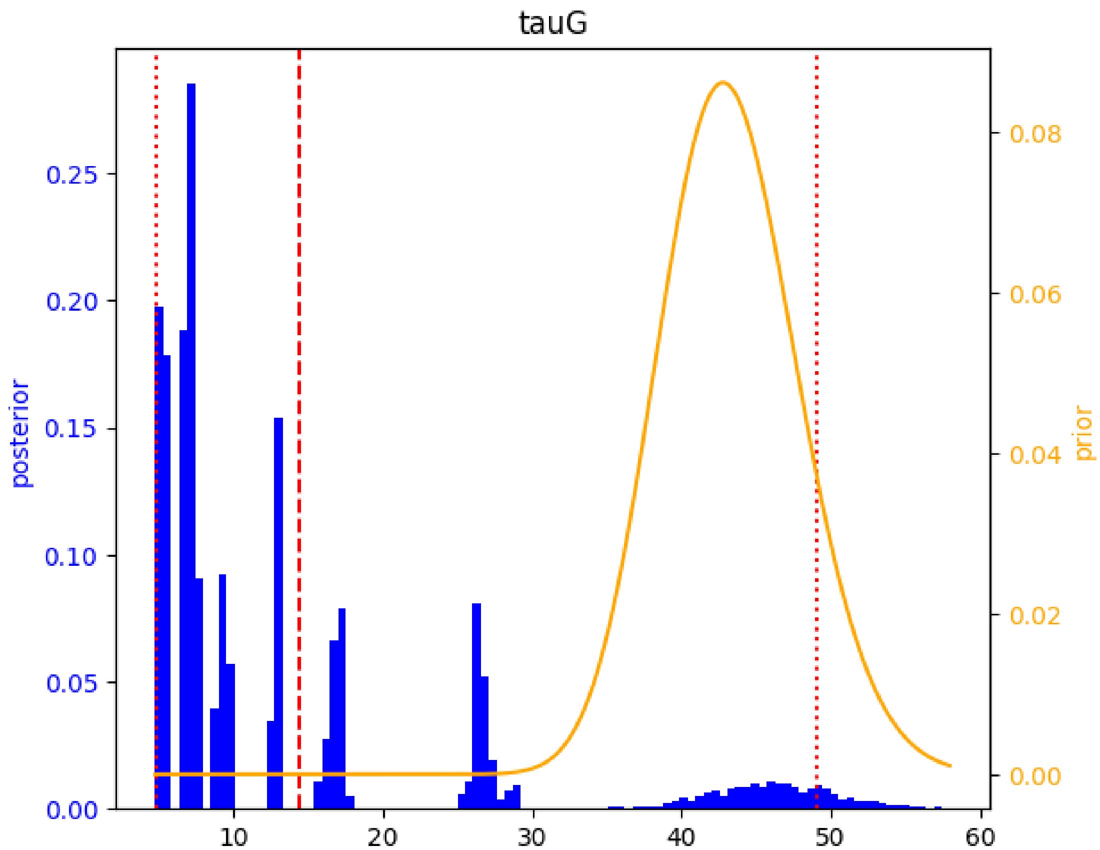
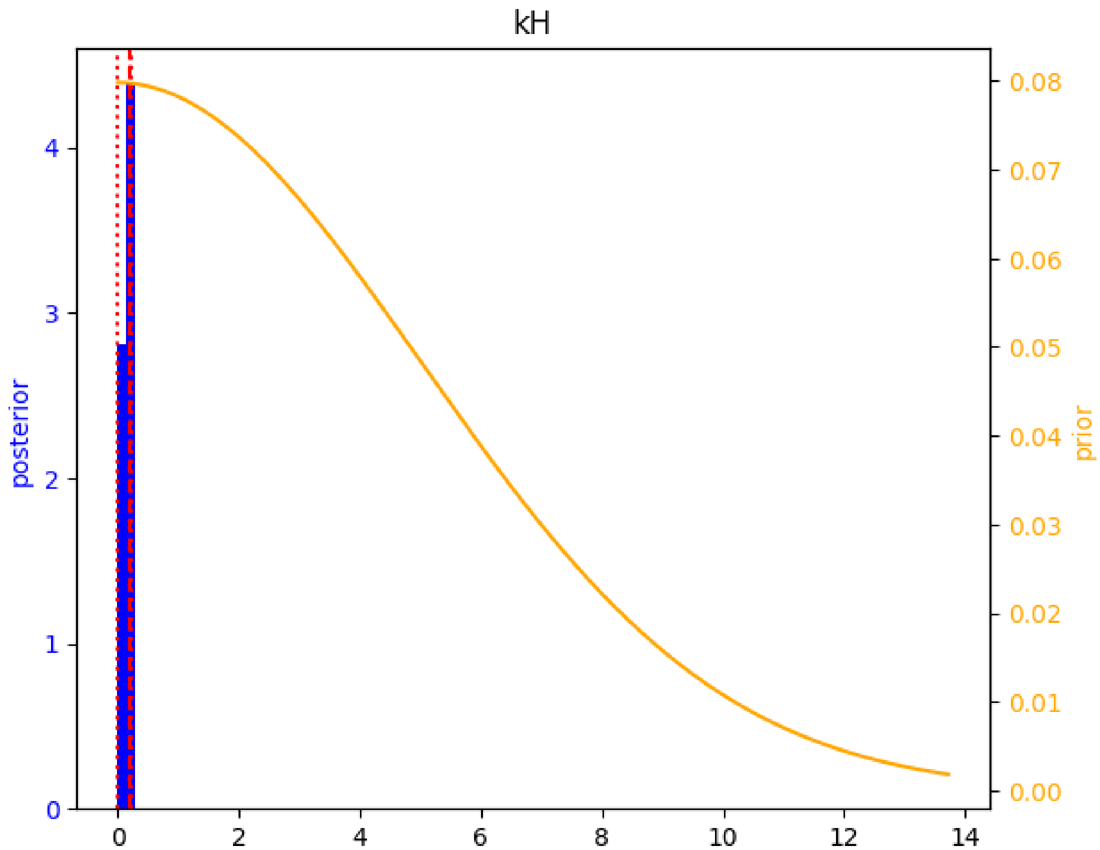
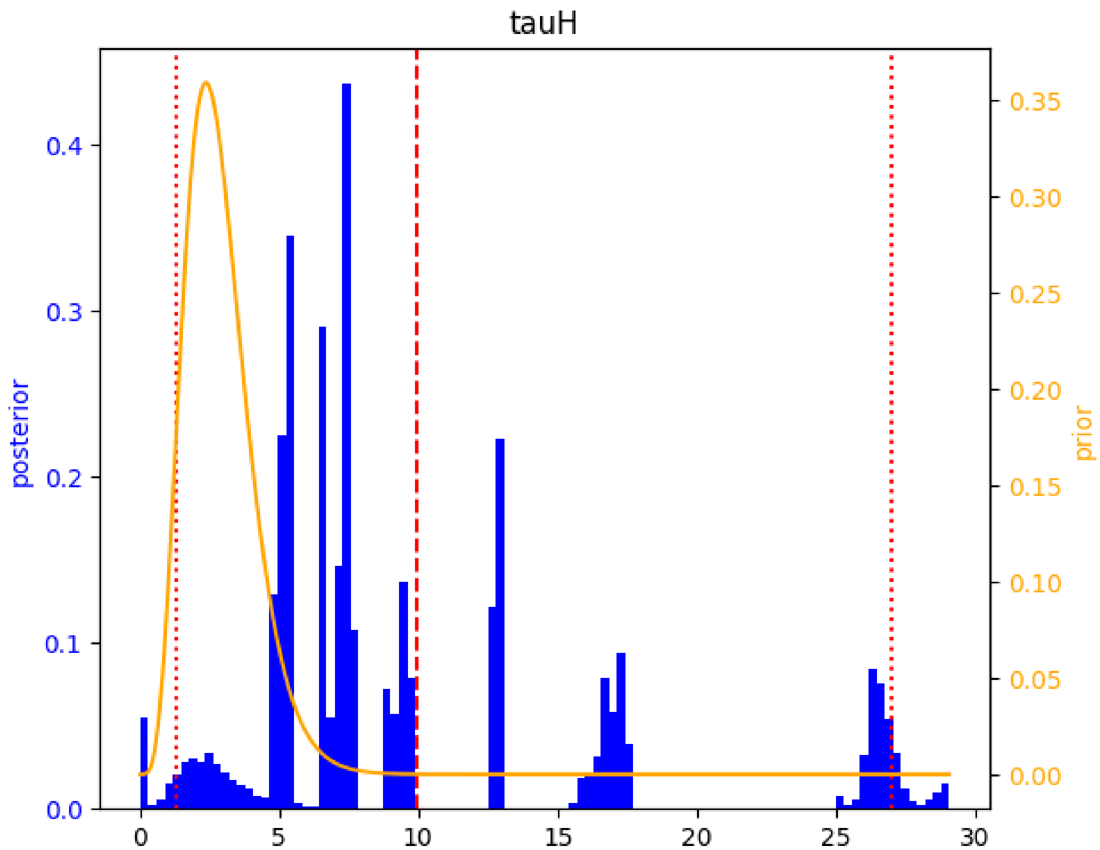
0.07972
0.07973
0.07974
0.07975
0.07976
0.07977
0.07978
0.07979

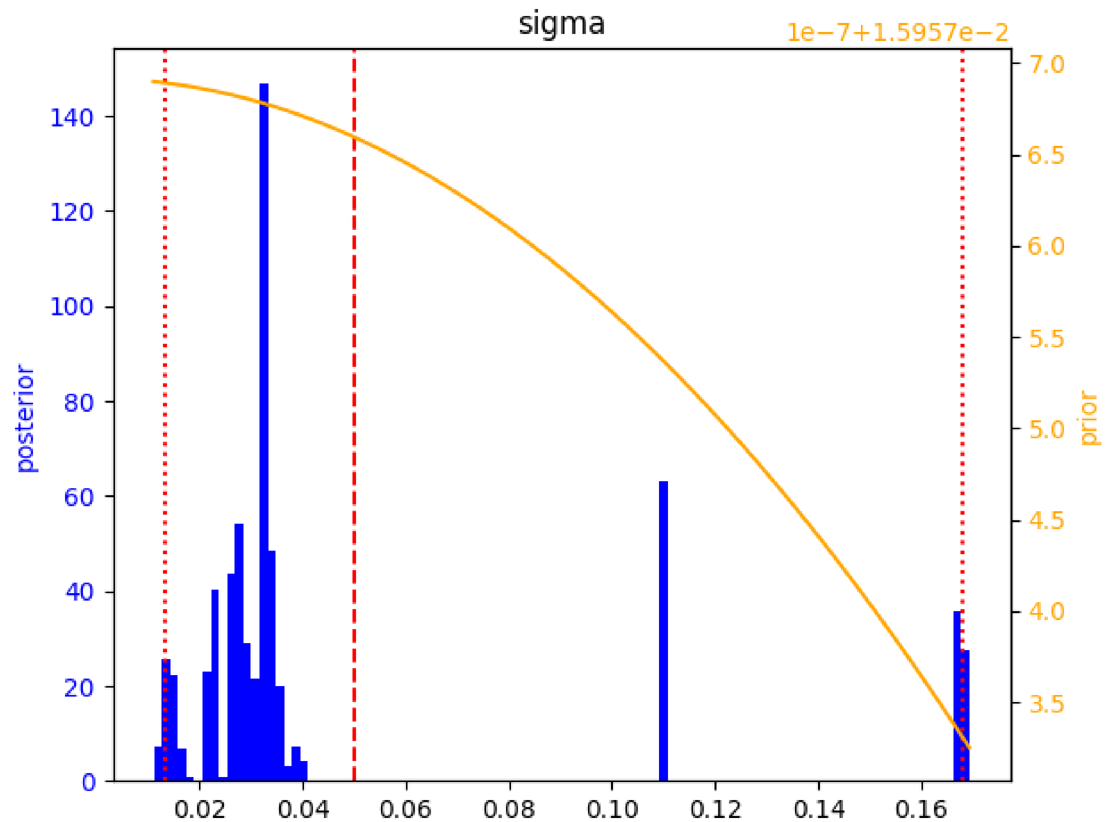


tauG
posterior
prior
0.00
0.05
0.10
0.15
0.20
0.25
0.00
0.02
0.04
0.06
0.08
10
20
30
40
50
60

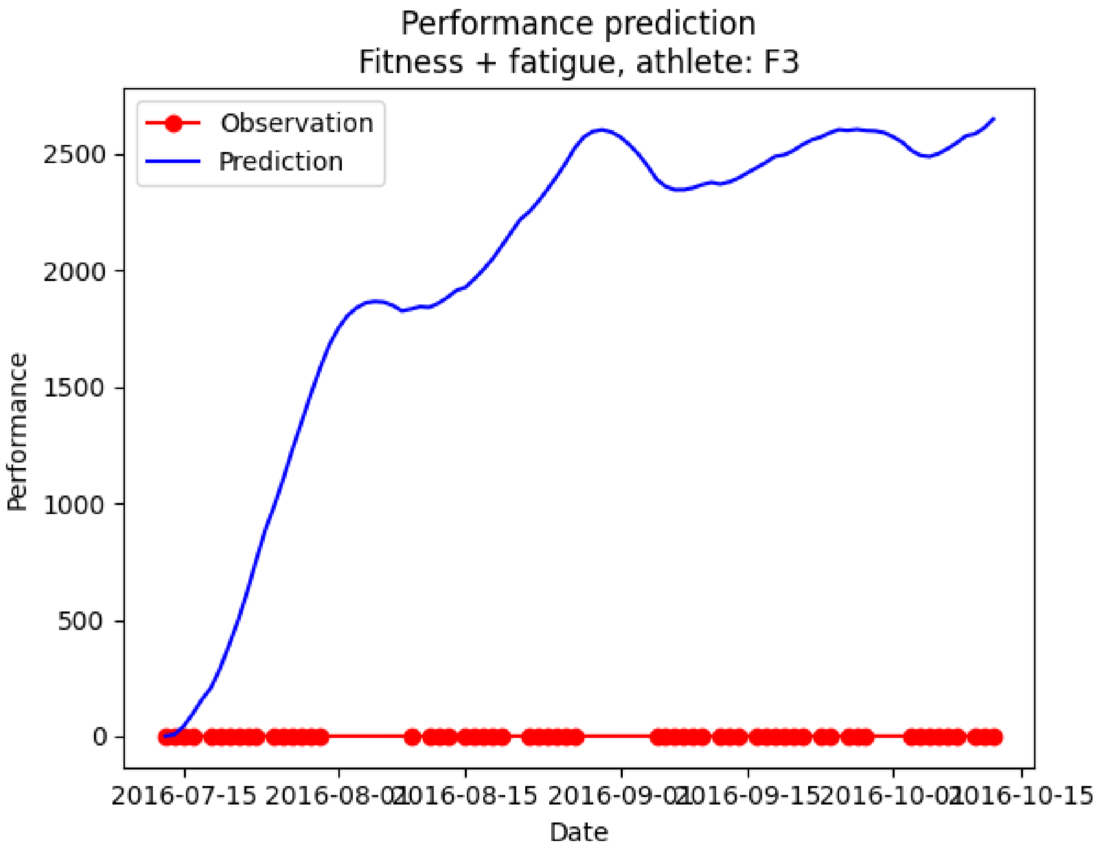

kH
posterior
prior
0
1
2
3
4
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0
2
4
6
8
10
12
14

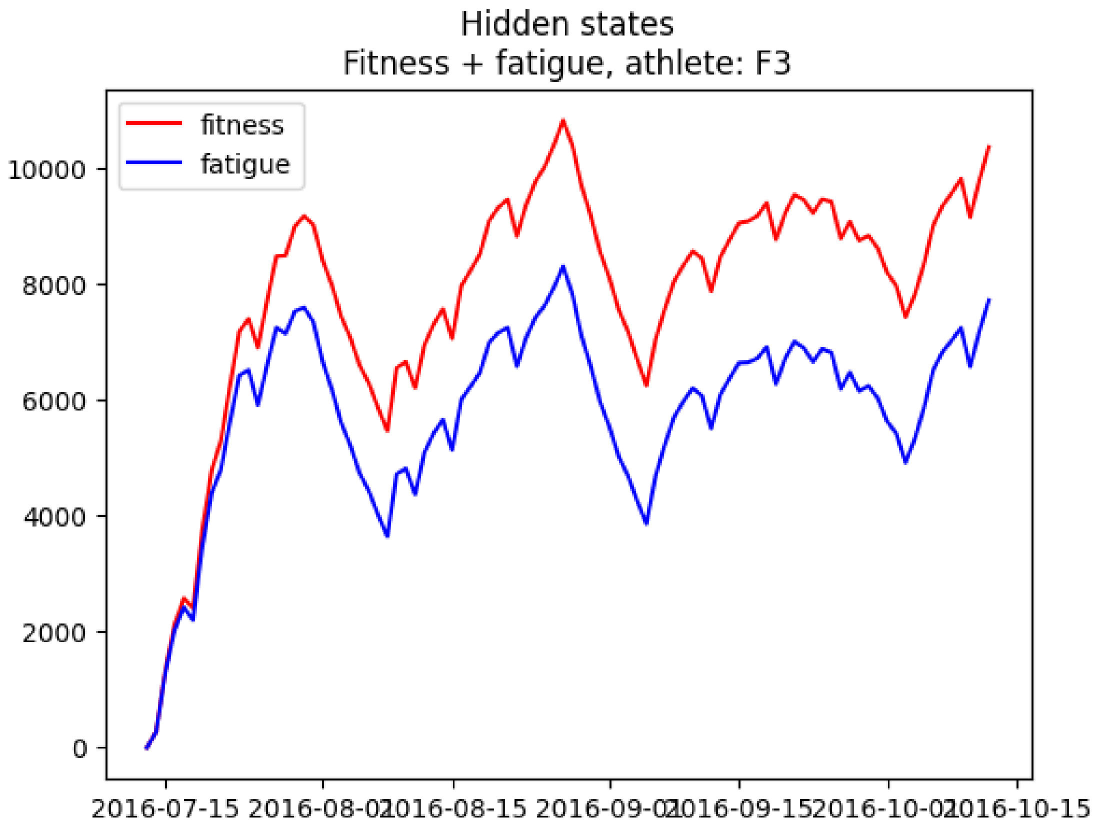


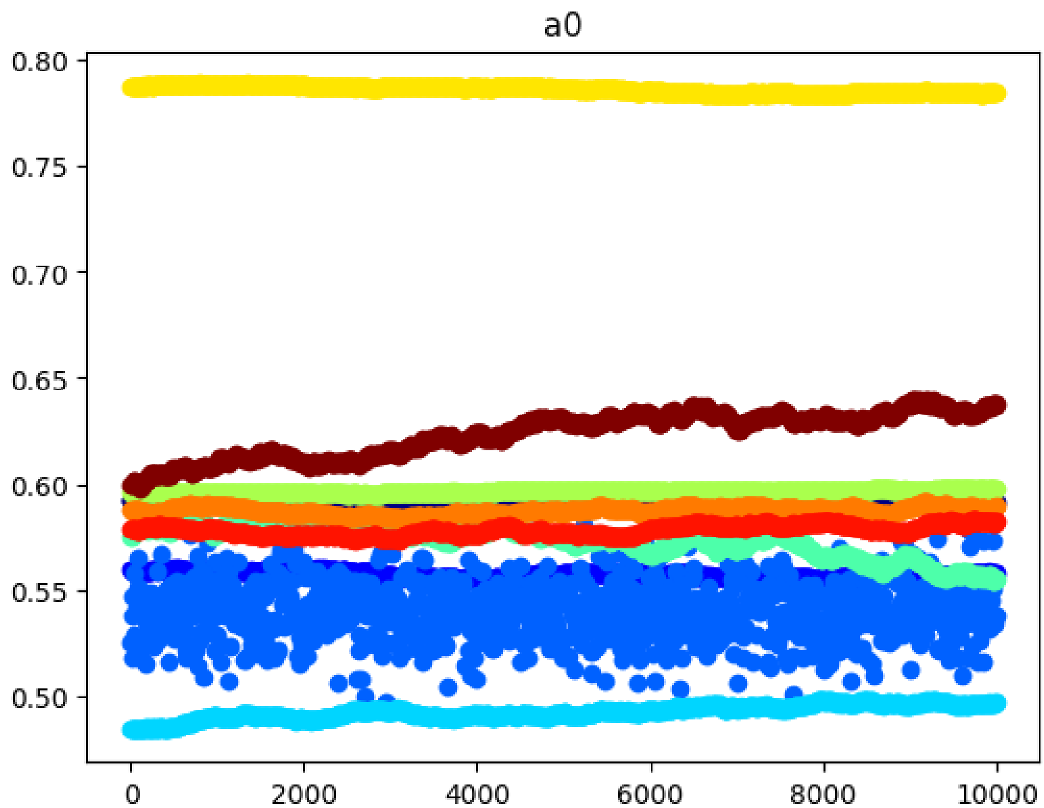
tauH
posterior
prior
0.0
0.1
0.2
0.3
0.4
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0
5
10
15
20
25
30

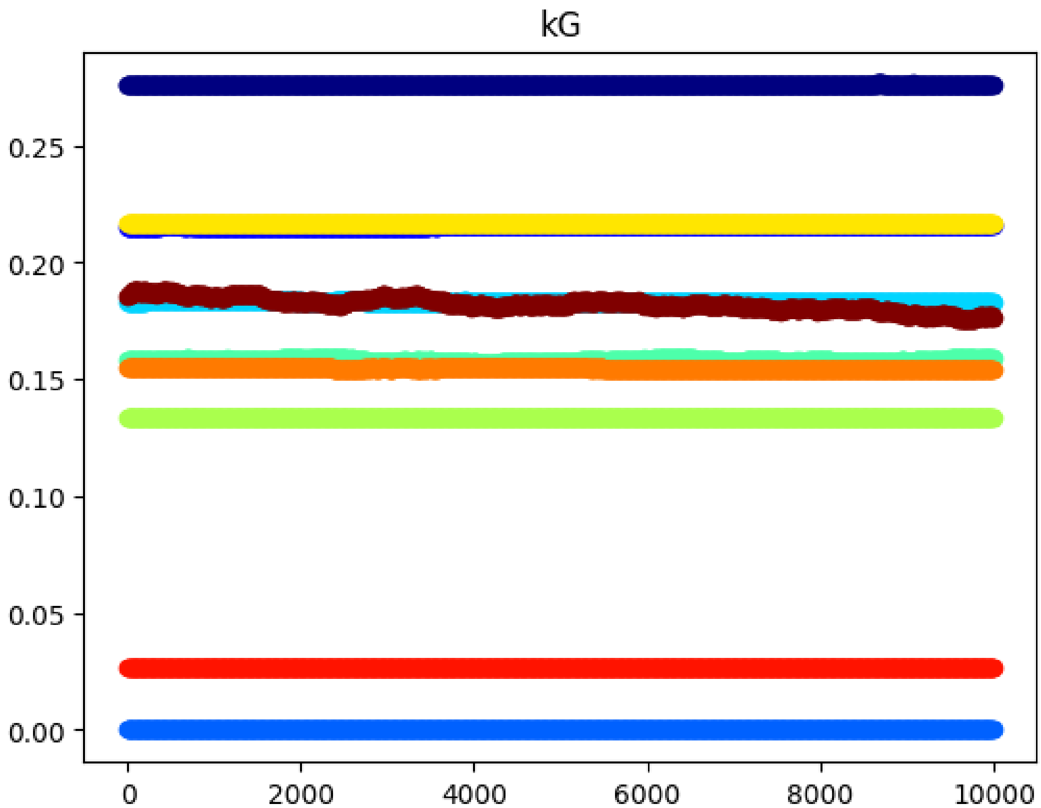


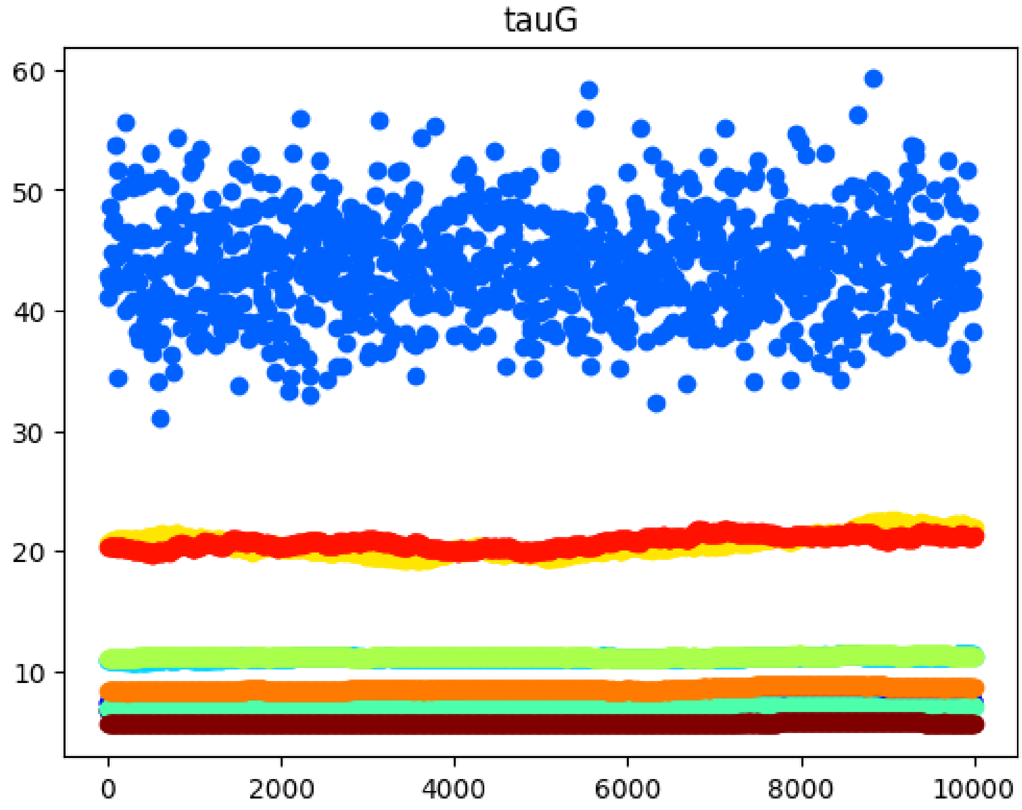
sigma
1e−7+1.5957e−2
posterior
prior
0
20
40
60
80
100
120
140
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16


Performance prediction
Fitness + fatigue, athlete: F3
Observation
Prediction
2500
2000
1500
1000
500
0
Performance
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

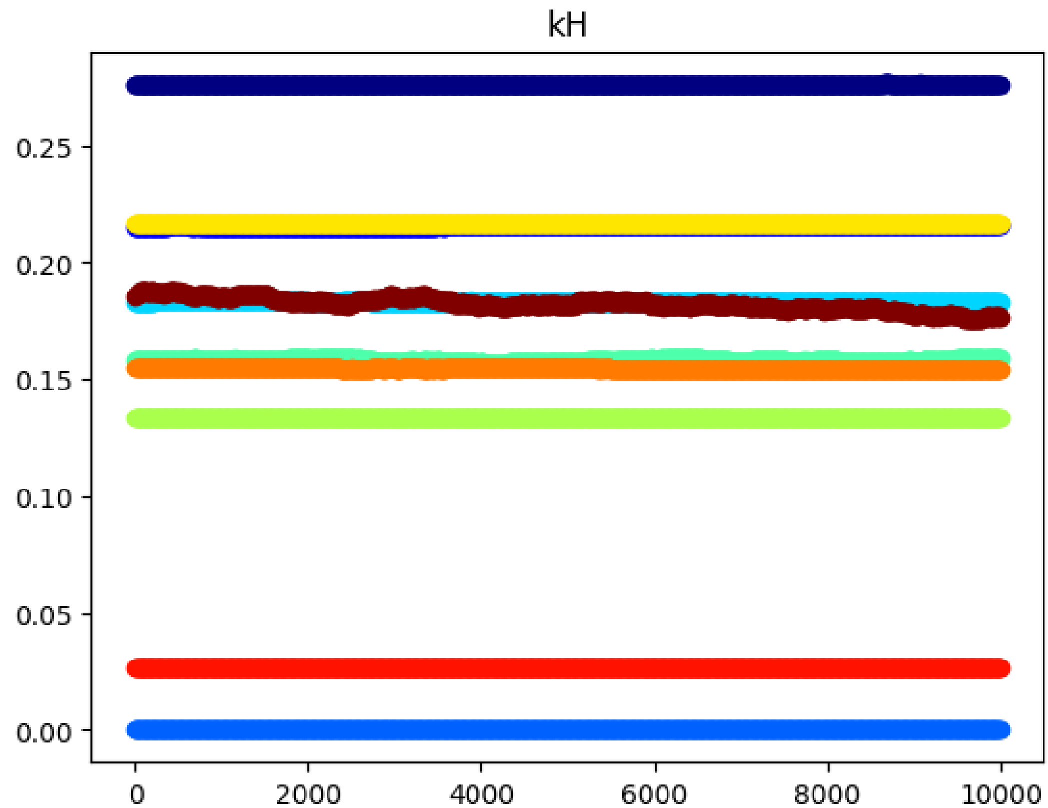

Hidden states
Fitness + fatigue, athlete: F3
fitness
fatigue
10000
8000
6000
4000
2000
0
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

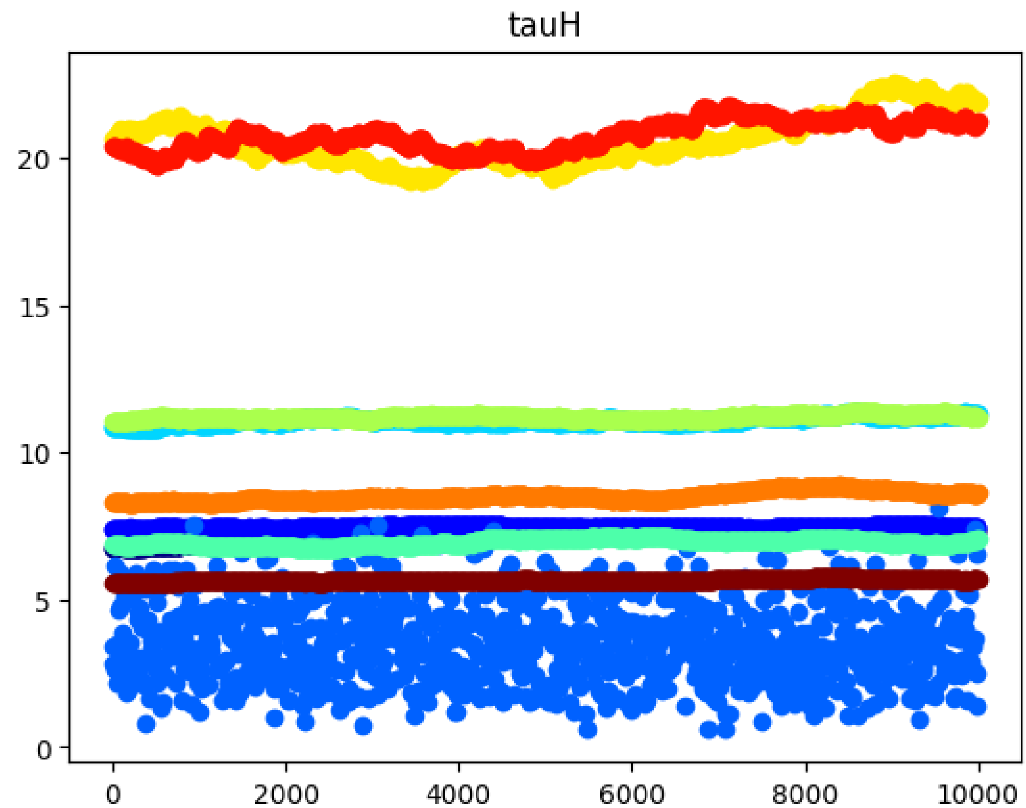

a0
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0
2000
4000
6000
8000
10000

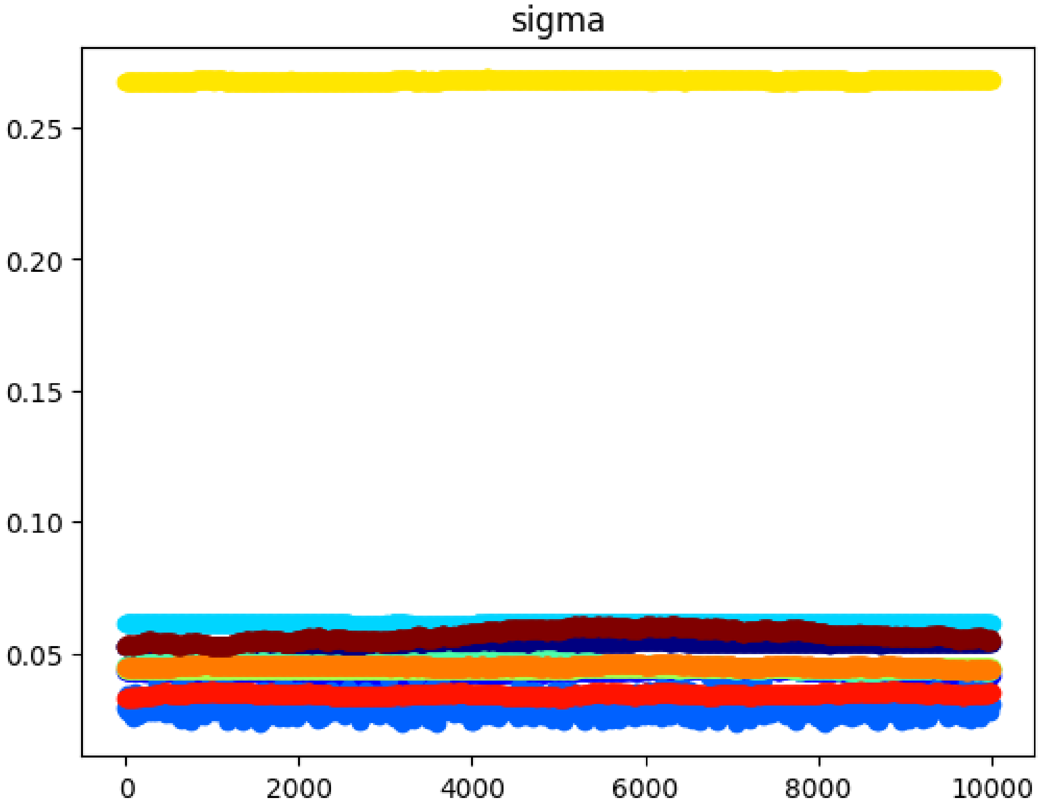

kG
0.25
0.20
0.15
0.10
0.05
0.00
0
2000
4000
6000
8000
10000

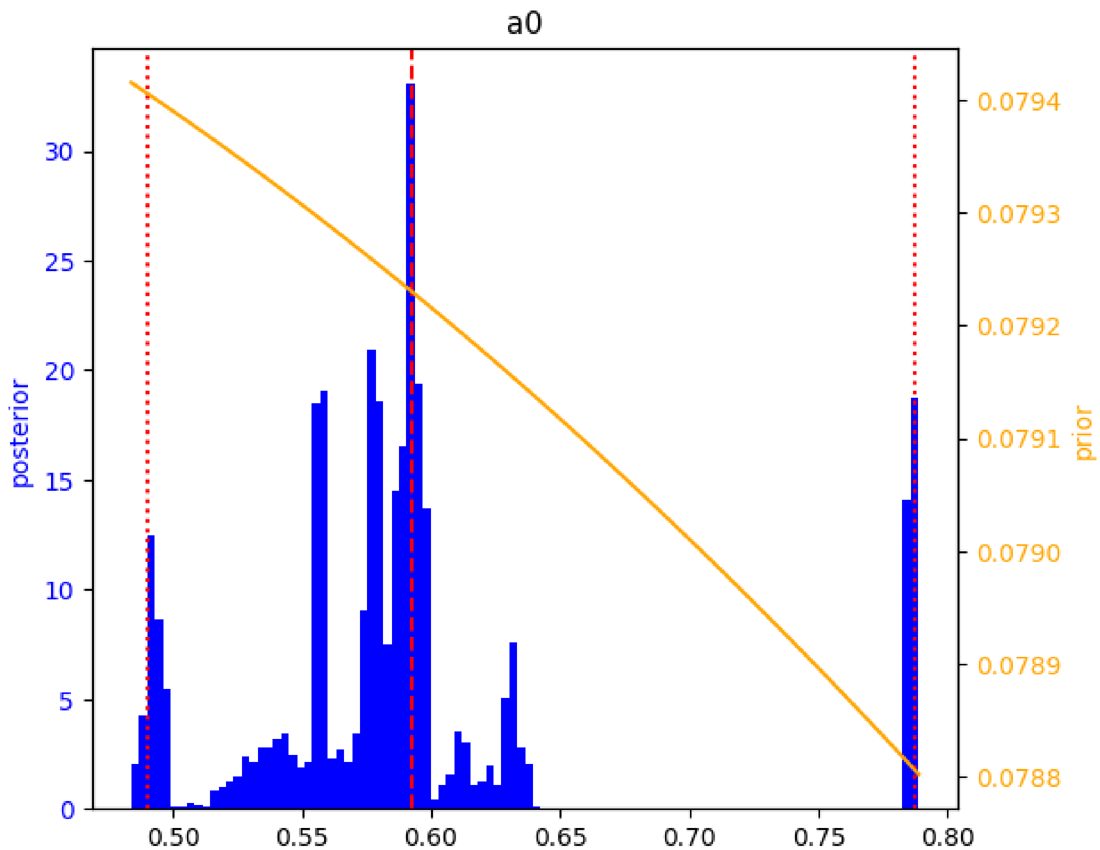


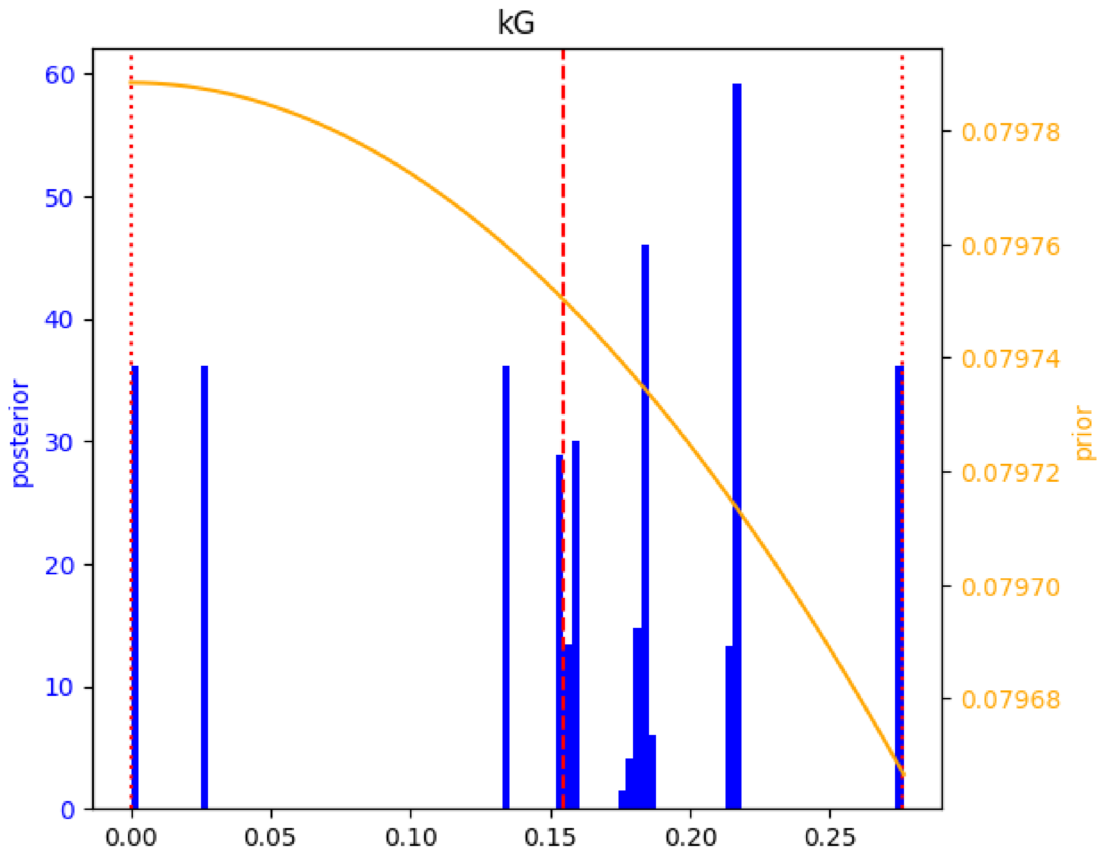
tauG
60
50
40
30
20
10
0
2000
4000
6000
8000
10000

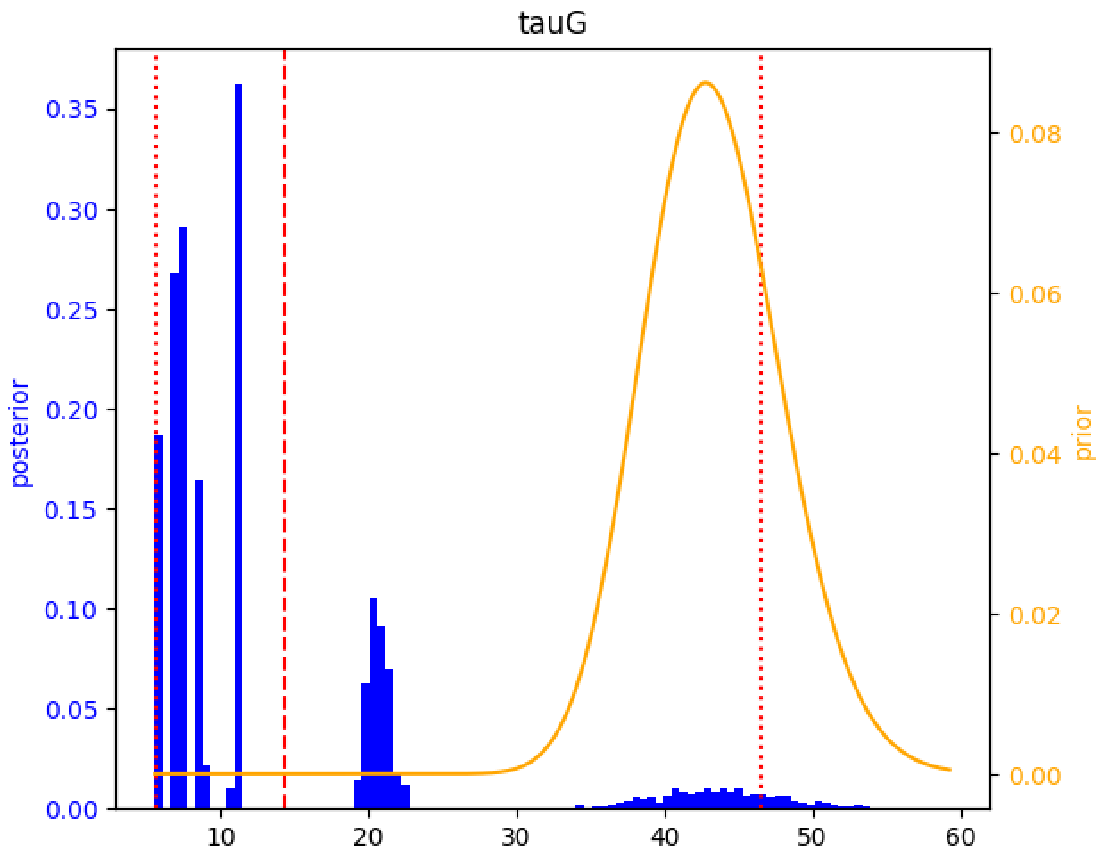

kH
0.25
0.20
0.15
0.10
0.05
0.00
0
2000
4000
6000
8000
10000

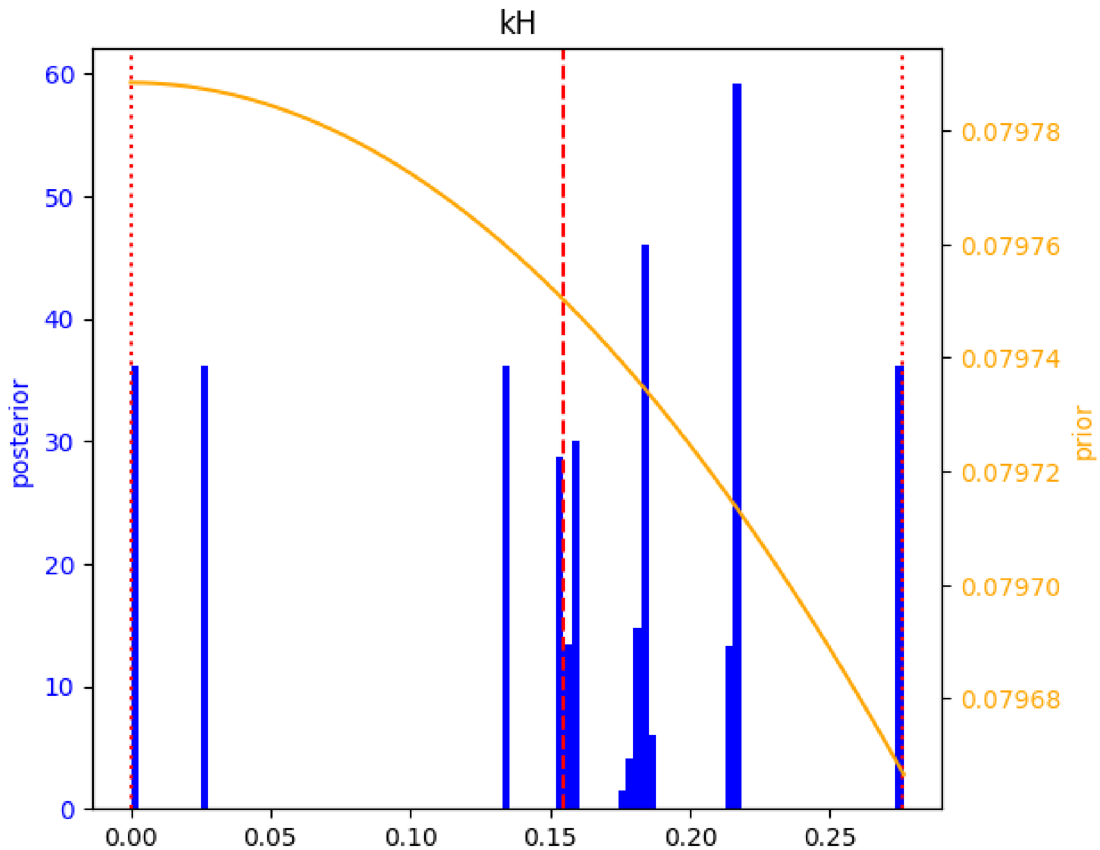

tauH
20
15
10
5
0
0
2000
4000
6000
8000
10000

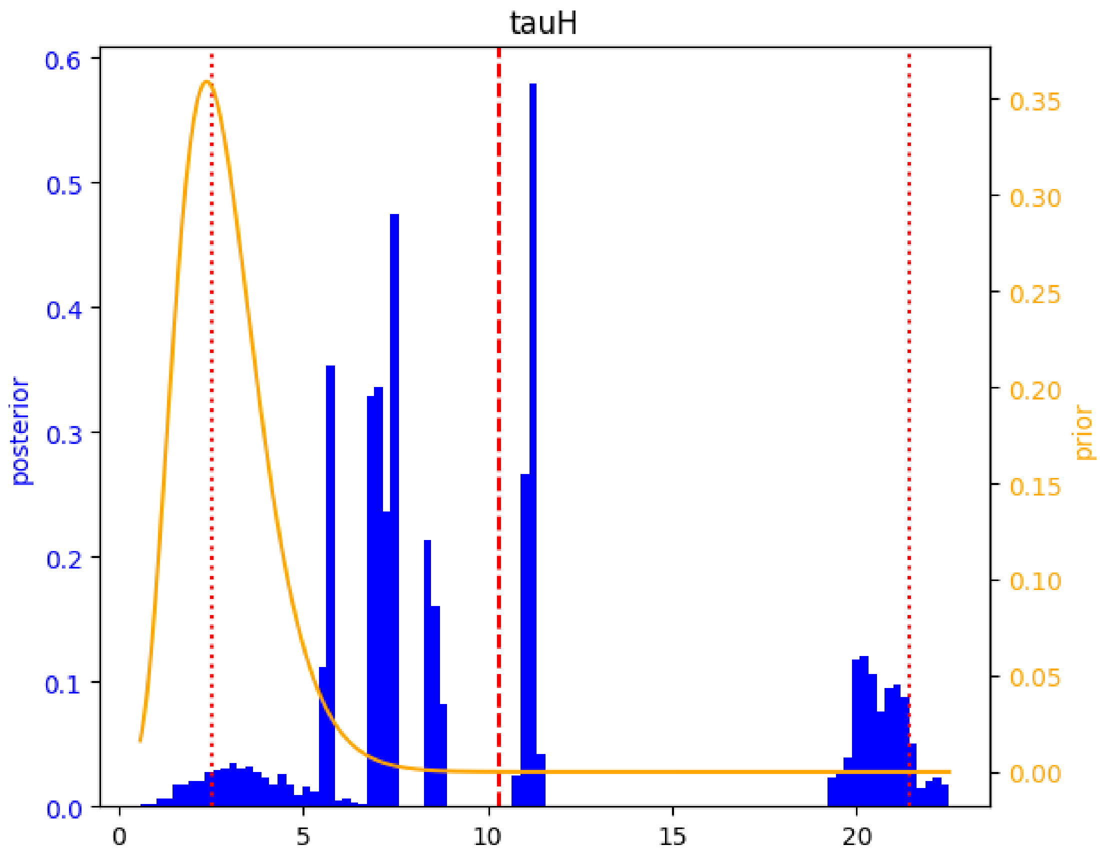

sigma
0.25
0.20
0.15
0.10
0.05
0
2000
4000
6000
8000
10000


a0
posterior
prior
0
5
10
15
20
25
30
0.50
0.55
0.60
0.65
0.70
0.75
0.80
0.0788
0.0789
0.0790
0.0791
0.0792
0.0793
0.0794

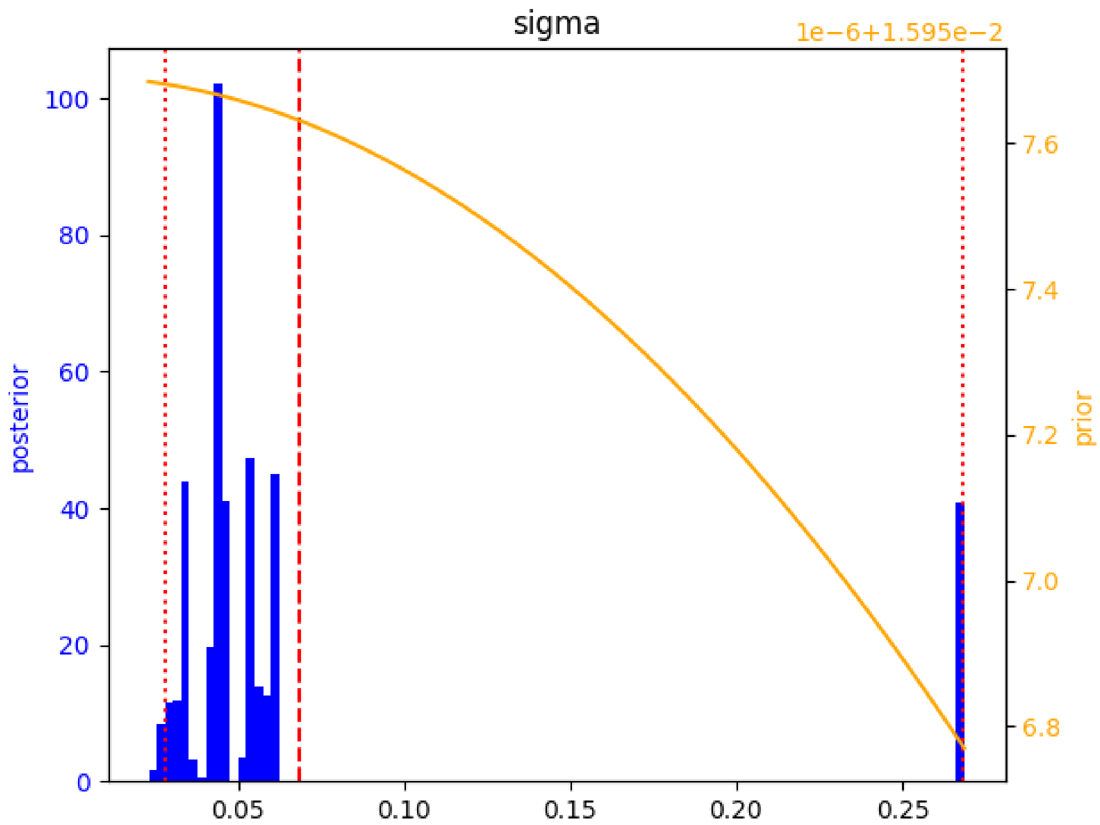

kG
posterior
prior
0
10
20
30
40
50
60
0.07968
0.07970
0.07972
0.07974
0.07976
0.07978
0.00
0.05
0.10
0.15
0.20
0.25

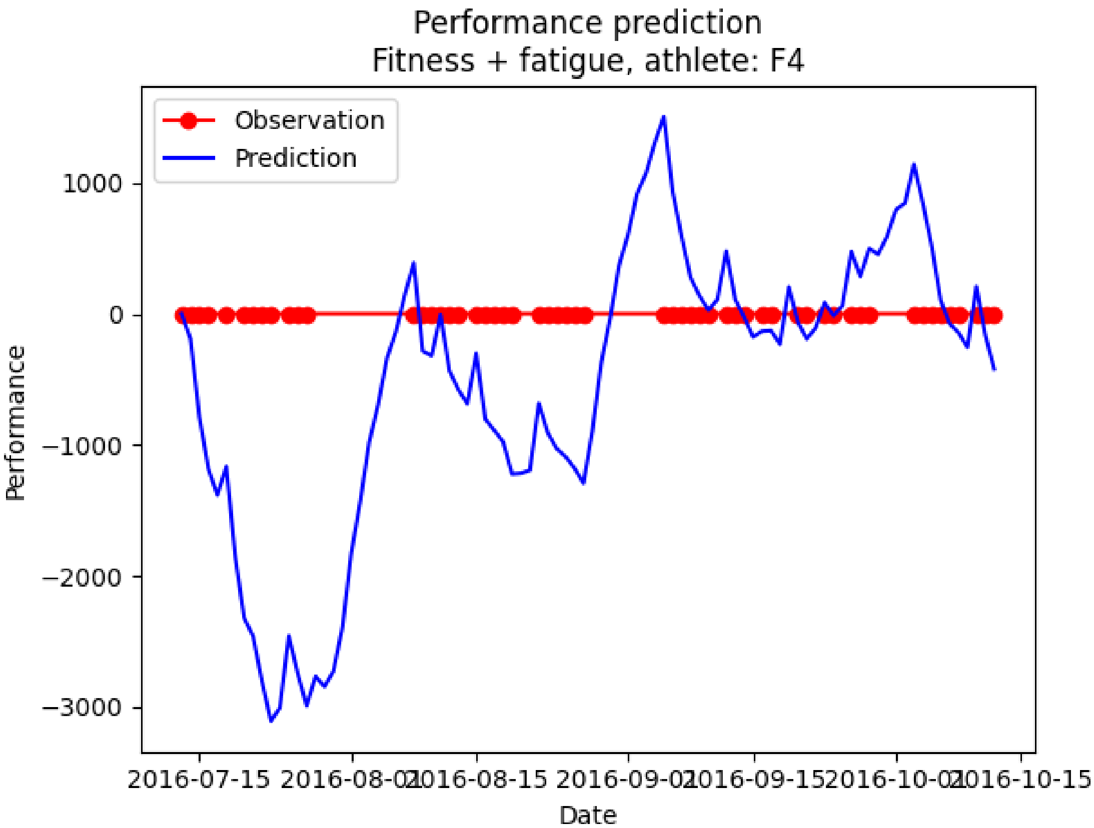

tauG
posterior
prior
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.00
0.02
0.04
0.06
0.08
10
20
30
40
50
60

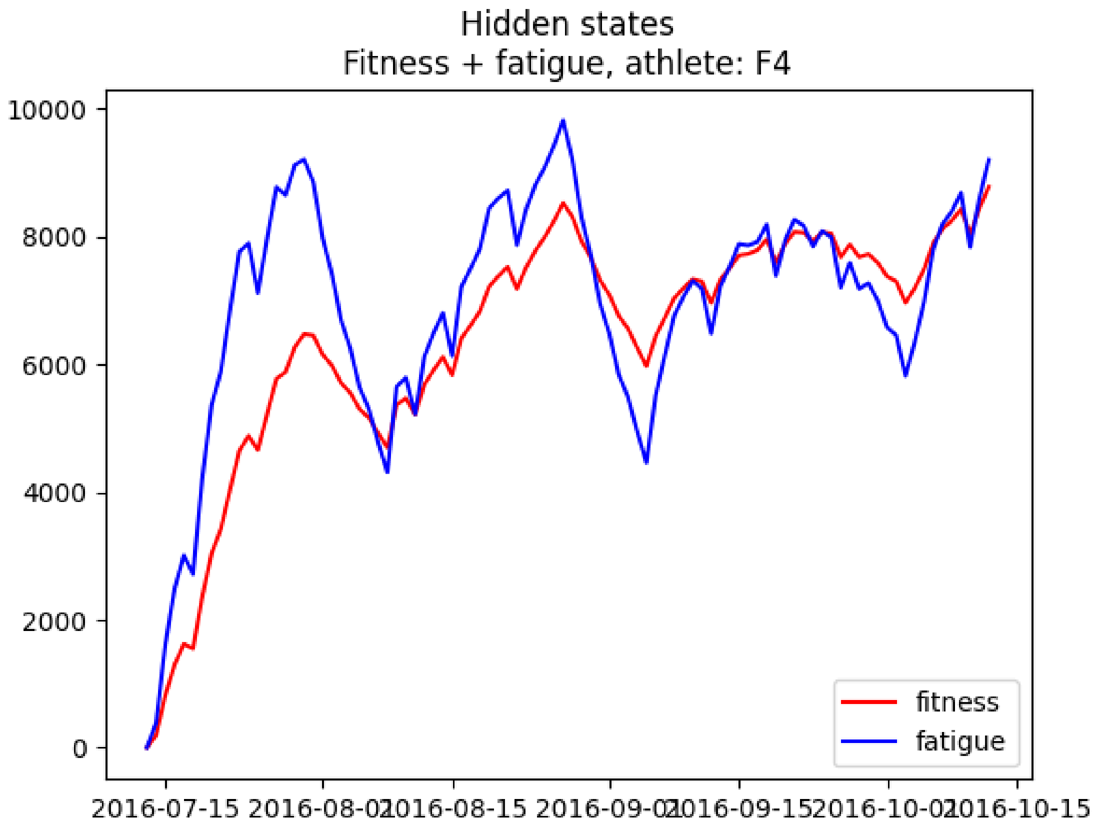

kH
posterior
prior
0
10
20
30
40
50
60
0.07968
0.07970
0.07972
0.07974
0.07976
0.07978
0.00
0.05
0.10
0.15
0.20
0.25

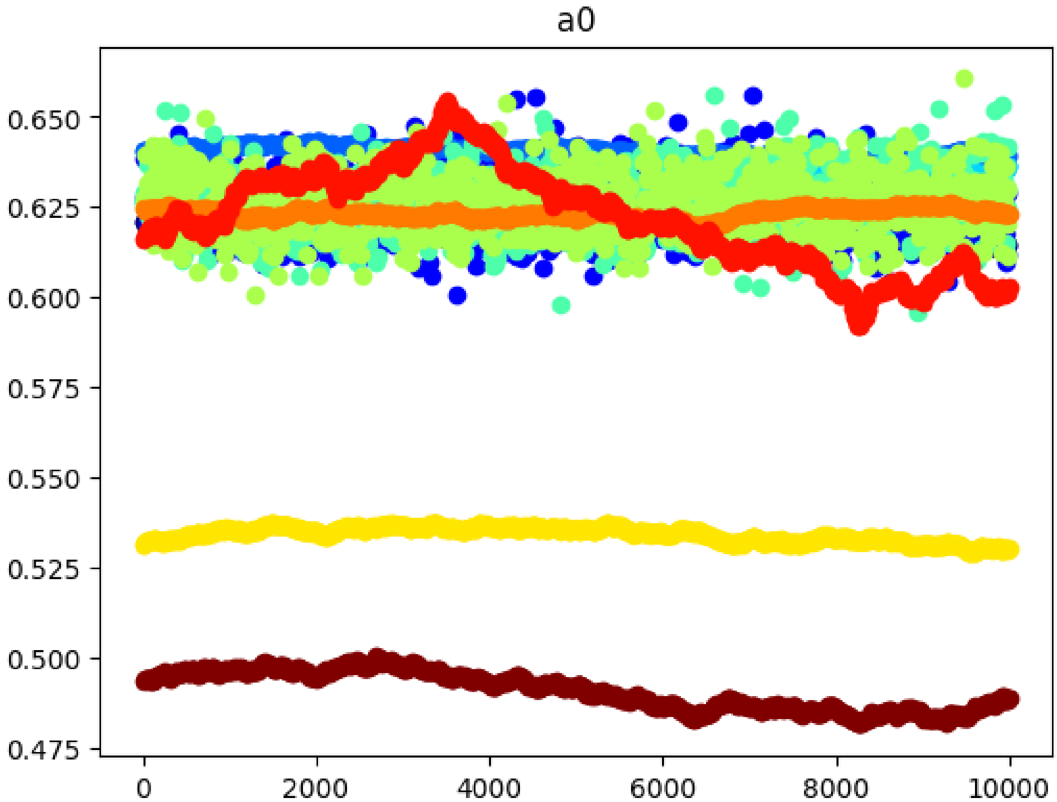


tauH
posterior
prior
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0
5
10
15
20

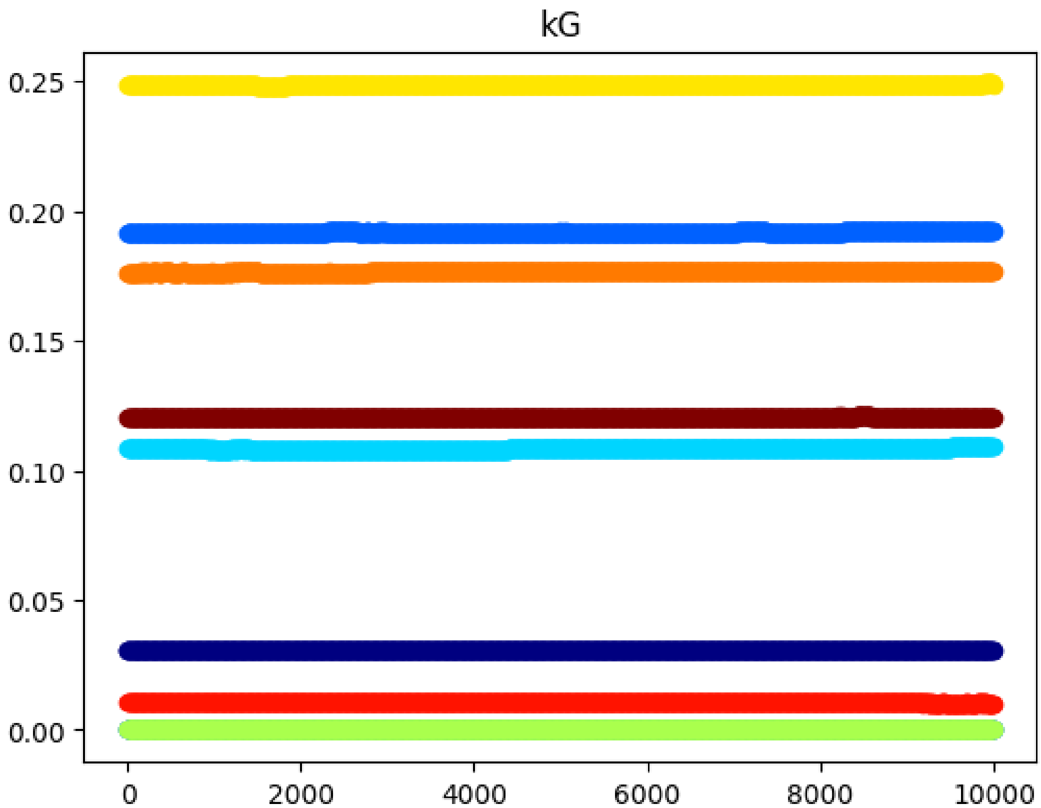

sigma
1e−6+1.595e−2
posterior
prior
0
20
40
60
80
100
0.05
0.10
0.15
0.20
0.25
6.8
7.0
7.2
7.4
7.6

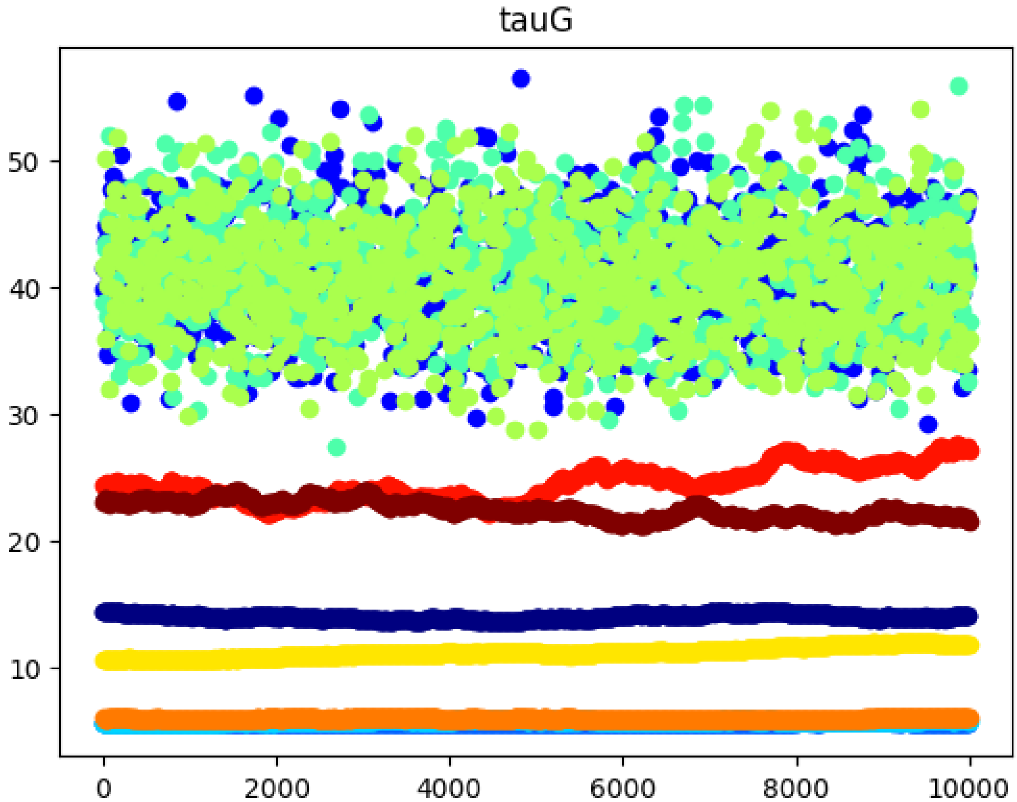

Performance prediction
Fitness + fatigue, athlete: F4
Observation
Prediction
1000
0
−1000
−2000
−3000
Performance
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

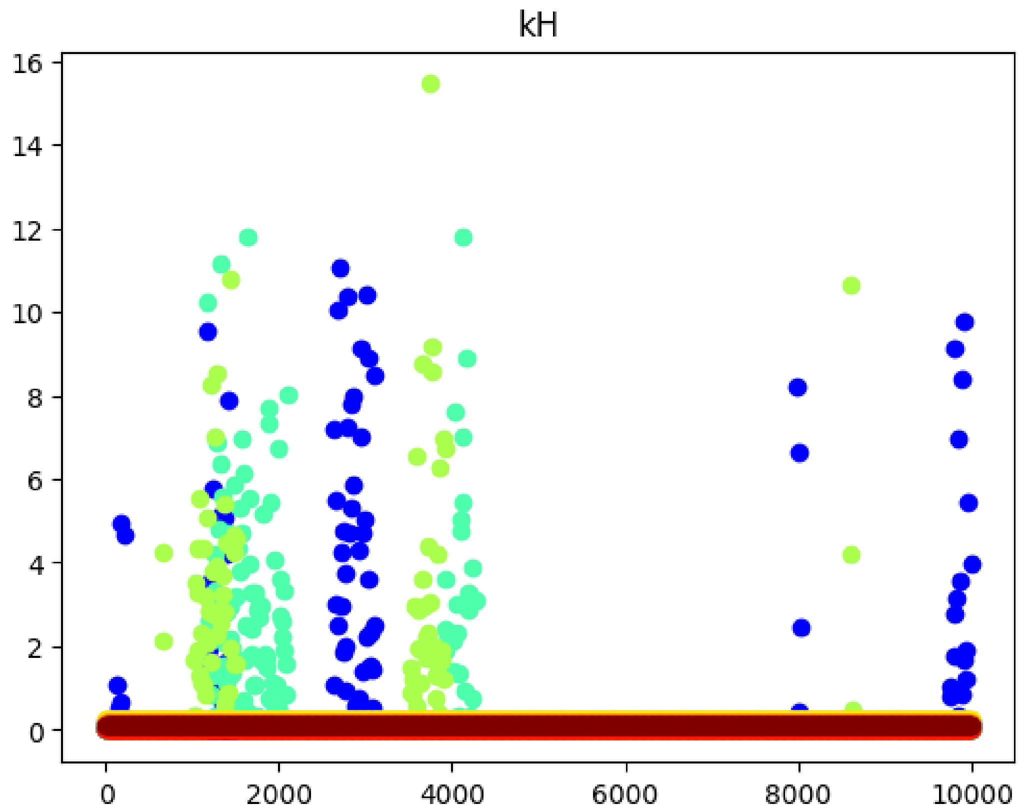

Hidden states
Fitness + fatigue, athlete: F4
10000
8000
6000
4000
2000
0
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
fitness
fatigue

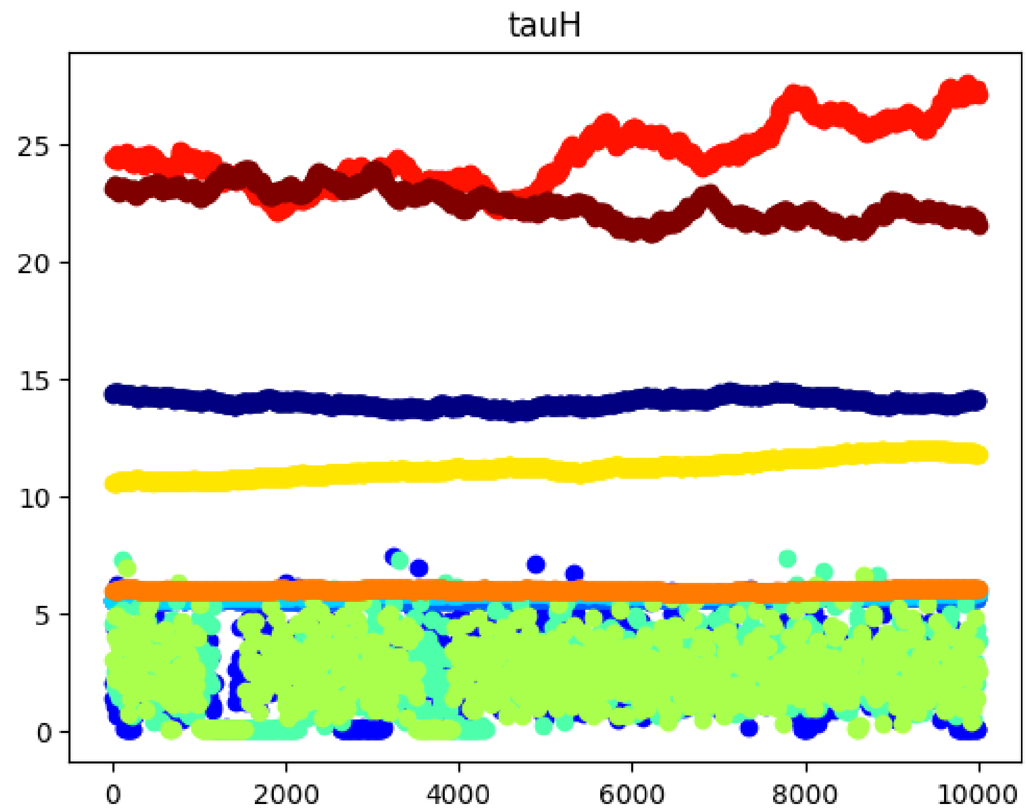


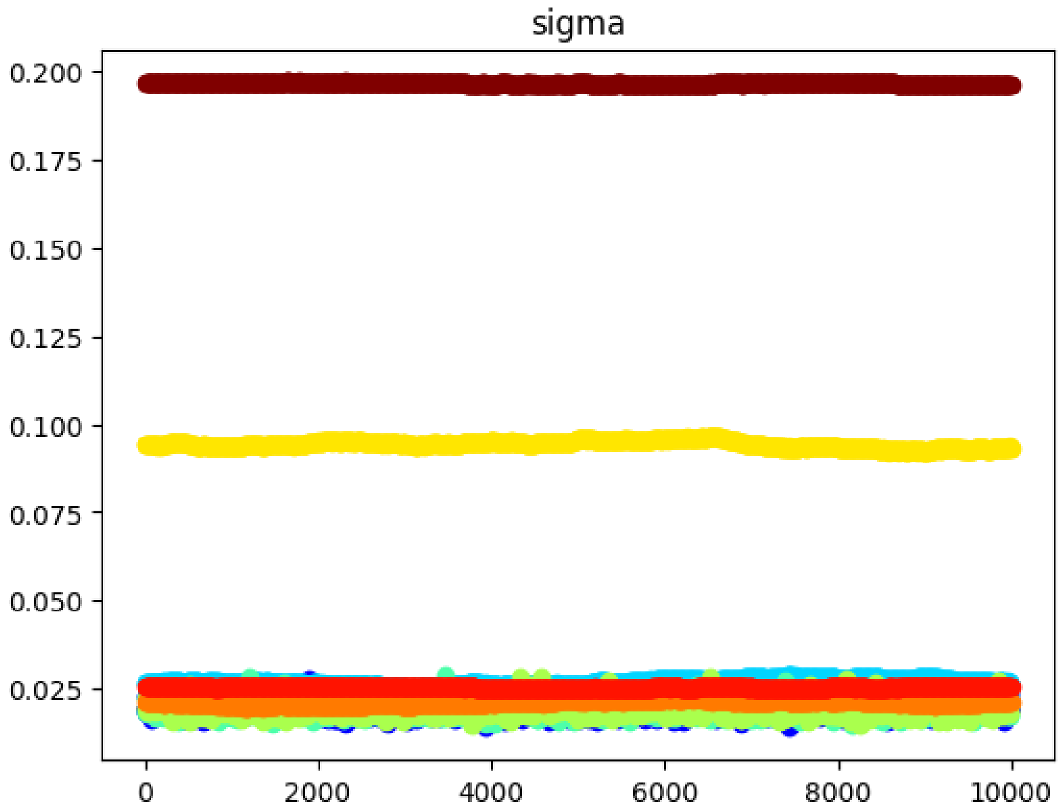
a0
0.650
0.625
0.600
0.575
0.550
0.525
0.500
0.475
0
2000
4000
6000
8000
10000

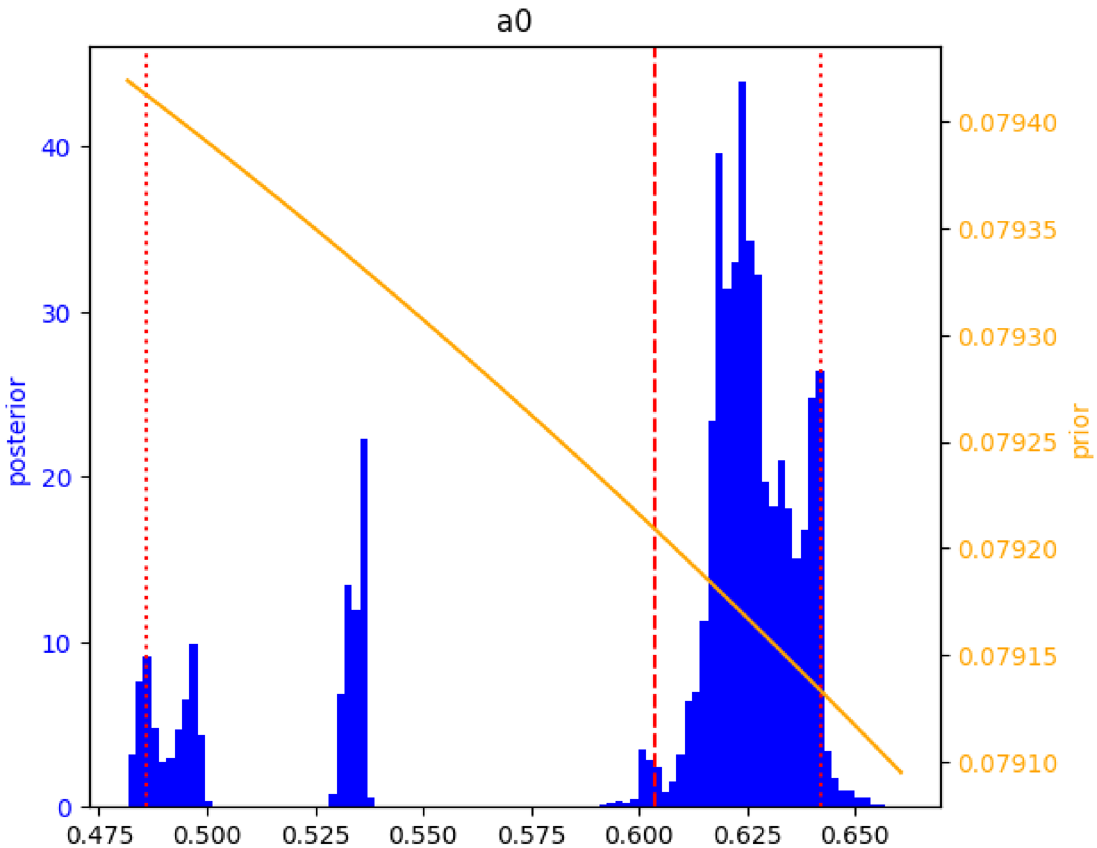

kG
0.25
0.20
0.15
0.10
0.05
0.00
0
2000
4000
6000
8000
10000


tauG
50
40
30
20
10
0
2000
4000
6000
8000
10000

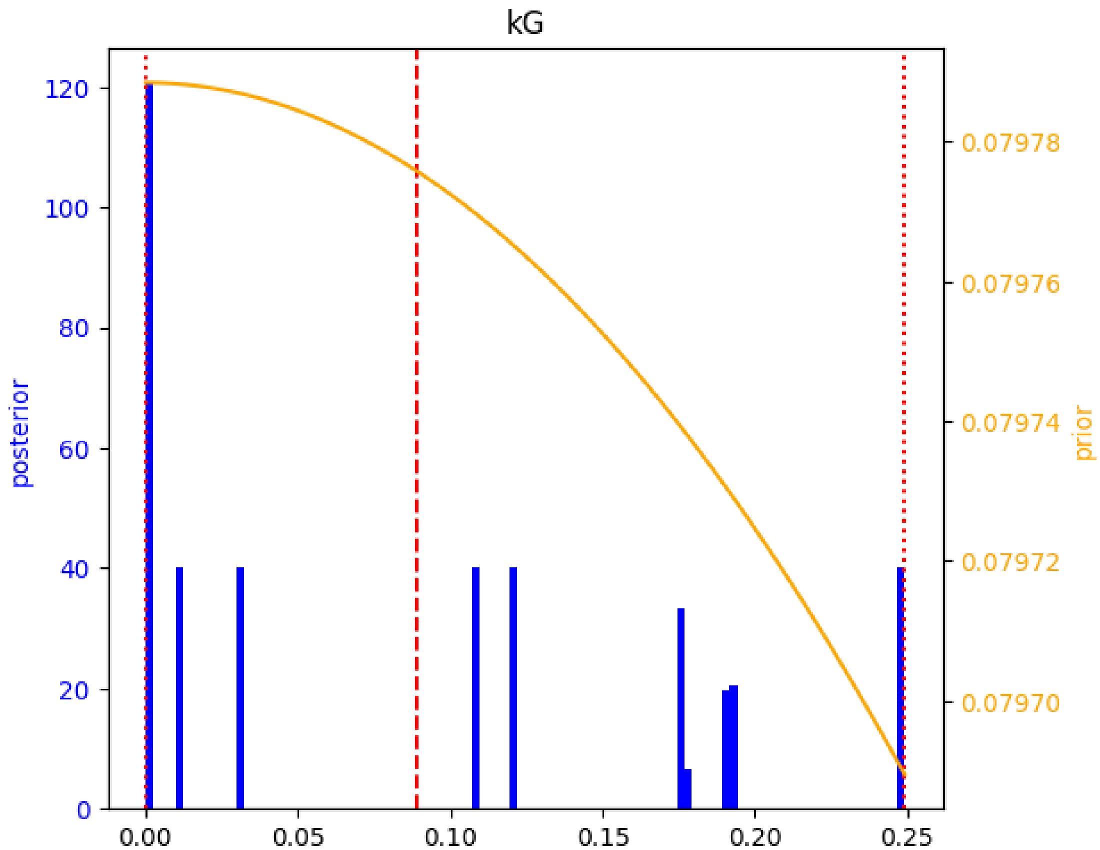

kH
16
14
12
10
8
6
4
2
0
0
2000
4000
6000
8000
10000

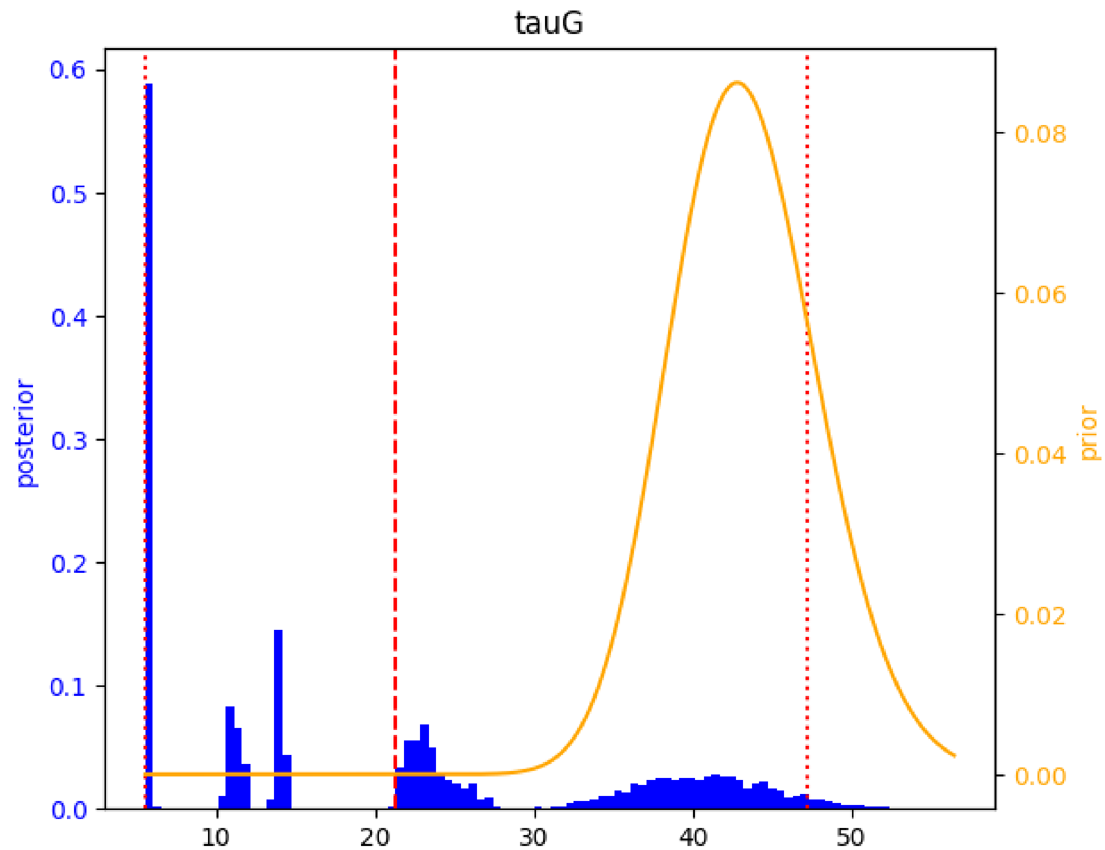

tauH
25
20
15
10
5
0
0
2000
4000
6000
8000
10000


sigma
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0
2000
4000
6000
8000
10000

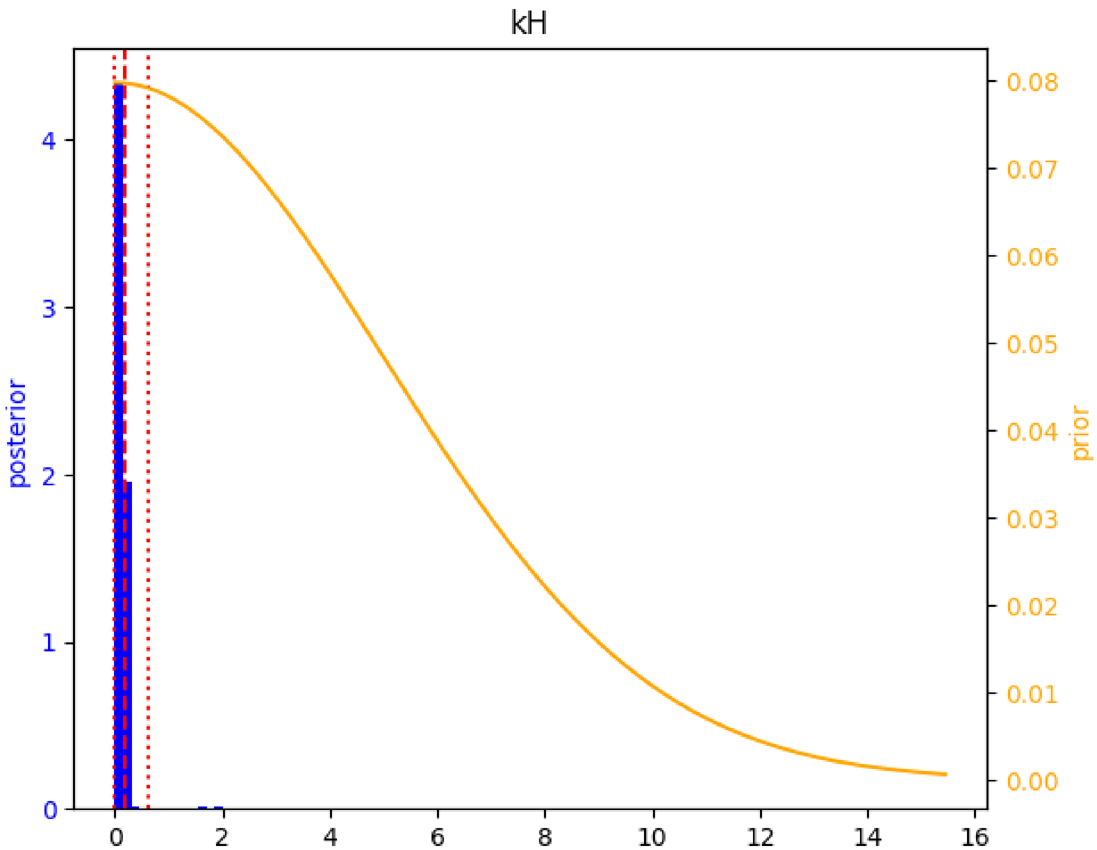


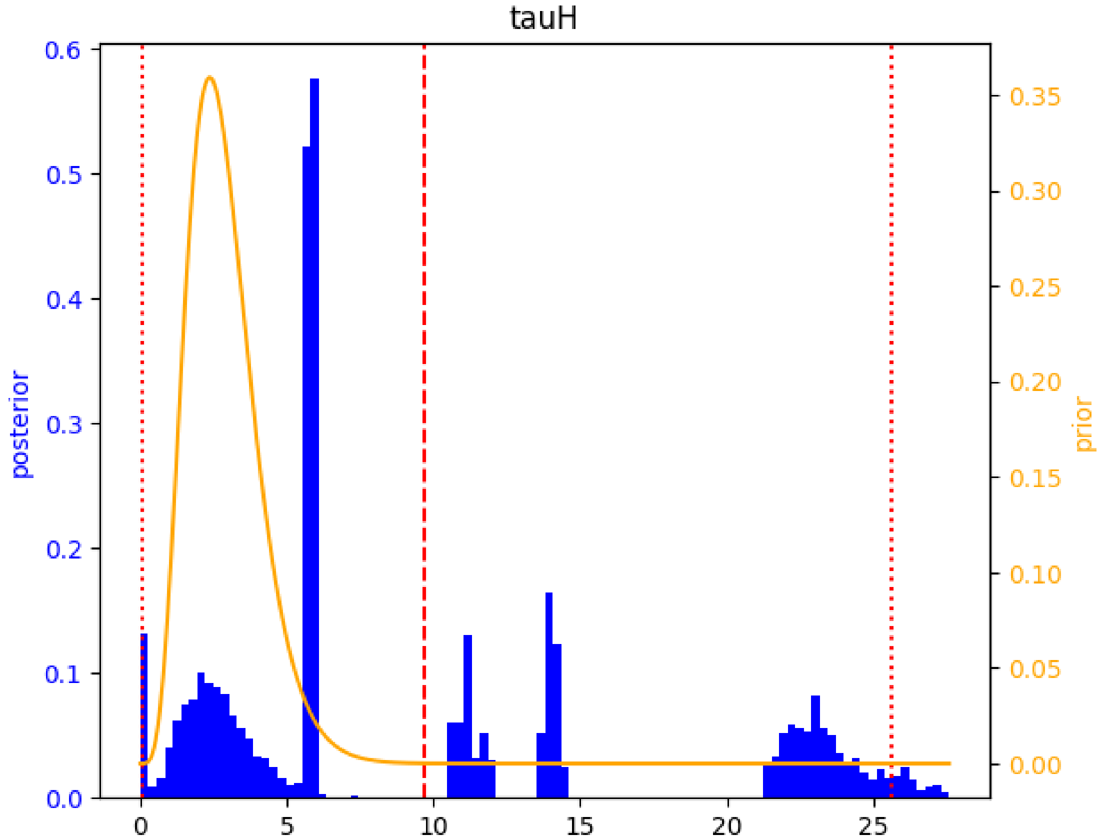
a0
posterior
prior
0
10
20
30
40
0.475
0.500
0.525
0.550
0.575
0.600
0.625
0.650
0.07910
0.07915
0.07920
0.07925
0.07930
0.07935
0.07940

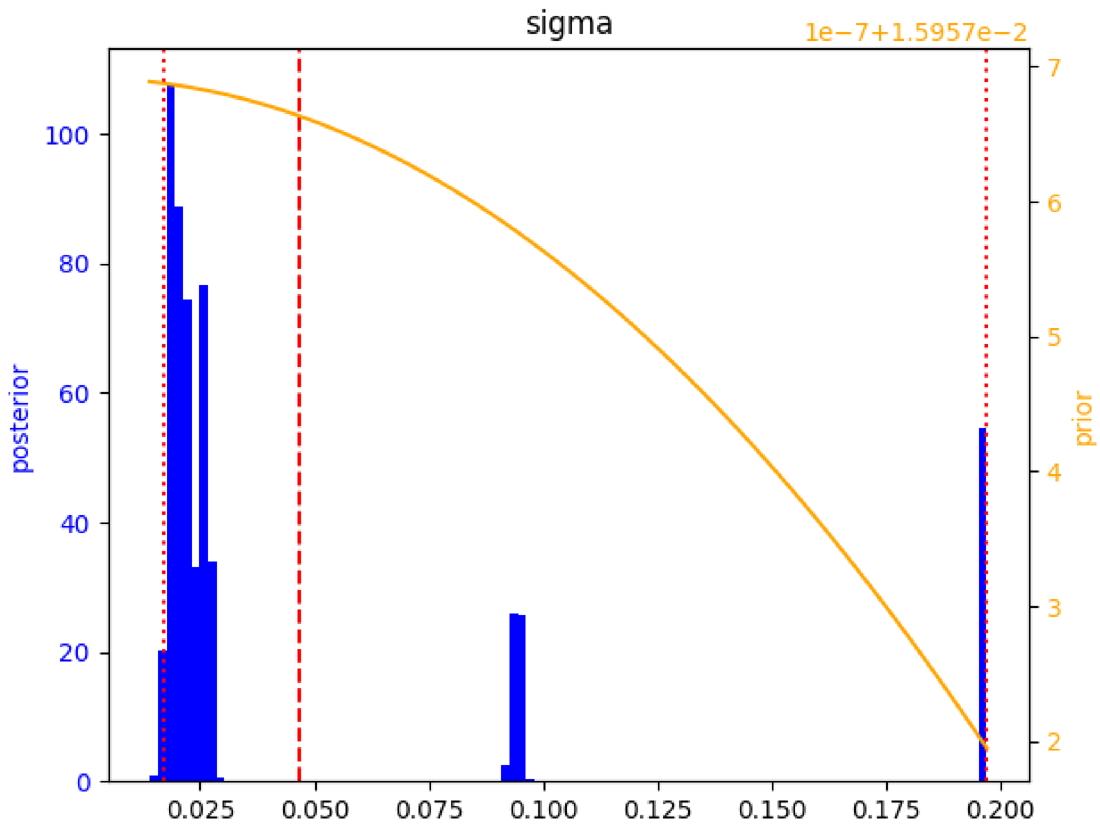

kG
posterior
prior
0
20
40
60
80
100
120
0.07970
0.07972
0.07974
0.07976
0.07978
0.00
0.05
0.10
0.15
0.20
0.25

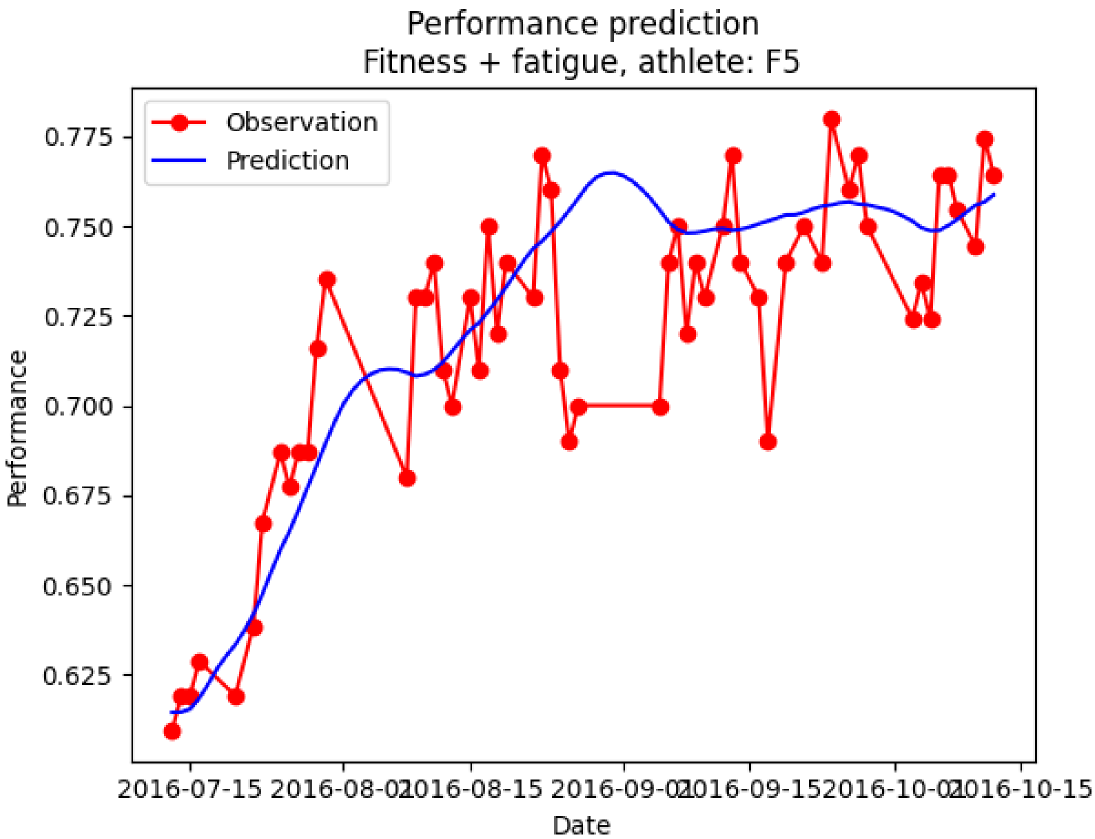


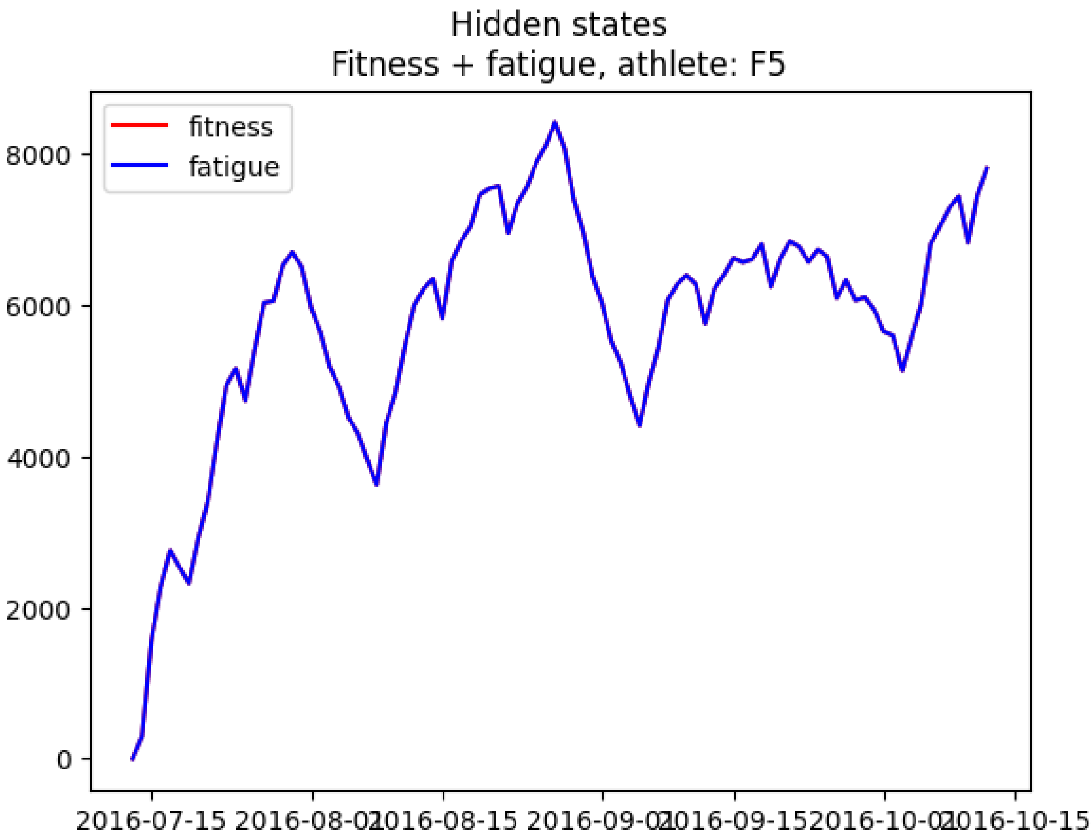
tauG
posterior
prior
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.00
0.02
0.04
0.06
0.08
10
20
30
40
50

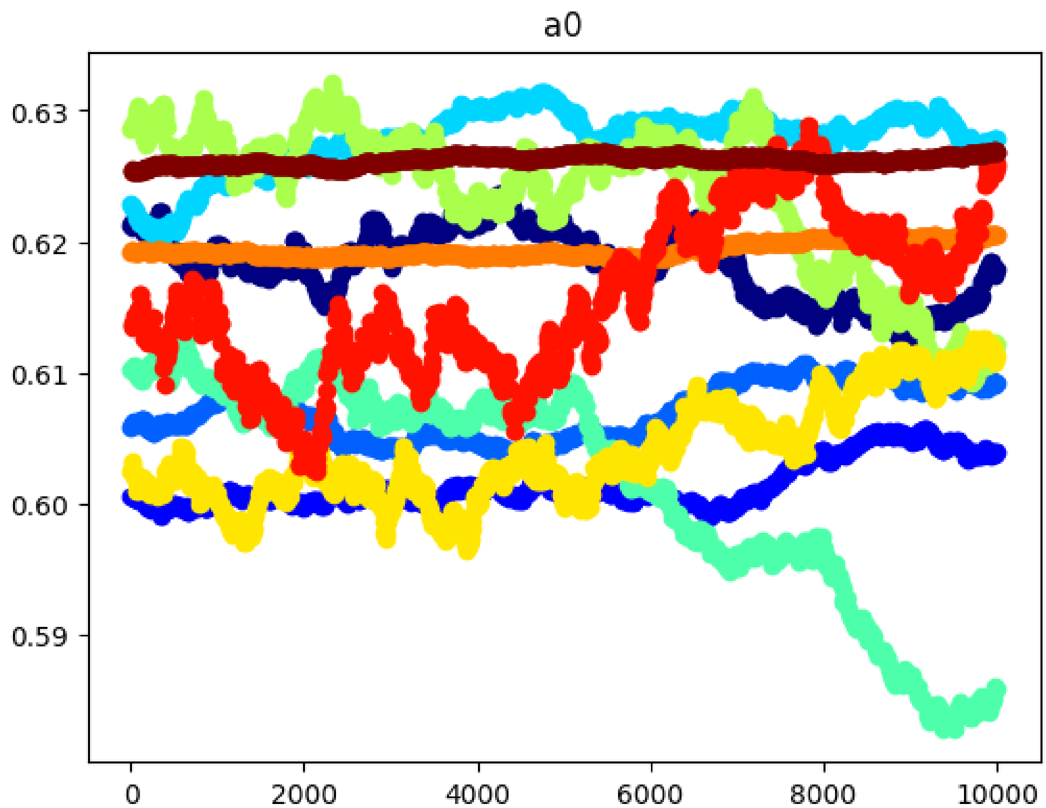

kH
posterior
prior
0
1
2
3
4
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0
2
4
6
8
10
12
14
16

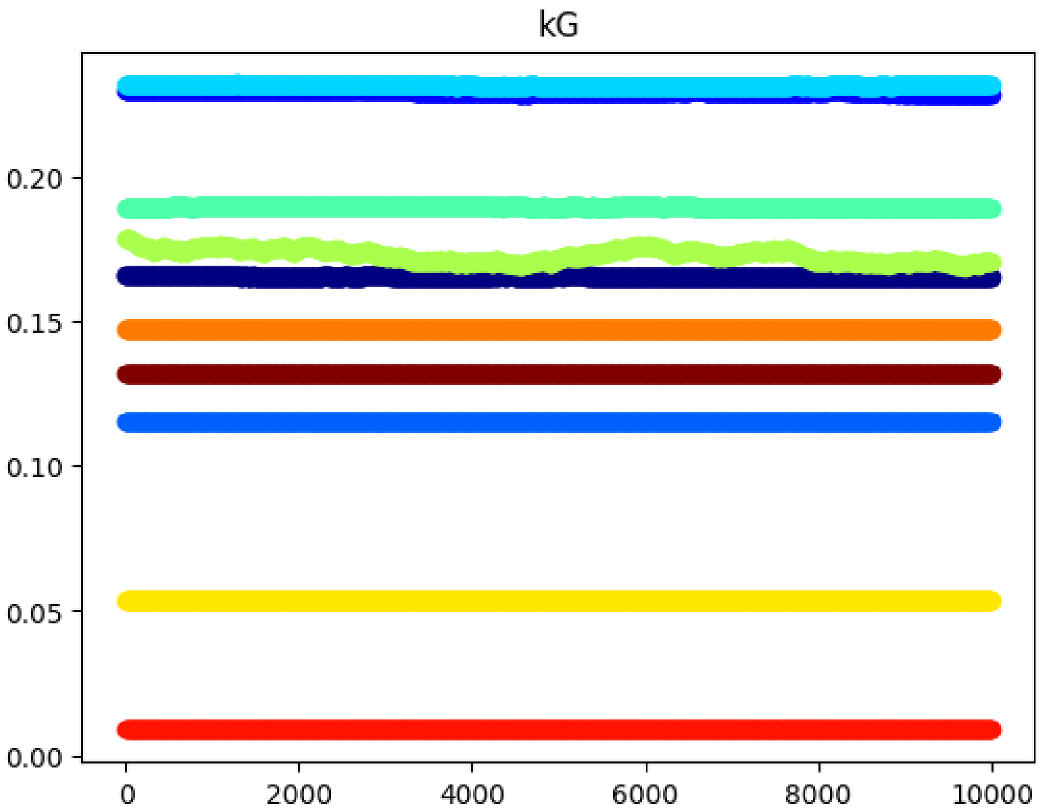

tauH
posterior
prior
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0
5
10
15
20
25

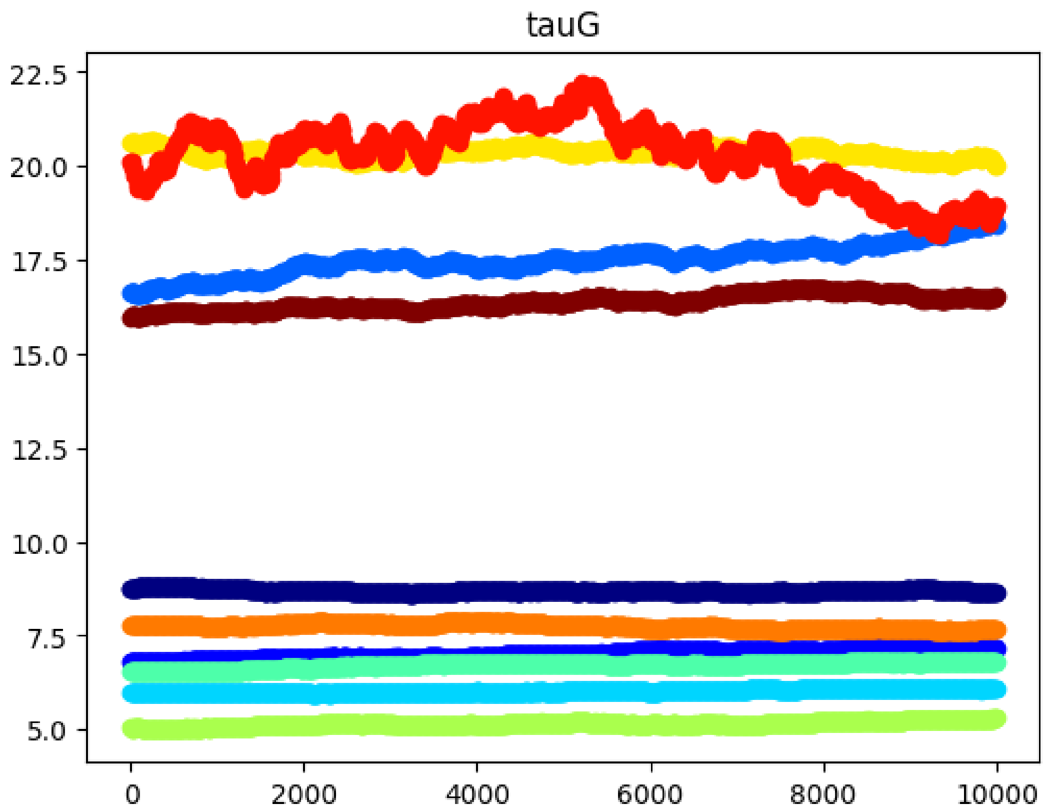

sigma
1e−7+1.5957e−2
posterior
prior
0
20
40
60
80
100
2
3
4
5
6
7
0.025
0.050
0.075
0.100
0.125
0.150
0.175
0.200

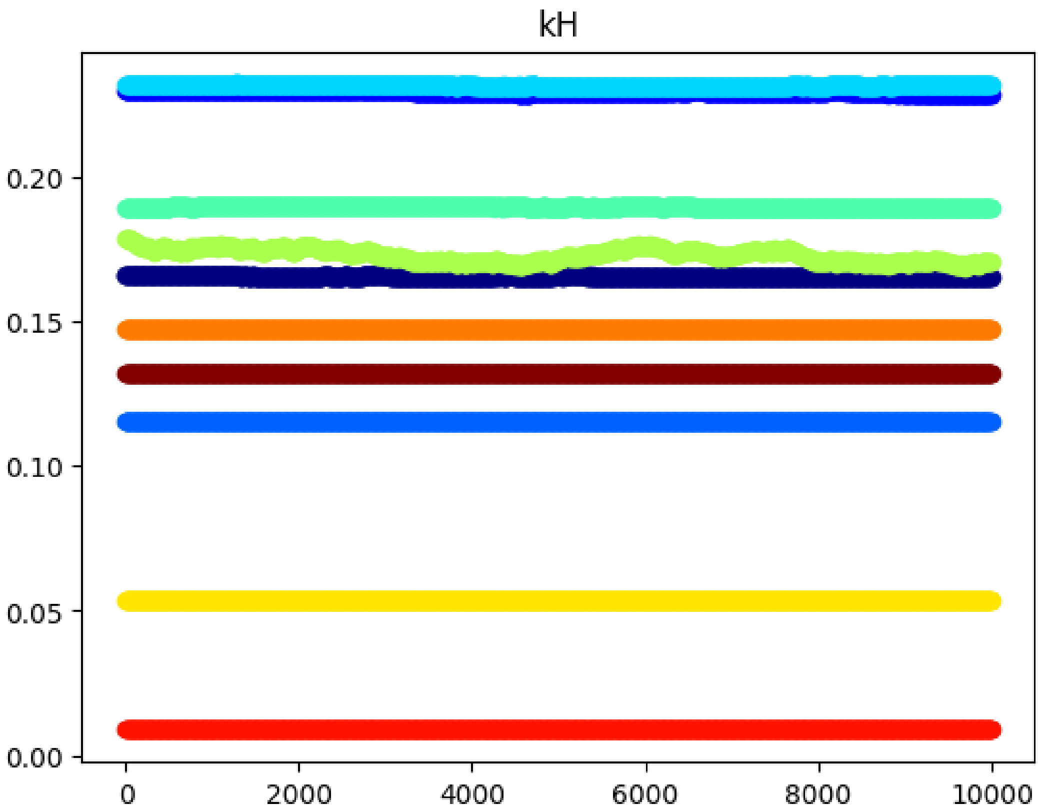

Performance prediction
Fitness + fatigue, athlete: F5
Observation
Prediction
0.775
0.750
0.725
0.700
0.675
0.650
0.625
Performance
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

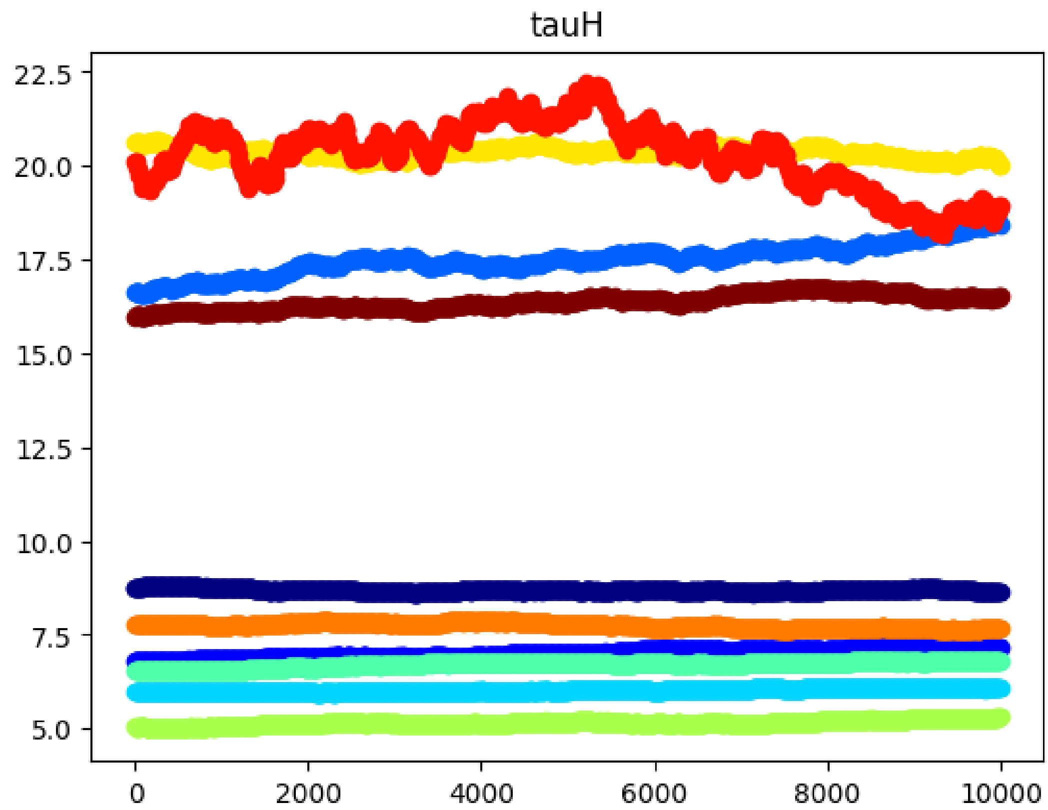

Hidden states
Fitness + fatigue, athlete: F5
fitness
fatigue
8000
6000
4000
2000
0
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15


a0
0.63
0.62
0.61
0.60
0.59
0
2000
4000
6000
8000
10000

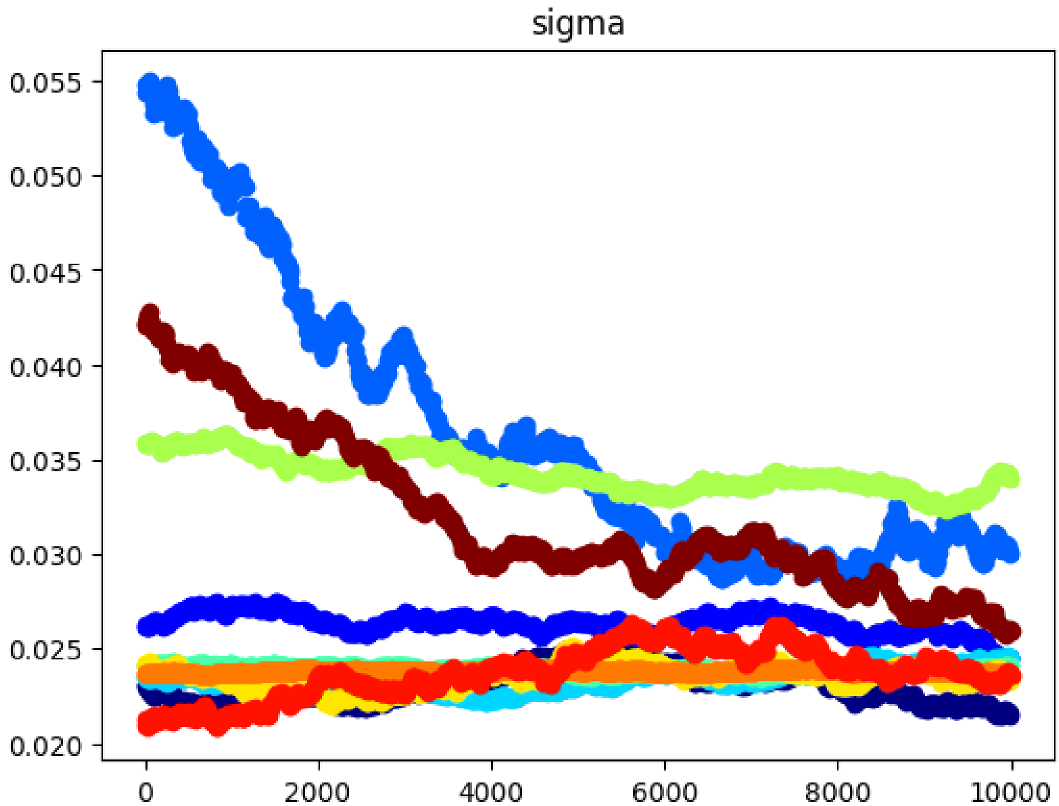

kG
0.20
0.15
0.10
0.05
0.00
0
2000
4000
6000
8000
10000

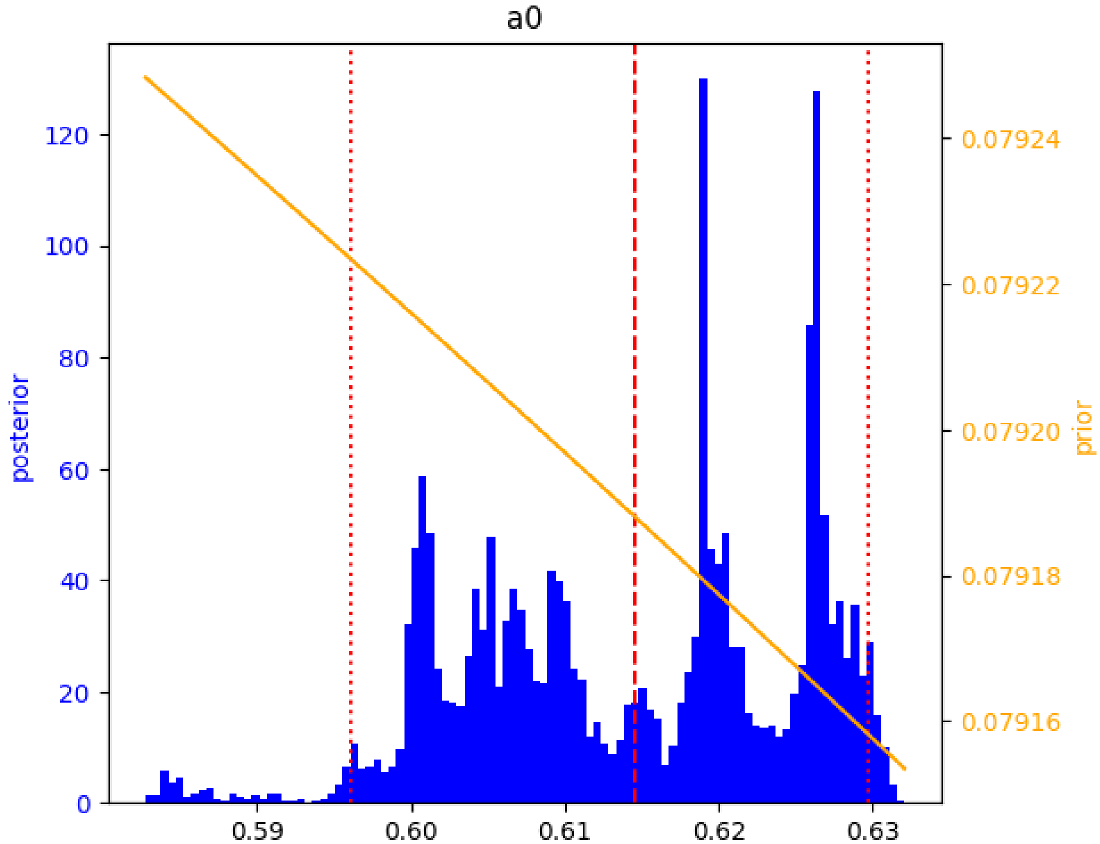

tauG
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
0
2000
4000
6000
8000
10000


kH
0.20
0.15
0.10
0.05
0.00
0
2000
4000
6000
8000
10000

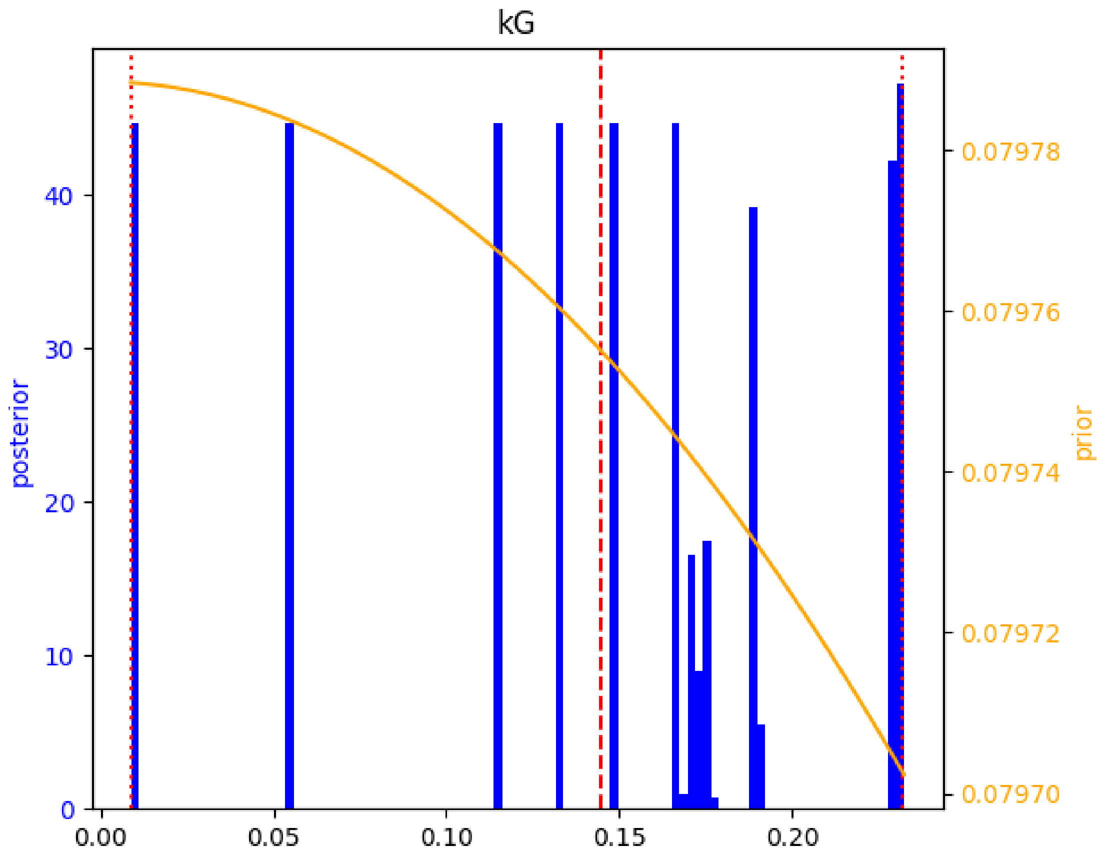


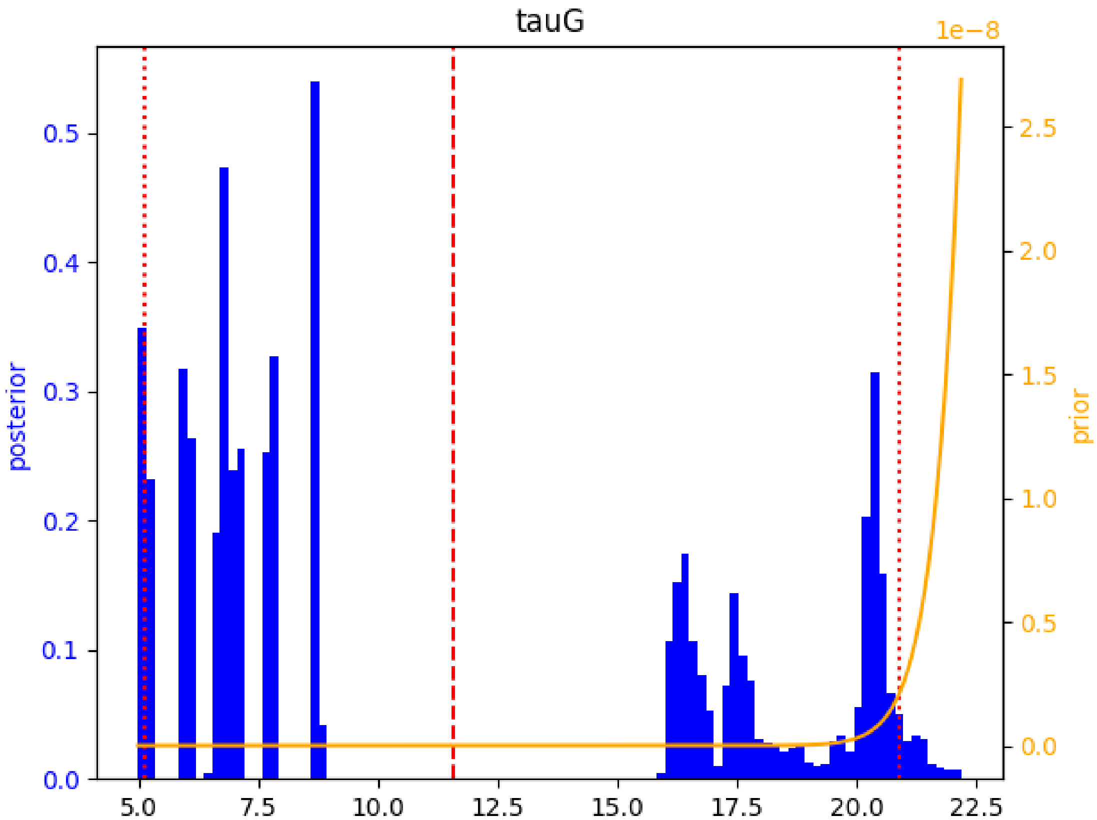
tauH
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
0
2000
4000
6000
8000
10000

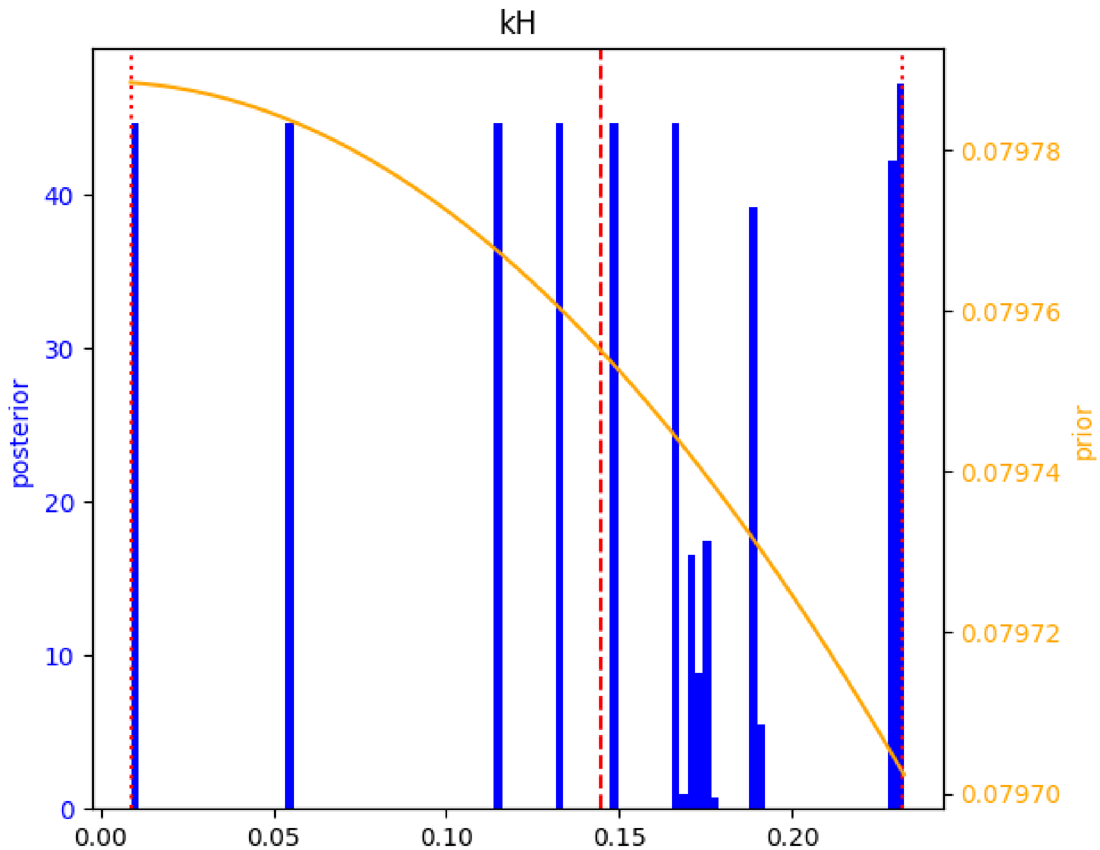

sigma
0.055
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0
2000
4000
6000
8000
10000

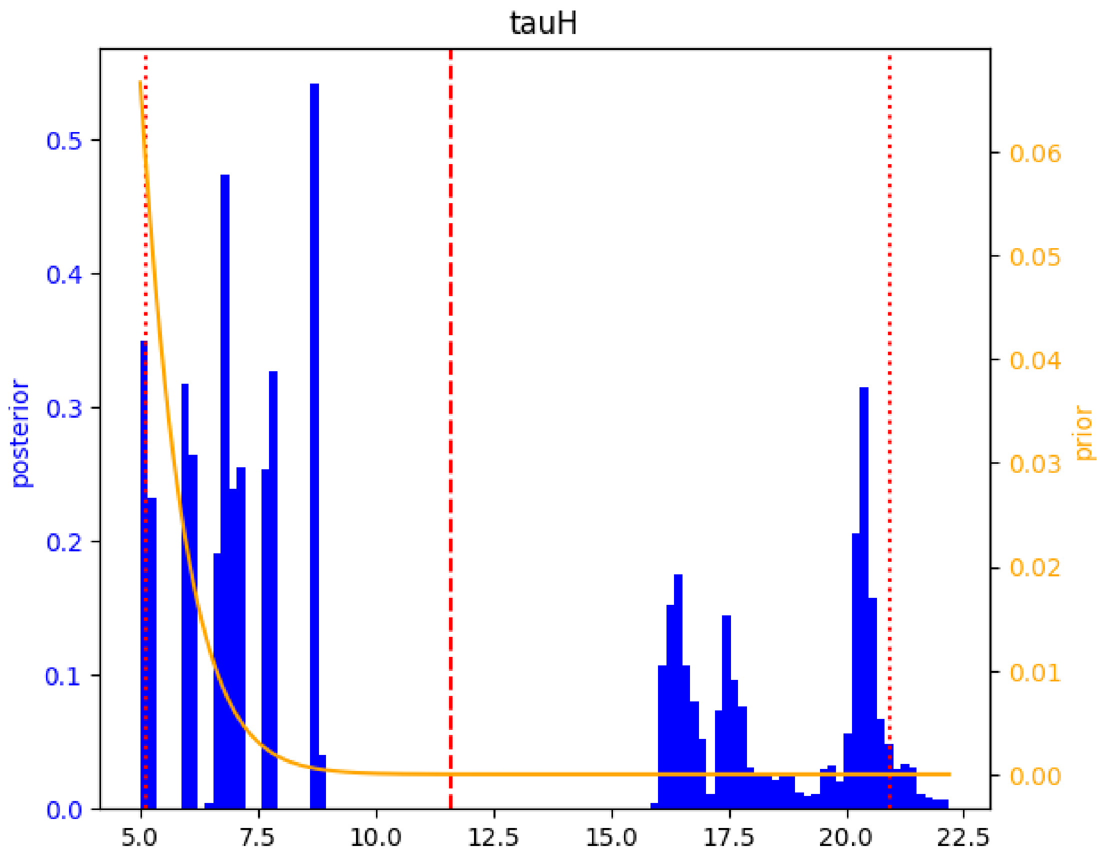


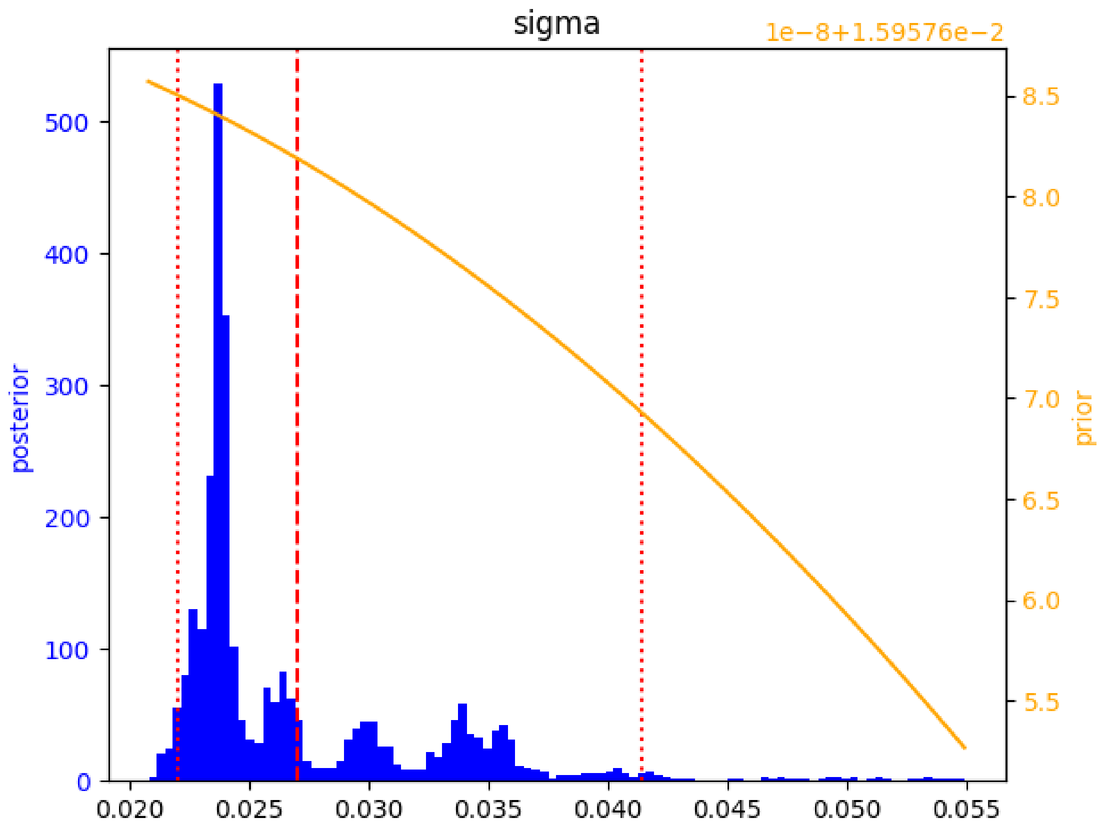
a0
posterior
prior
0
20
40
60
80
100
120
0.59
0.60
0.61
0.62
0.63
0.07916
0.07918
0.07920
0.07922
0.07924


kG
posterior
prior
0
10
20
30
40
0.07970
0.07972
0.07974
0.07976
0.07978
0.00
0.05
0.10
0.15
0.20

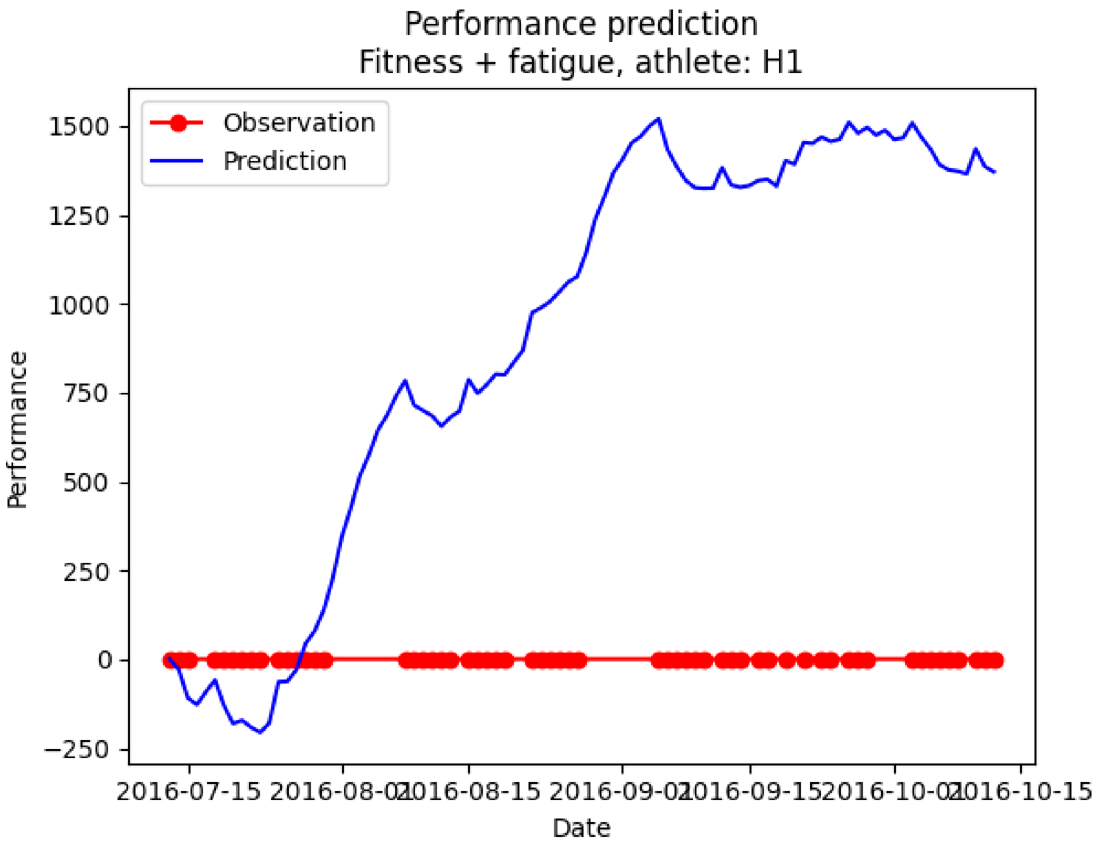

tauG
1e−8
posterior
prior
0.0
0.1
0.2
0.3
0.4
0.5
0.0
0.5
1.0
1.5
2.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5

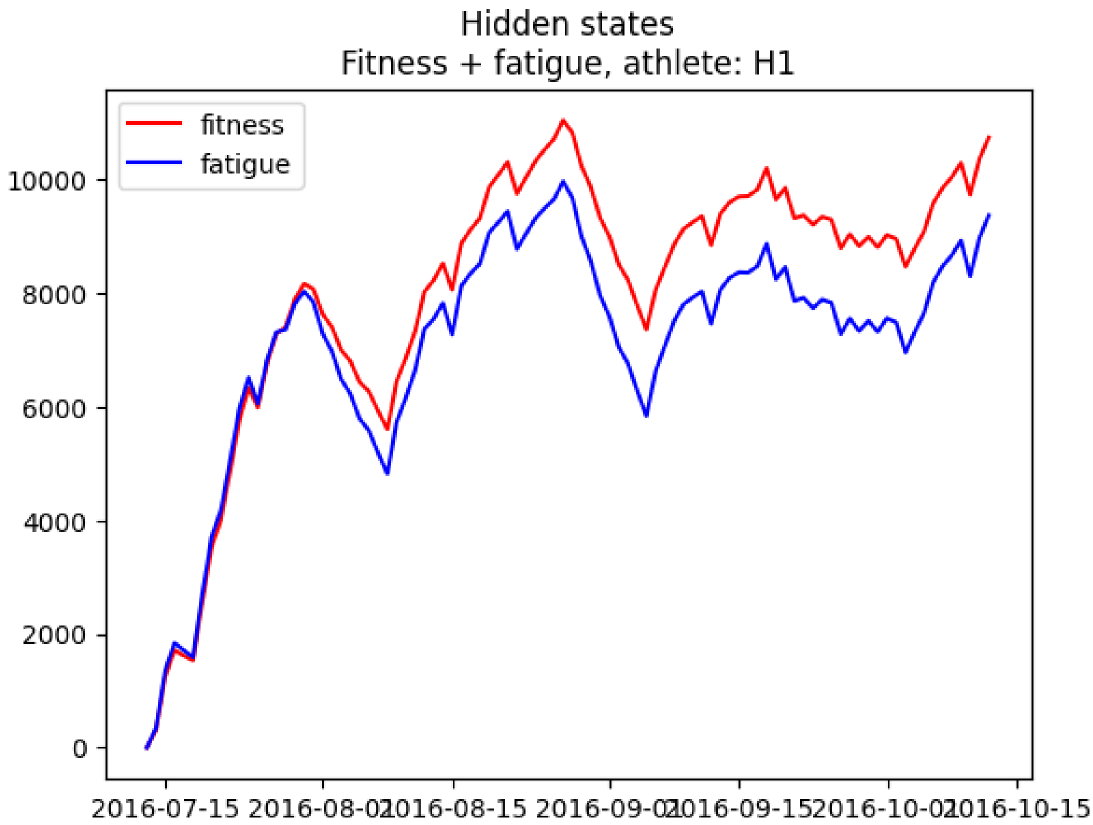

kH
posterior
prior
0
10
20
30
40
0.00
0.05
0.10
0.15
0.20
0.07970
0.07972
0.07974
0.07976
0.07978


tauH
posterior
prior
0.0
0.1
0.2
0.3
0.4
0.5
0.00
0.01
0.02
0.03
0.04
0.05
0.06
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5

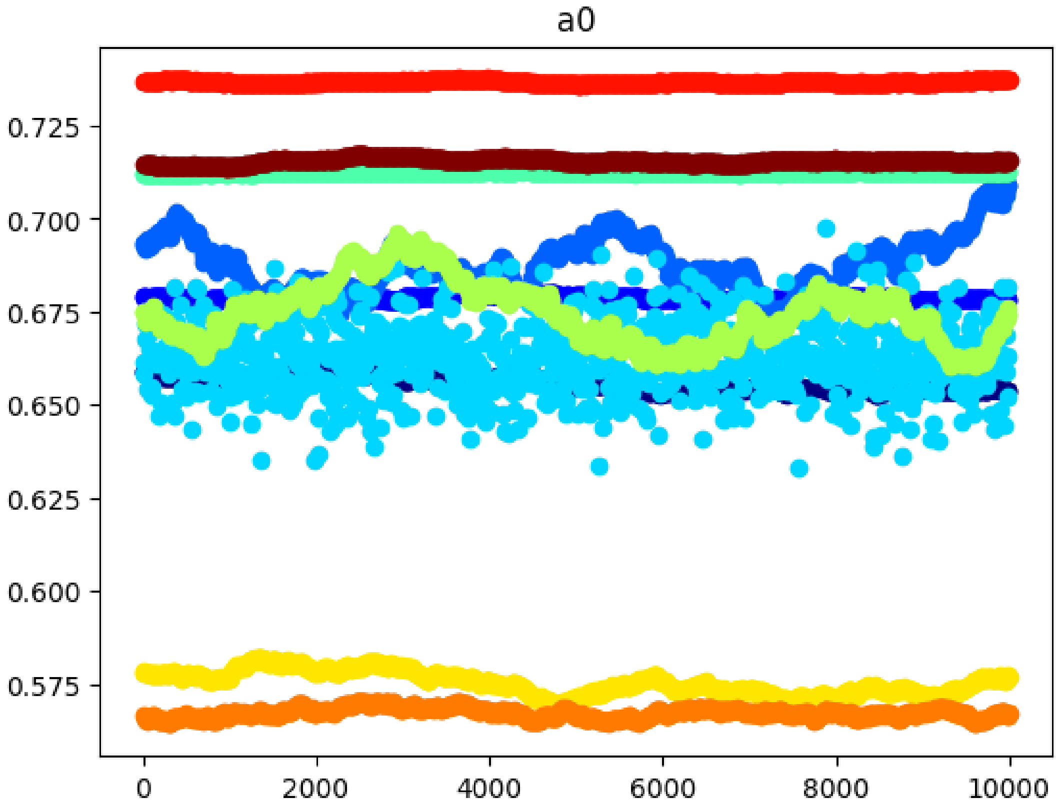


sigma
1e−8+1.59576e−2
posterior
prior
0
100
200
300
400
500
5.5
6.0
6.5
7.0
7.5
8.0
8.5
0.020
0.025
0.030
0.035
0.040
0.045
0.050
0.055

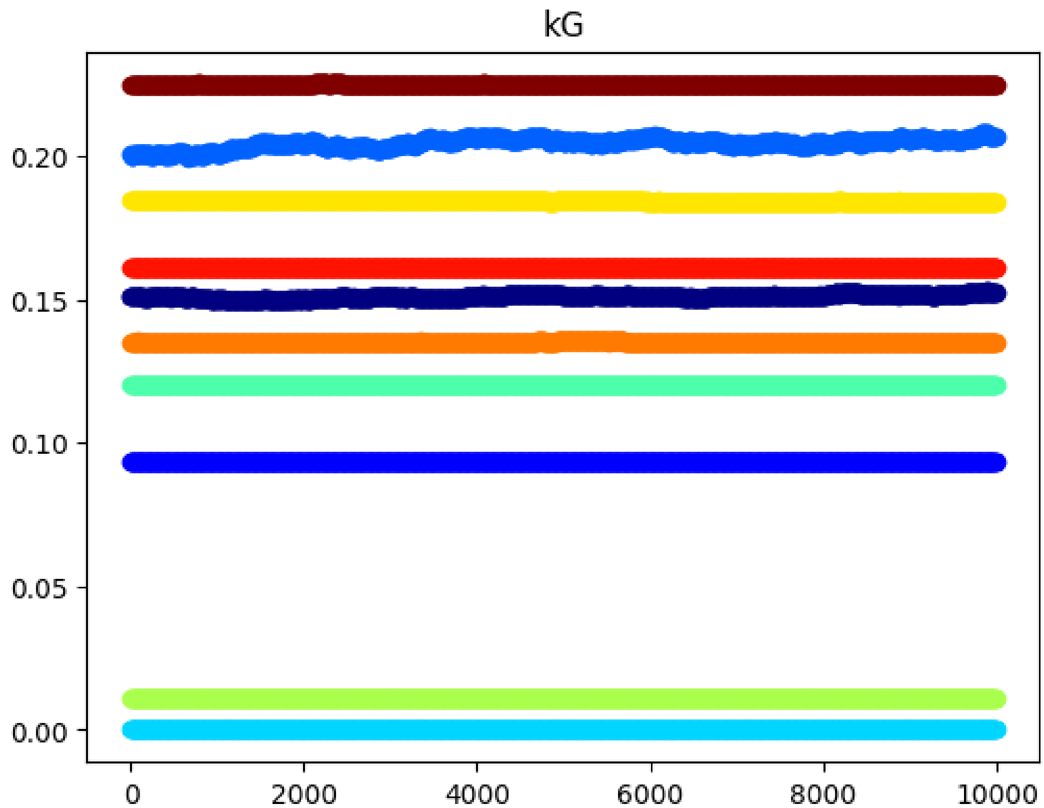

Performance prediction
Fitness + fatigue, athlete: H1
Observation
Prediction
1500
1250
1000
750
500
250
0
−250
Performance
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

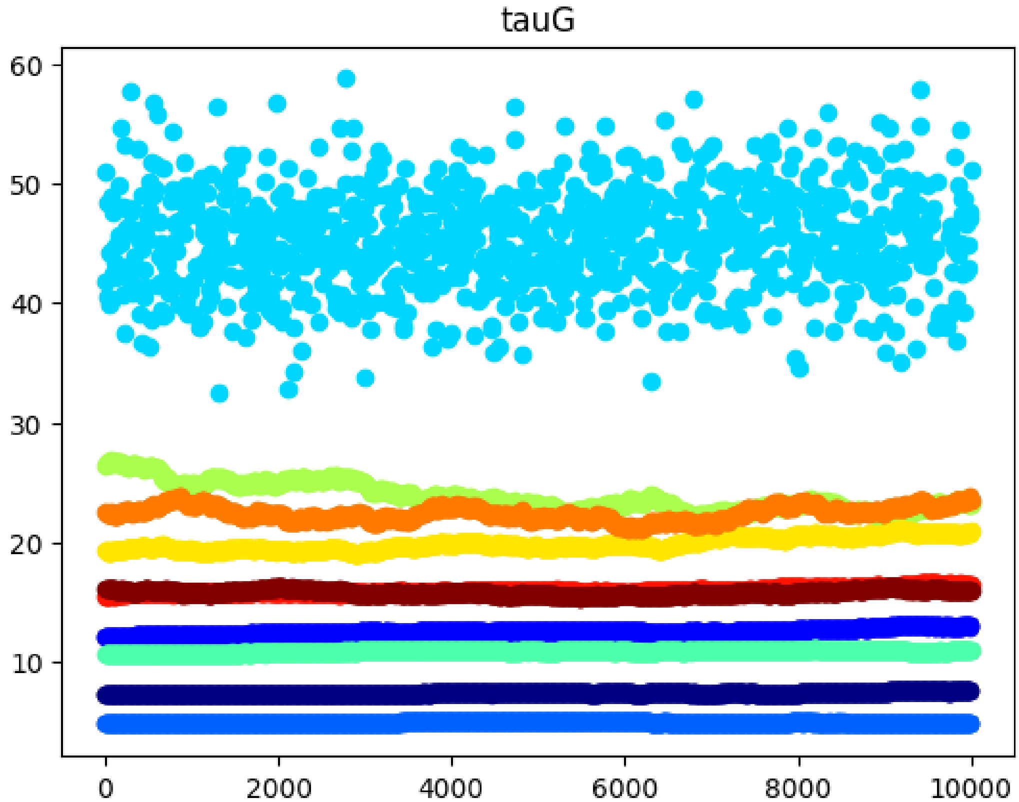


Hidden states
Fitness + fatigue, athlete: H1
fitness
fatigue
10000
8000
6000
4000
2000
0
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

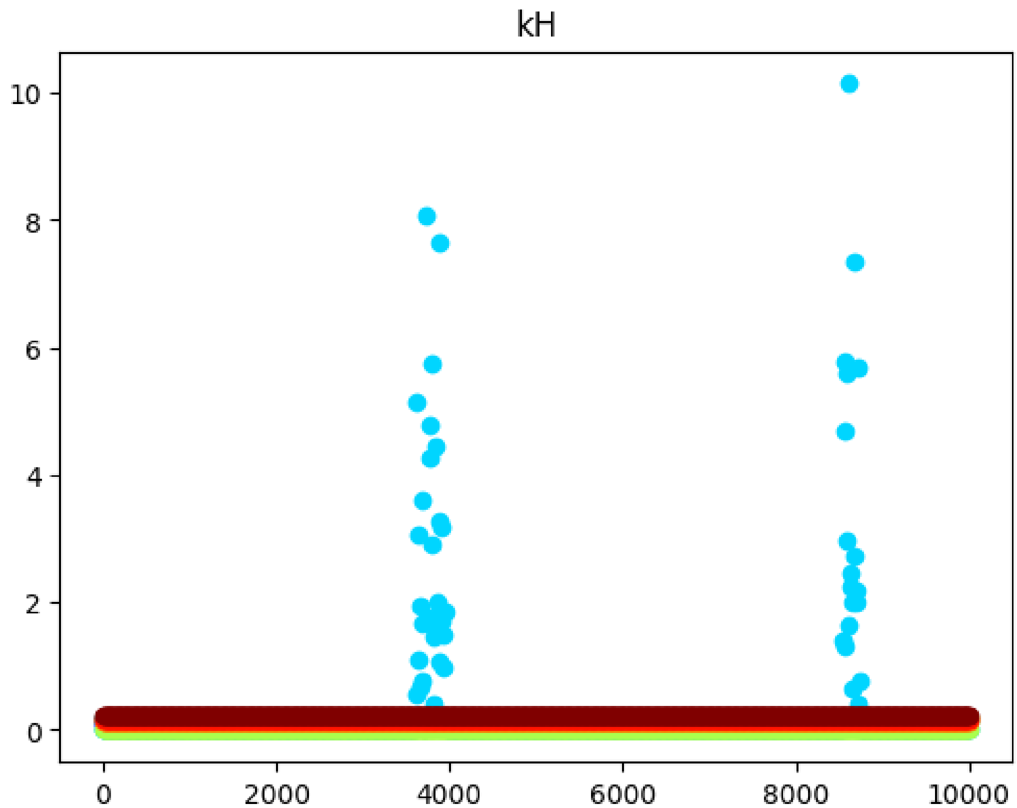


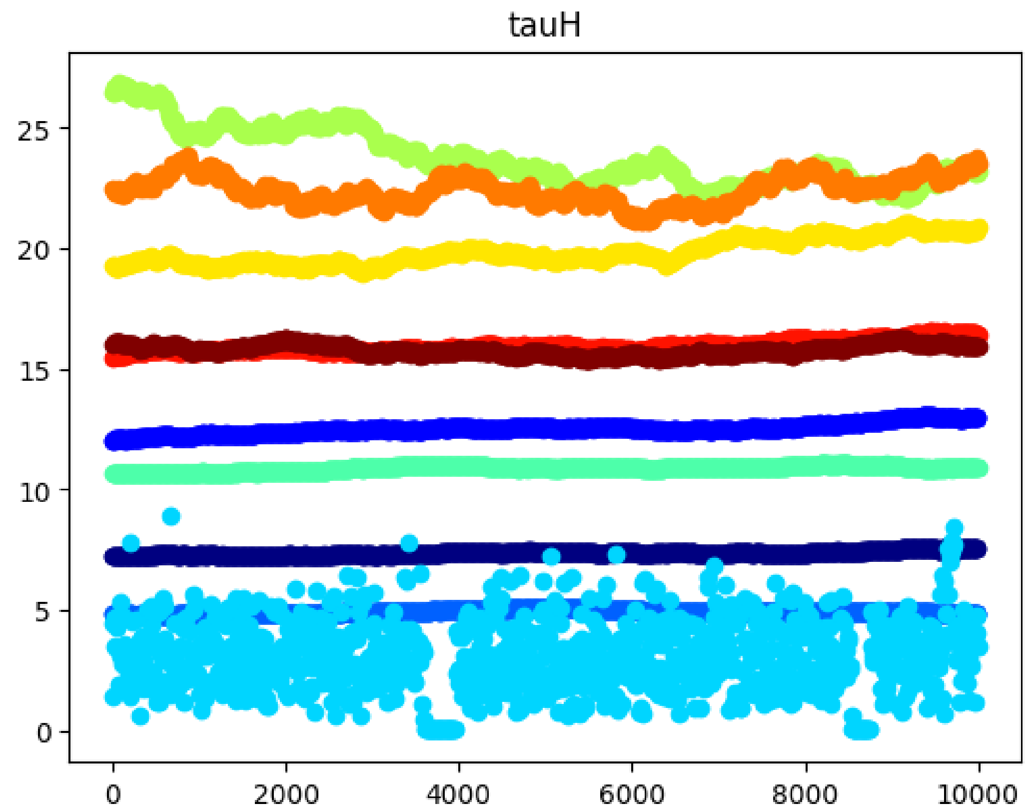
a0
0.725
0.700
0.675
0.650
0.625
0.600
0.575
0
2000
4000
6000
8000
10000

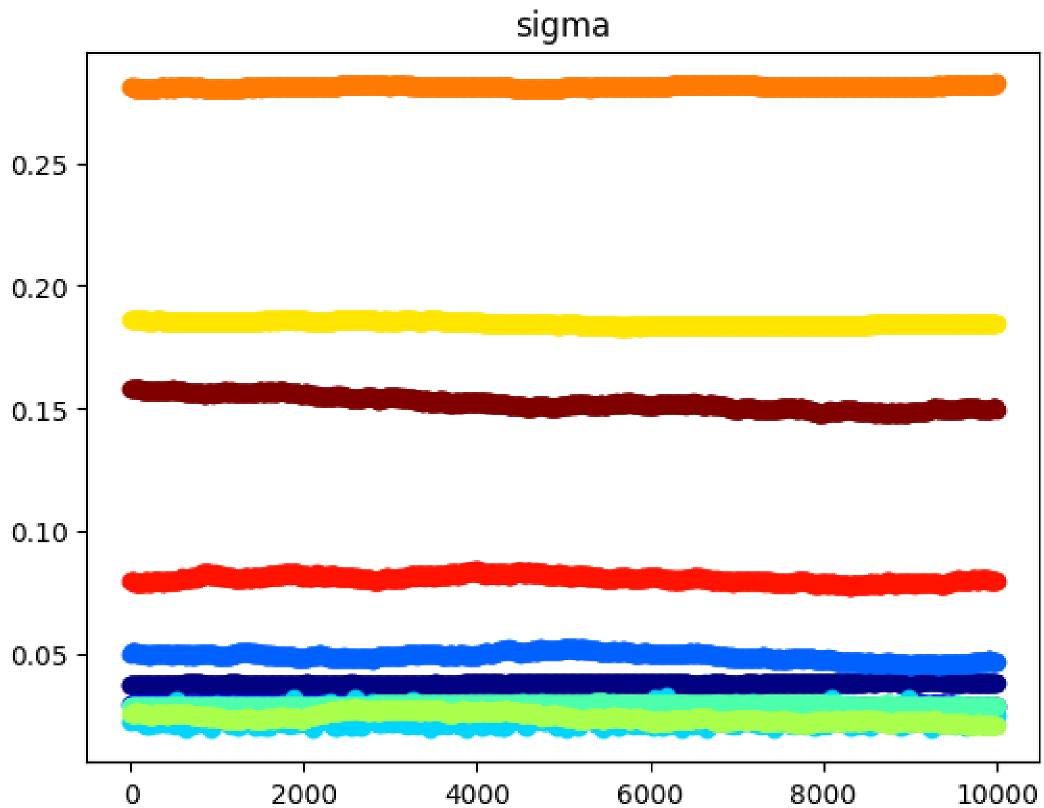

kG
0.20
0.15
0.10
0.05
0.00
0
2000
4000
6000
8000
10000

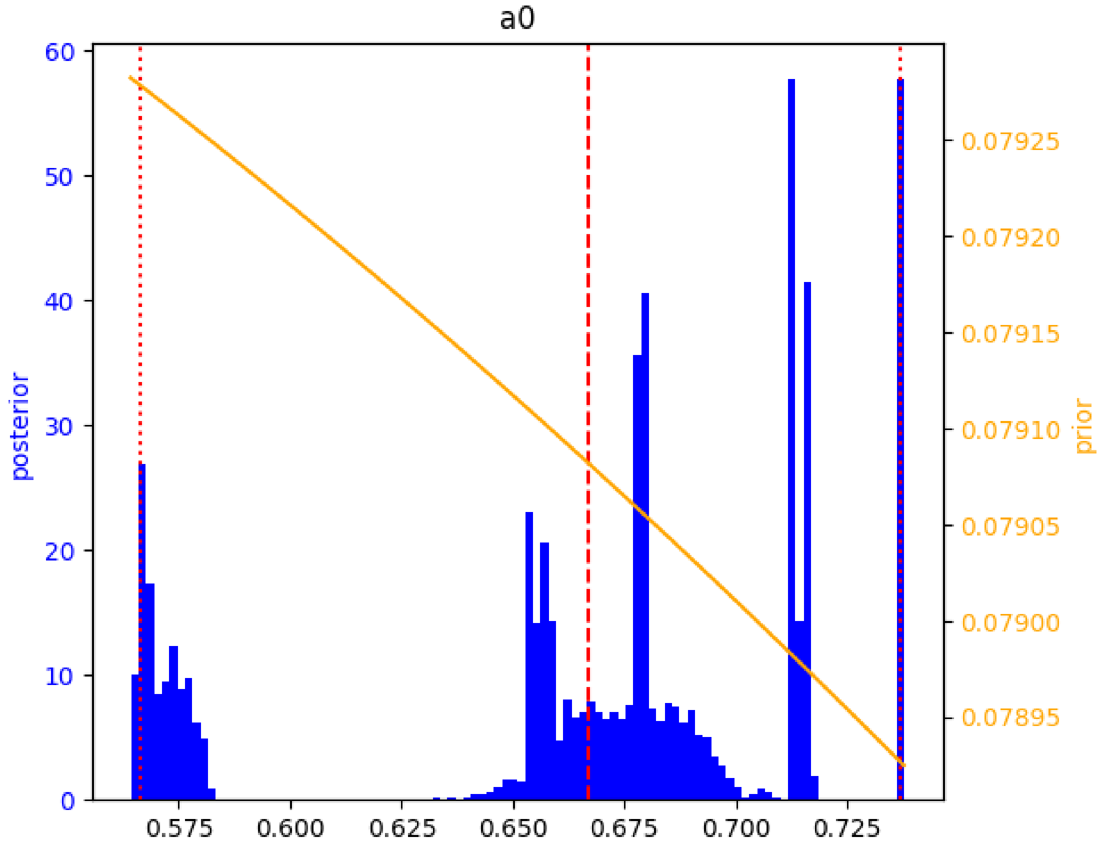


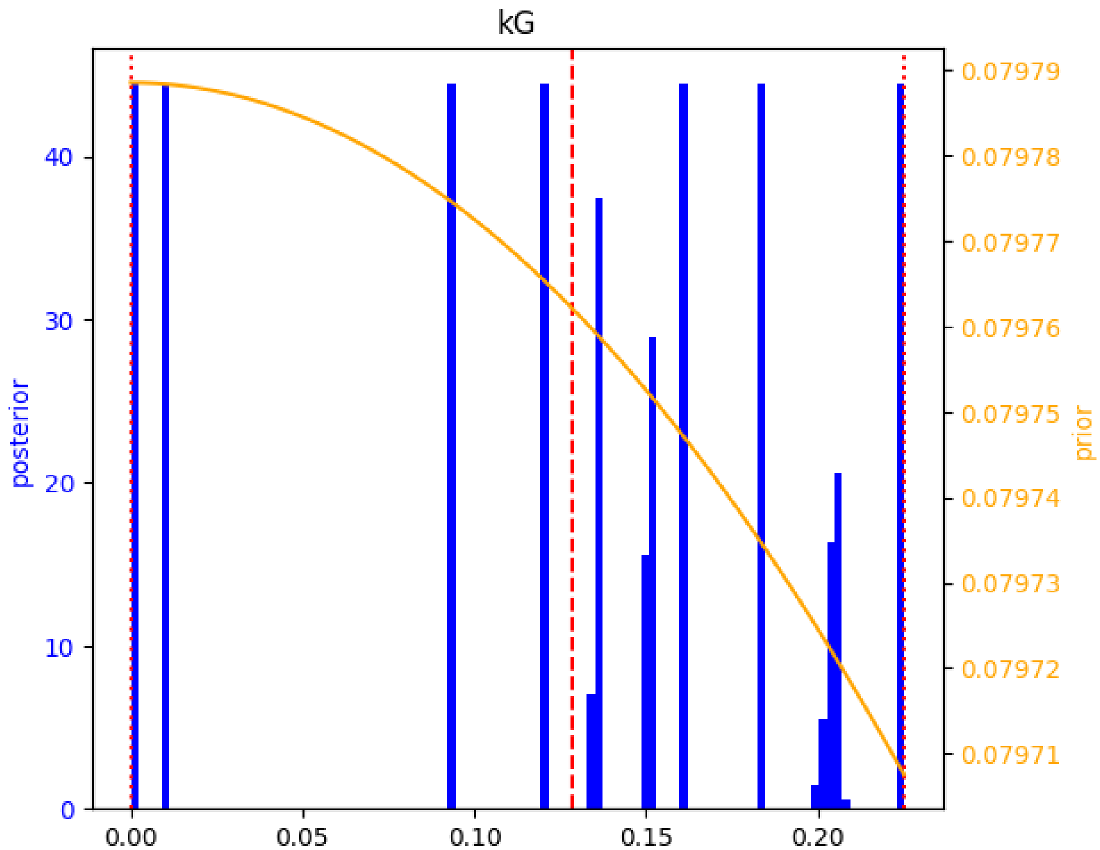
tauG
60
50
40
30
20
10
0
2000
4000
6000
8000
10000

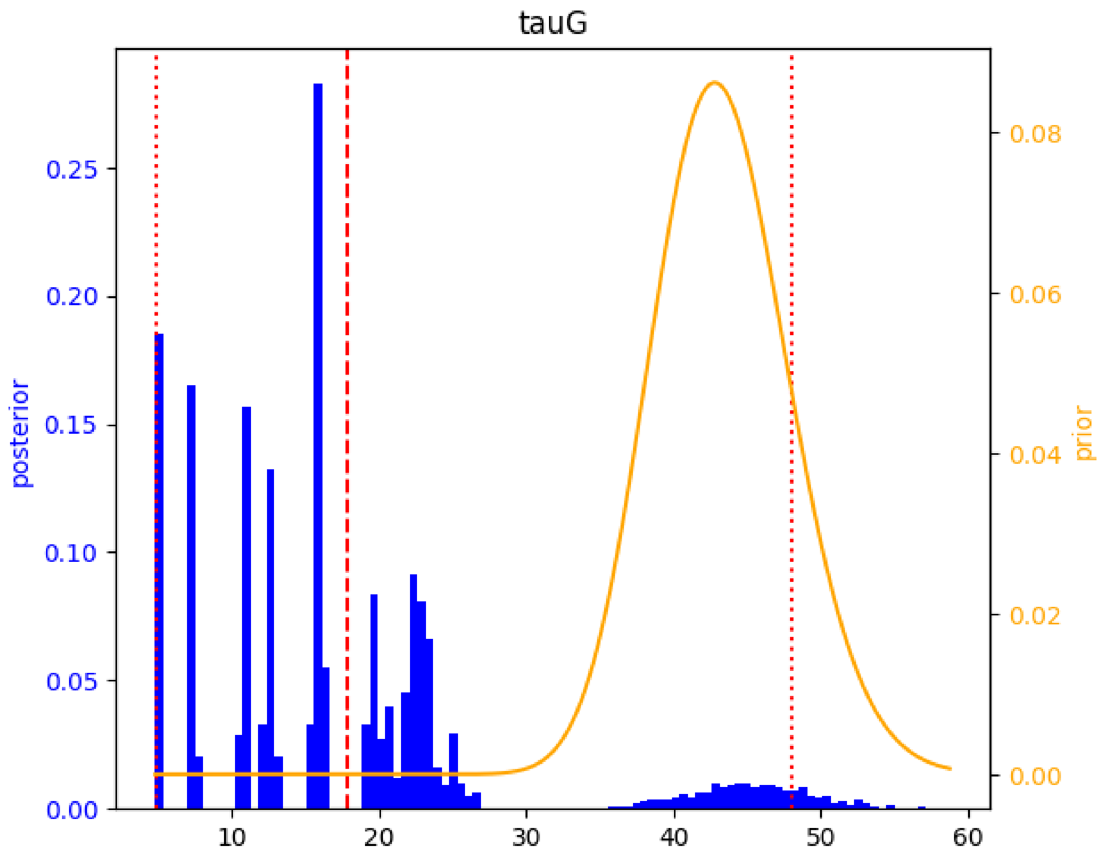

kH
10
8
6
4
2
0
0
2000
4000
6000
8000
10000

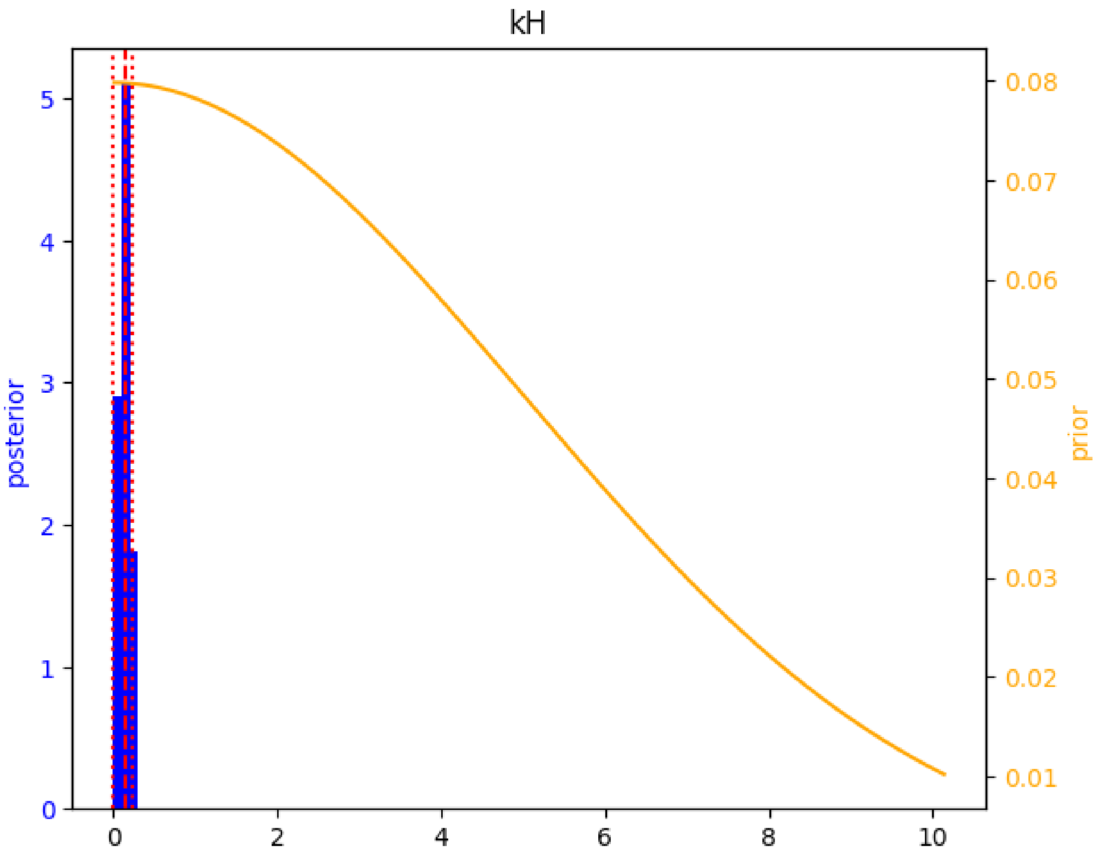

tauH
25
20
15
10
5
0
0
2000
4000
6000
8000
10000

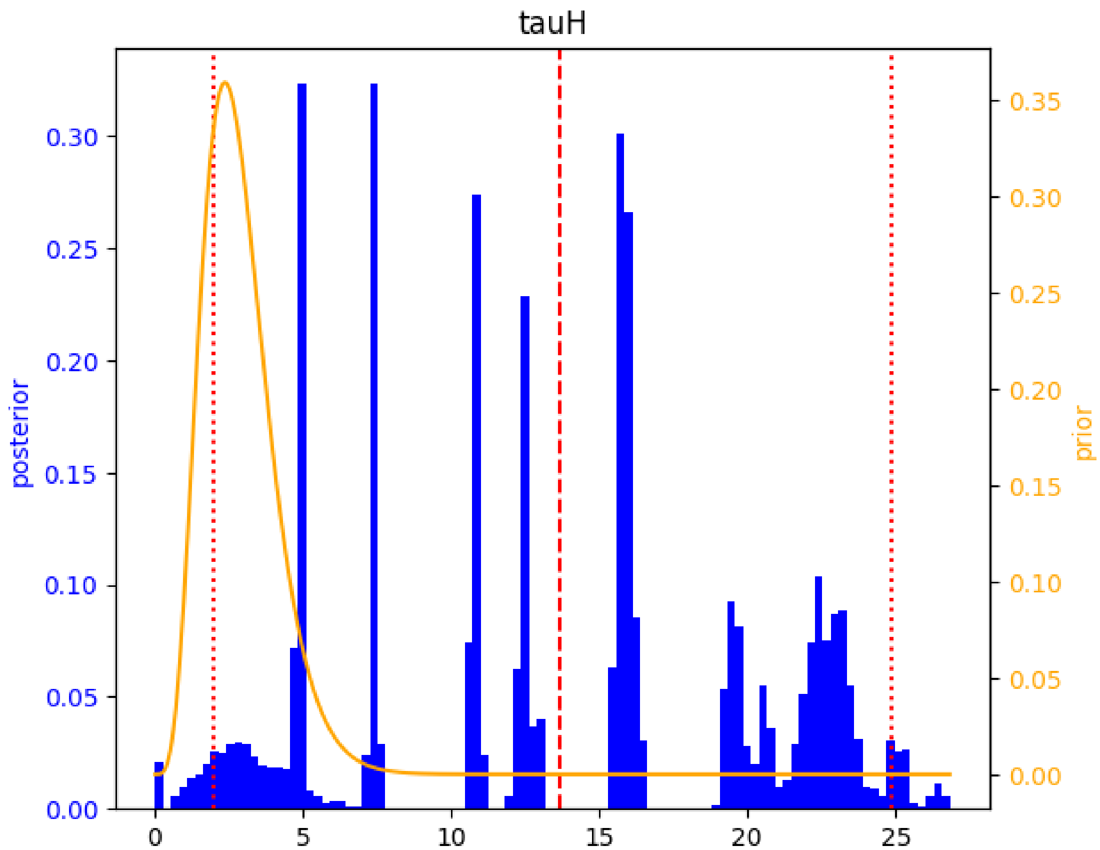

sigma
0.25
0.20
0.15
0.10
0.05
0
2000
4000
6000
8000
10000

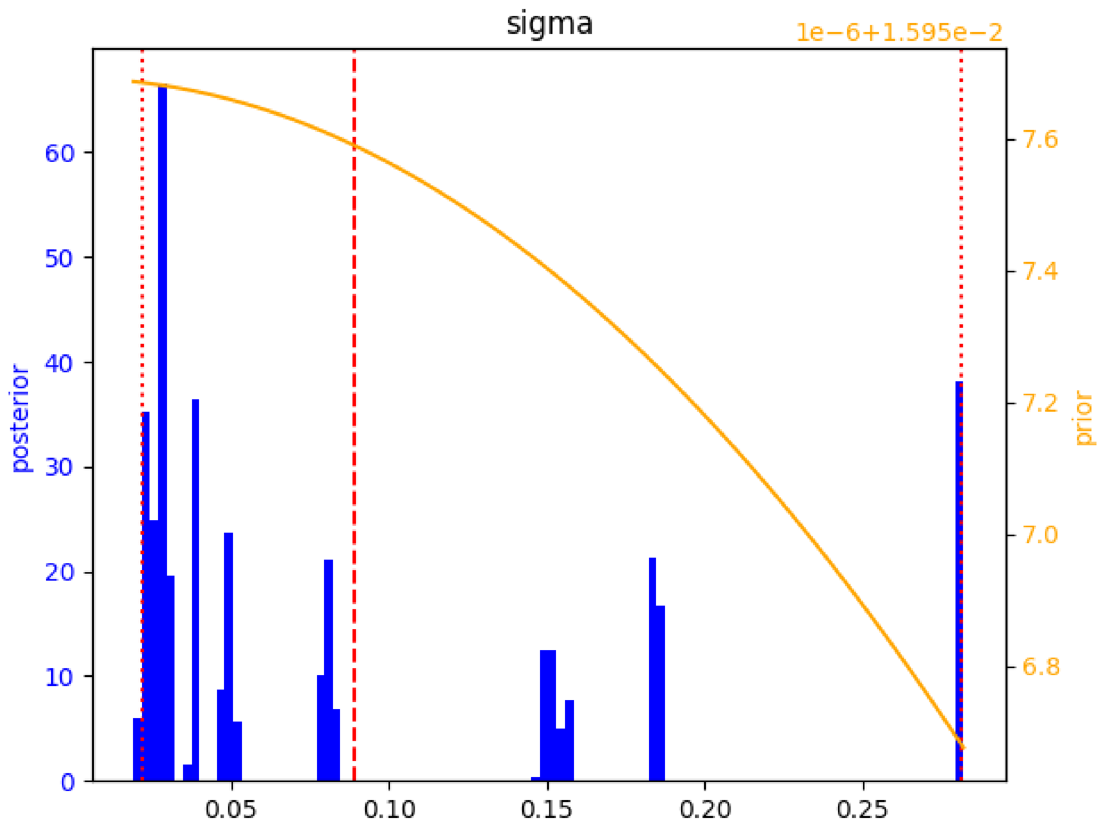

a0
posterior
prior
0
10
20
30
40
50
60
0.07895
0.07900
0.07905
0.07910
0.07915
0.07920
0.07925
0.575
0.600
0.625
0.650
0.675
0.700
0.725

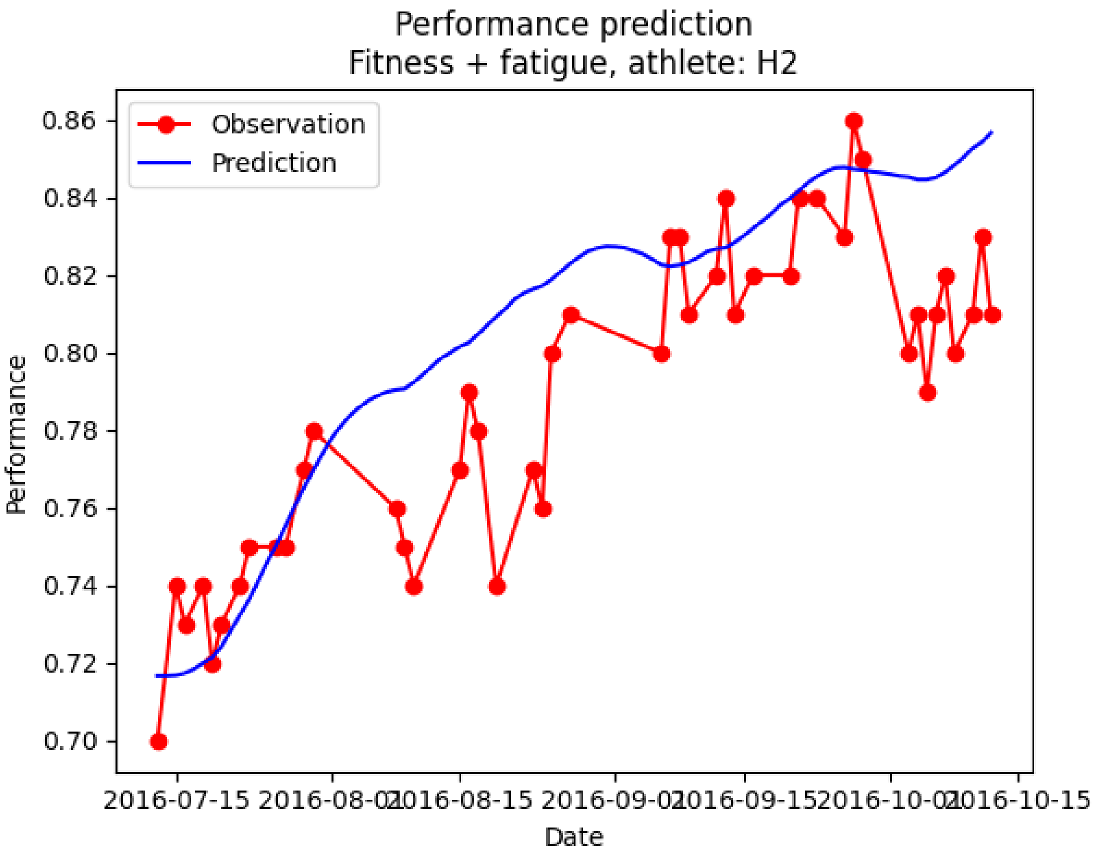

kG
posterior
prior
0
10
20
30
40
0.00
0.05
0.10
0.15
0.20
0.07971
0.07972
0.07973
0.07974
0.07975
0.07976
0.07977
0.07978
0.07979

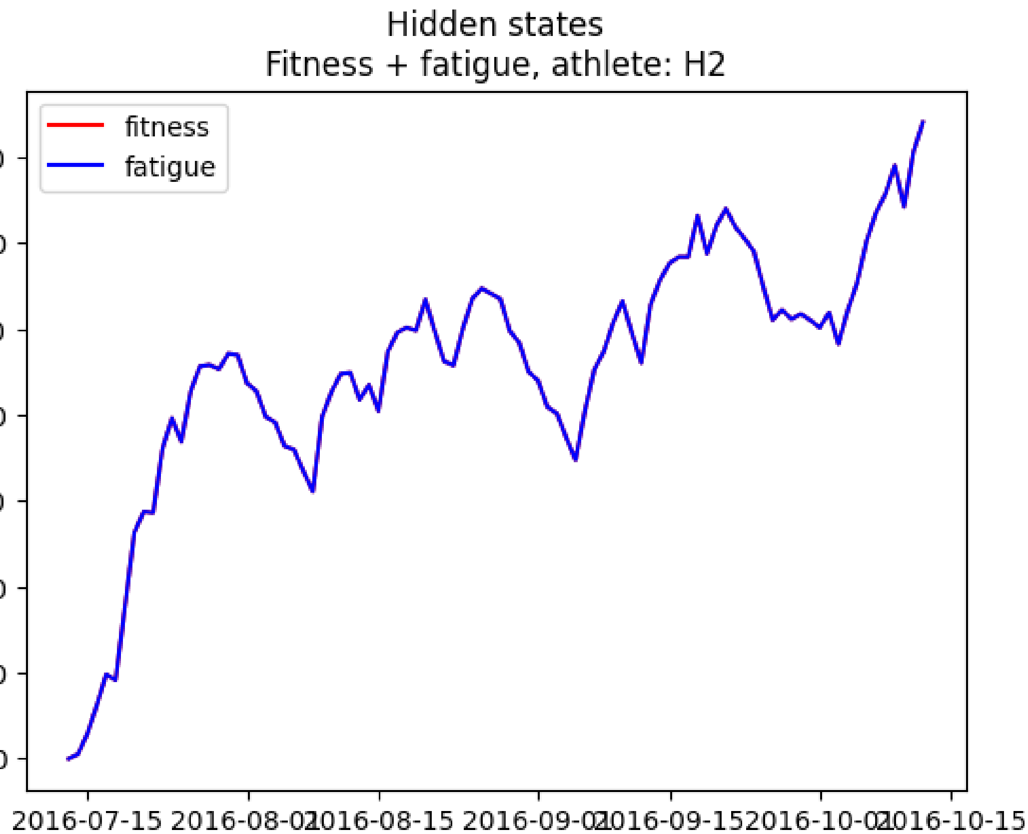

tauG
posterior
prior
0.00
0.05
0.10
0.15
0.20
0.25
0.00
0.02
0.04
0.06
0.08
10
20
30
40
50
60

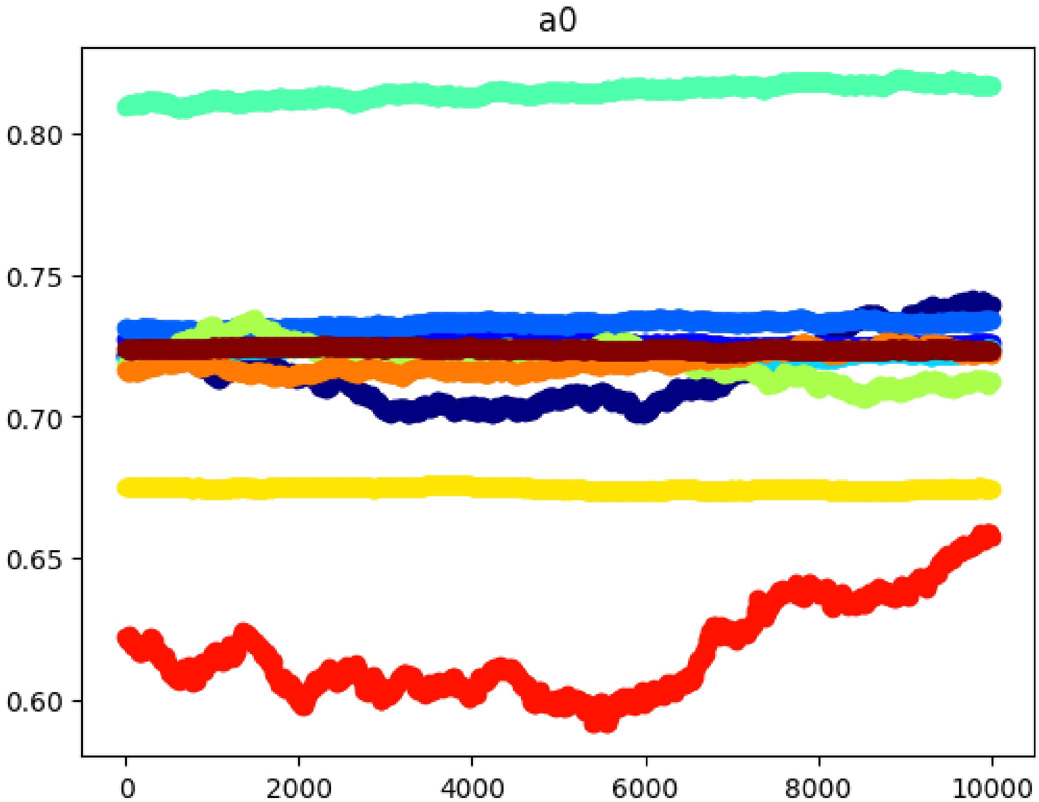

kH
posterior
prior
0
1
2
3
4
5
0
2
4
6
8
10
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08


tauH
posterior
prior
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0
5
10
15
20
25

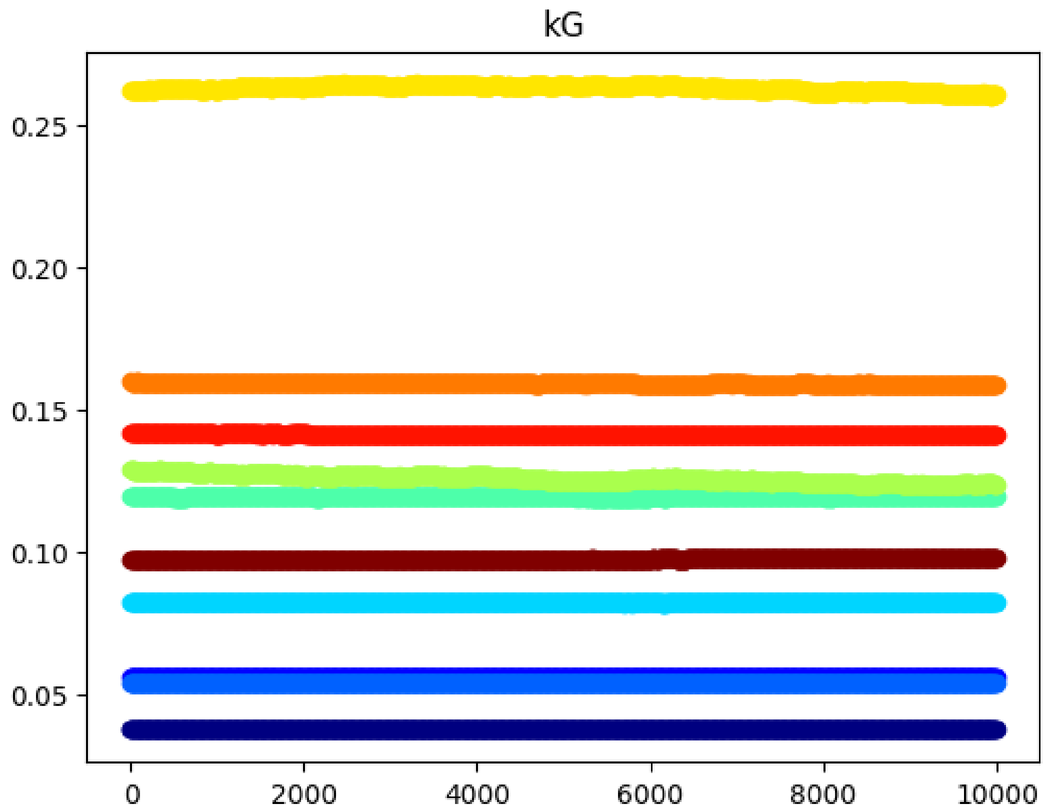

sigma
1e−6+1.595e−2
posterior
prior
0
10
20
30
40
50
60
0.05
0.10
0.15
0.20
0.25
6.8
7.0
7.2
7.4
7.6


Performance prediction
Fitness + fatigue, athlete: H2
Observation
Prediction
0.86
0.84
0.82
0.80
0.78
0.76
0.74
0.72
0.70
Performance
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

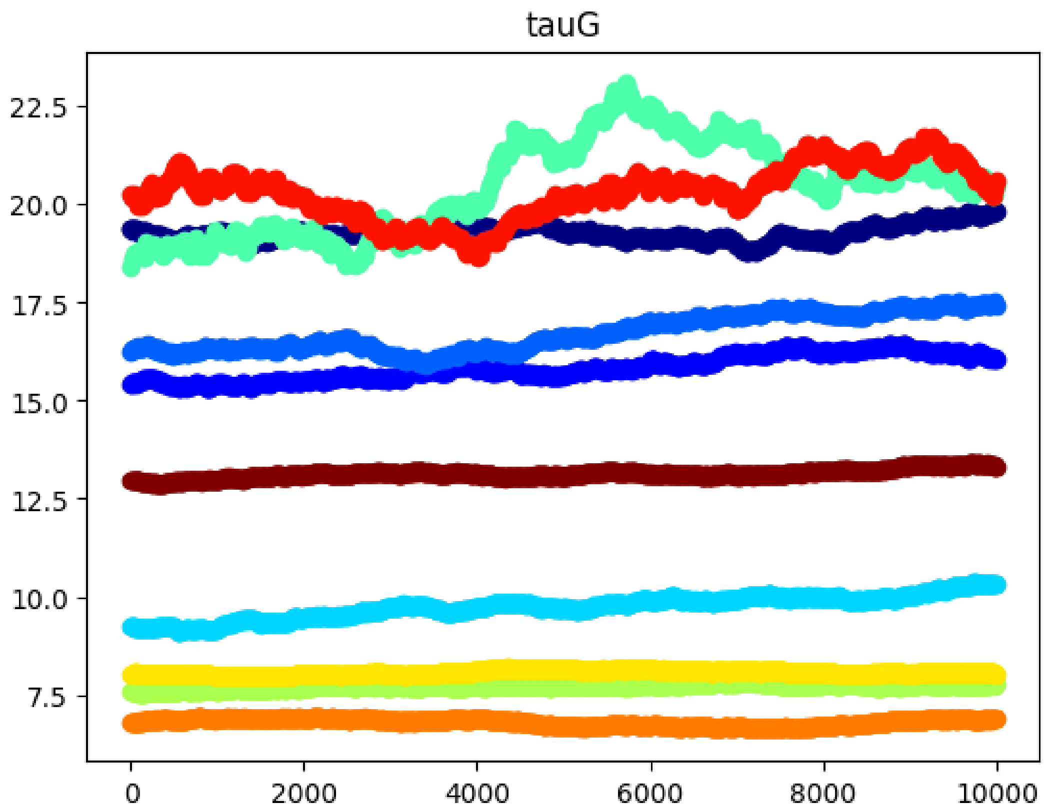

Hidden states
Fitness + fatigue, athlete: H2
fitness
fatigue
7000
6000
5000
4000
3000
2000
1000
0
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

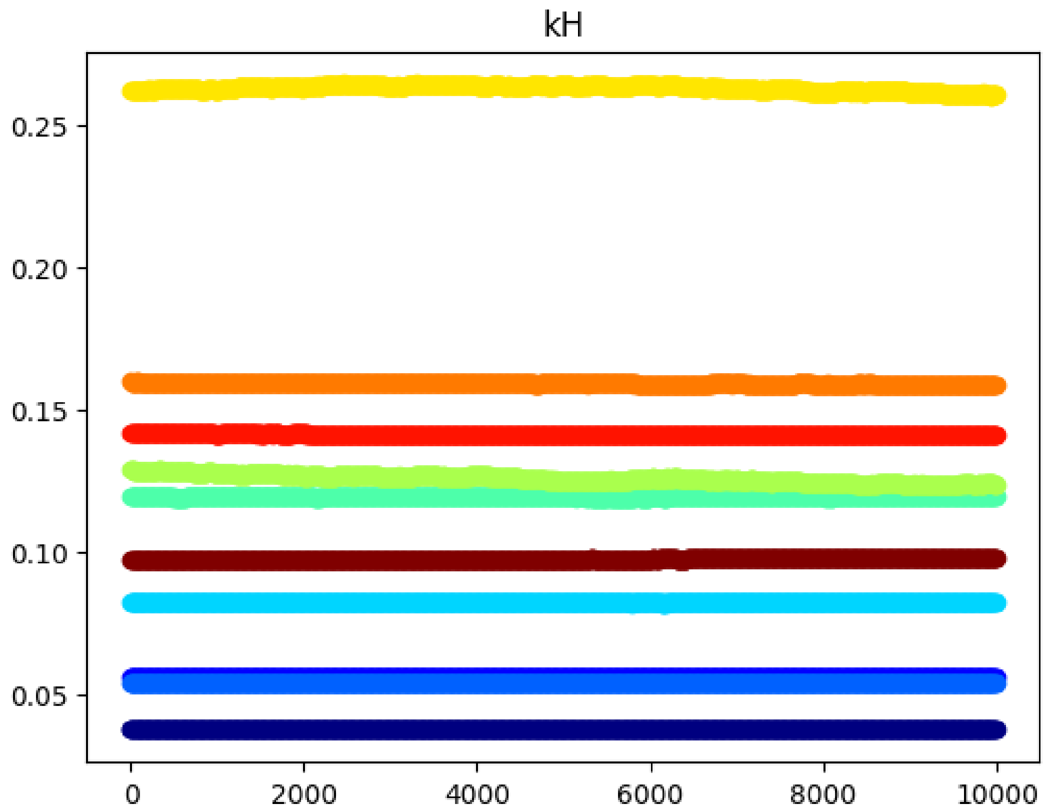


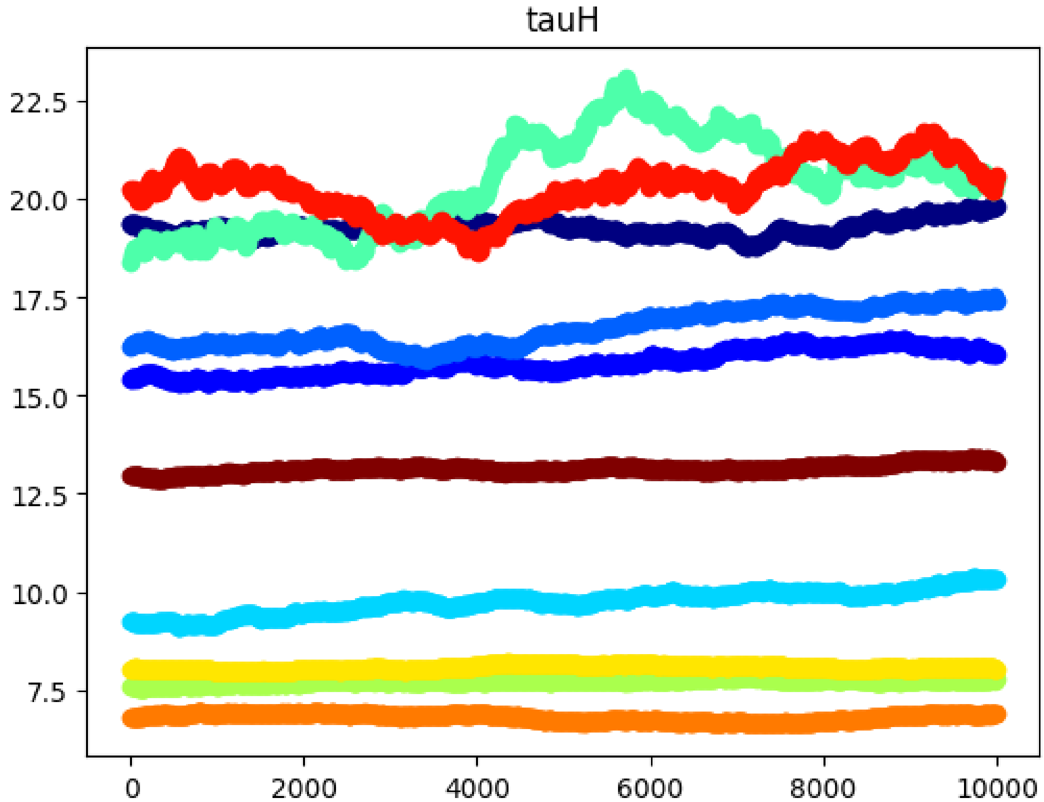
a0
0.80
0.75
0.70
0.65
0.60
0
2000
4000
6000
8000
10000

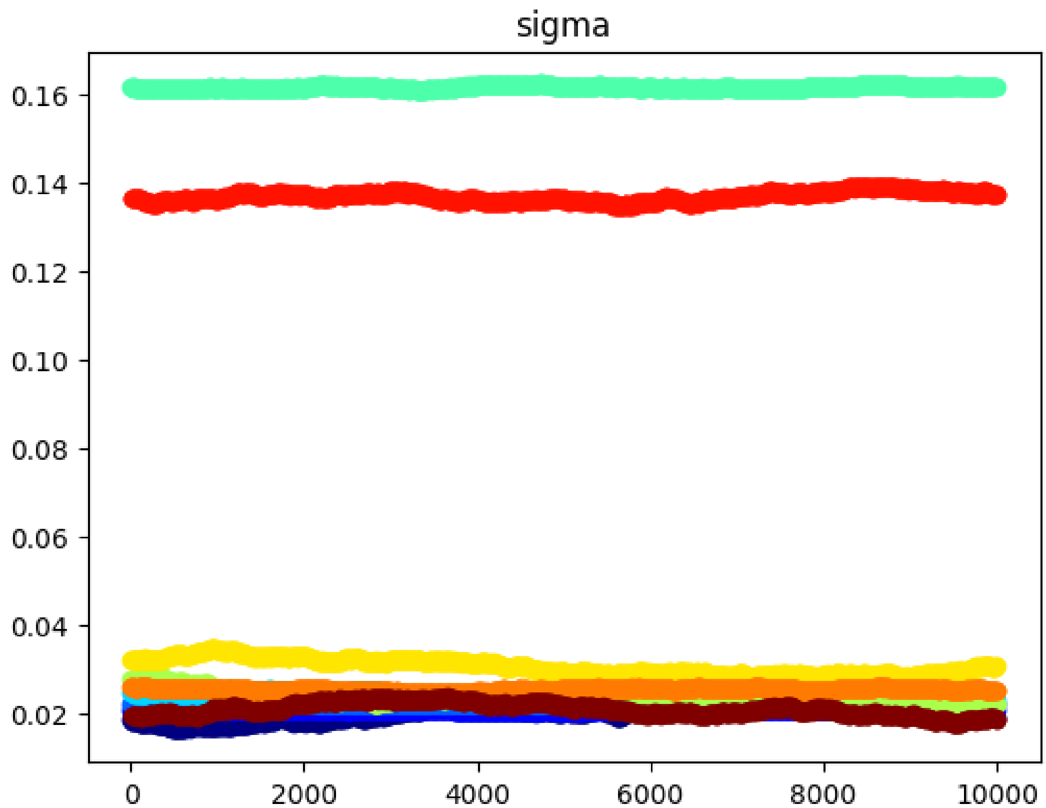


kG
0.25
0.20
0.15
0.10
0.05
0
2000
4000
6000
8000
10000

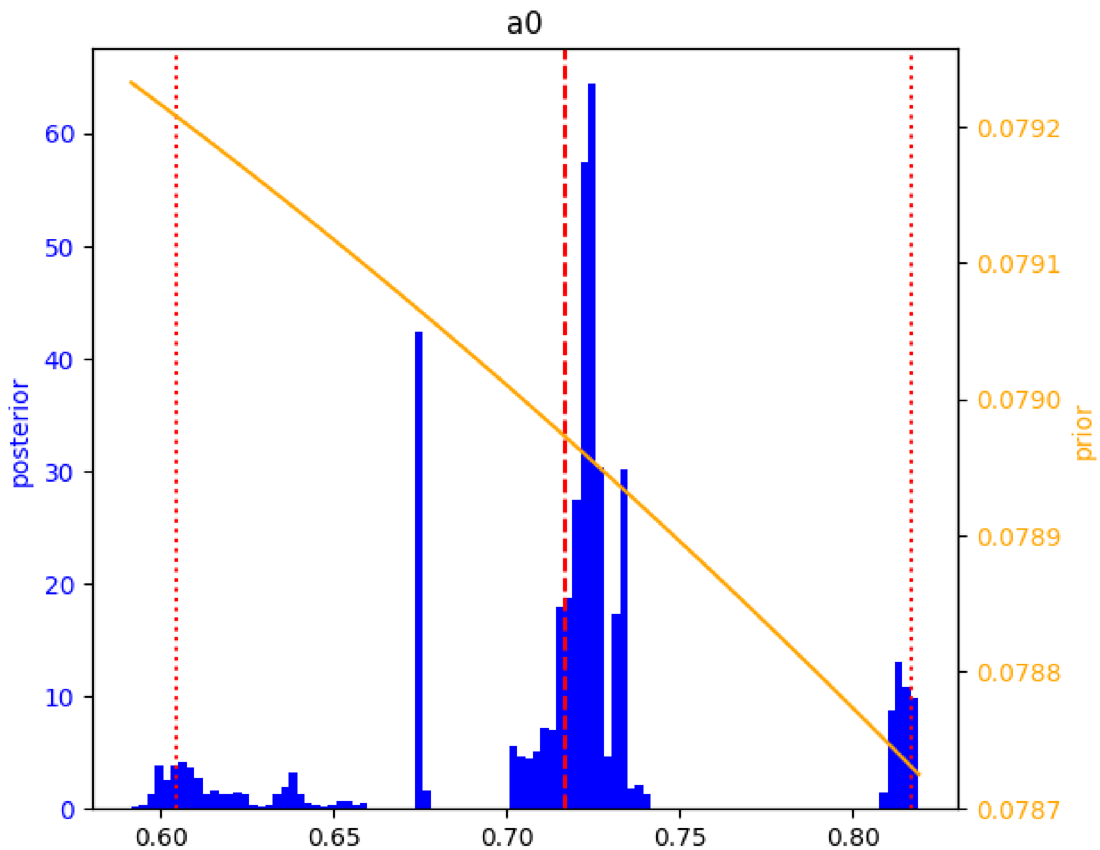

tauG
22.5
20.0
17.5
15.0
12.5
10.0
7.5
0
2000
4000
6000
8000
10000

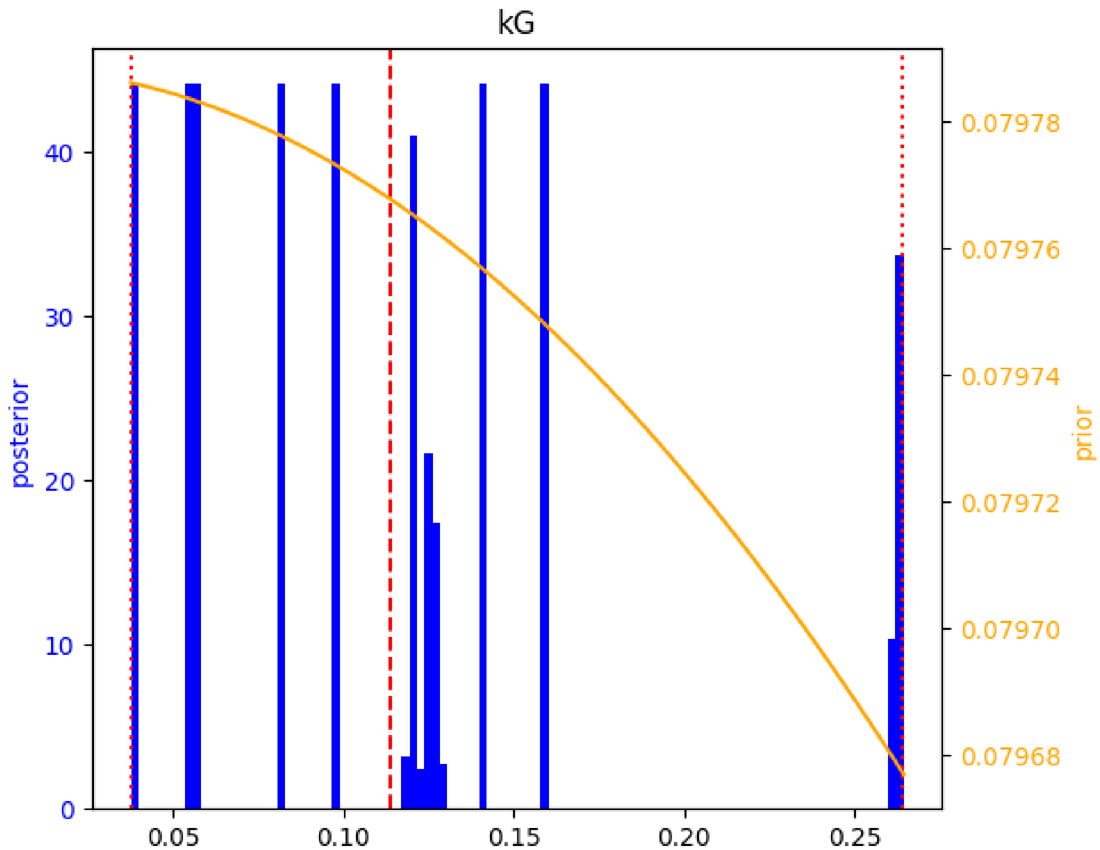

kH
0.25
0.20
0.15
0.10
0.05
0
2000
4000
6000
8000
10000

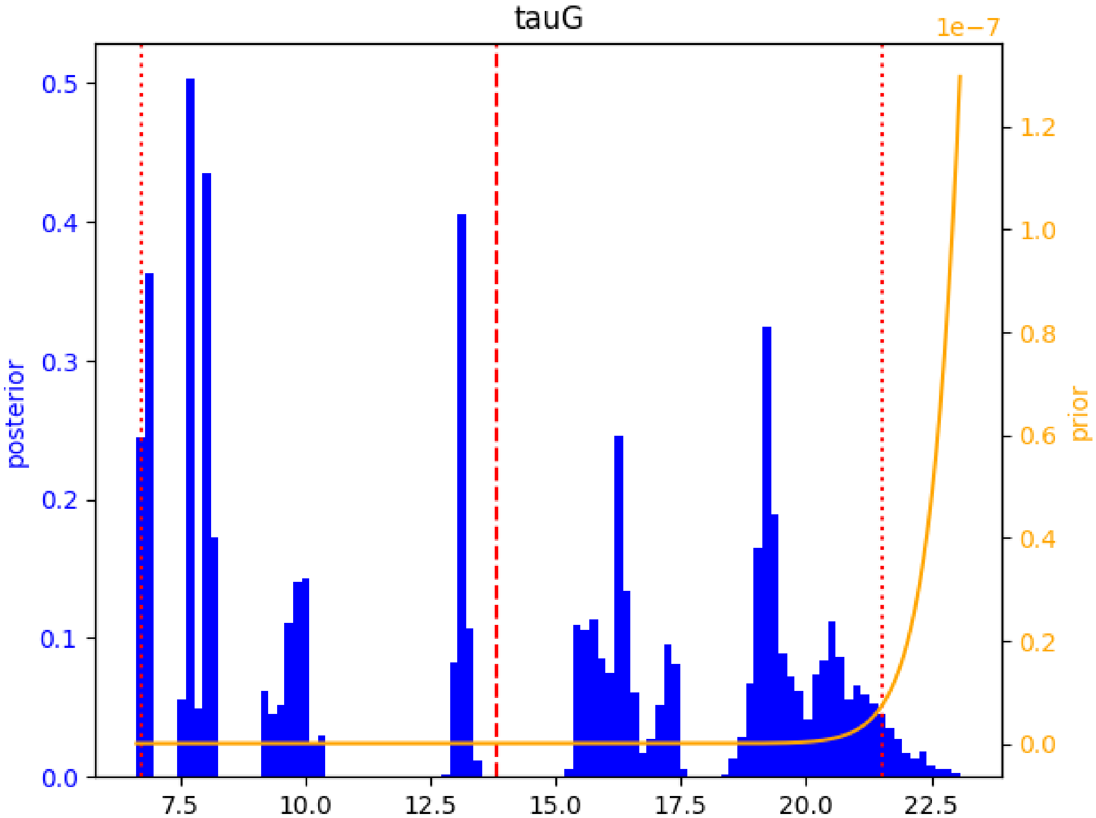

tauH
22.5
20.0
17.5
15.0
12.5
10.0
7.5
0
2000
4000
6000
8000
10000

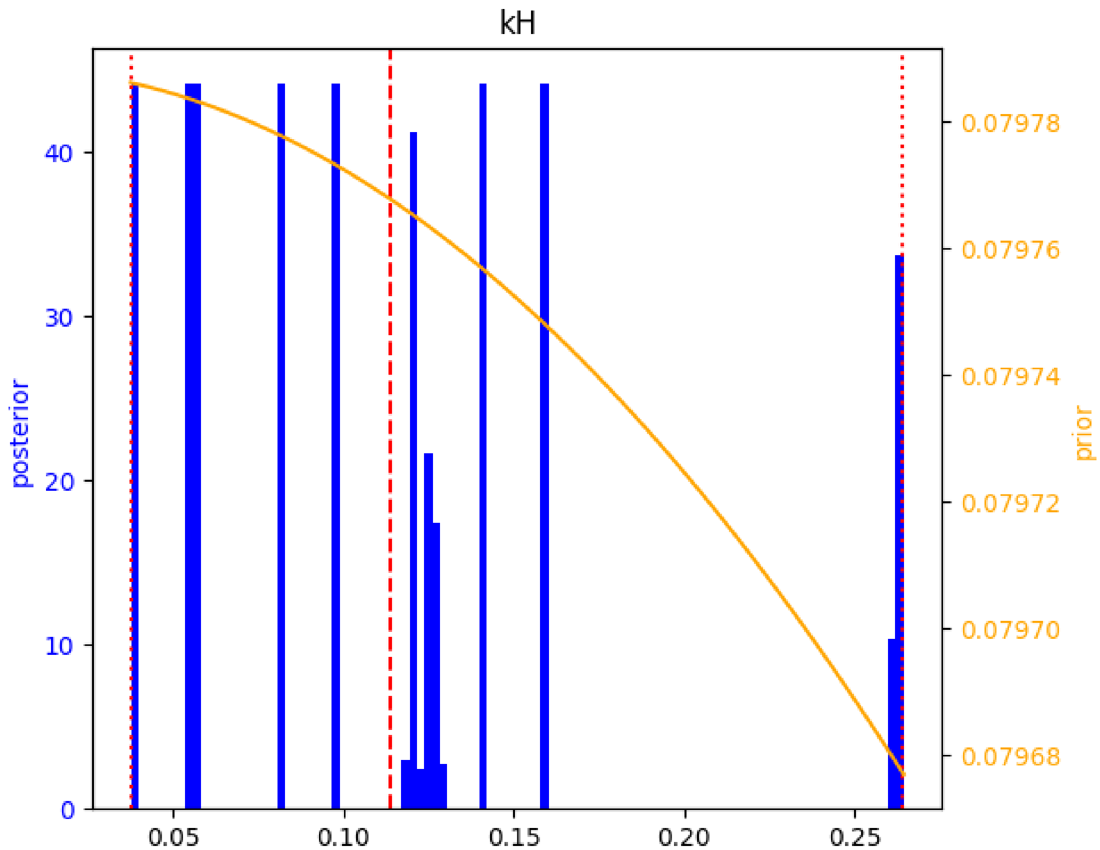


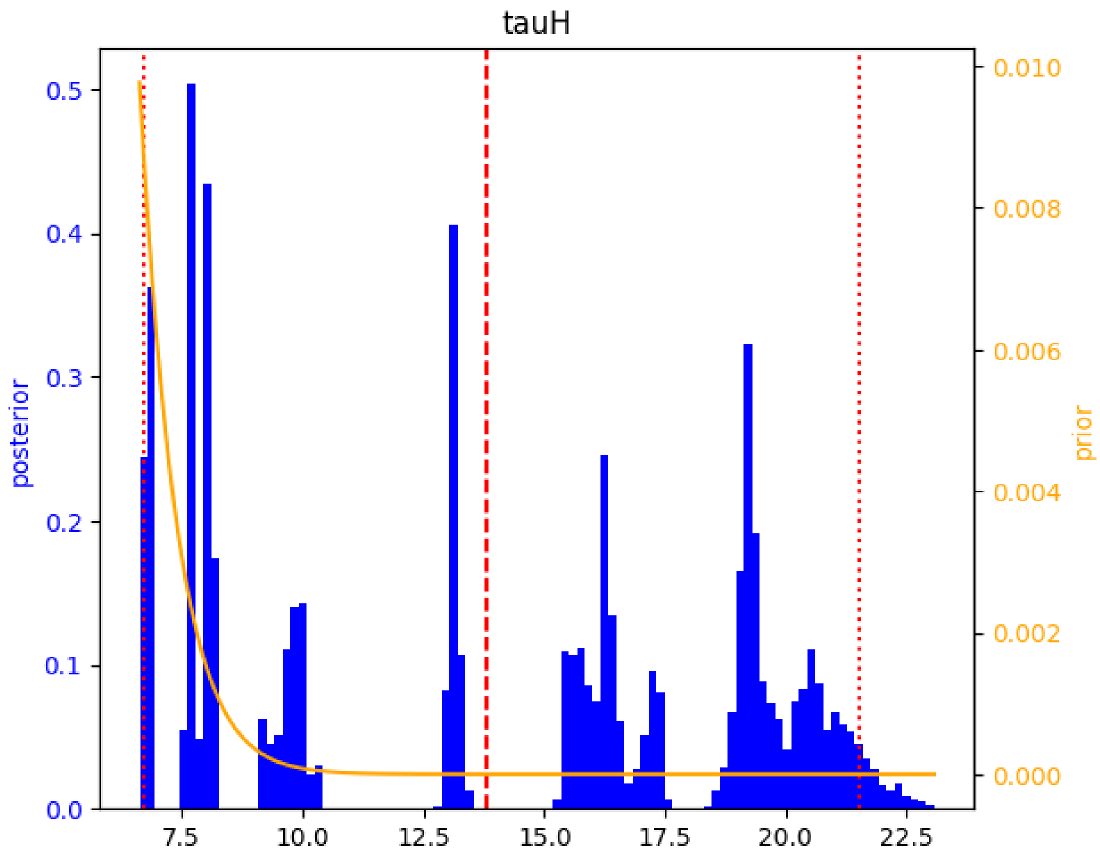
sigma
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0
2000
4000
6000
8000
10000

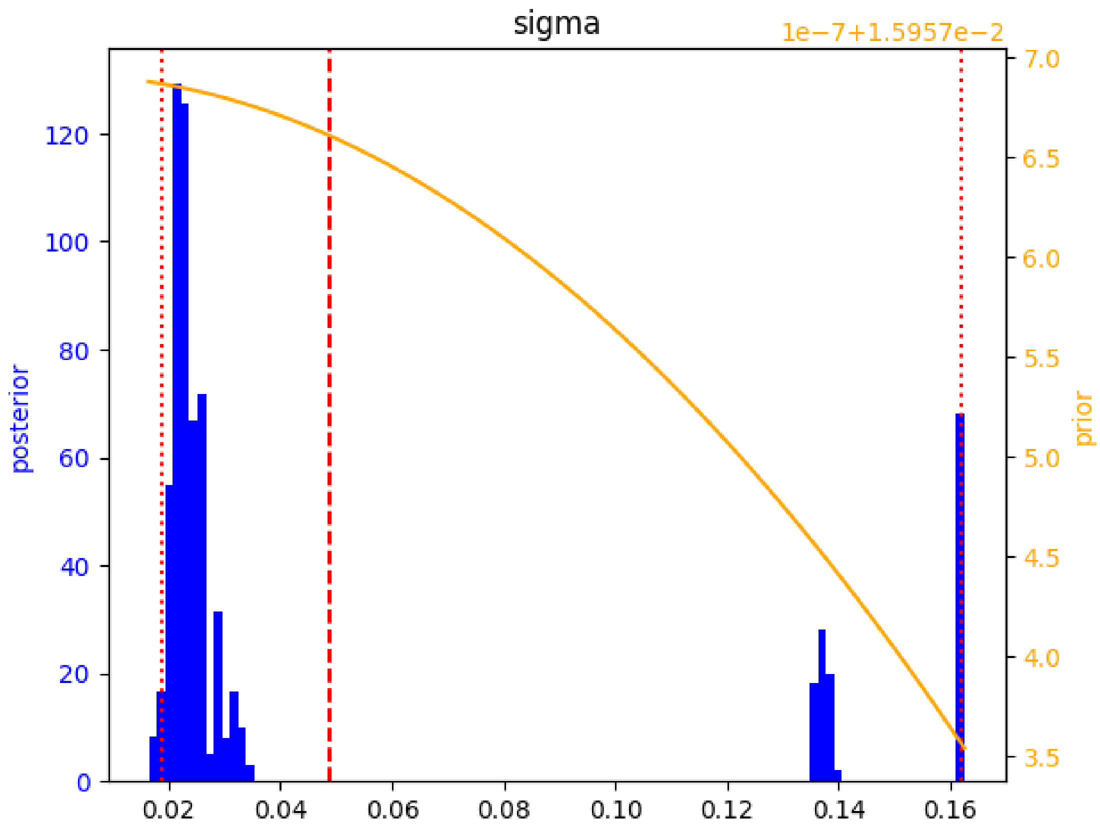

a0
posterior
prior
0
10
20
30
40
50
60
0.0787
0.0788
0.0789
0.0790
0.0791
0.0792
0.60
0.65
0.70
0.75
0.80


kG
posterior
prior
0
10
20
30
40
0.05
0.10
0.15
0.20
0.25
0.07968
0.07970
0.07972
0.07974
0.07976
0.07978

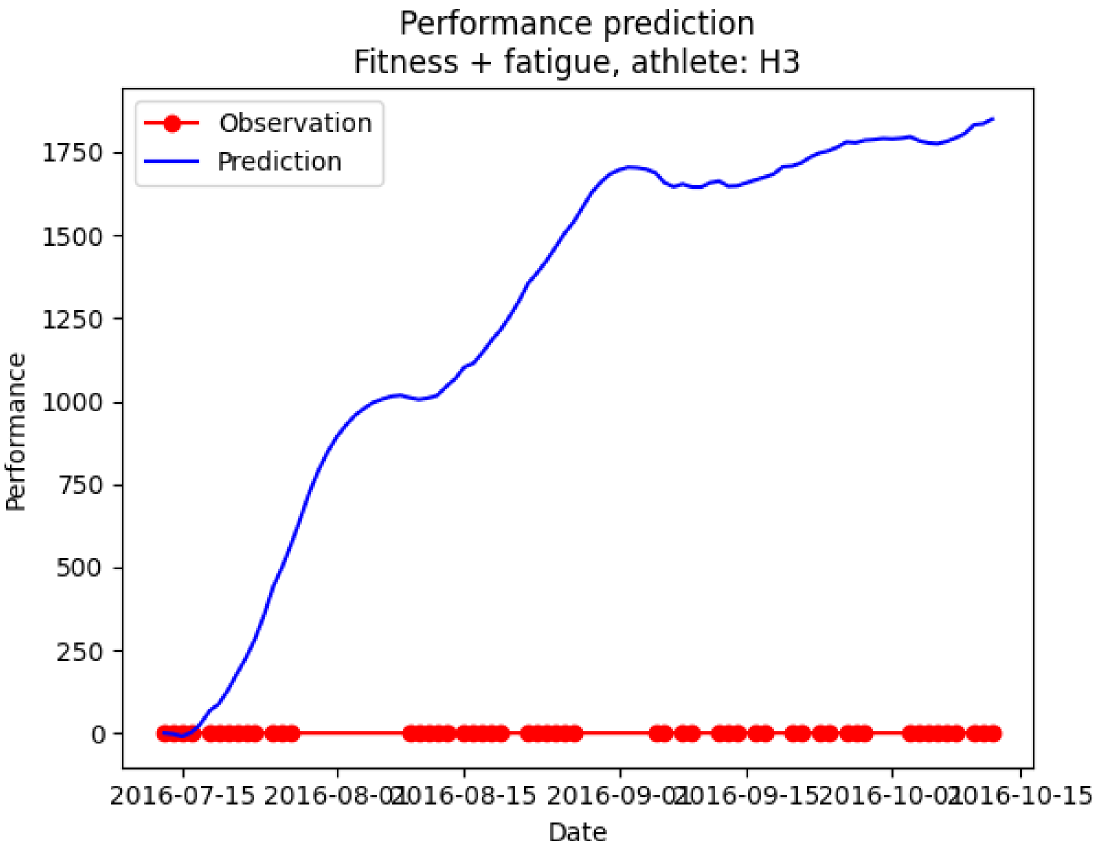

tauG
1e−7
posterior
prior
0.0
0.1
0.2
0.3
0.4
0.5
0.0
0.2
0.4
0.6
0.8
1.0
1.2
7.5
10.0
12.5
15.0
17.5
20.0
22.5

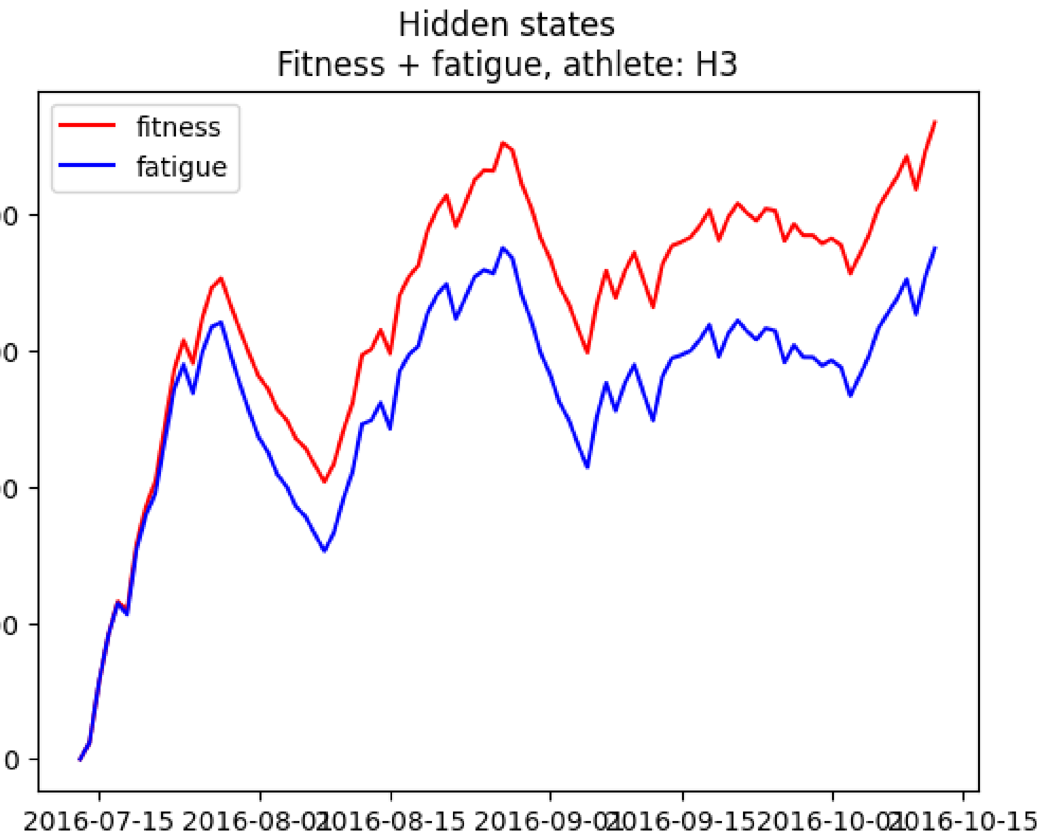

kH
posterior
prior
0
10
20
30
40
0.05
0.10
0.15
0.20
0.25
0.07968
0.07970
0.07972
0.07974
0.07976
0.07978

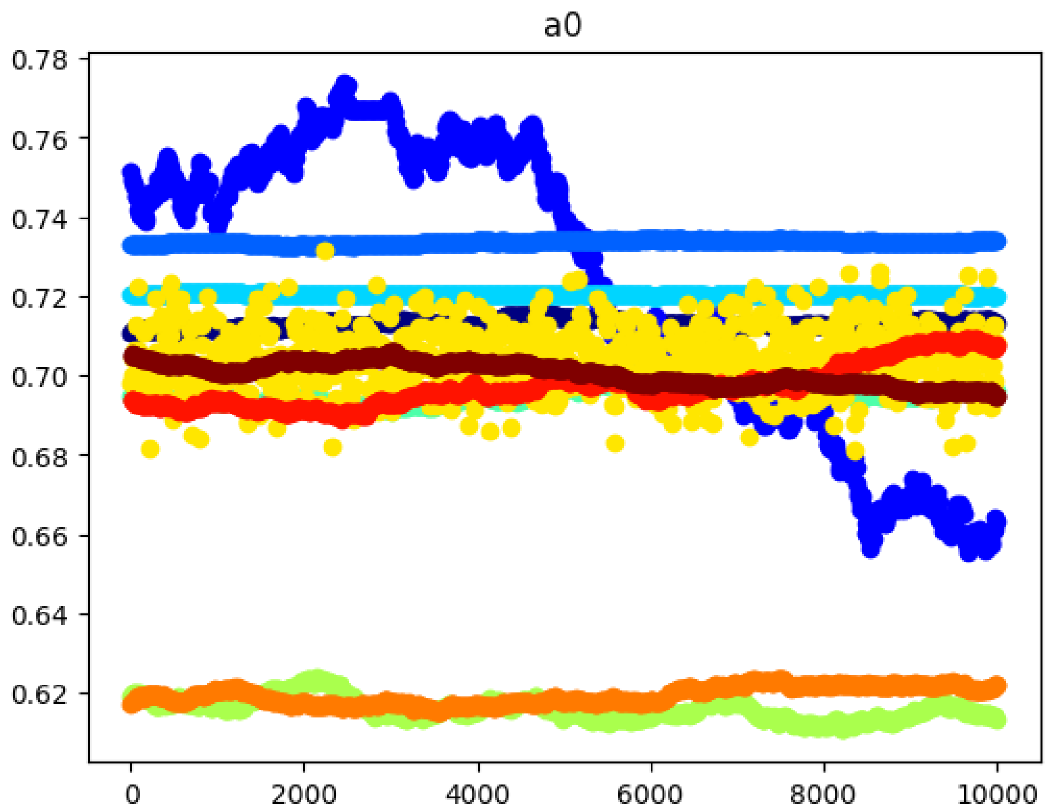

tauH
posterior
prior
0.0
0.1
0.2
0.3
0.4
0.5
0.010
0.008
0.006
0.004
0.002
0.000
7.5
10.0
12.5
15.0
17.5
20.0
22.5



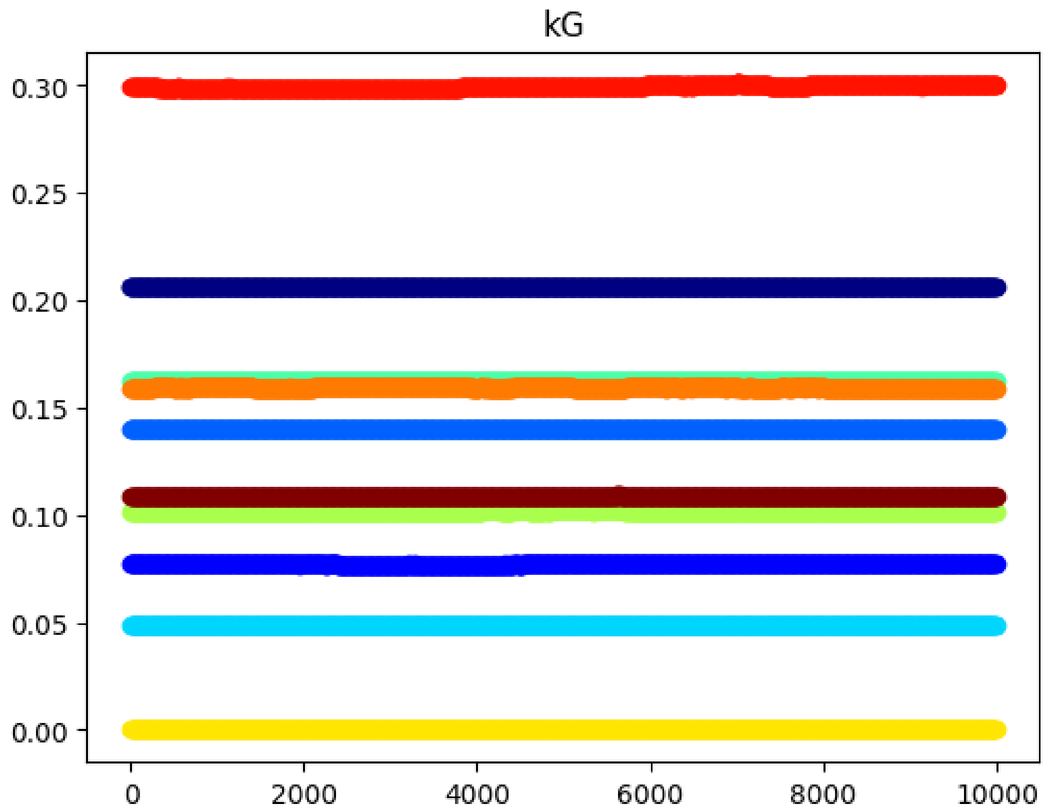
sigma
1e−7+1.5957e−2
posterior
prior
0
20
40
60
80
100
120
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0

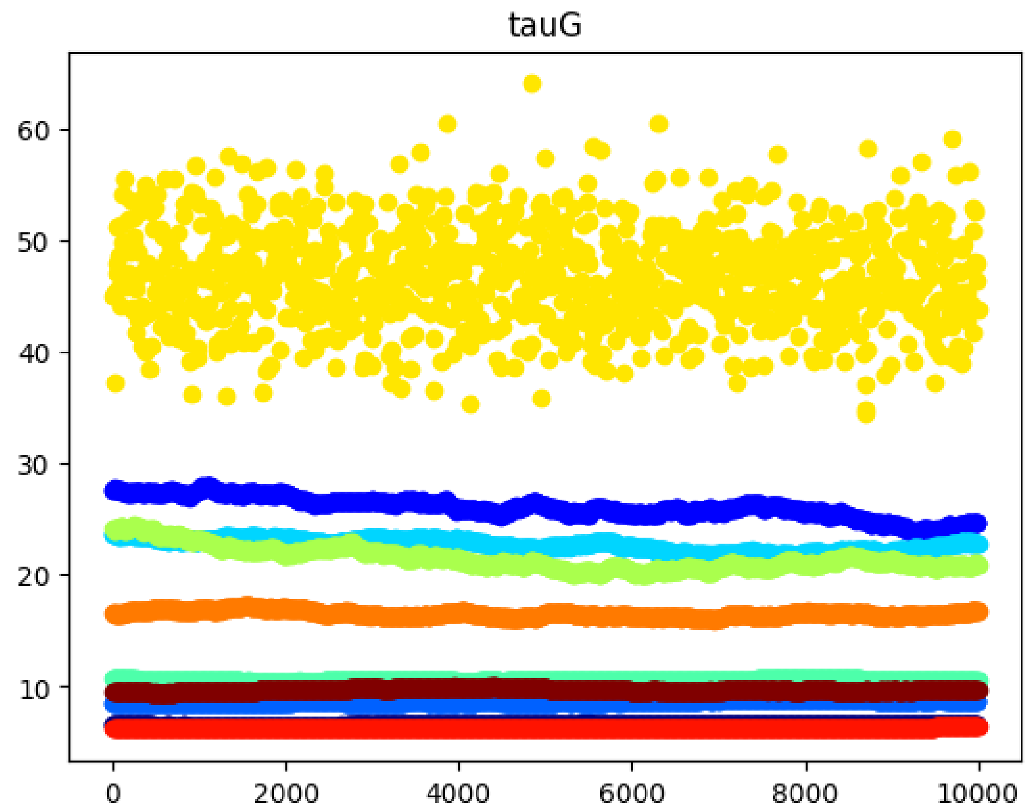

Performance prediction
Fitness + fatigue, athlete: H3
Observation
Prediction
1750
1500
1250
1000
750
500
250
0
Performance
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

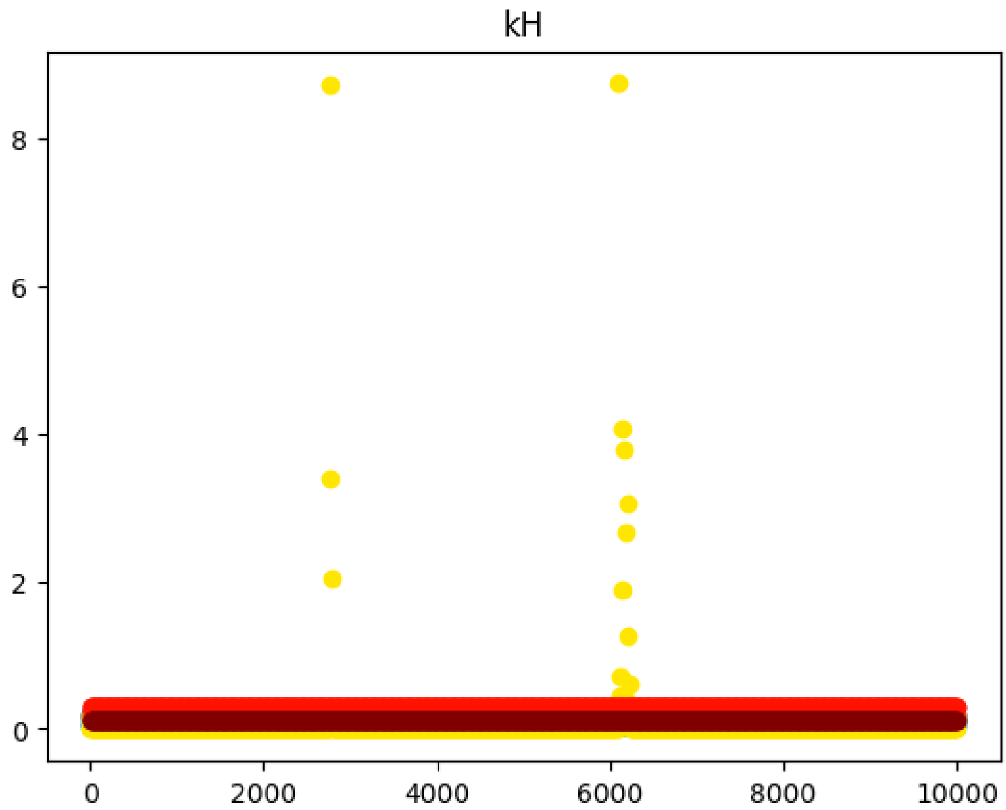

Hidden states
Fitness + fatigue, athlete: H3
fitness
fatigue
0
2000
4000
6000
8000
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

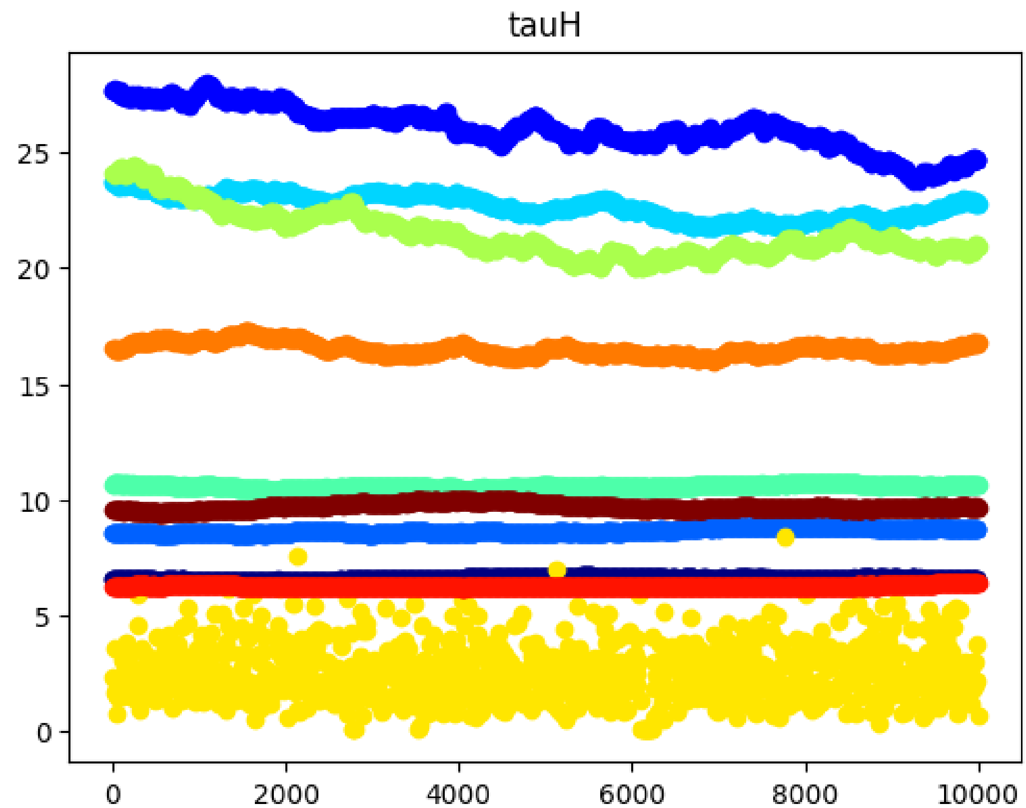


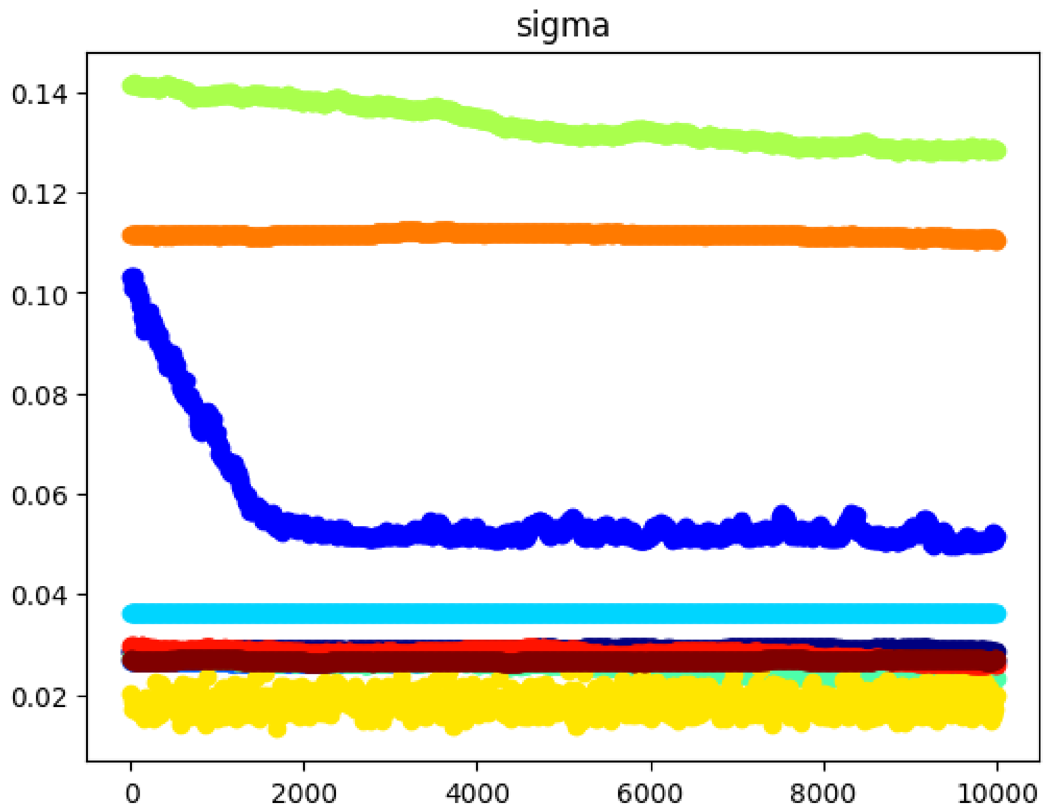
a0
0.78
0.76
0.74
0.72
0.70
0.68
0.66
0.64
0.62
0
2000
4000
6000
8000
10000

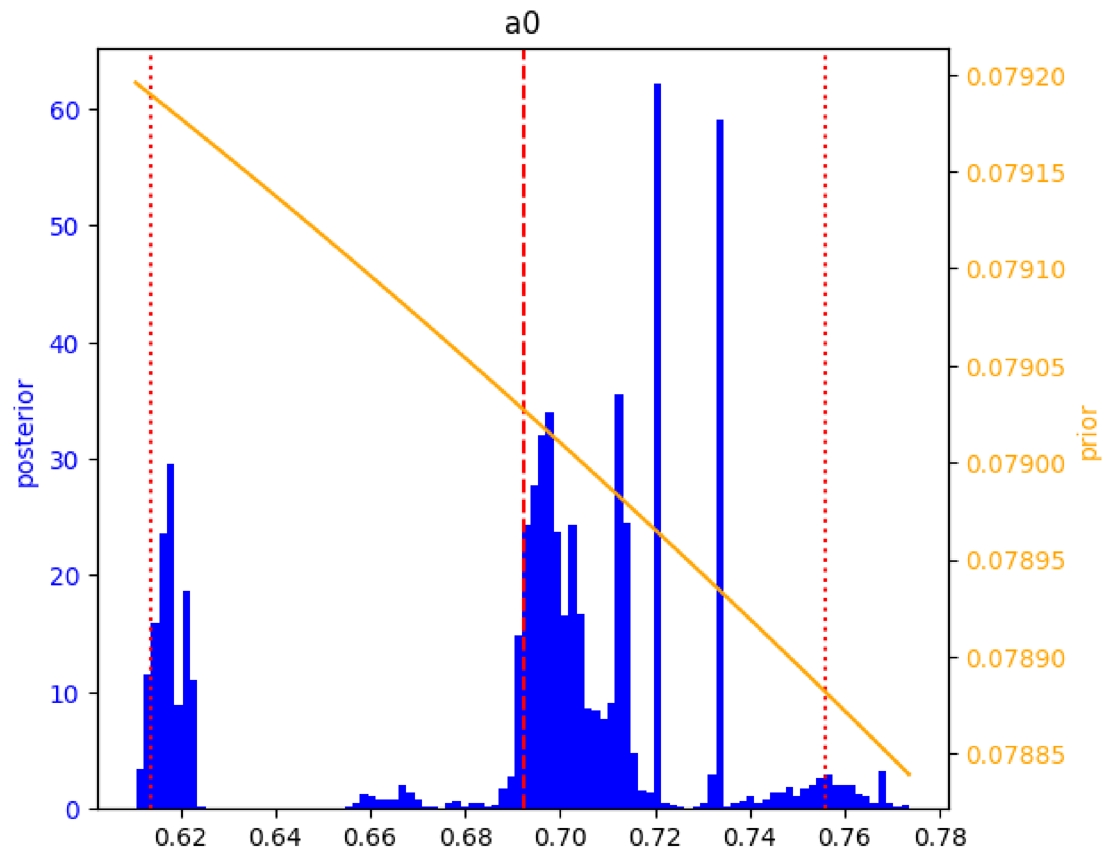

kG
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
2000
4000
6000
8000
10000

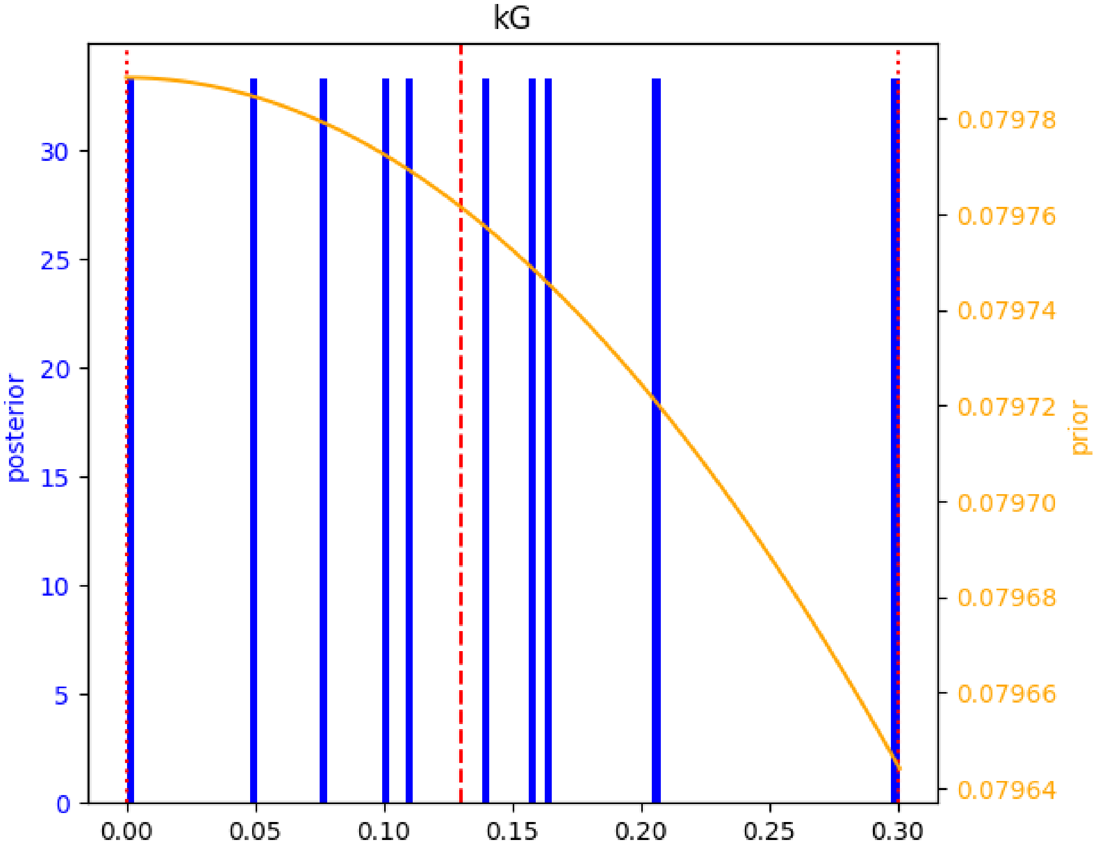

tauG
60
50
40
30
20
10
0
2000
4000
6000
8000
10000

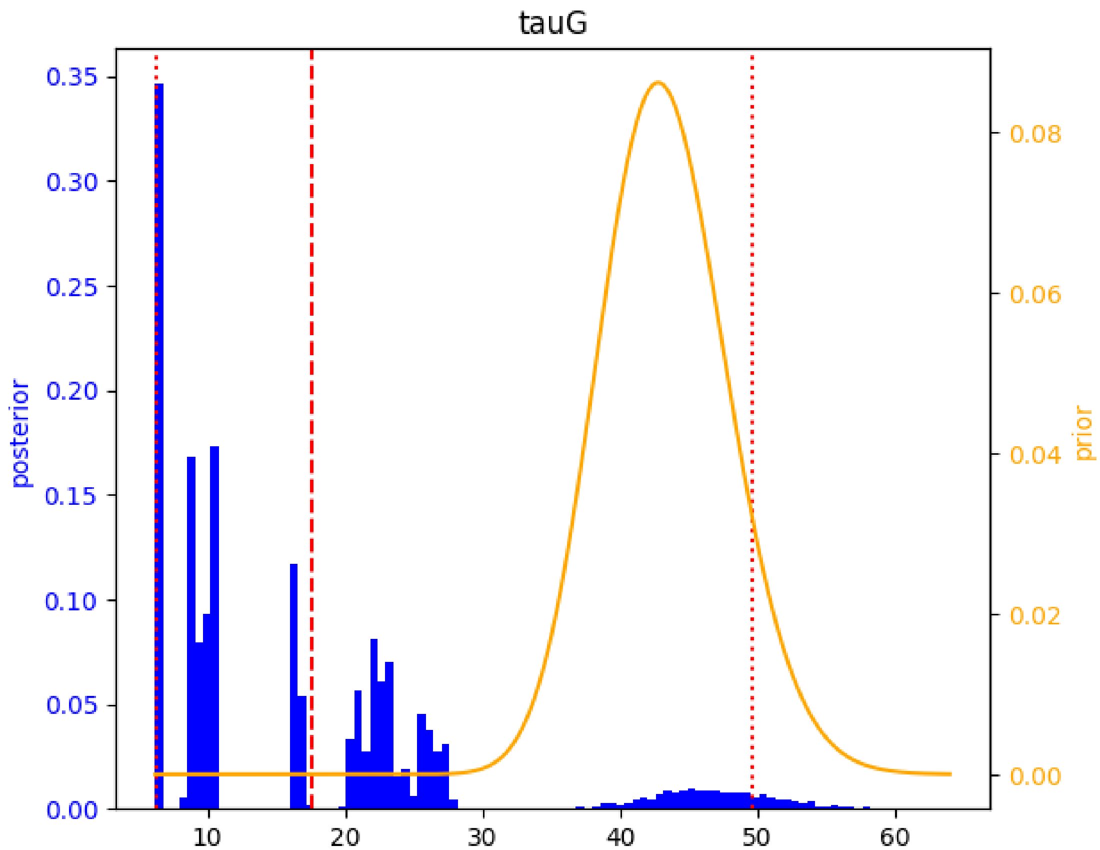

kH
8
6
4
2
0
0
2000
4000
6000
8000
10000


tauH
25
20
15
10
5
0
0
2000
4000
6000
8000
10000

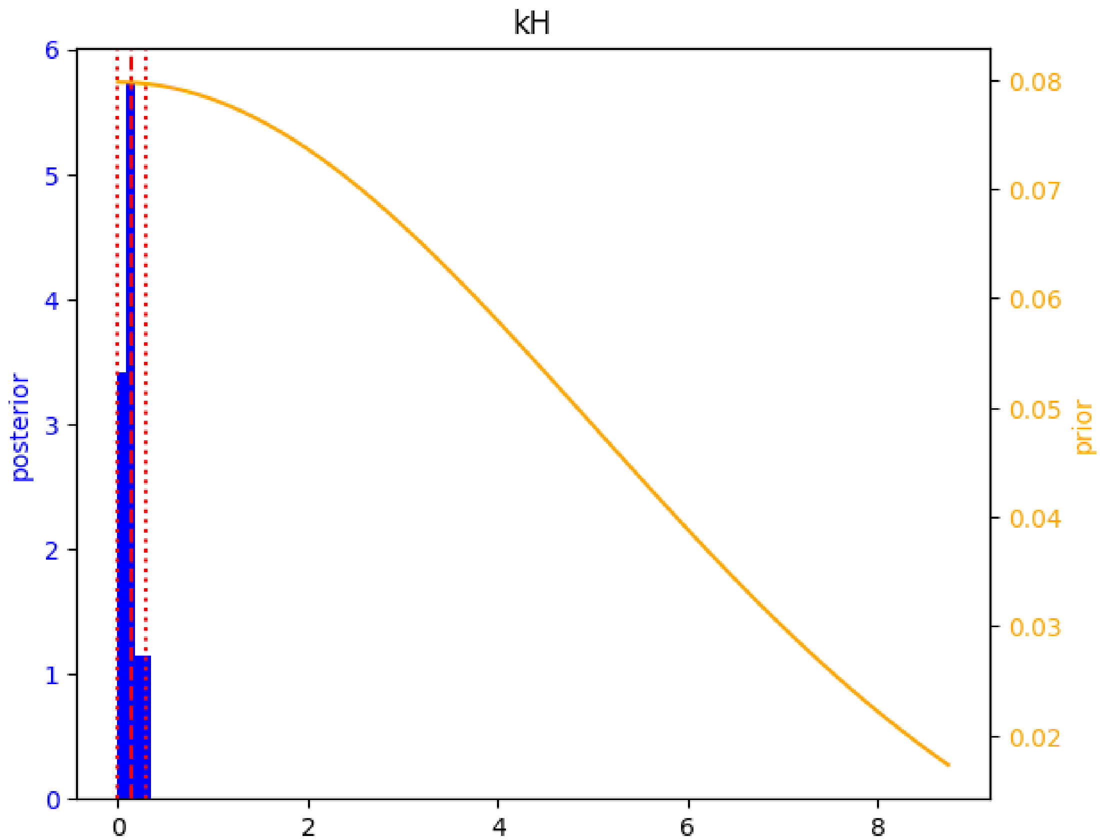

sigma
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0
2000
4000
6000
8000
10000

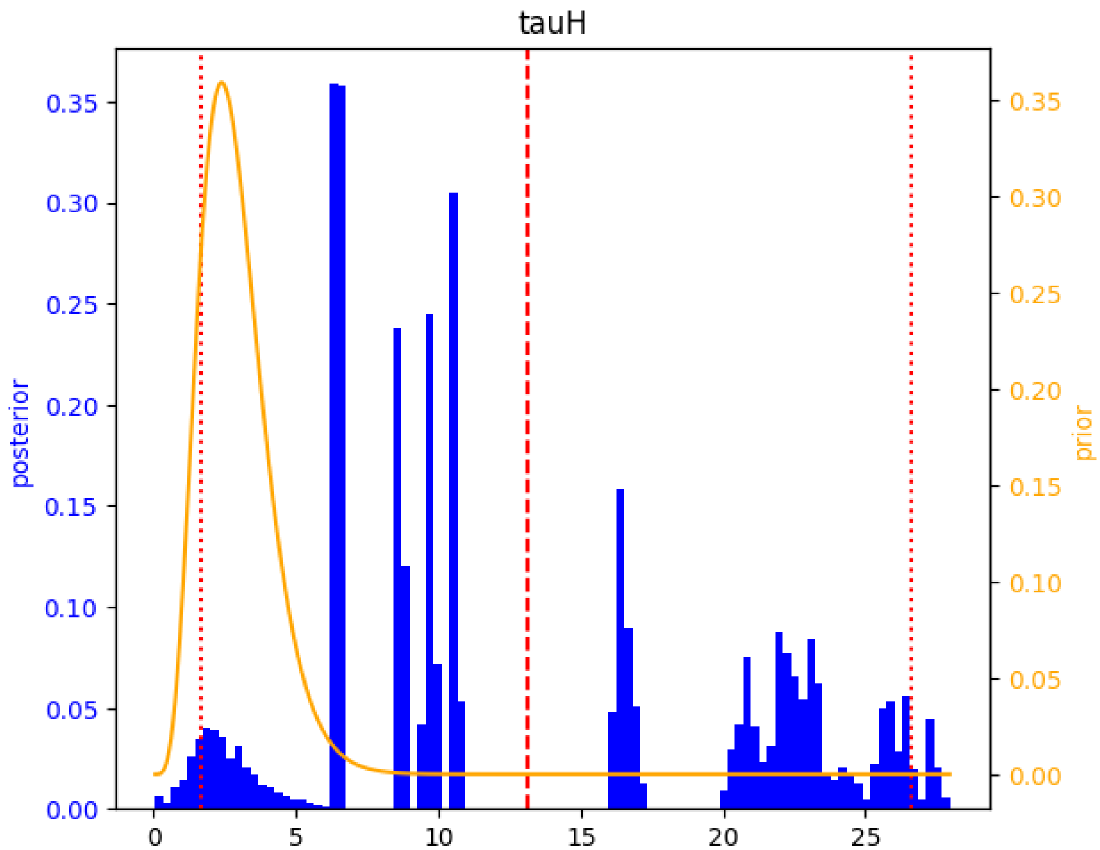

a0
posterior
prior
0
10
20
30
40
50
60
0.07885
0.07890
0.07895
0.07900
0.07905
0.07910
0.07915
0.07920
0.62
0.64
0.66
0.68
0.70
0.72
0.74
0.76
0.78

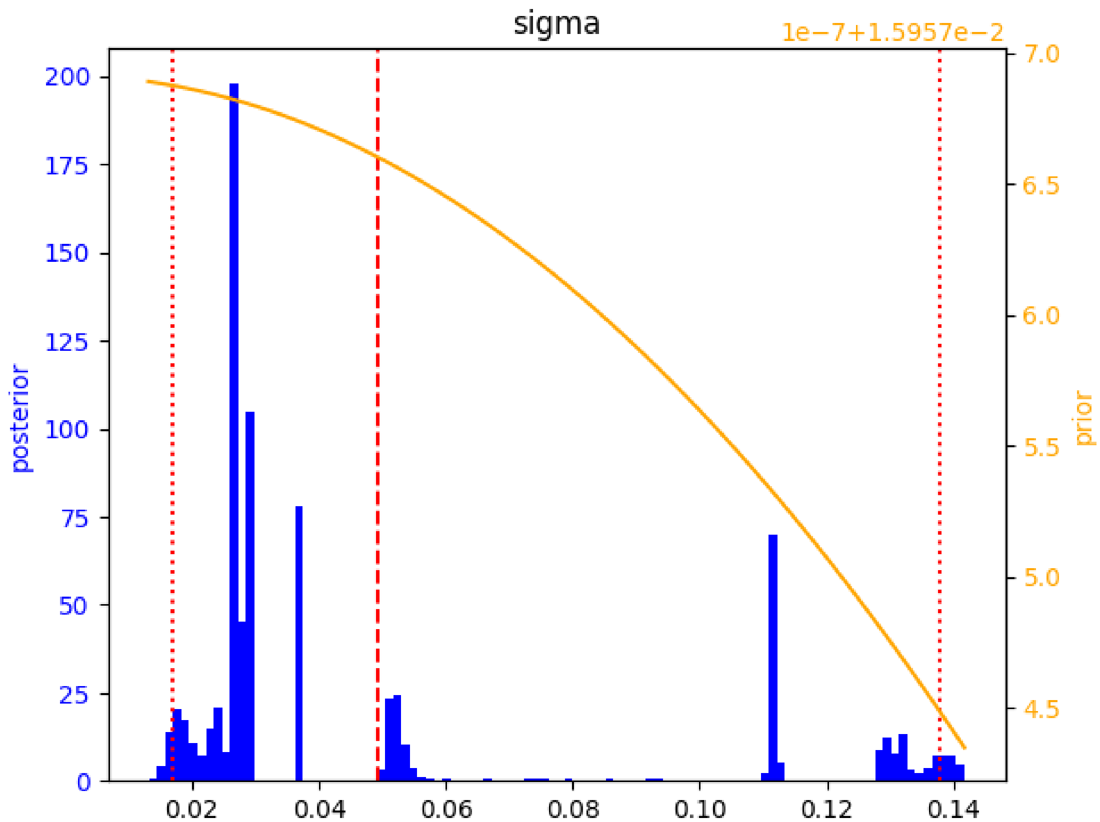

kG
posterior
prior
0
5
10
15
20
25
30
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.07964
0.07966
0.07968
0.07970
0.07972
0.07974
0.07976
0.07978

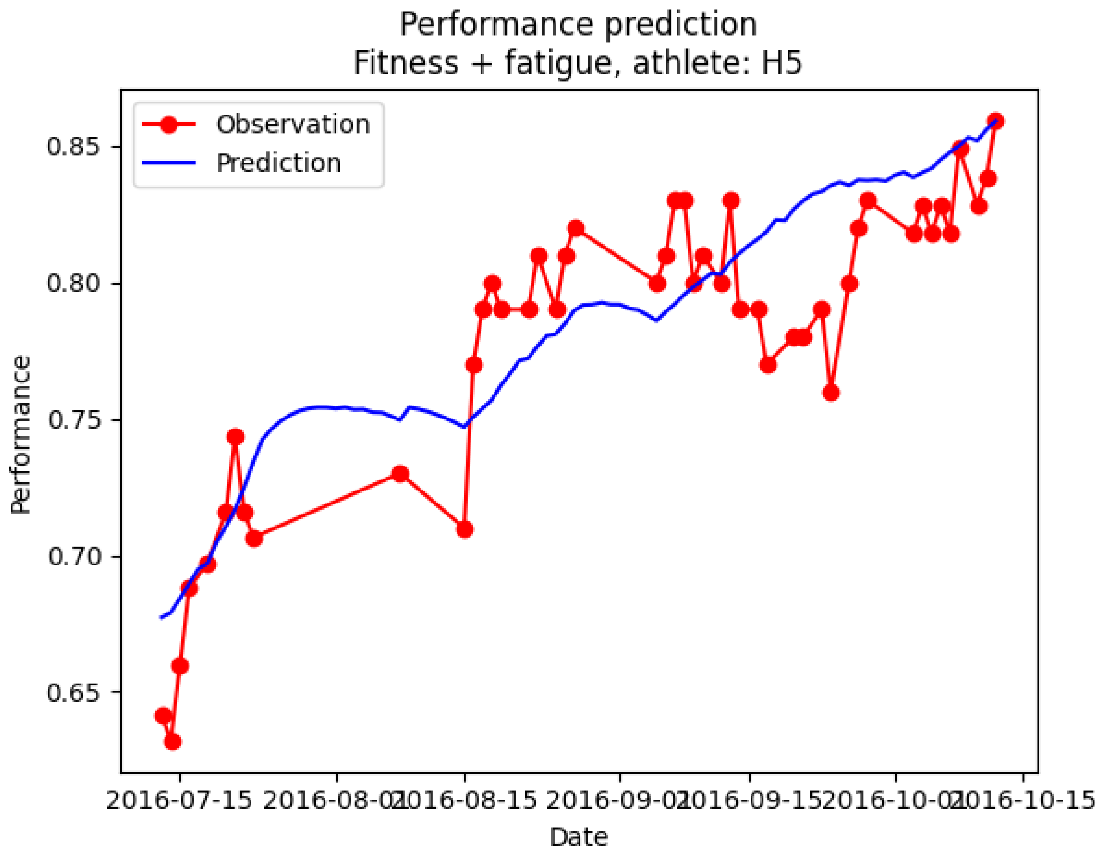


tauG
posterior
prior
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.00
0.02
0.04
0.06
0.08
10
20
30
40
50
60

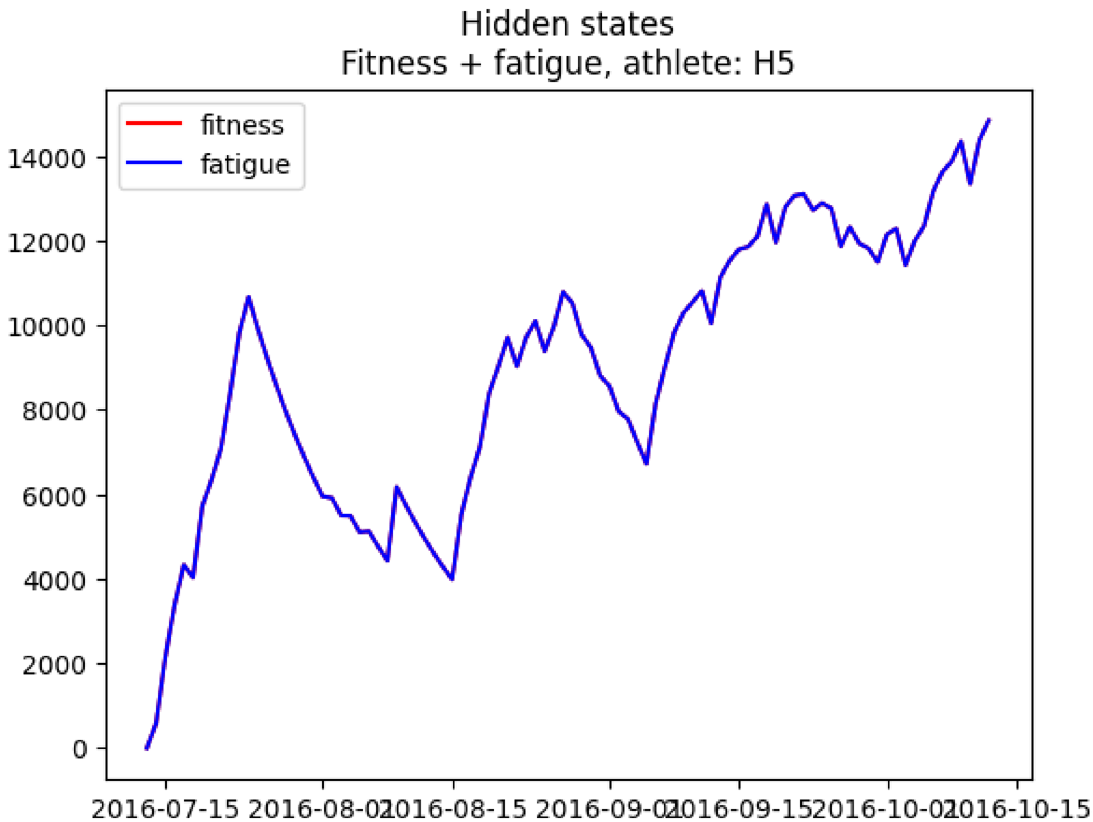

kH
posterior
prior
0
1
2
3
4
5
6
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0
2
4
6
8

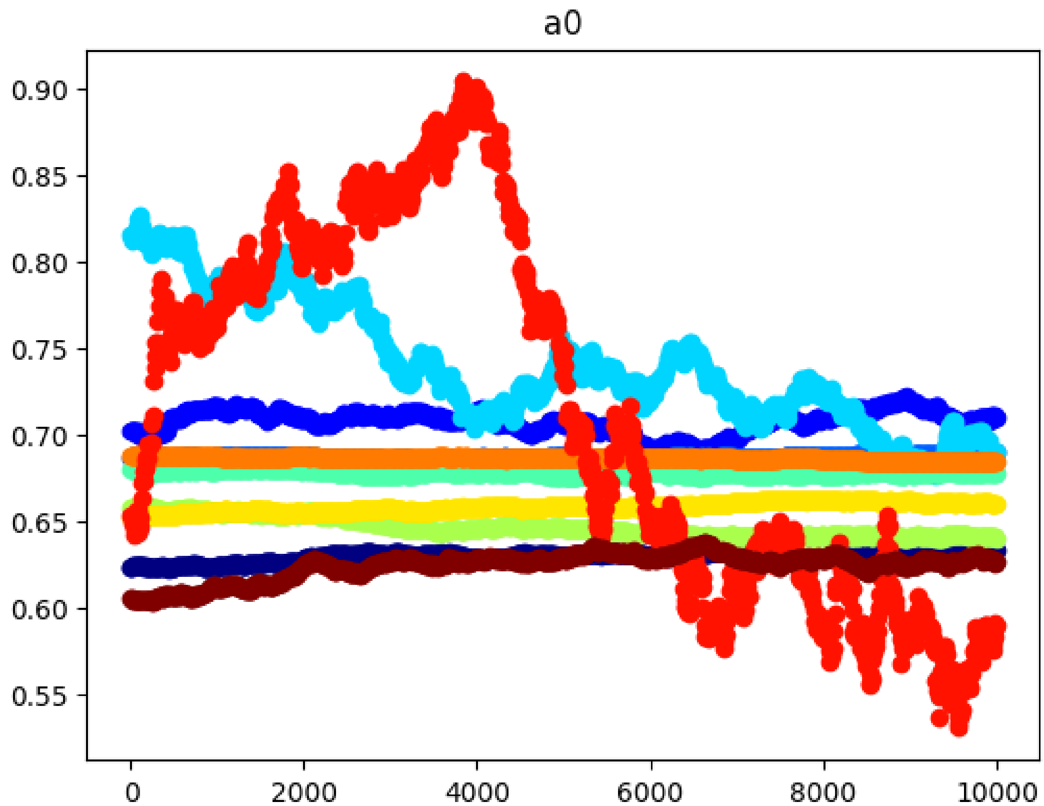

tauH
posterior
prior
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0
5
10
15
20
25

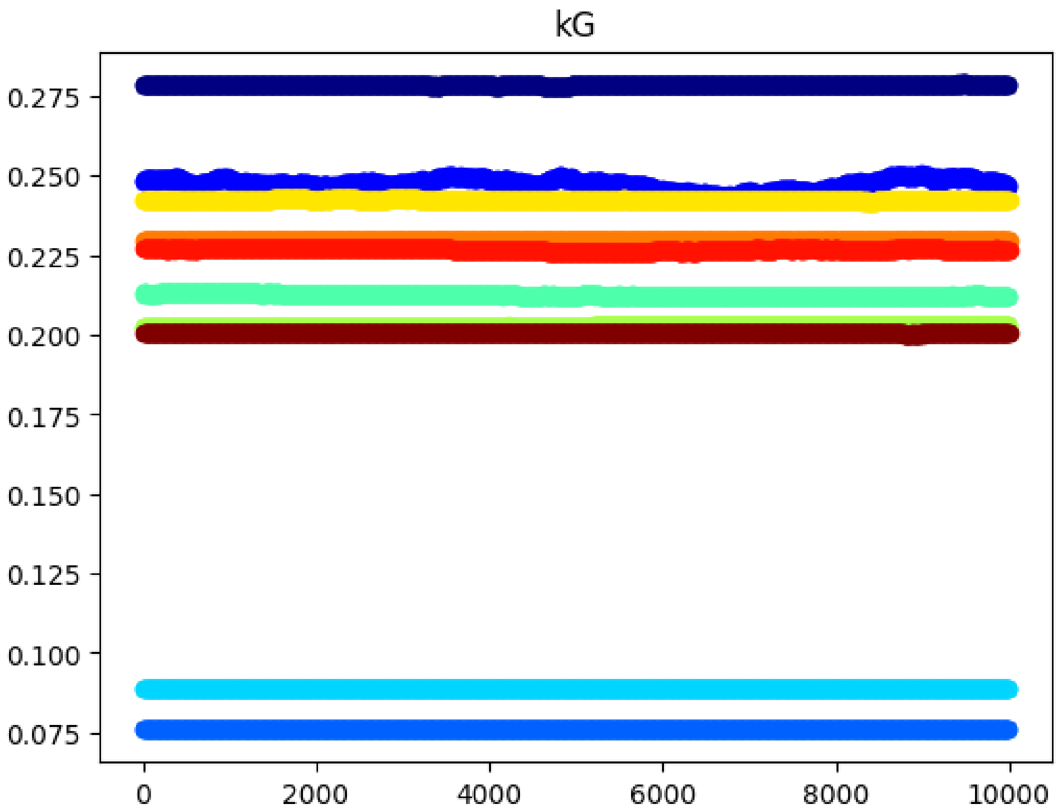

sigma
1e−7+1.5957e−2
posterior
prior
200
175
150
125
100
75
50
25
0
7.0
6.5
6.0
5.5
5.0
4.5
0.02
0.04
0.06
0.08
0.10
0.12
0.14



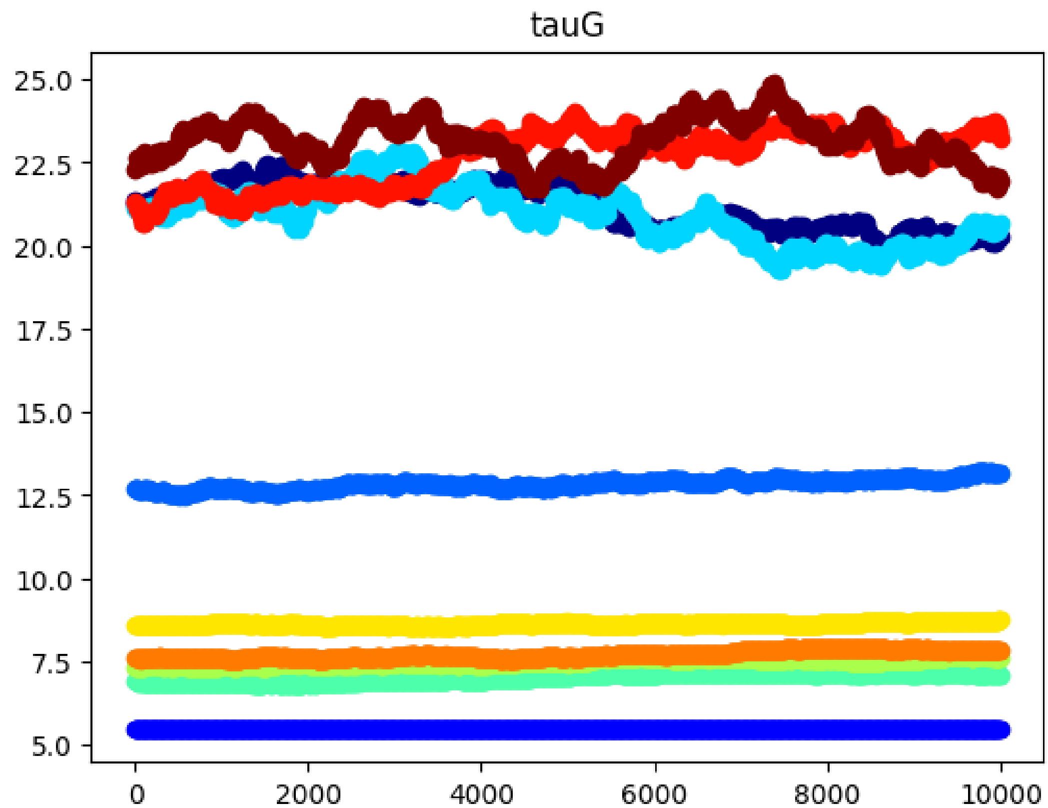
Performance prediction
Fitness + fatigue, athlete: H5
Observation
Prediction
0.85
0.80
0.75
0.70
0.65
Performance
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

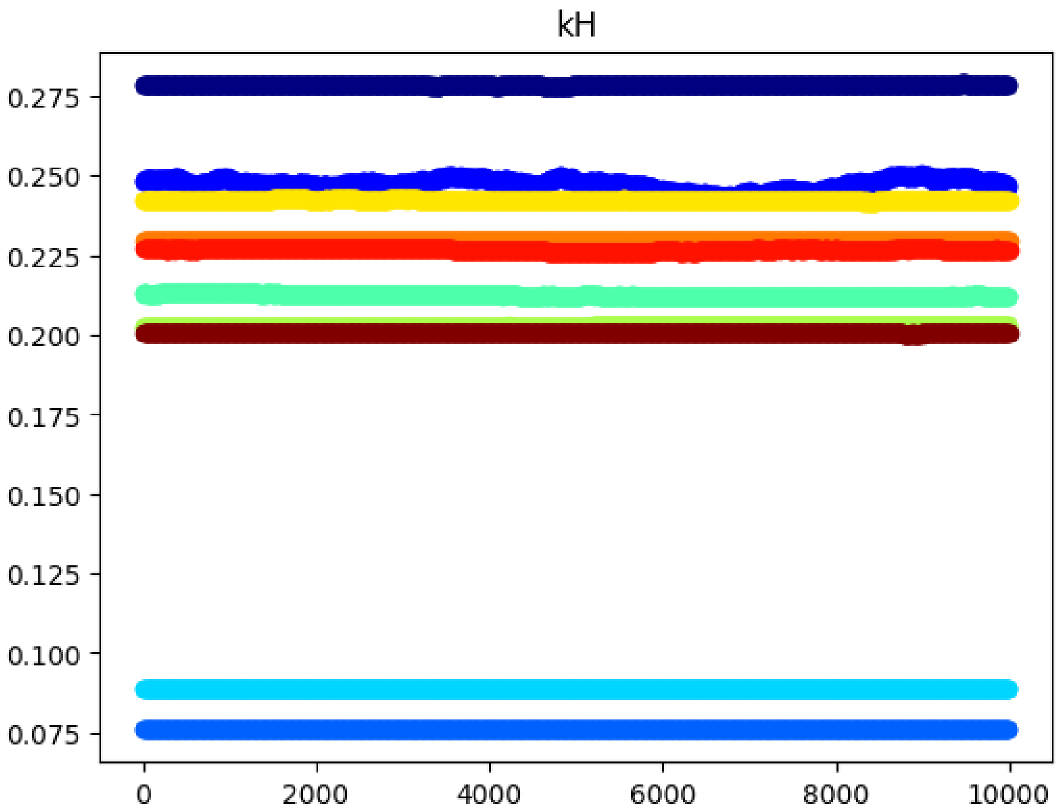

Hidden states
Fitness + fatigue, athlete: H5
fitness
fatigue
14000
12000
10000
8000
6000
4000
2000
0
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

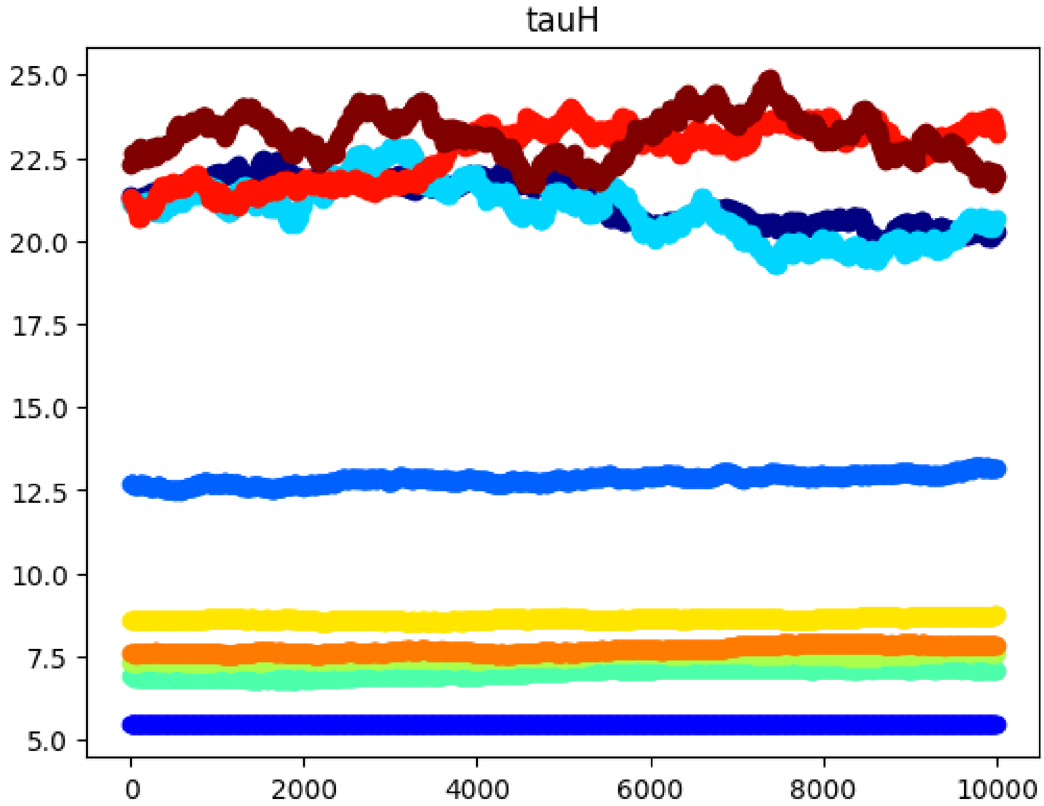

a0
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0
2000
4000
6000
8000
10000

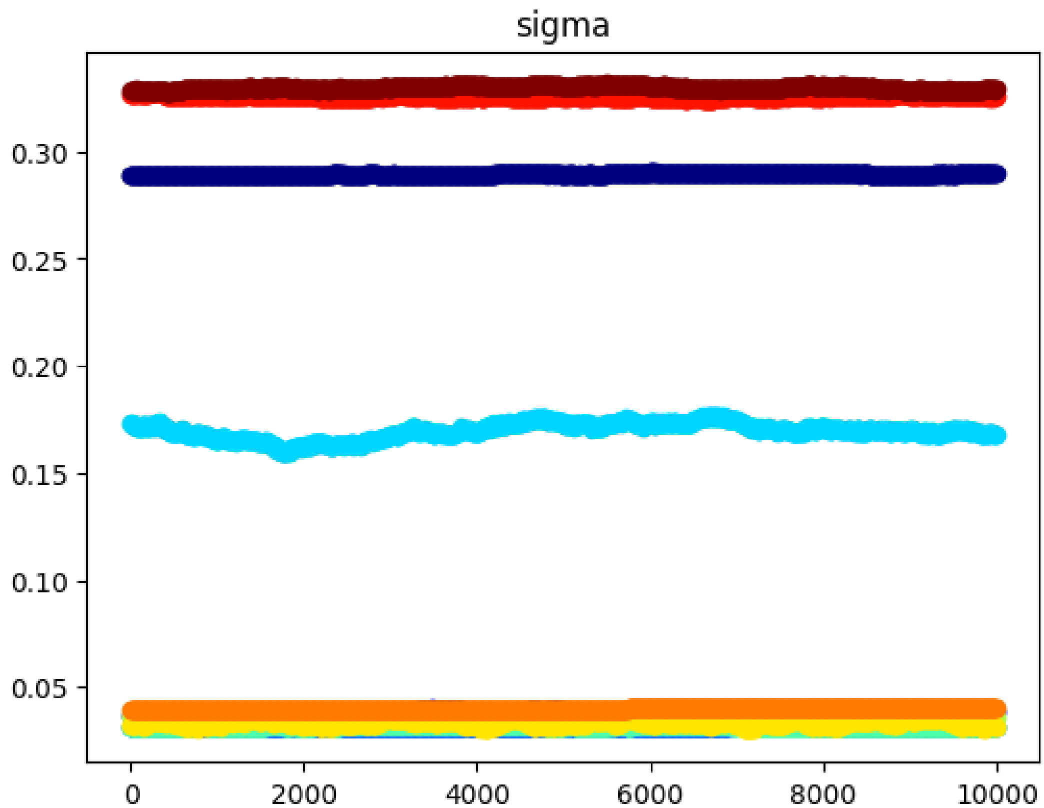


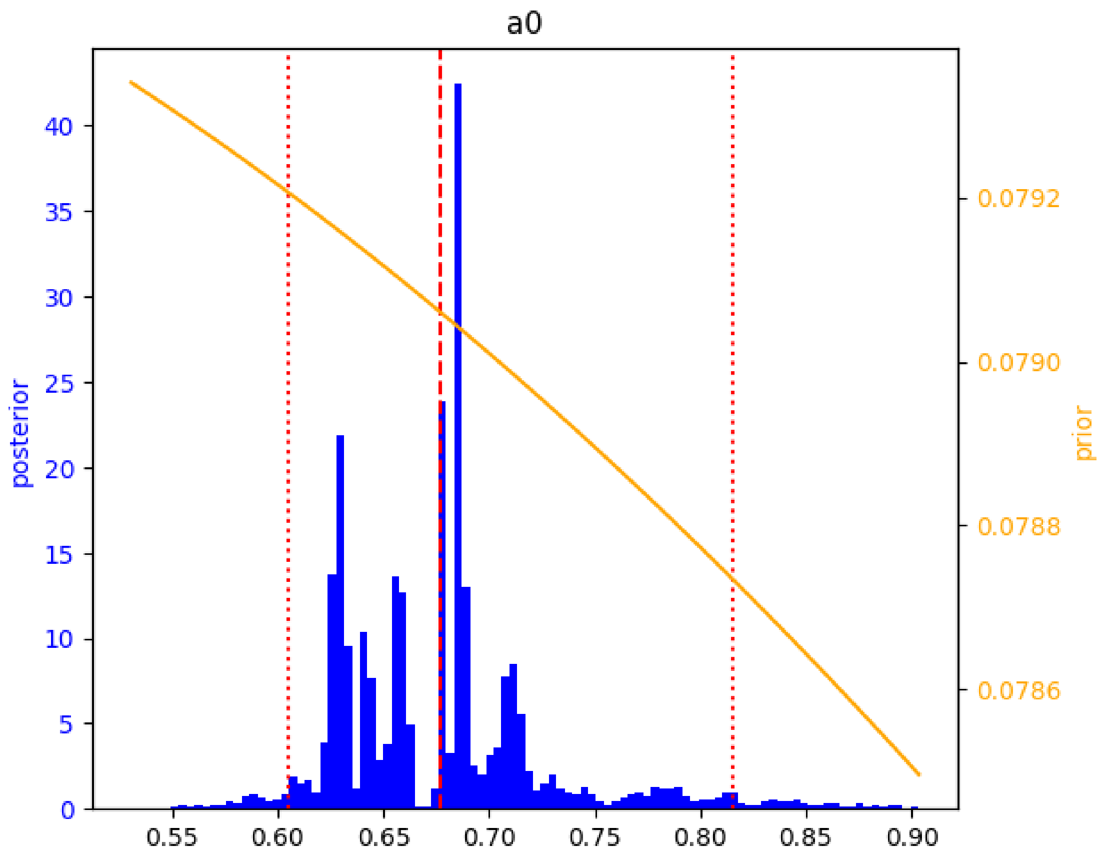
kG
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0
2000
4000
6000
8000
10000

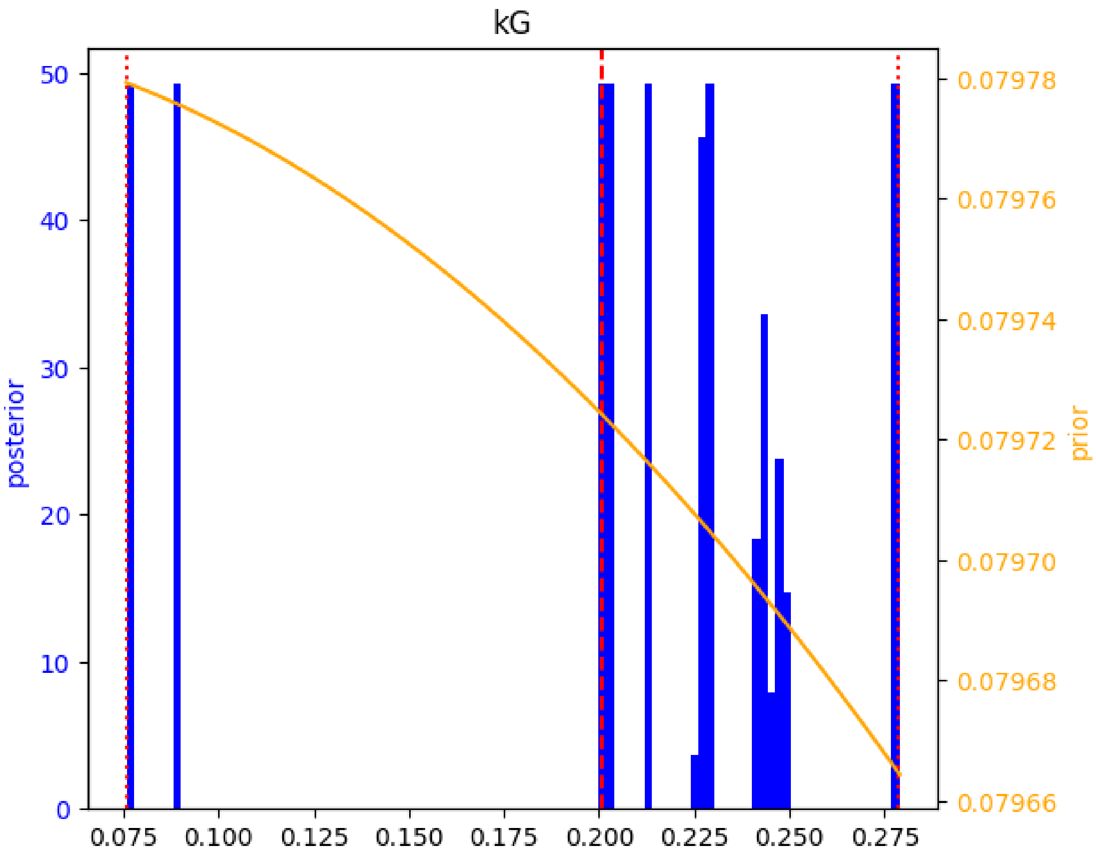

tauG
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
0
2000
4000
6000
8000
10000

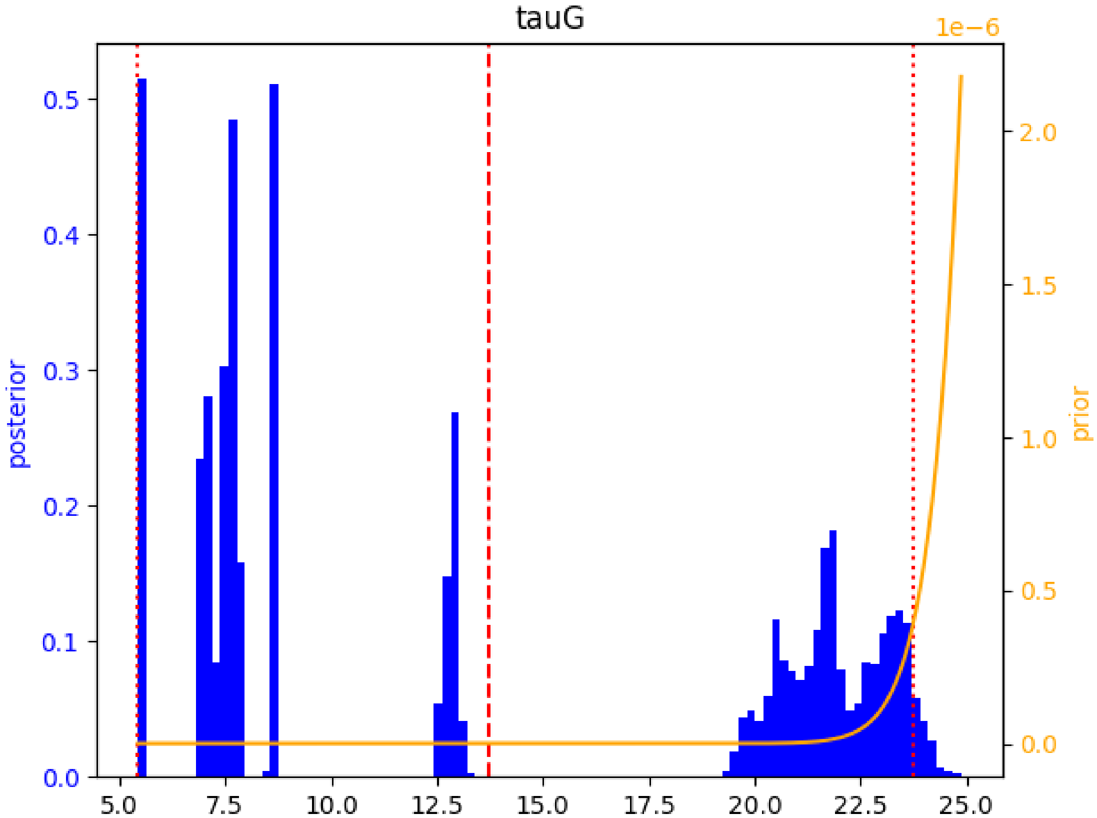

kH
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0
2000
4000
6000
8000
10000

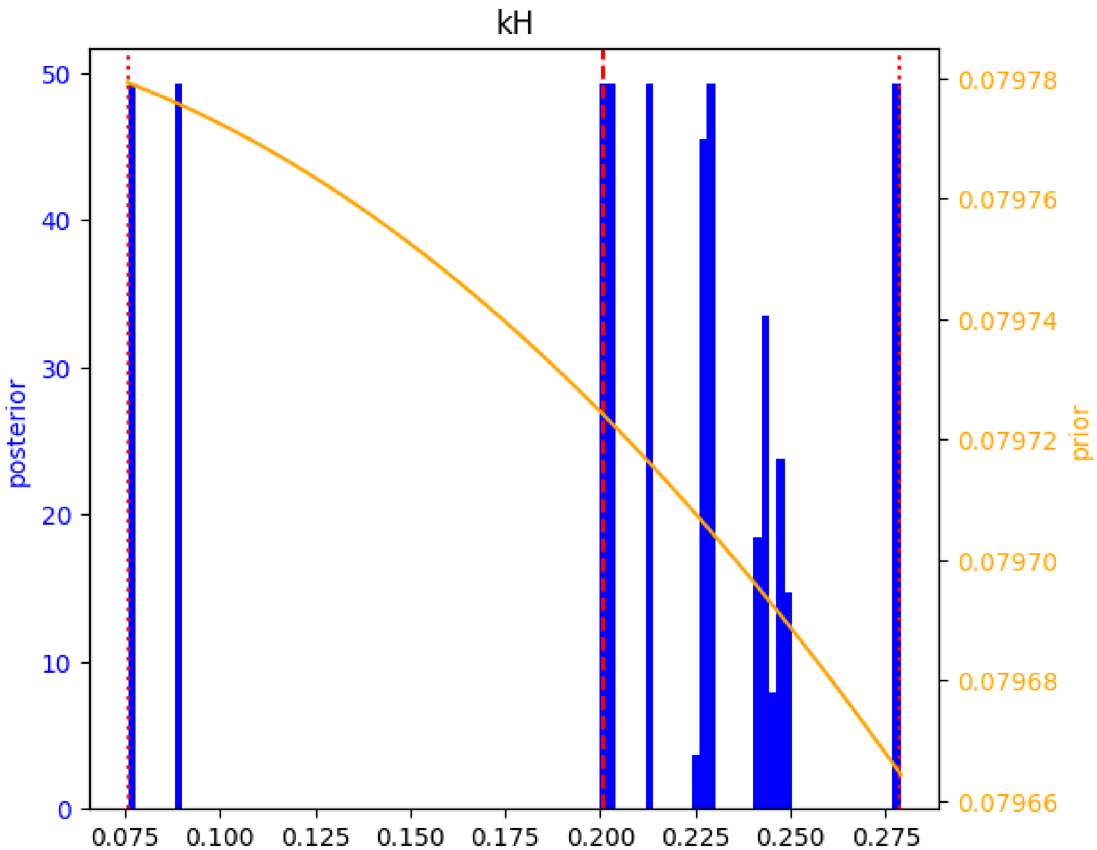

tauH
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
0
2000
4000
6000
8000
10000

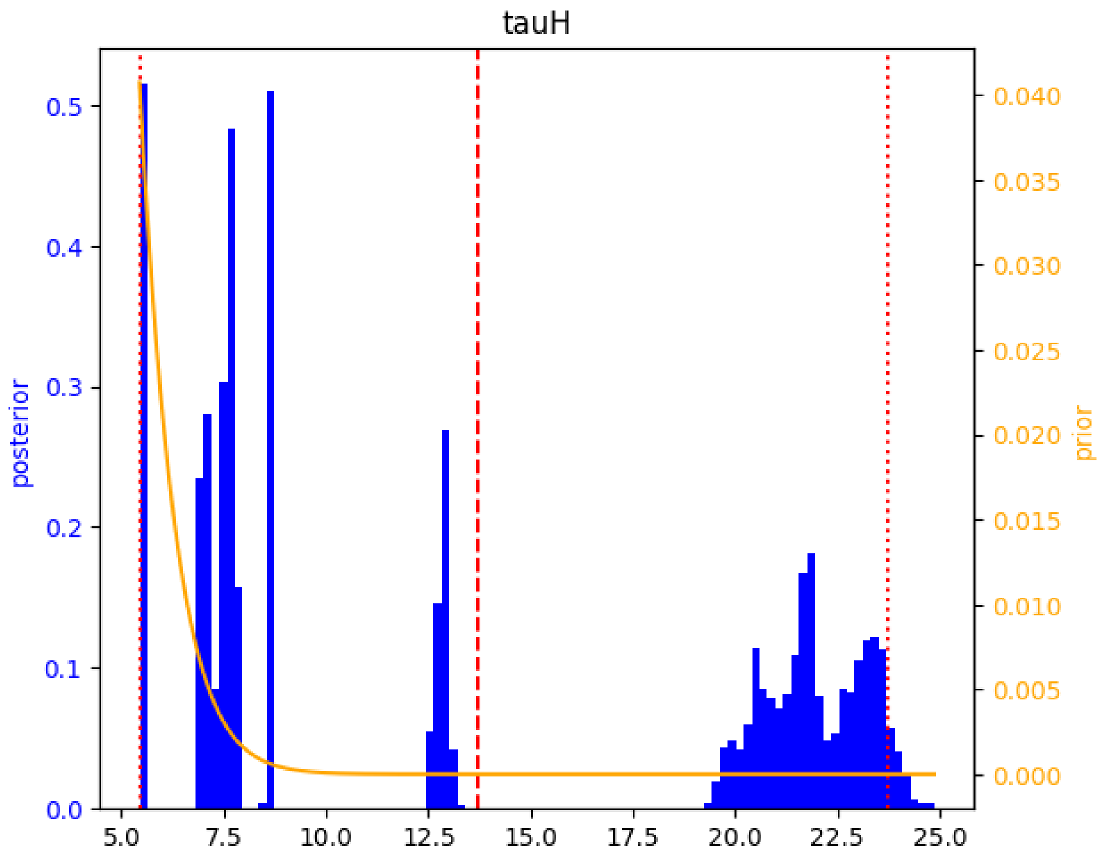

sigma
0.30
0.25
0.20
0.15
0.10
0.05
0
2000
4000
6000
8000
10000

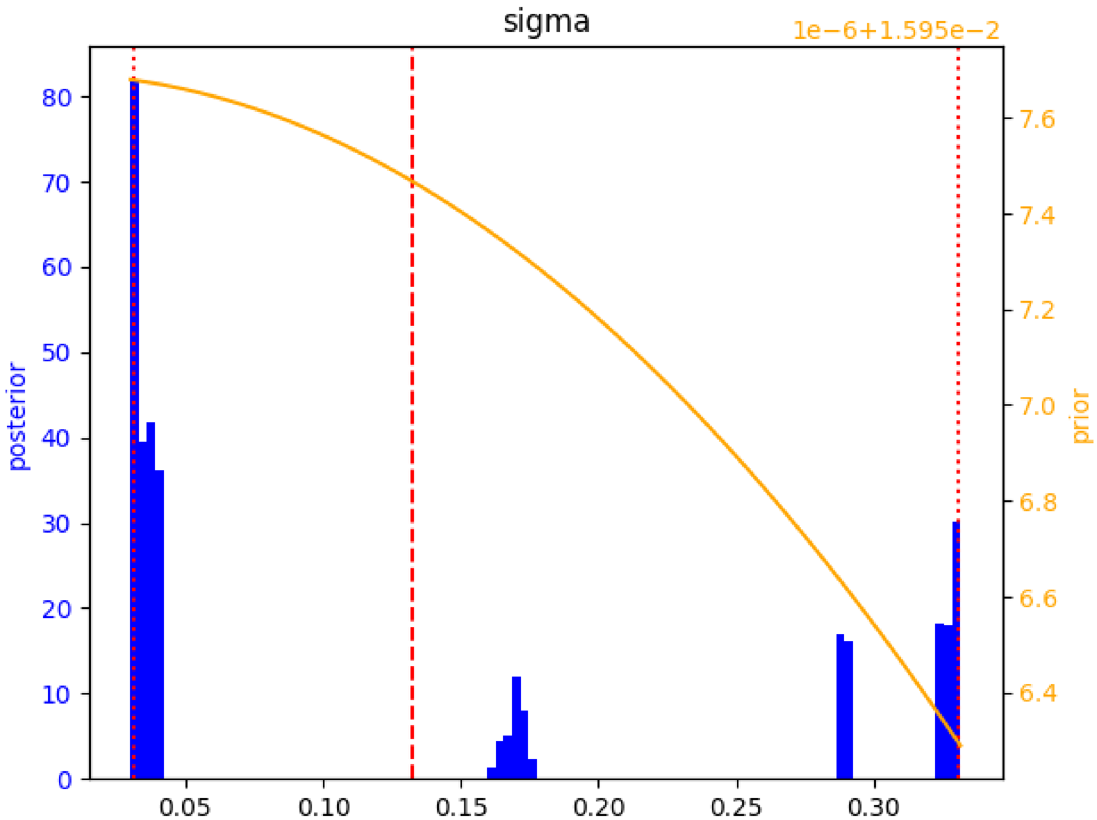

a0
posterior
prior
0
5
10
15
20
25
30
35
40
0.0786
0.0788
0.0790
0.0792
0.55
0.60
0.65
0.70
0.75
0.80
0.85
0.90


kG
posterior
prior
50
40
30
20
10
0
0.07978
0.07976
0.07974
0.07972
0.07970
0.07968
0.07966
0.075
0.100
0.125
0.150
0.175
0.200
0.225
0.250
0.275

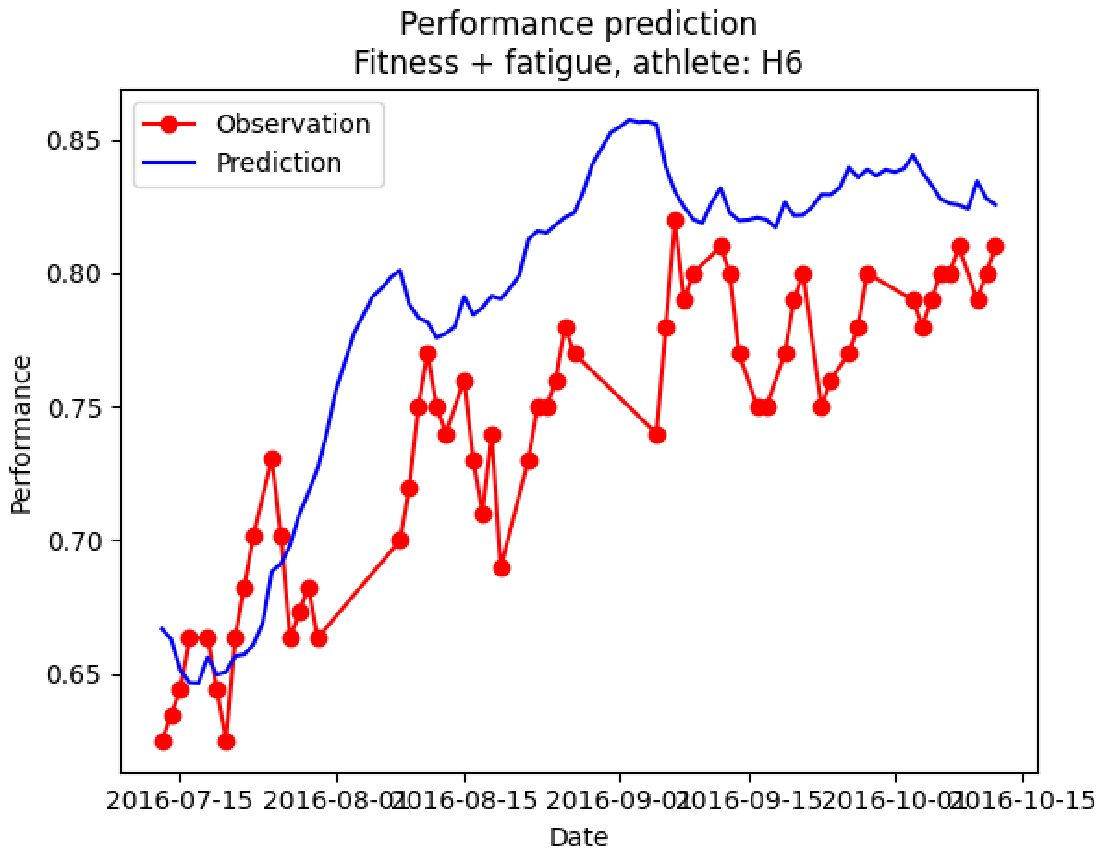

tauG
1e−6
posterior
prior
0.0
0.1
0.2
0.3
0.4
0.5
0.0
0.5
1.0
1.5
2.0
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0

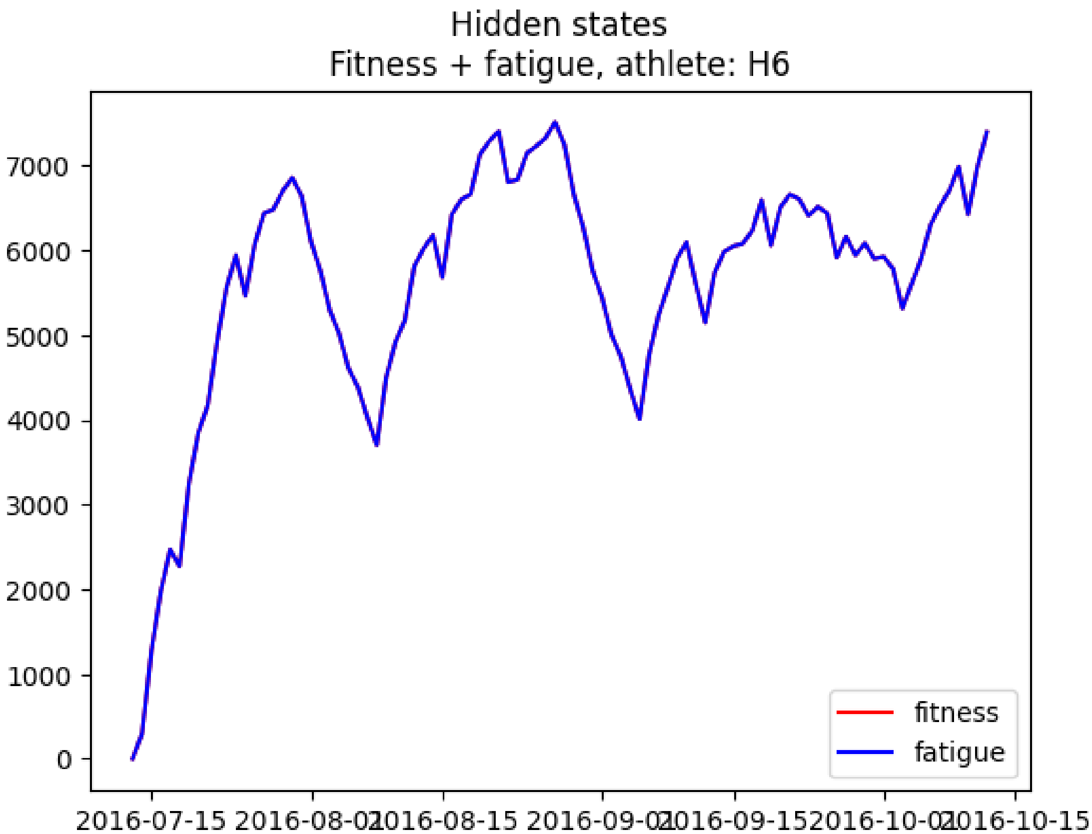

kH
posterior
prior
50
40
30
20
10
0
0.07978
0.07976
0.07974
0.07972
0.07970
0.07968
0.07966
0.075
0.100
0.125
0.150
0.175
0.200
0.225
0.250
0.275

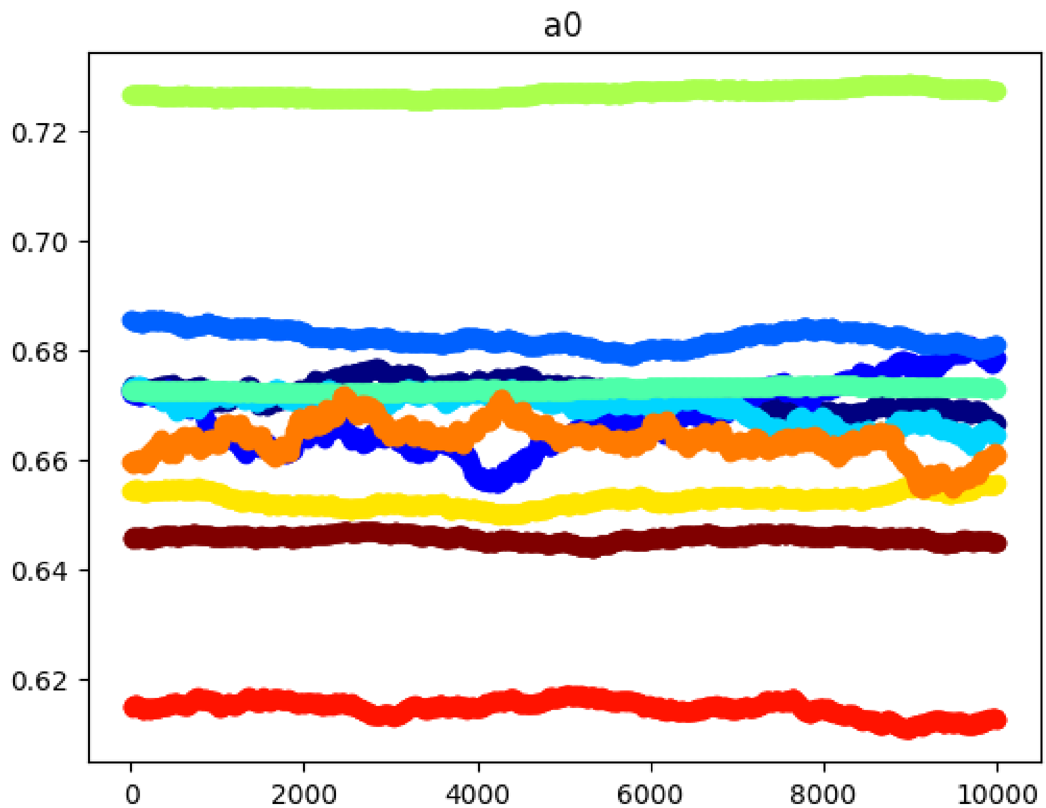

tauH
posterior
prior
0.0
0.1
0.2
0.3
0.4
0.5
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0.035
0.040
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0

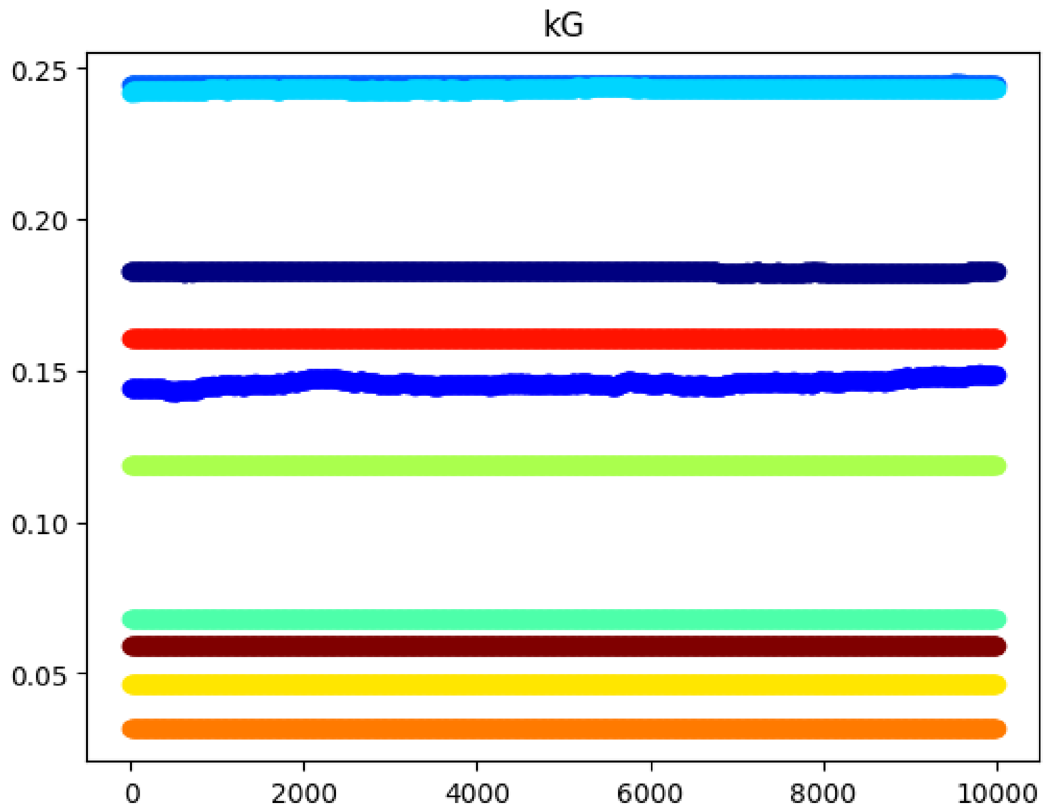


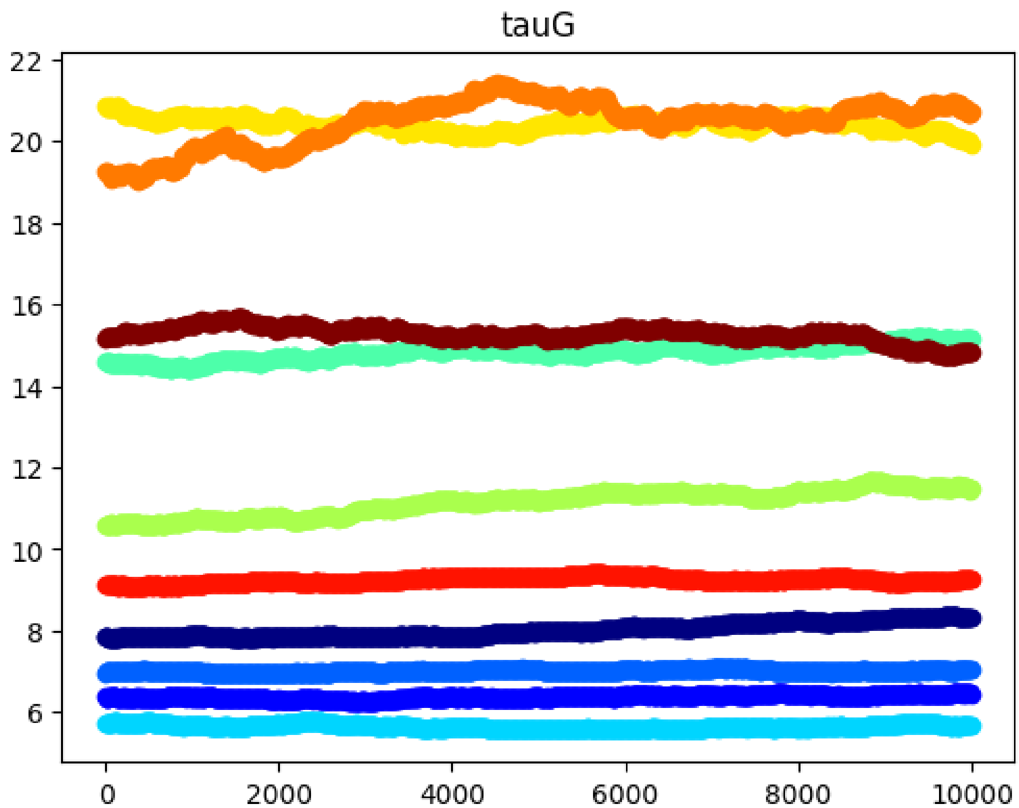
sigma
1e−6+1.595e−2
posterior
prior
80
70
60
50
40
30
20
10
0
7.6
7.4
7.2
7.0
6.8
6.6
6.4
0.05
0.10
0.15
0.20
0.25
0.30


Performance prediction
Fitness + fatigue, athlete: H6
Observation
Prediction
0.85
0.80
0.75
0.70
0.65
Performance
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

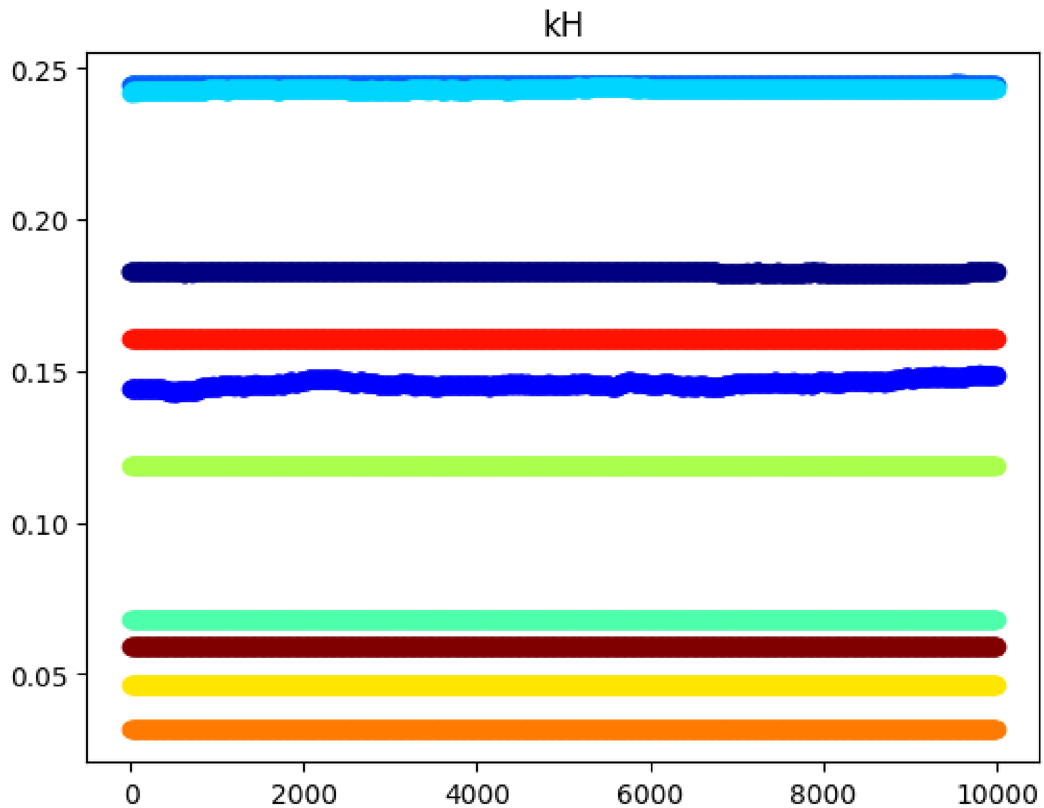

Hidden states
Fitness + fatigue, athlete: H6
7000
6000
5000
4000
3000
2000
1000
0
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
fitness
fatigue

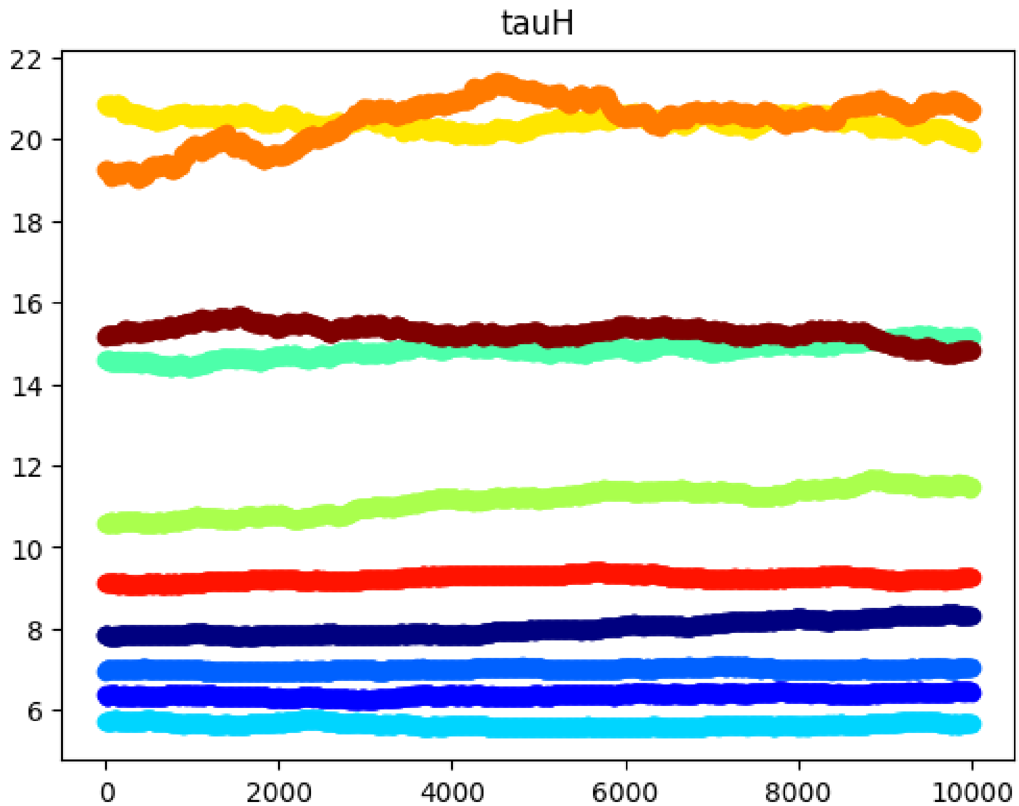

a0
0.72
0.70
0.68
0.66
0.64
0.62
0
2000
4000
6000
8000
10000


kG
0.25
0.20
0.15
0.10
0.05
0
2000
4000
6000
8000
10000

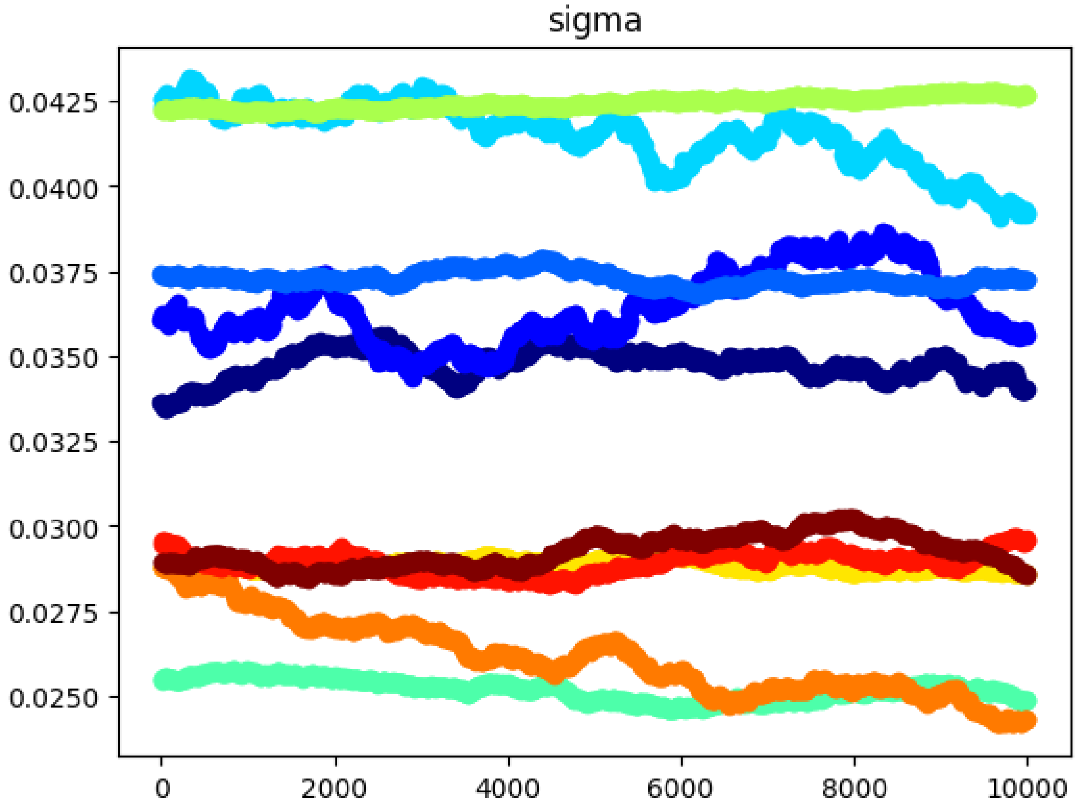


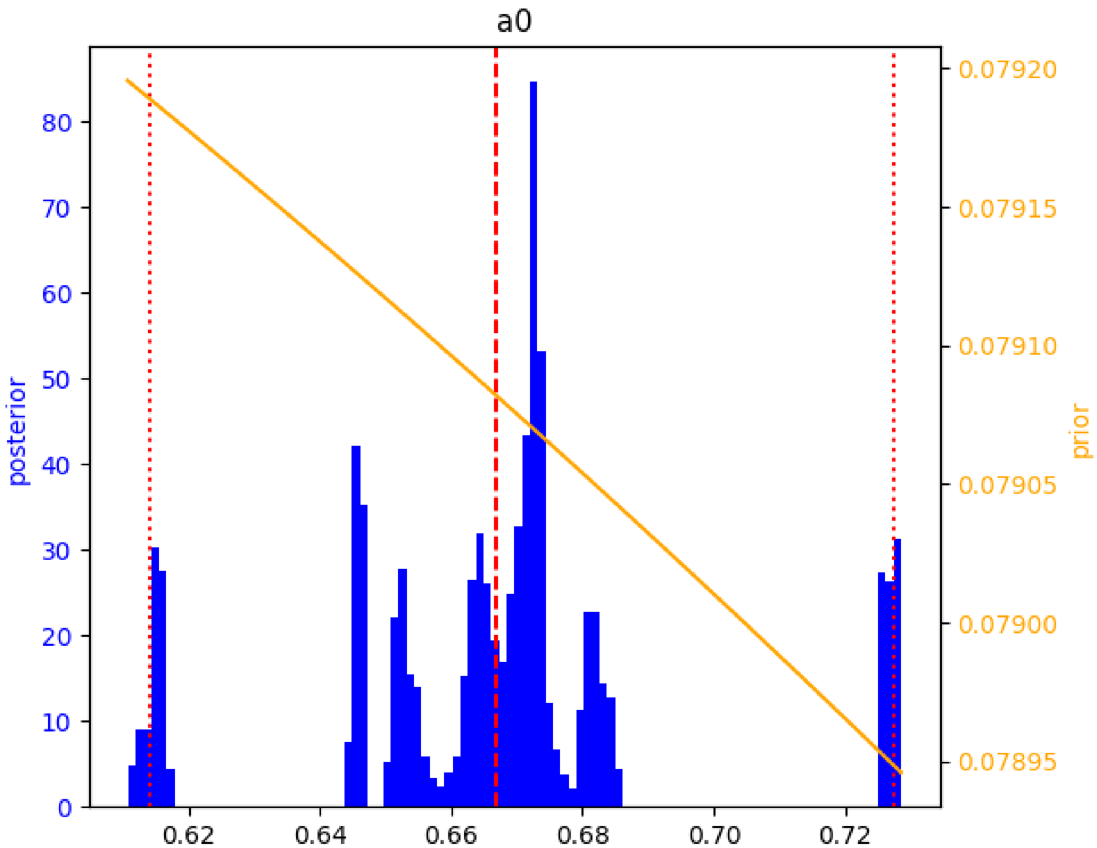
tauG
22
20
18
16
14
12
10
8
6
0
2000
4000
6000
8000
10000

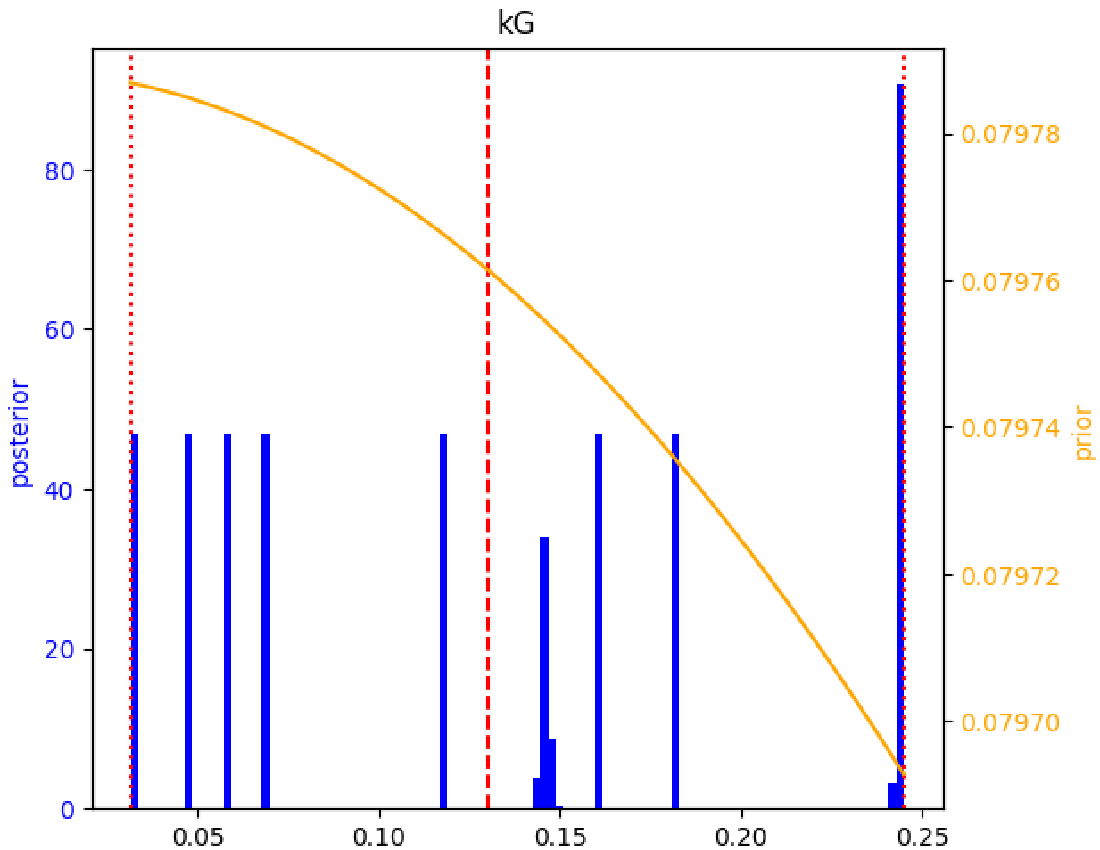

kH
0.25
0.20
0.15
0.10
0.05
0
2000
4000
6000
8000
10000

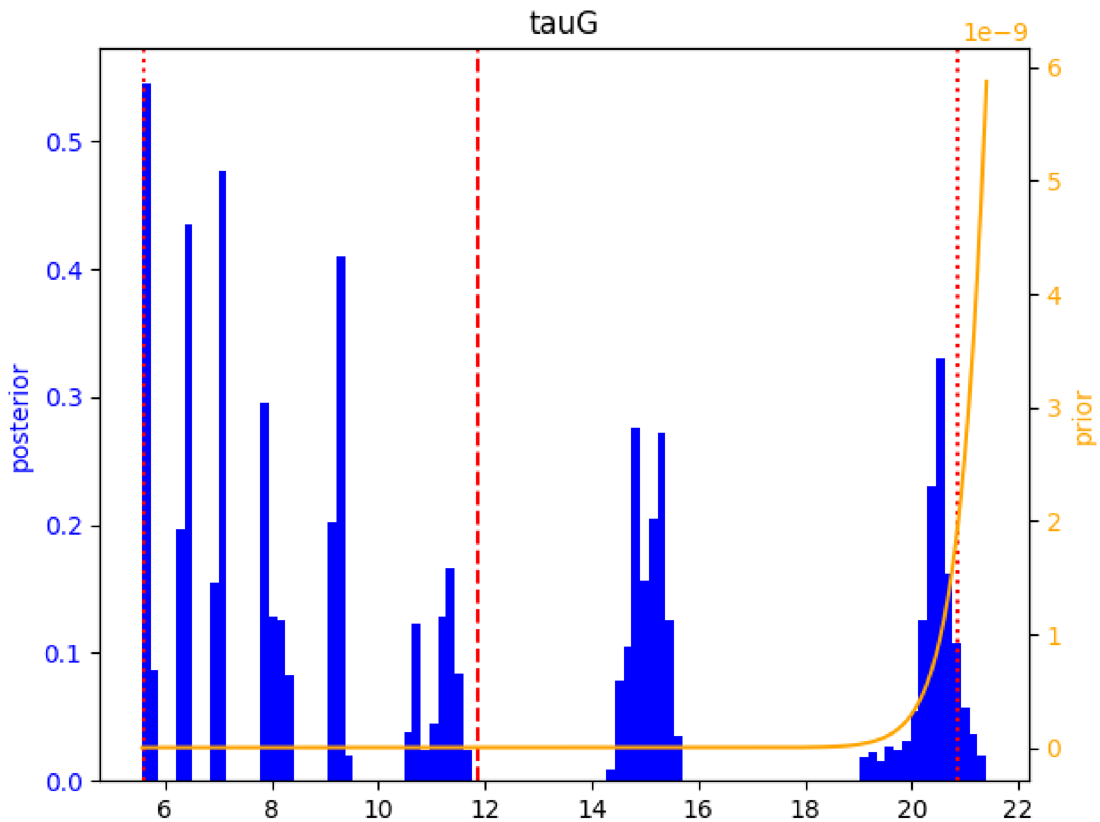


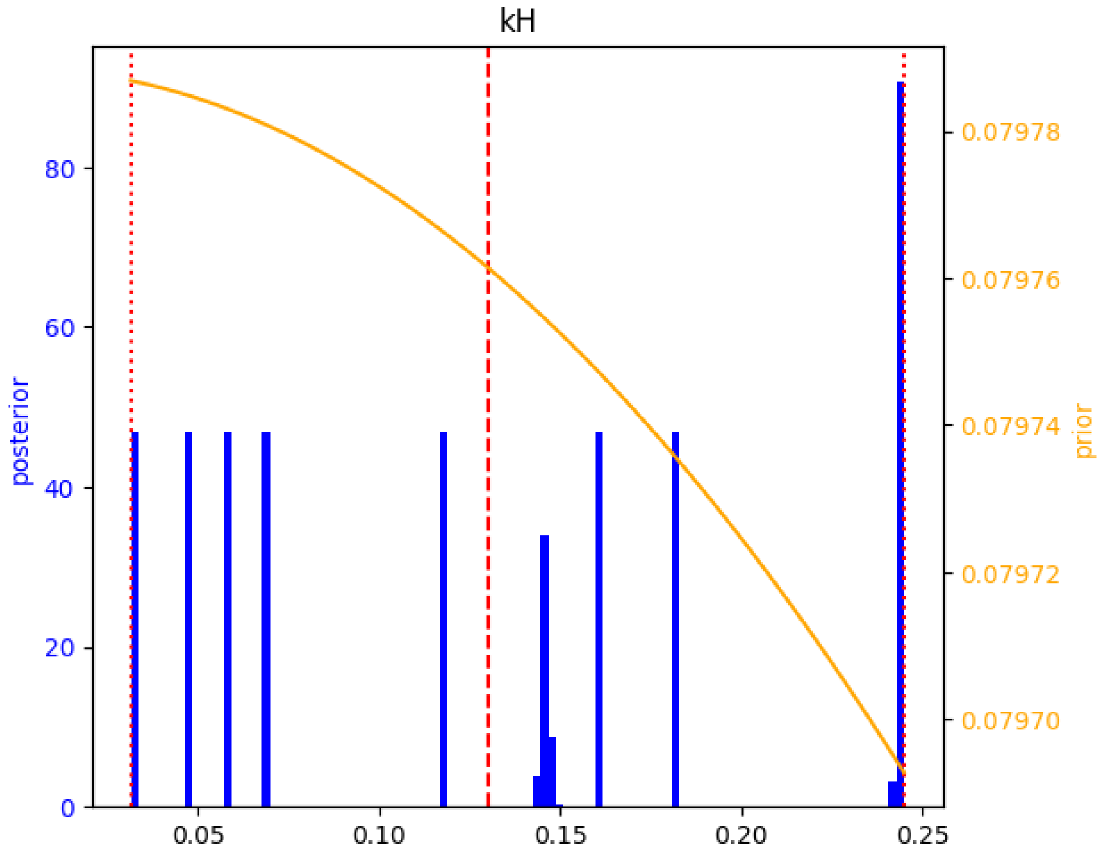
tauH
22
20
18
16
14
12
10
8
6
0
2000
4000
6000
8000
10000

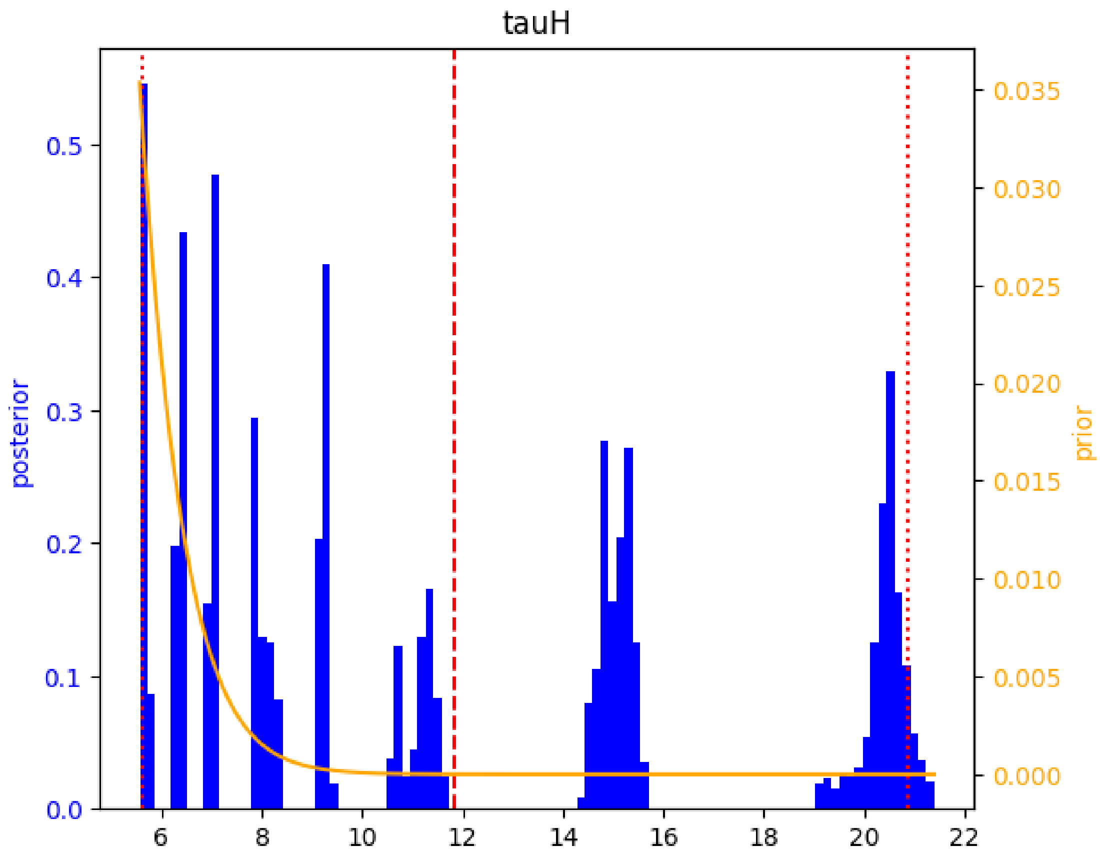

sigma
0.0425
0.0400
0.0375
0.0350
0.0325
0.0300
0.0275
0.0250
0
2000
4000
6000
8000
10000

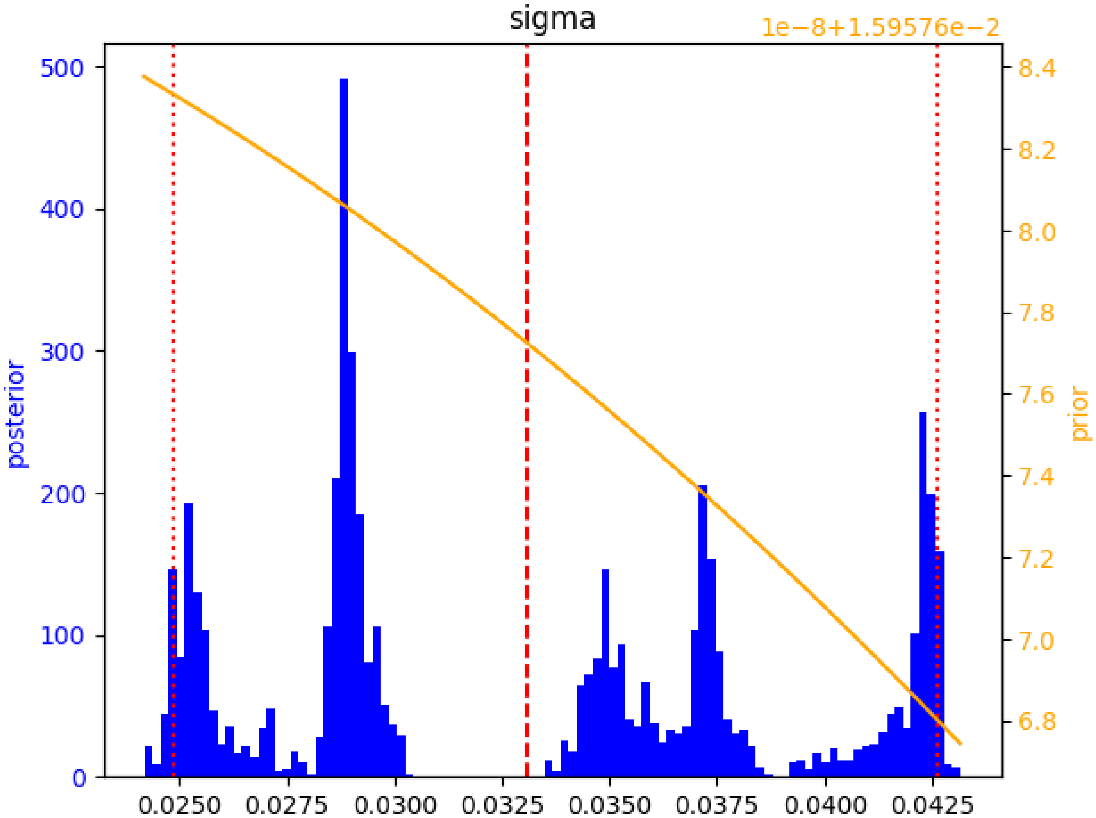

a0
posterior
prior
0
10
20
30
40
50
60
70
80
0.62
0.64
0.66
0.68
0.70
0.72
0.07895
0.07900
0.07905
0.07910
0.07915
0.07920

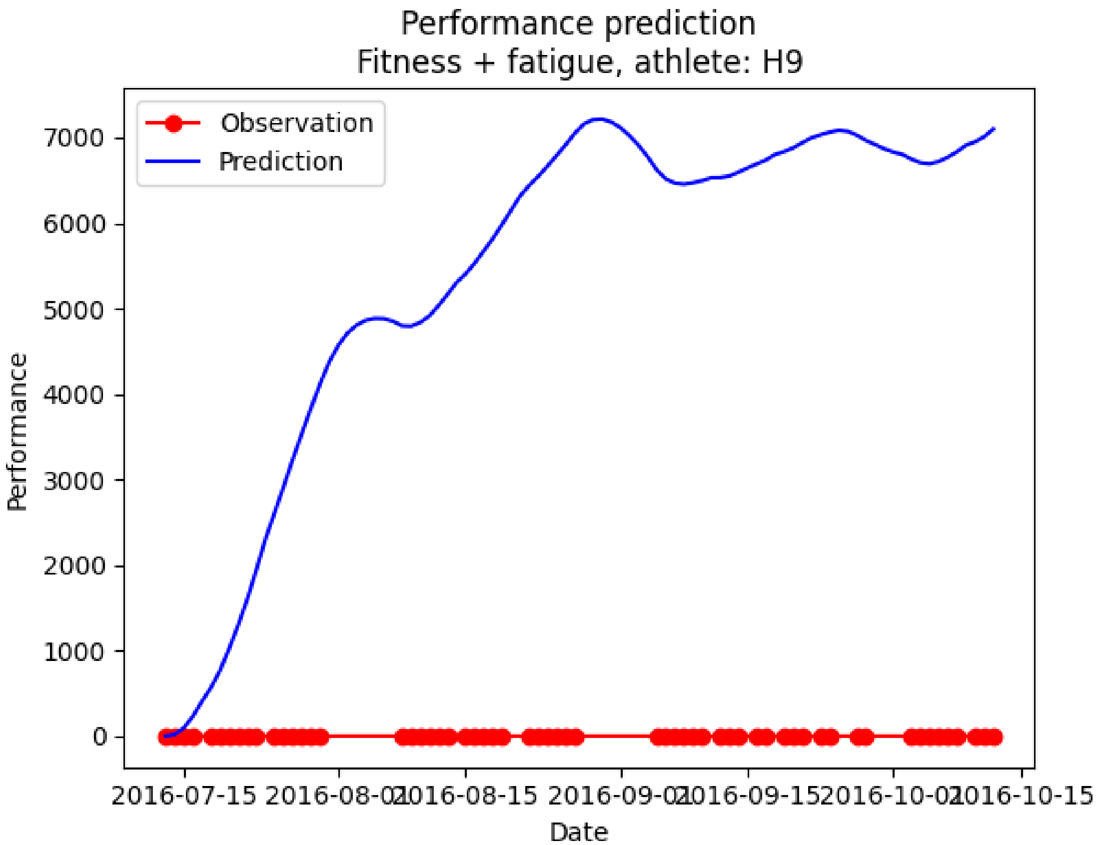

kG
posterior
prior
0
20
40
60
80
0.05
0.10
0.15
0.20
0.25
0.07970
0.07972
0.07974
0.07976
0.07978

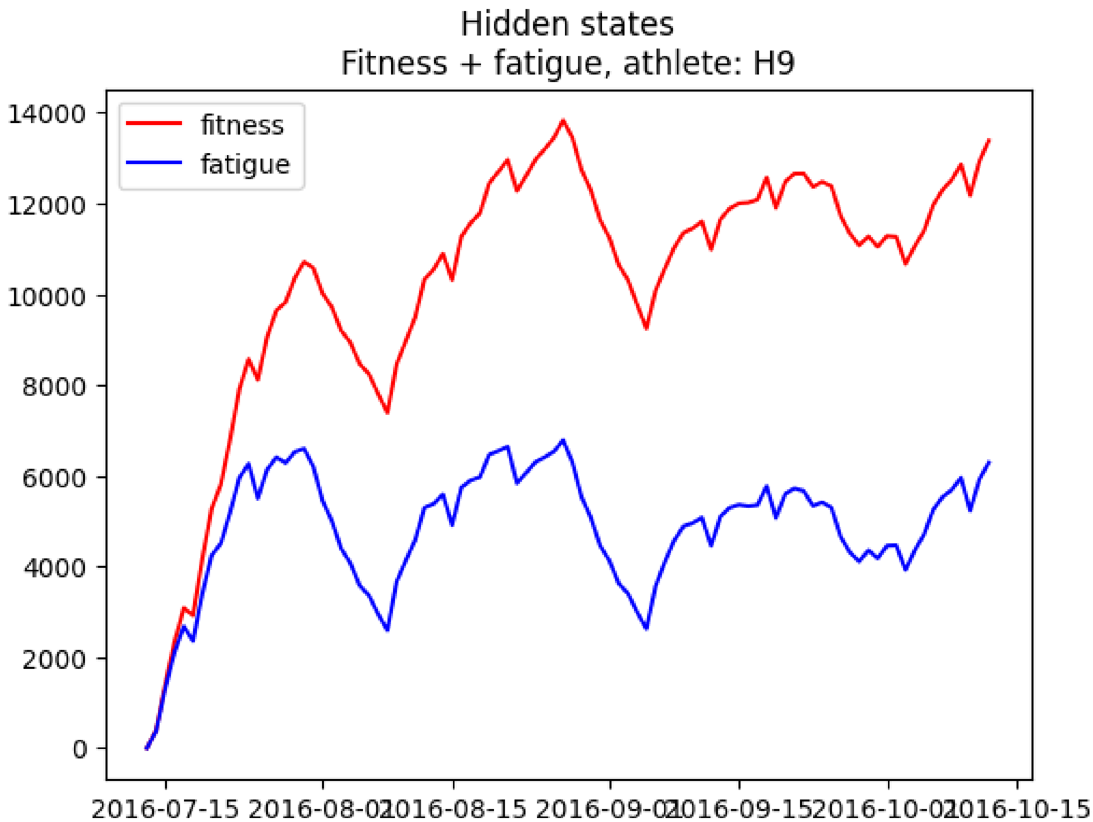

tauG
1e−9
posterior
prior
0.0
0.1
0.2
0.3
0.4
0.5
0
1
2
3
4
5
6
6
8
10
12
14
16
18
20
22


kH
posterior
prior
0
20
40
60
80
0.05
0.10
0.15
0.20
0.25
0.07970
0.07972
0.07974
0.07976
0.07978

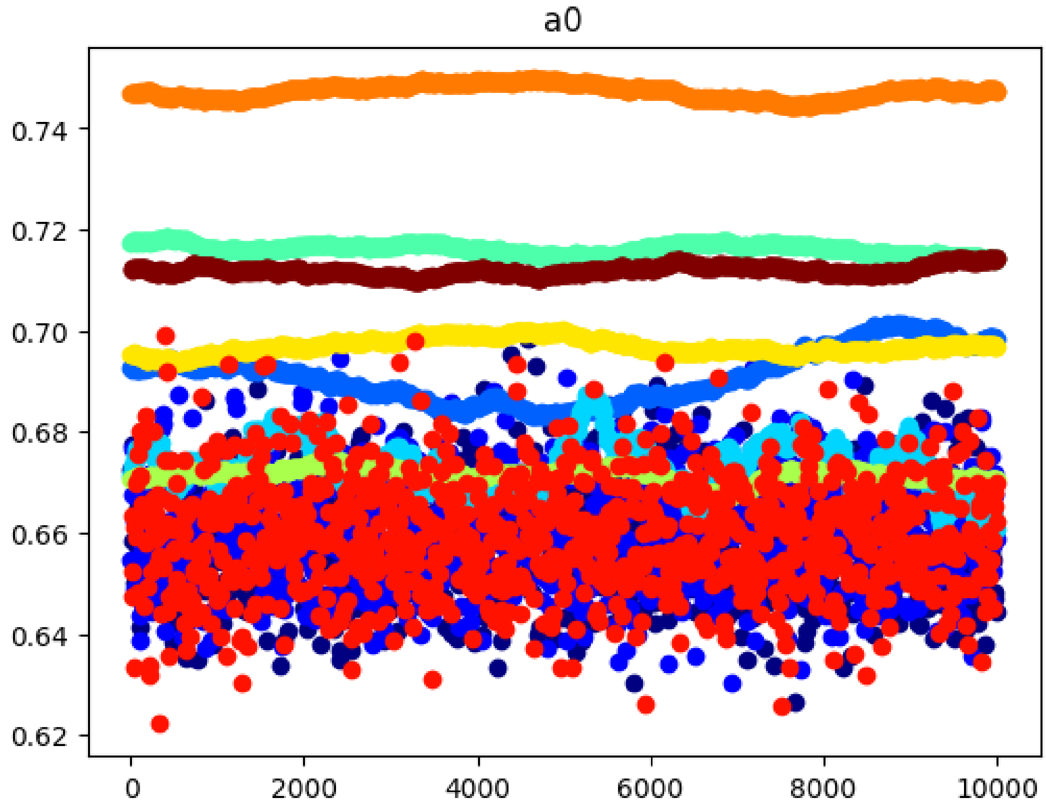

tauH
posterior
prior
0.0
0.1
0.2
0.3
0.4
0.5
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0.035
6
8
10
12
14
16
18
20
22


sigma
1e−8+1.59576e−2
posterior
prior
0
100
200
300
400
500
6.8
7.0
7.2
7.4
7.6
7.8
8.0
8.2
8.4
0.0250
0.0275
0.0300
0.0325
0.0350
0.0375
0.0400
0.0425

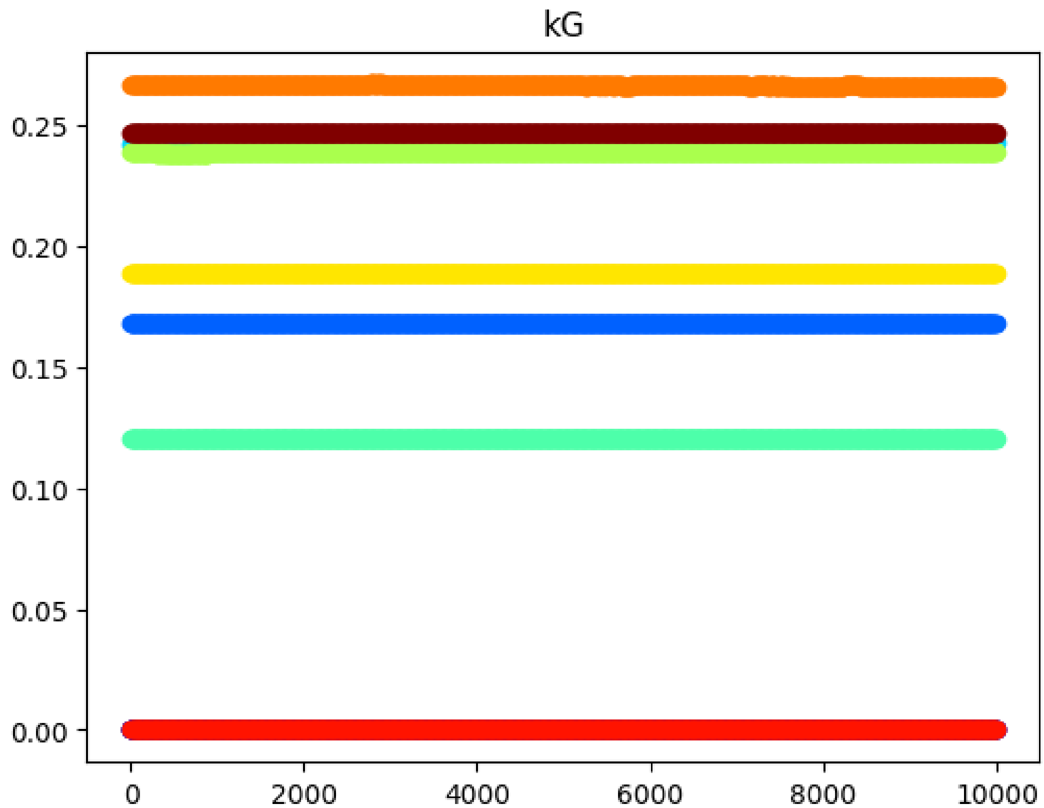

Performance prediction
Fitness + fatigue, athlete: H9
Observation
Prediction
7000
6000
5000
4000
3000
2000
1000
0
Performance
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
Date

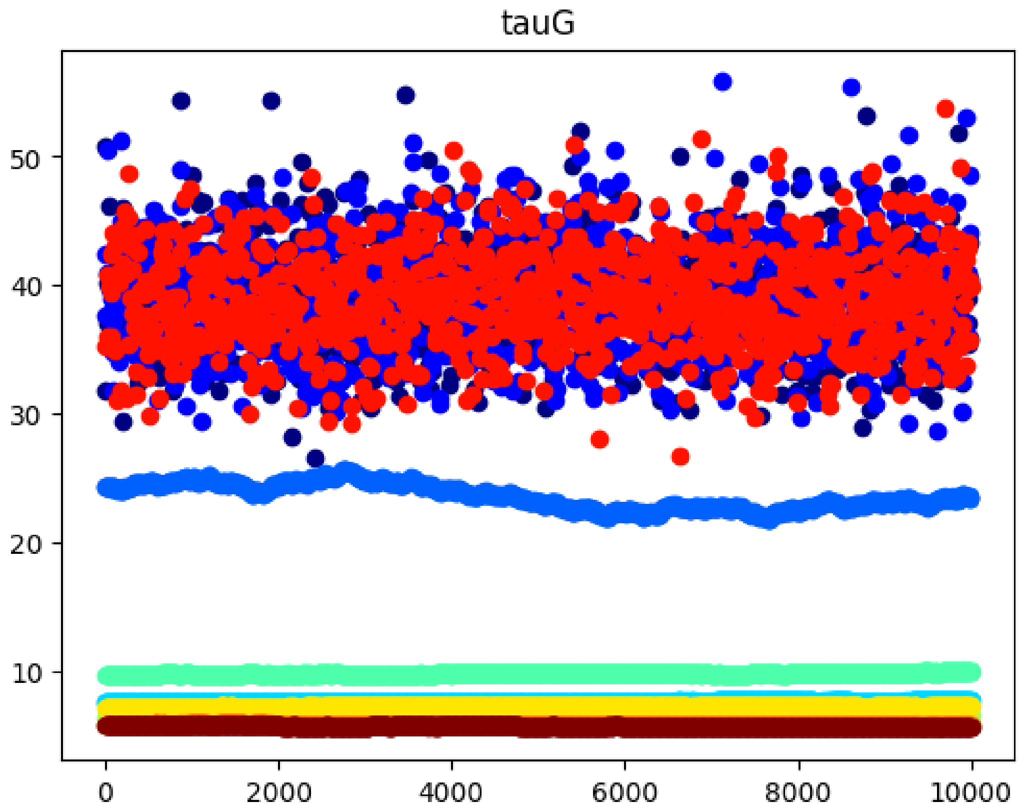


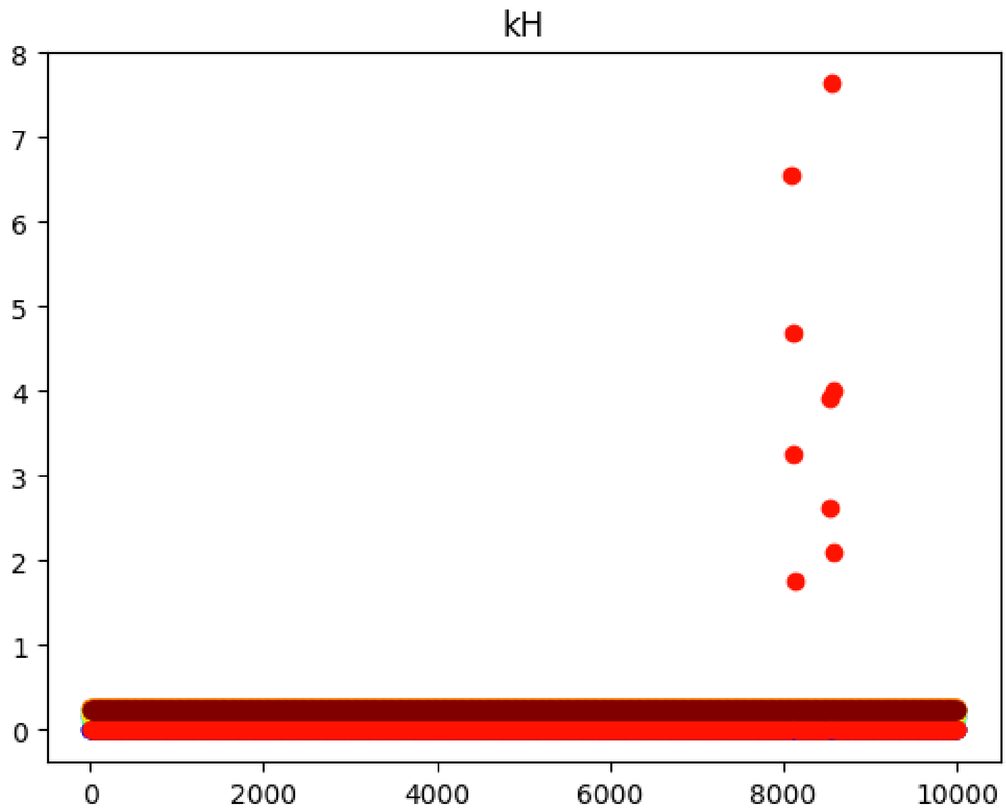
Hidden states
Fitness + fatigue, athlete: H9
fitness
fatigue
14000
12000
10000
8000
6000
4000
2000
0
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

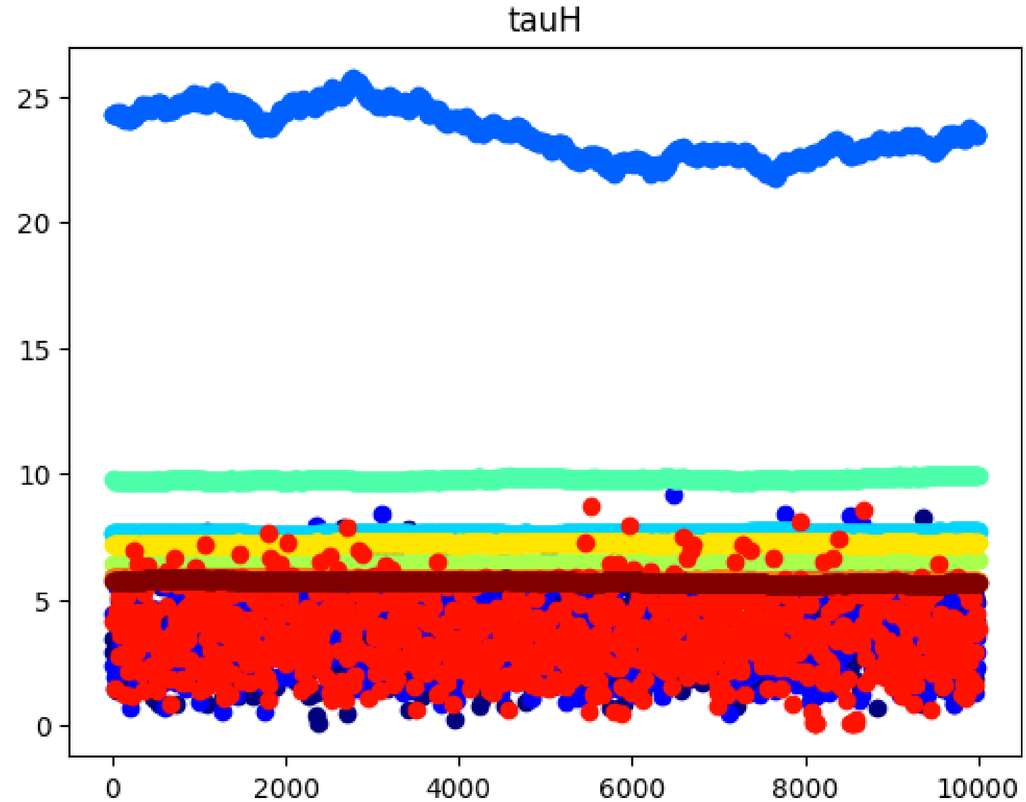


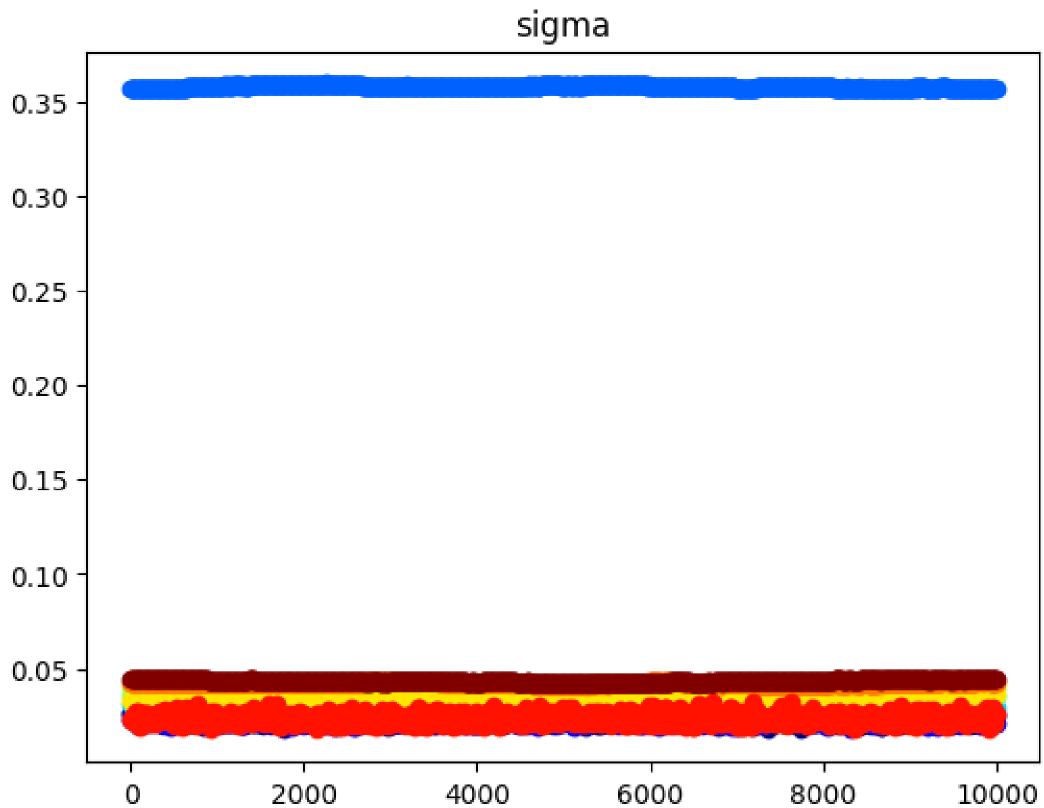
a0
0.74
0.72
0.70
0.68
0.66
0.64
0.62
0
2000
4000
6000
8000
10000

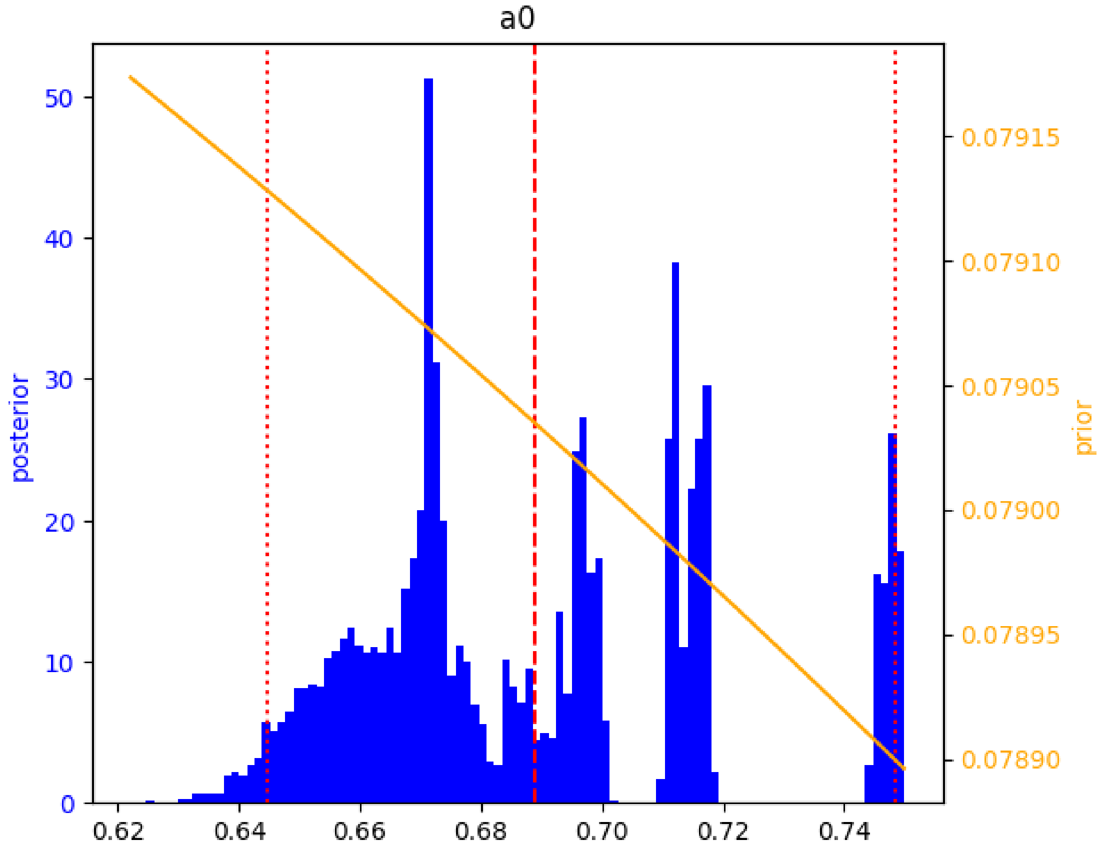

kG
0.25
0.20
0.15
0.10
0.05
0.00
0
2000
4000
6000
8000
10000


tauG
50
40
30
20
10
0
2000
4000
6000
8000
10000

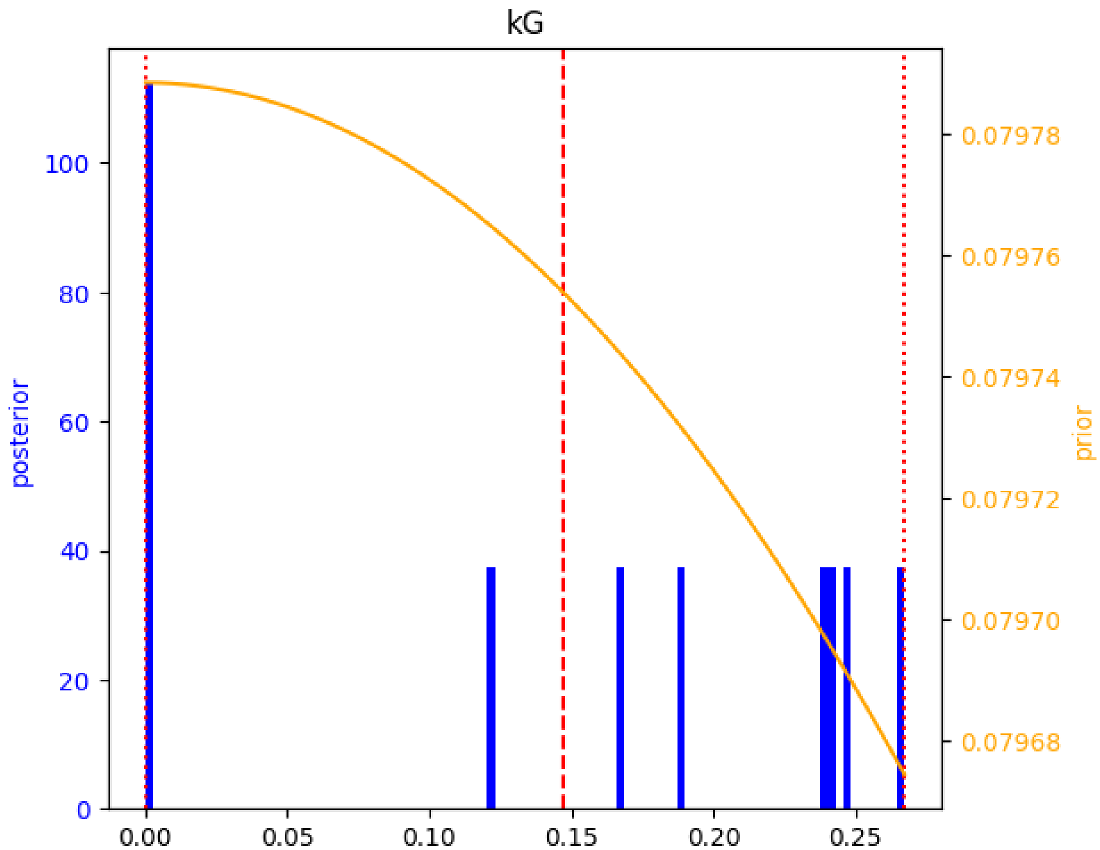

kH
8
7
6
5
4
3
2
1
0
0
2000
4000
6000
8000
10000


tauH
25
20
15
10
5
0
0
2000
4000
6000
8000
10000

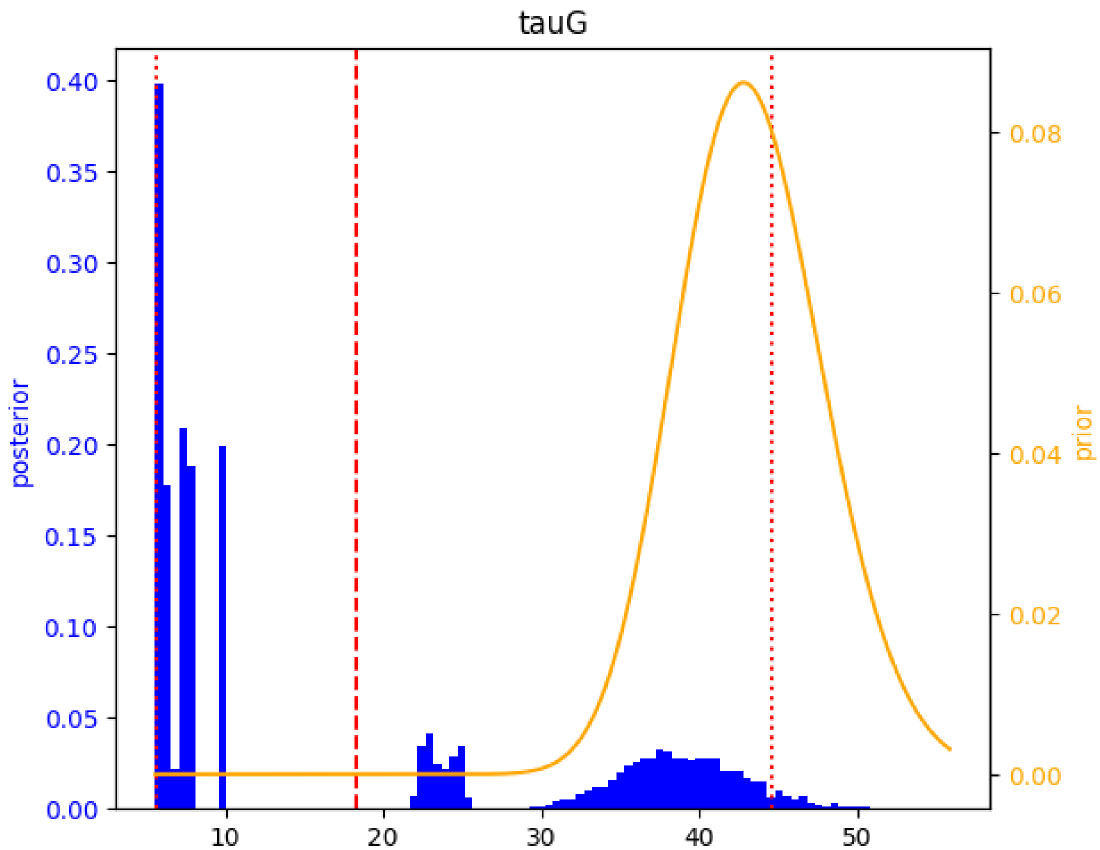

sigma
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0
2000
4000
6000
8000
10000

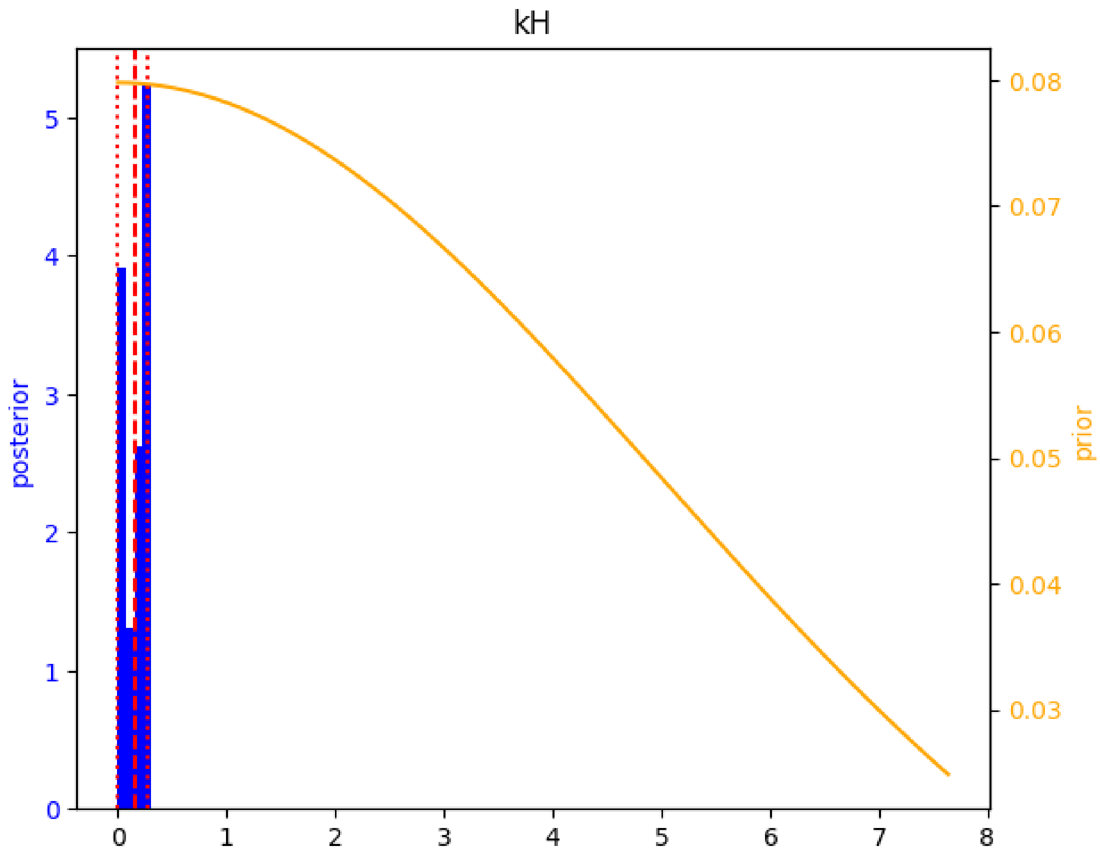


a0
posterior
prior
0
10
20
30
40
50
0.62
0.64
0.66
0.68
0.70
0.72
0.74
0.07890
0.07895
0.07900
0.07905
0.07910
0.07915

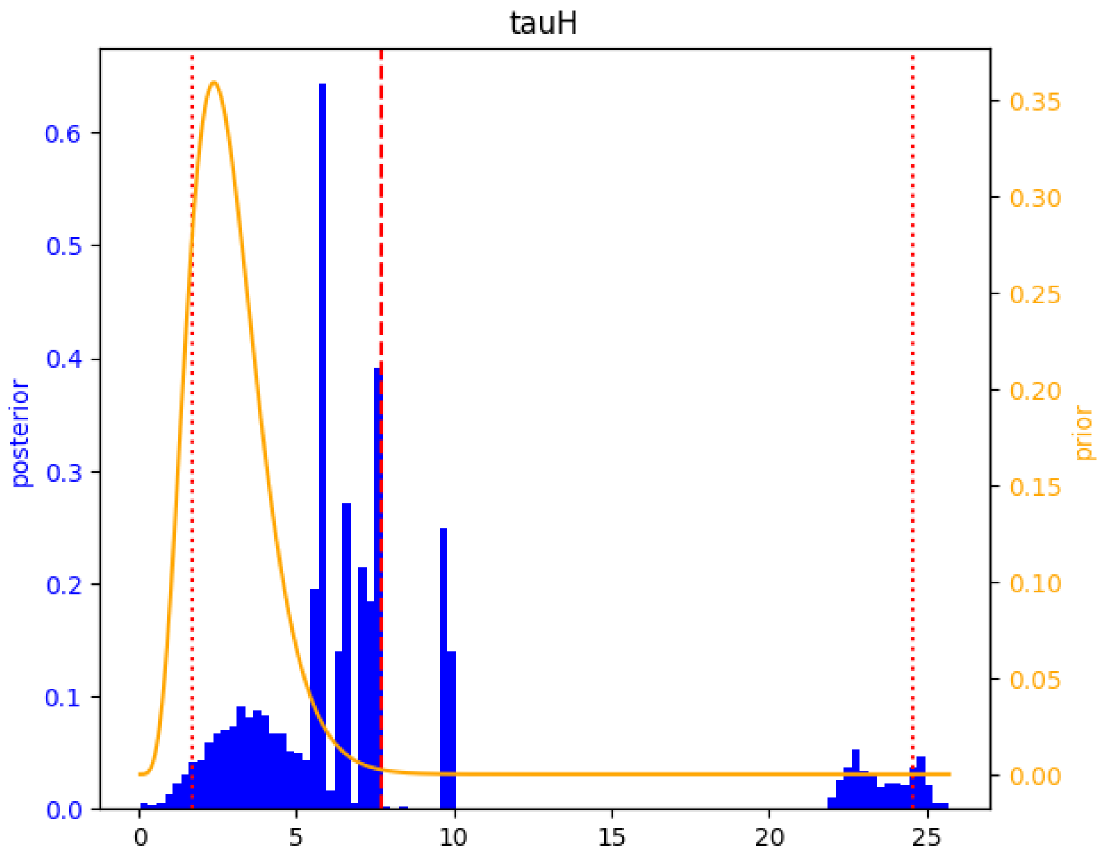


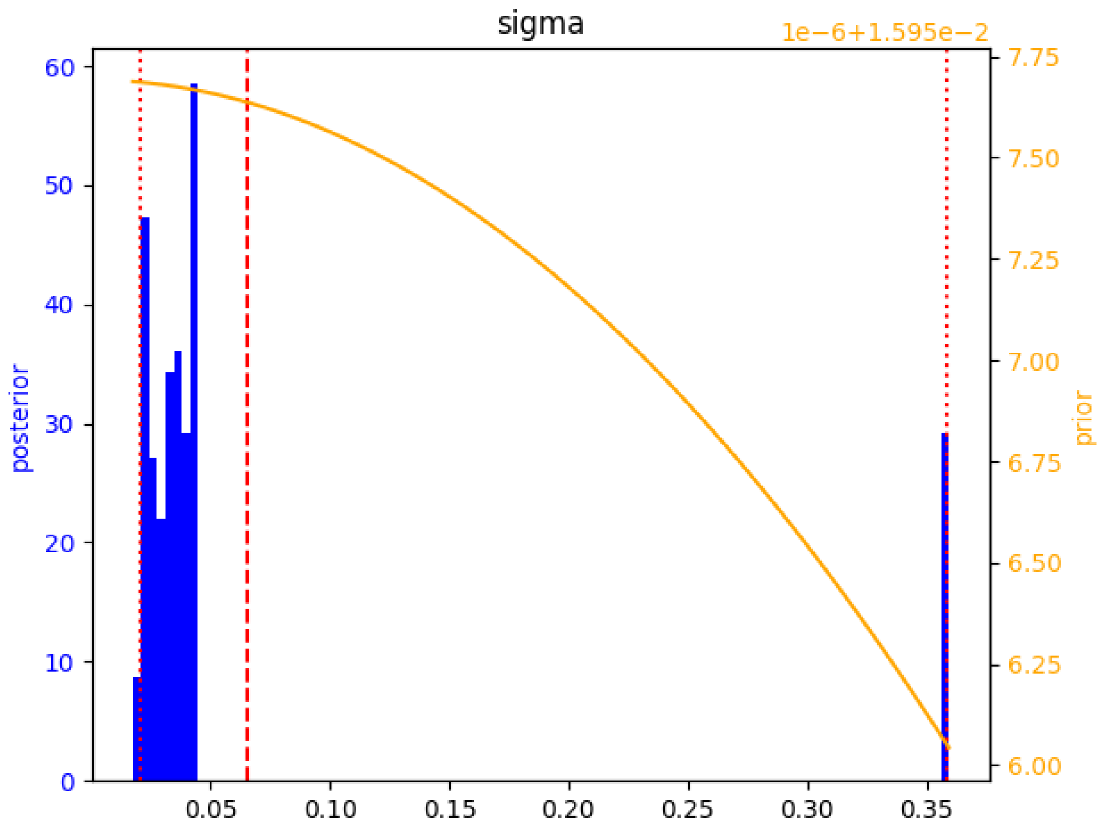
kG
posterior
prior
0
20
40
60
80
100
0.00
0.05
0.10
0.15
0.20
0.25
0.07968
0.07970
0.07972
0.07974
0.07976
0.07978

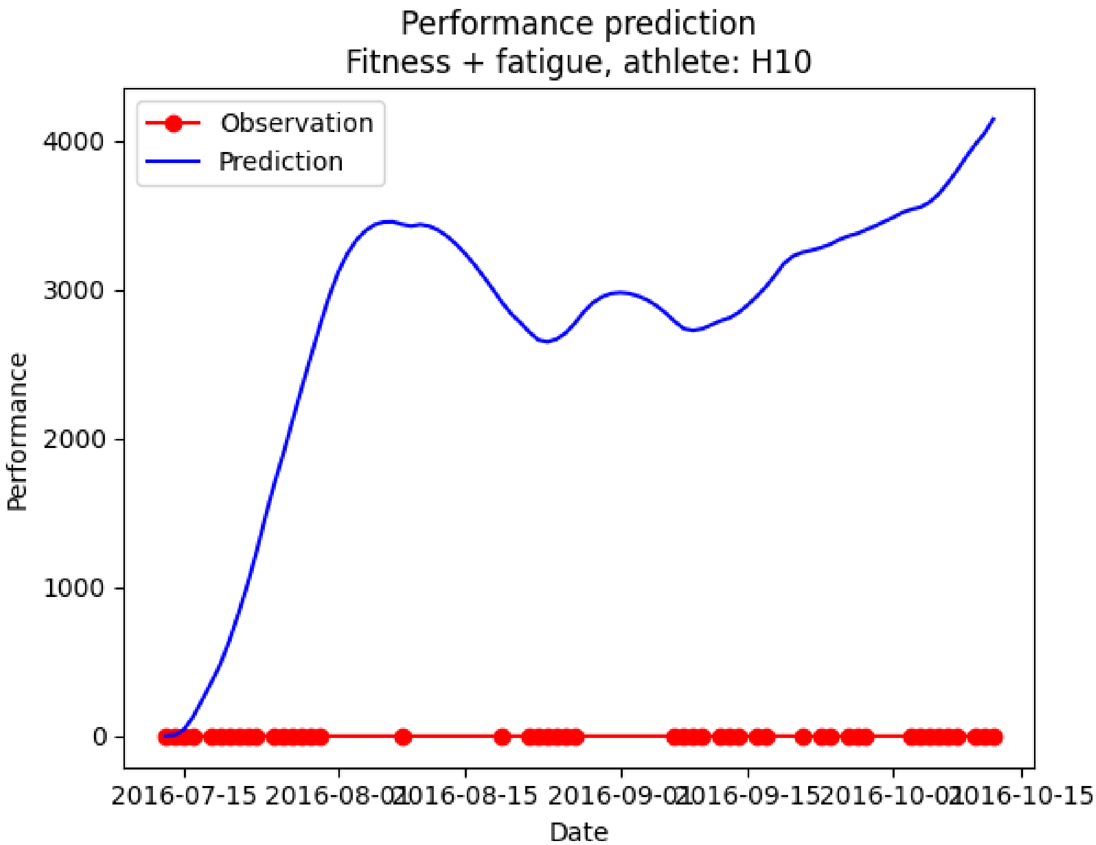

tauG
posterior
prior
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.00
0.02
0.04
0.06
0.08
10
20
30
40
50

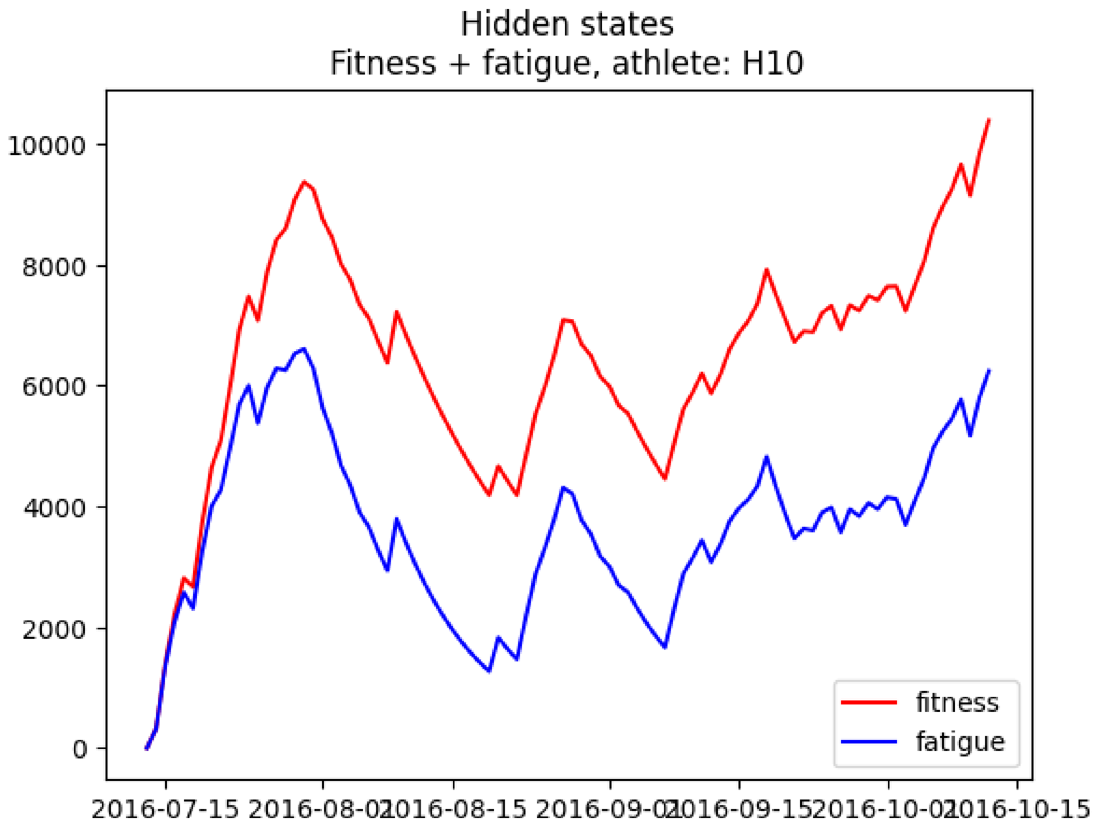


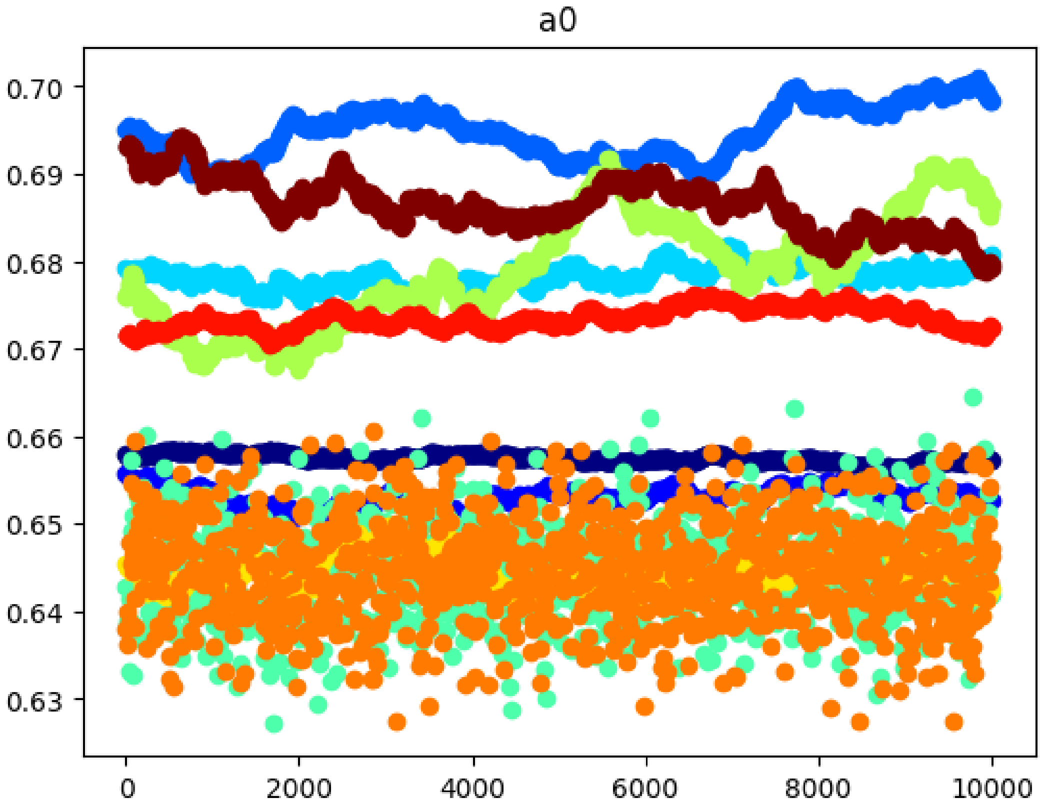
kH
posterior
prior
0
1
2
3
4
5
6
7
8
0.03
0.04
0.05
0.06
0.07
0.08

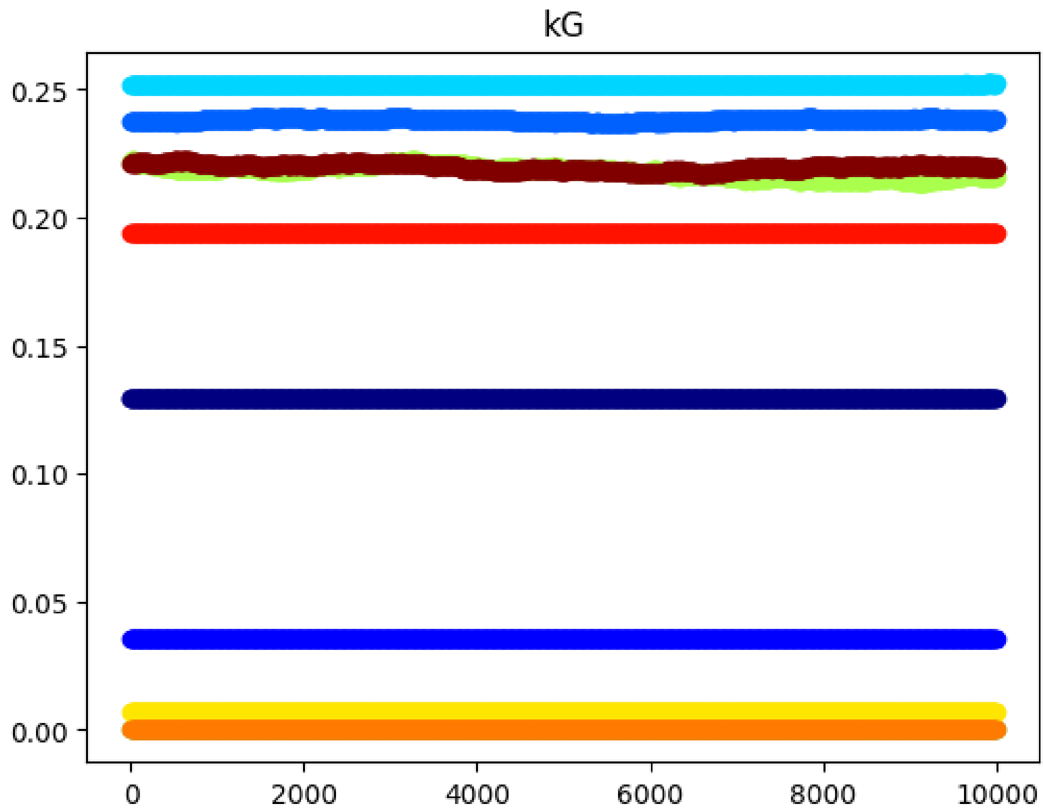

tauH
posterior
prior
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0
5
10
15
20
25

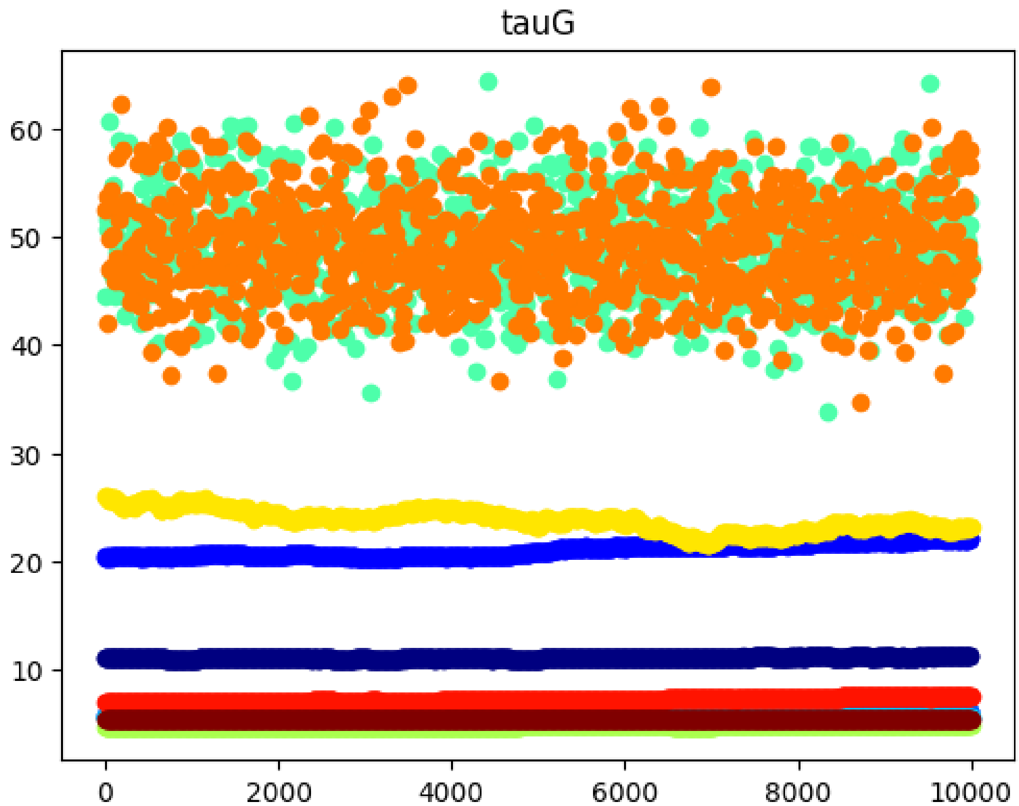

sigma
1e−6+1.595e−2
posterior
prior
0
10
20
30
40
50
60
6.00
6.25
6.50
6.75
7.00
7.25
7.50
7.75
0.05
0.10
0.15
0.20
0.25
0.30
0.35

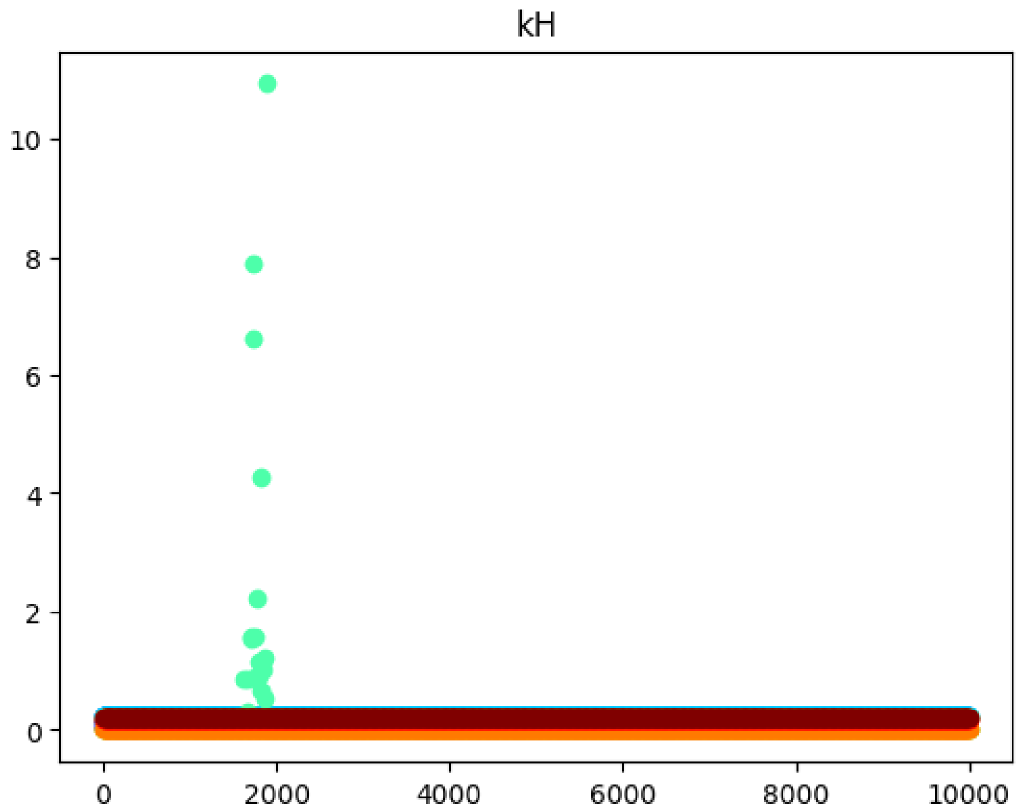

Performance prediction
Fitness + fatigue, athlete: H10
Observation
Prediction
Performance
0
1000
2000
3000
4000
Date
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

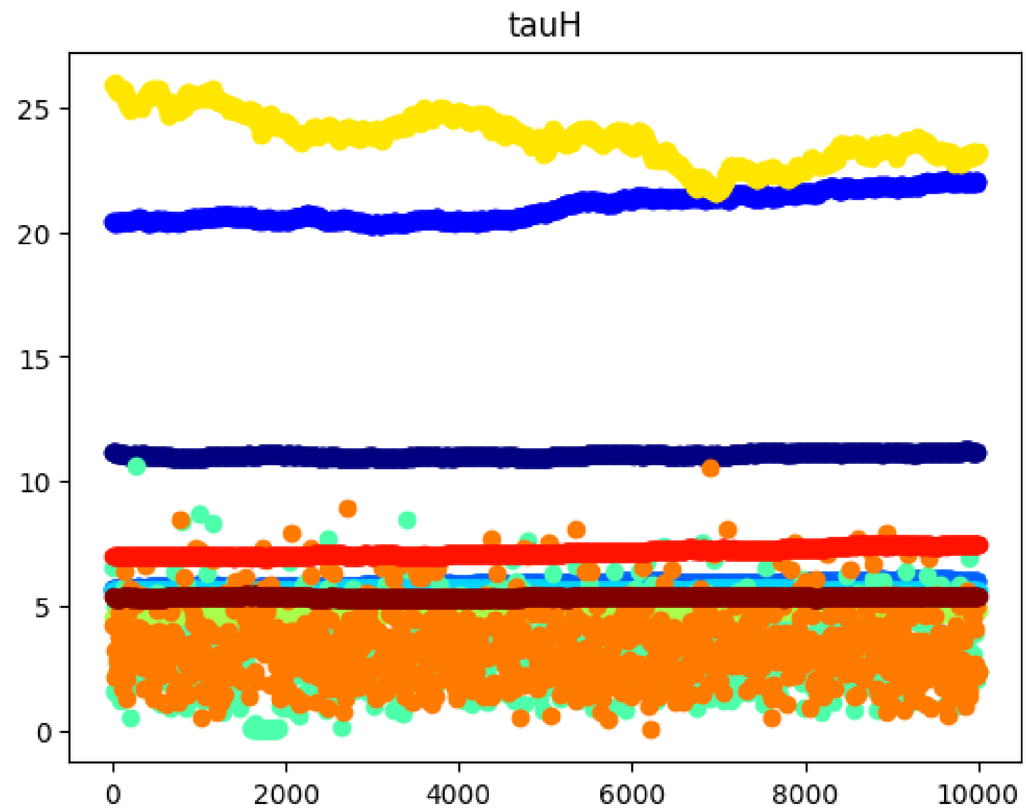

Hidden states
Fitness + fatigue, athlete: H10
10000
8000
6000
4000
2000
0
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15
fitness
fatigue

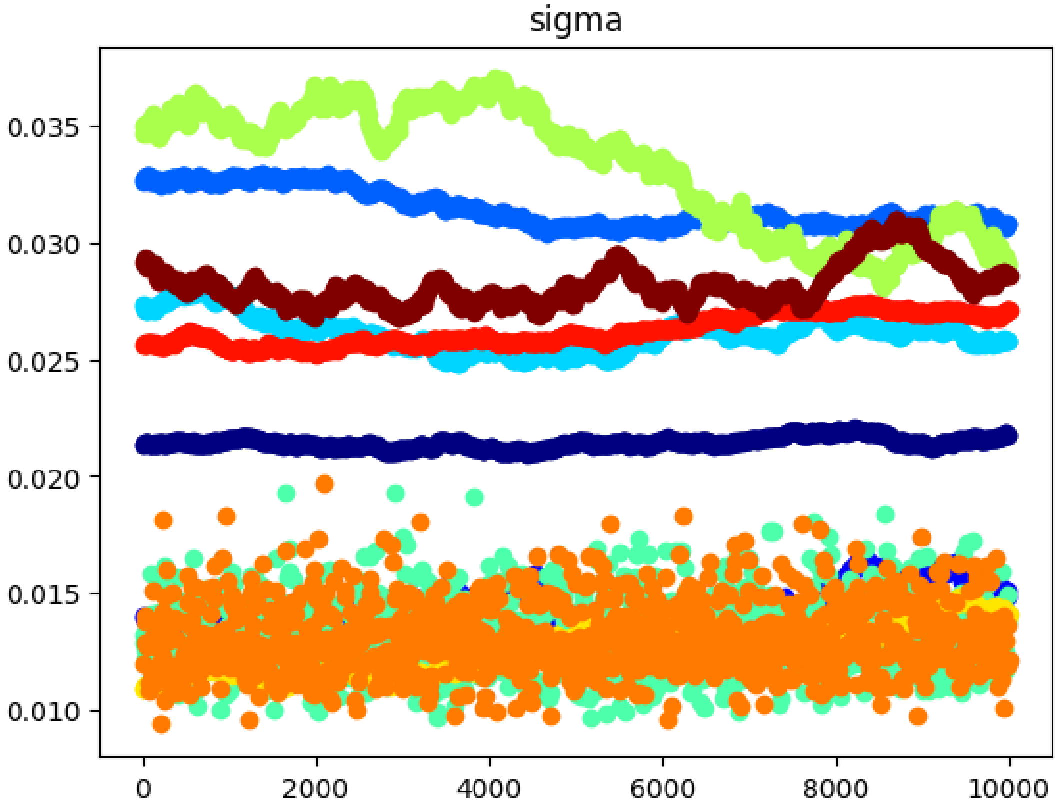

a0
0.70
0.69
0.68
0.67
0.66
0.65
0.64
0.63
0
2000
4000
6000
8000
10000

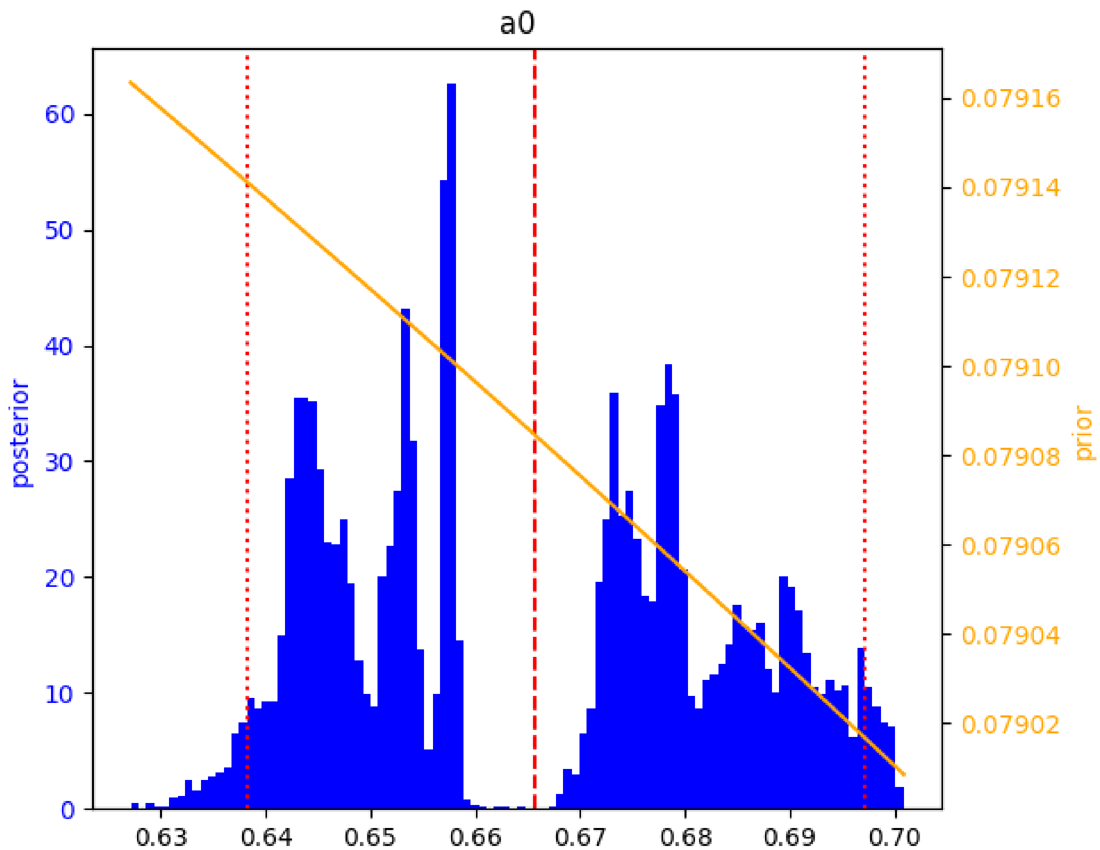

kG
0.25
0.20
0.15
0.10
0.05
0.00
0
2000
4000
6000
8000
10000


tauG
60
50
40
30
20
10
0
2000
4000
6000
8000
10000

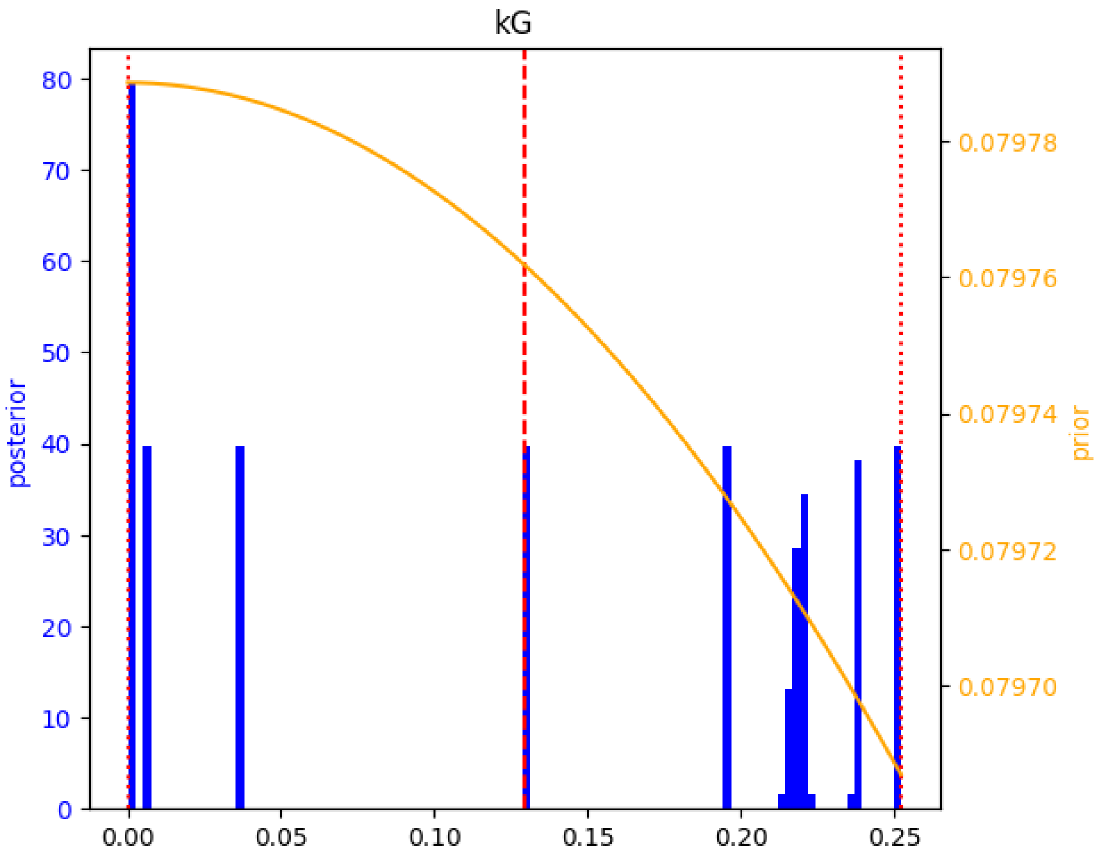

kH
10
8
6
4
2
0
0
2000
4000
6000
8000
10000


tauH
25
20
15
10
5
0
0
2000
4000
6000
8000
10000

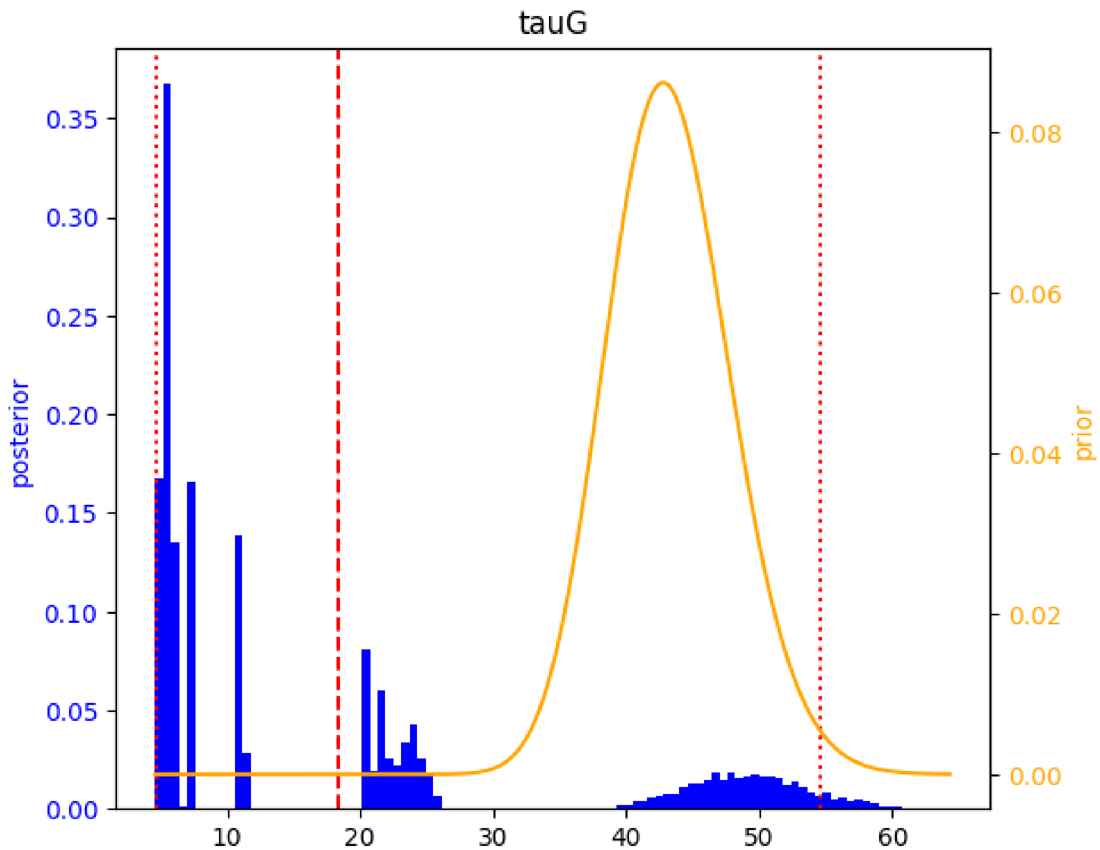

sigma
0.035
0.030
0.025
0.020
0.015
0.010
0
2000
4000
6000
8000
10000



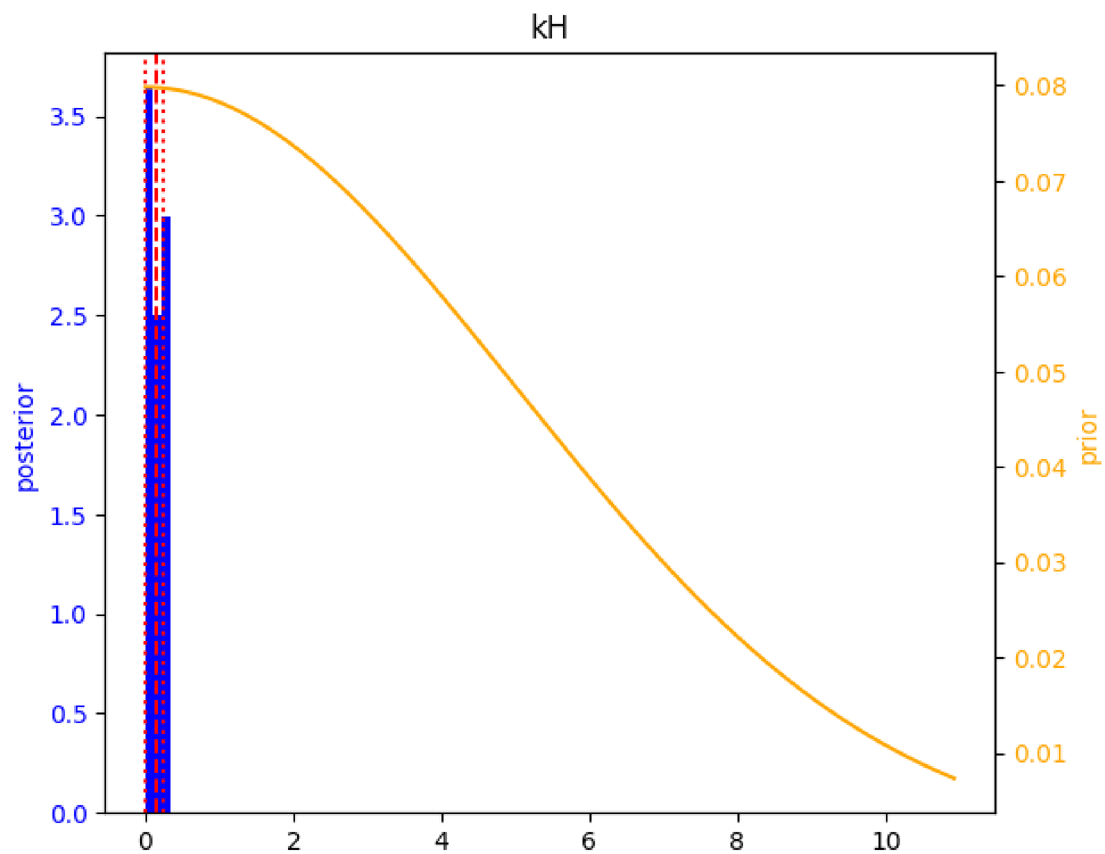
a0
posterior
prior
0
10
20
30
40
50
60
0.63
0.64
0.65
0.66
0.67
0.68
0.69
0.70
0.07902
0.07904
0.07906
0.07908
0.07910
0.07912
0.07914
0.07916

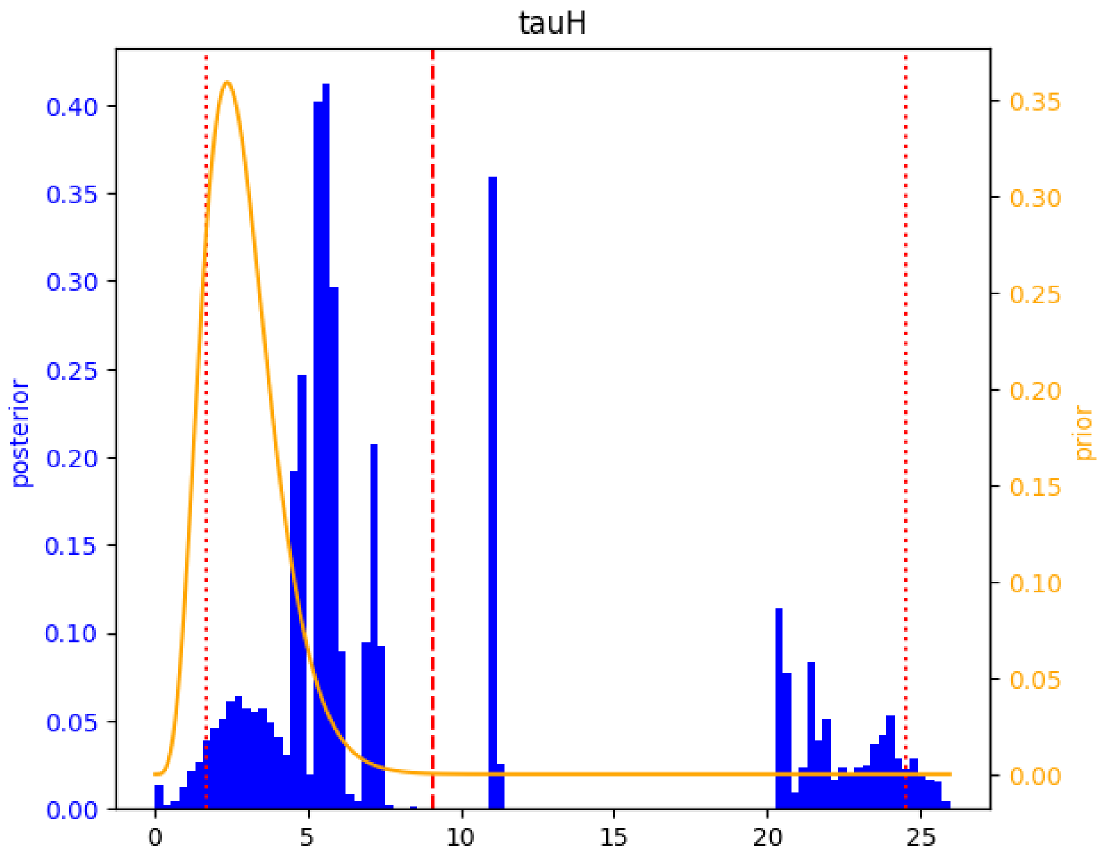


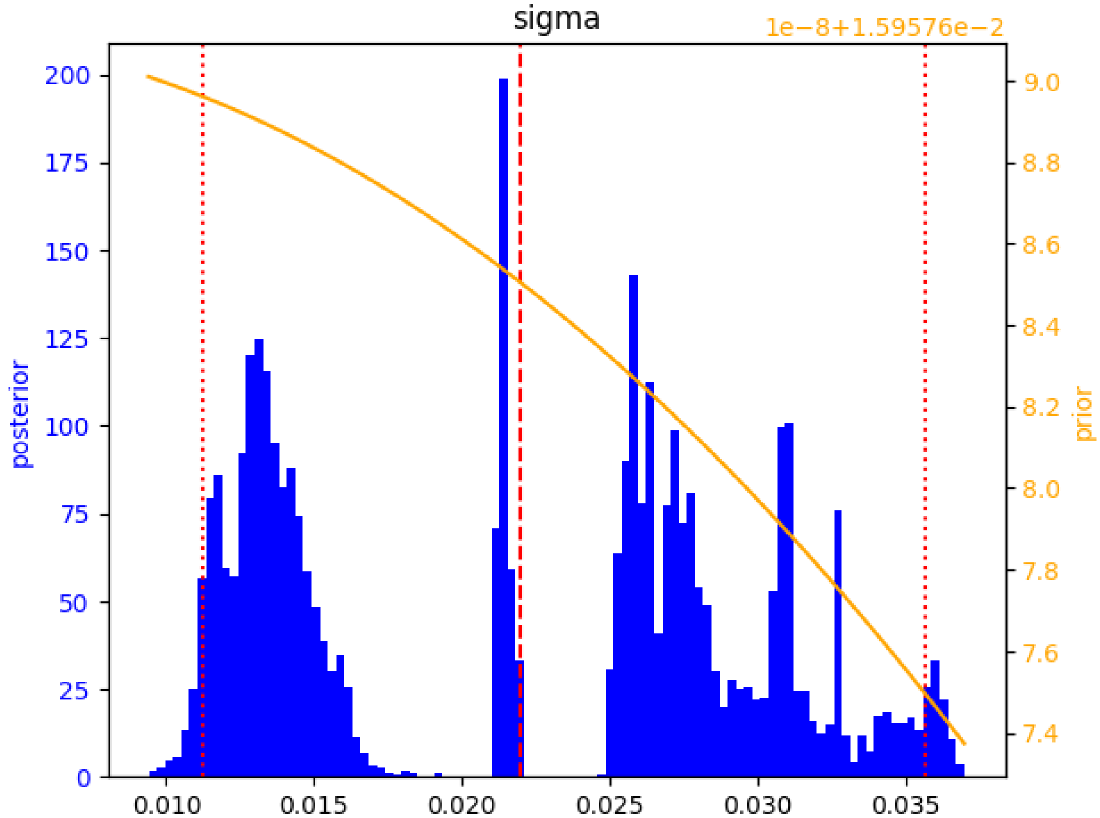
kG
posterior
prior
80
70
60
50
40
30
20
10
0
0.07978
0.07976
0.07974
0.07972
0.07970
0.00
0.05
0.10
0.15
0.20
0.25

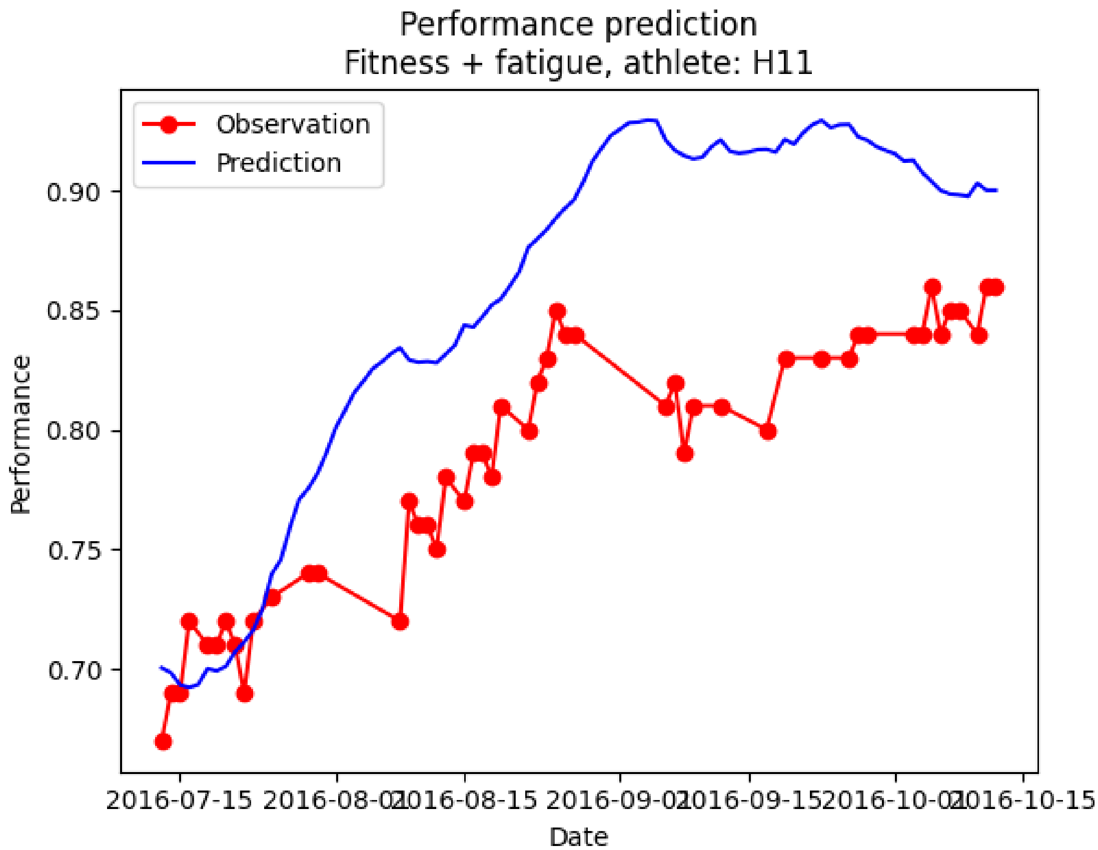


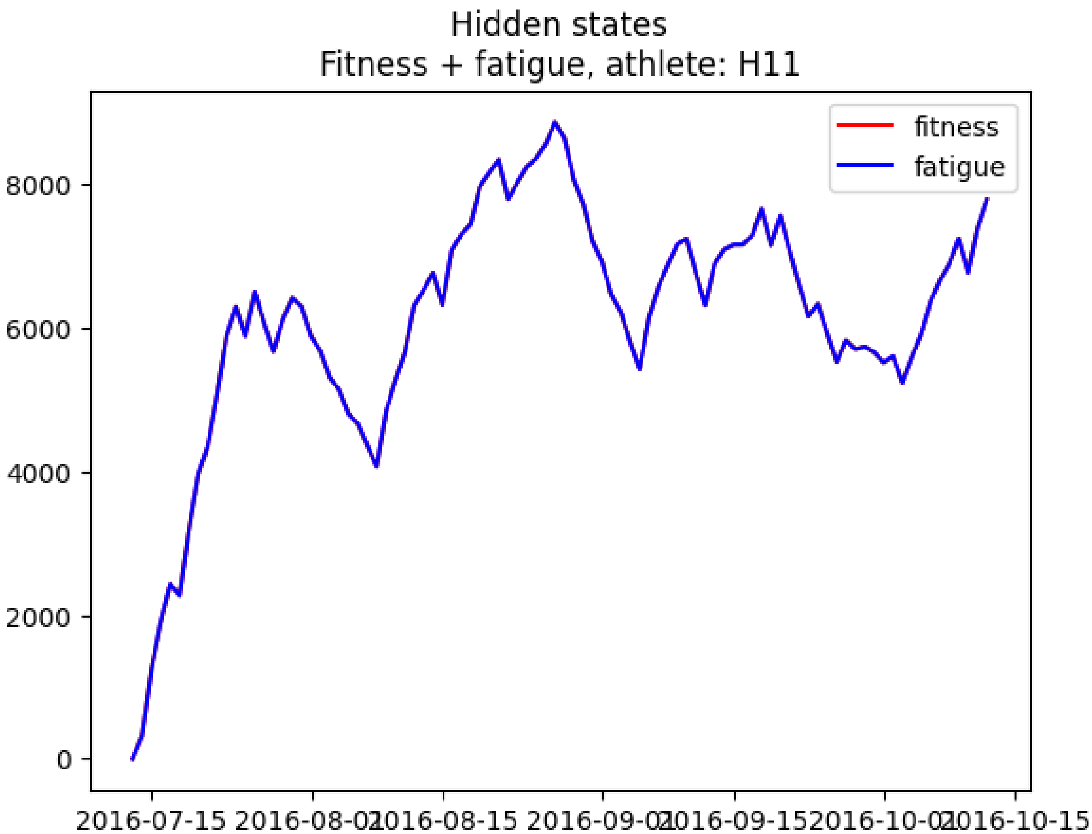
tauG
posterior
prior
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.00
0.02
0.04
0.06
0.08
10
20
30
40
50
60

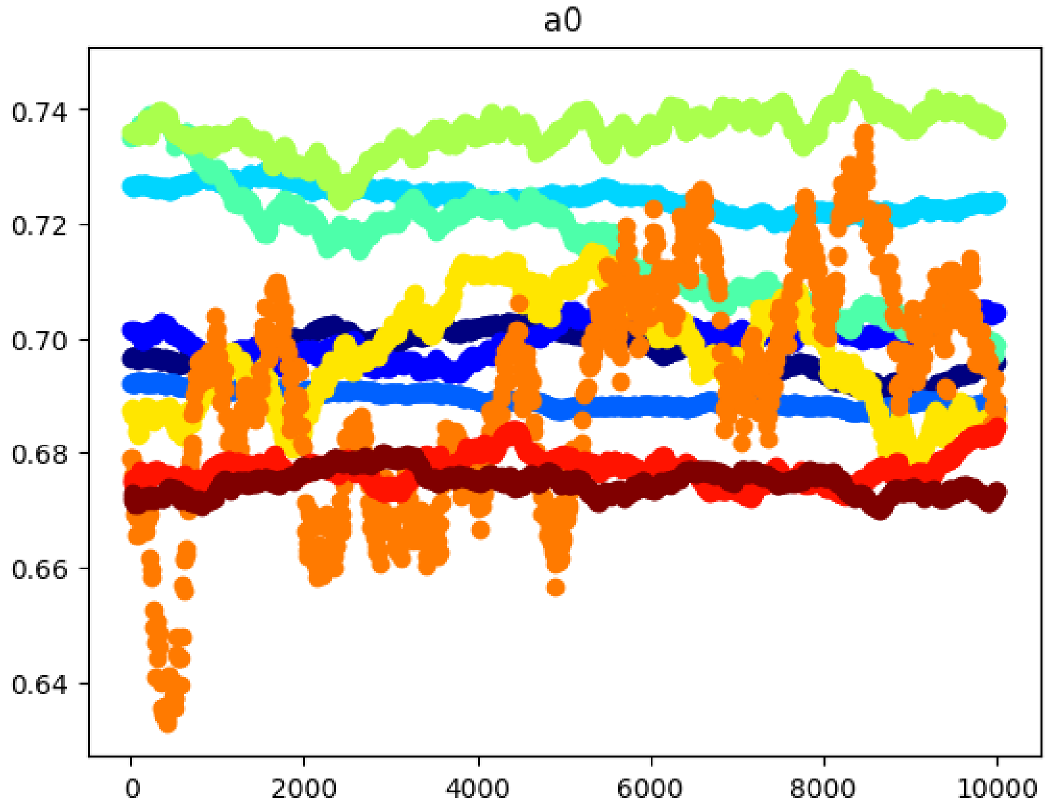

kH
posterior
prior
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
2
4
6
8
10

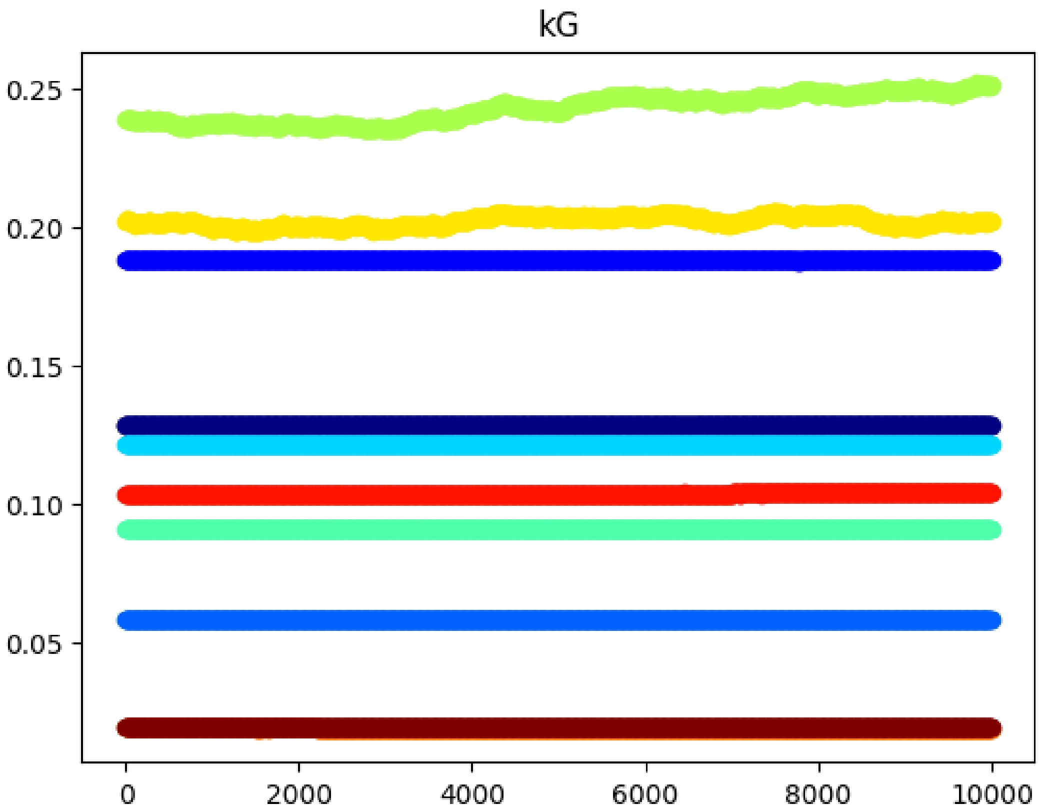

tauH
posterior
prior
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0
5
10
15
20
25

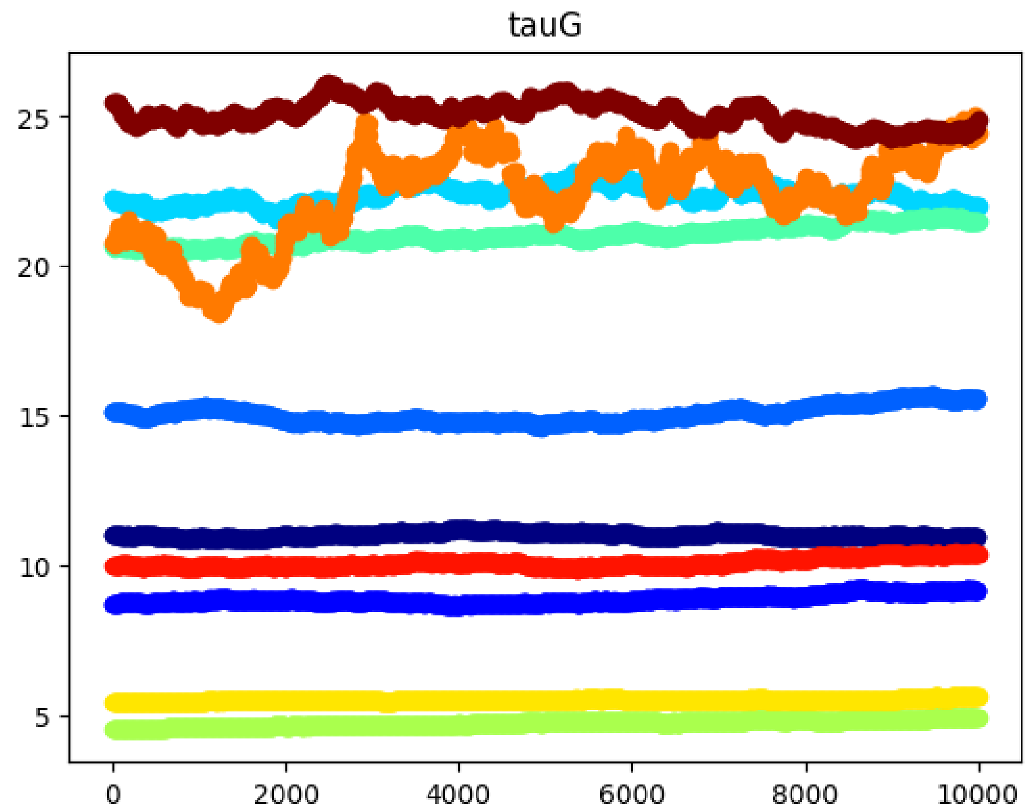

sigma
1e−8+1.59576e−2
posterior
prior
200
175
150
125
100
75
50
25
0
9.0
8.8
8.6
8.4
8.2
8.0
7.8
7.6
7.4
0.010
0.015
0.020
0.025
0.030
0.035

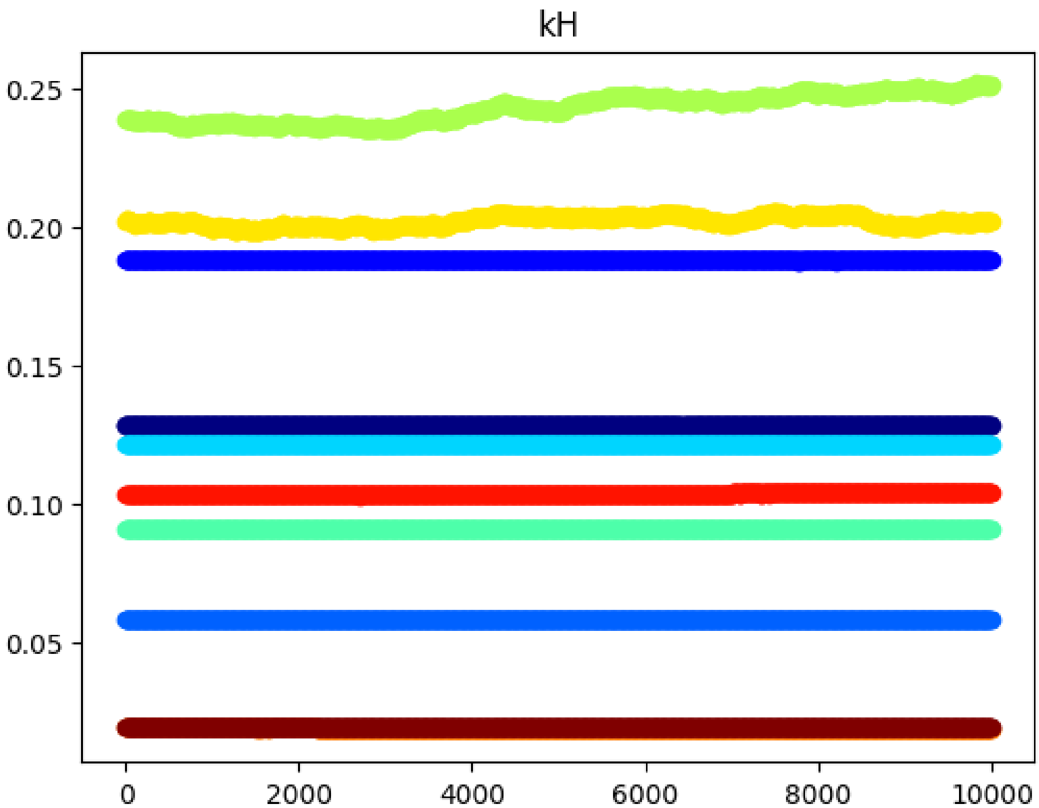

Performance prediction
Fitness + fatigue, athlete: H11
Observation
Prediction
Performance
0.90
0.85
0.80
0.75
0.70
Date
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15


Hidden states
Fitness + fatigue, athlete: H11
fitness
fatigue
8000
6000
4000
2000
0
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15

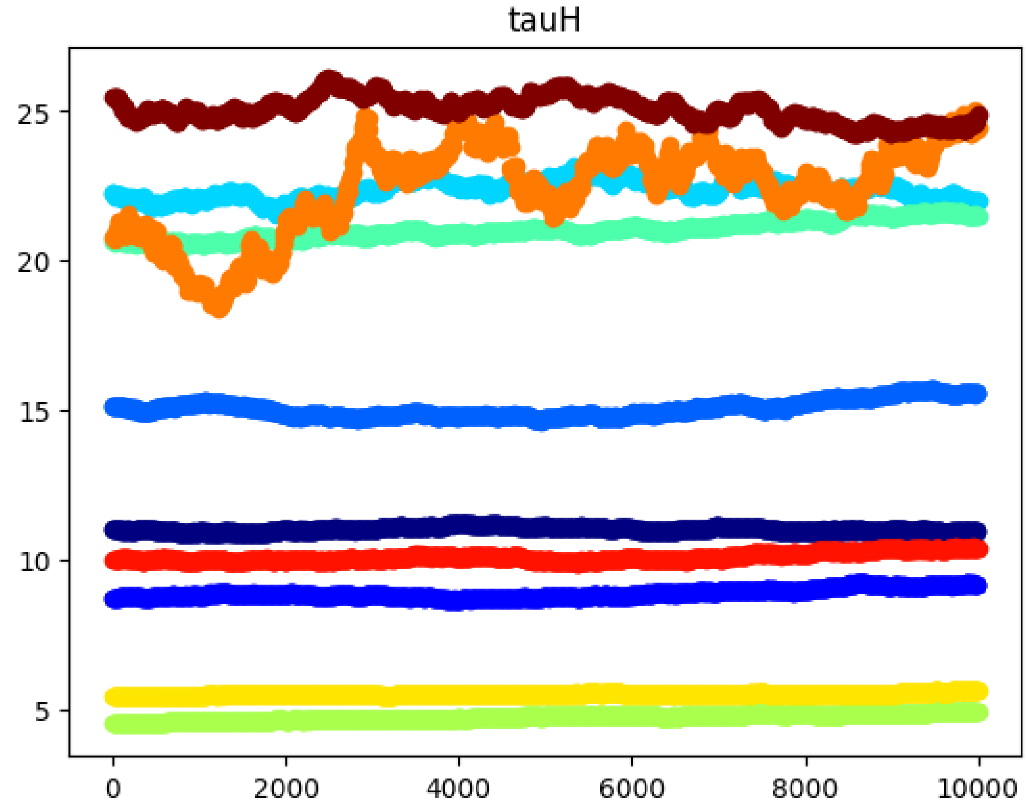

a0
0.74
0.72
0.70
0.68
0.66
0.64
0
2000
4000
6000
8000
10000

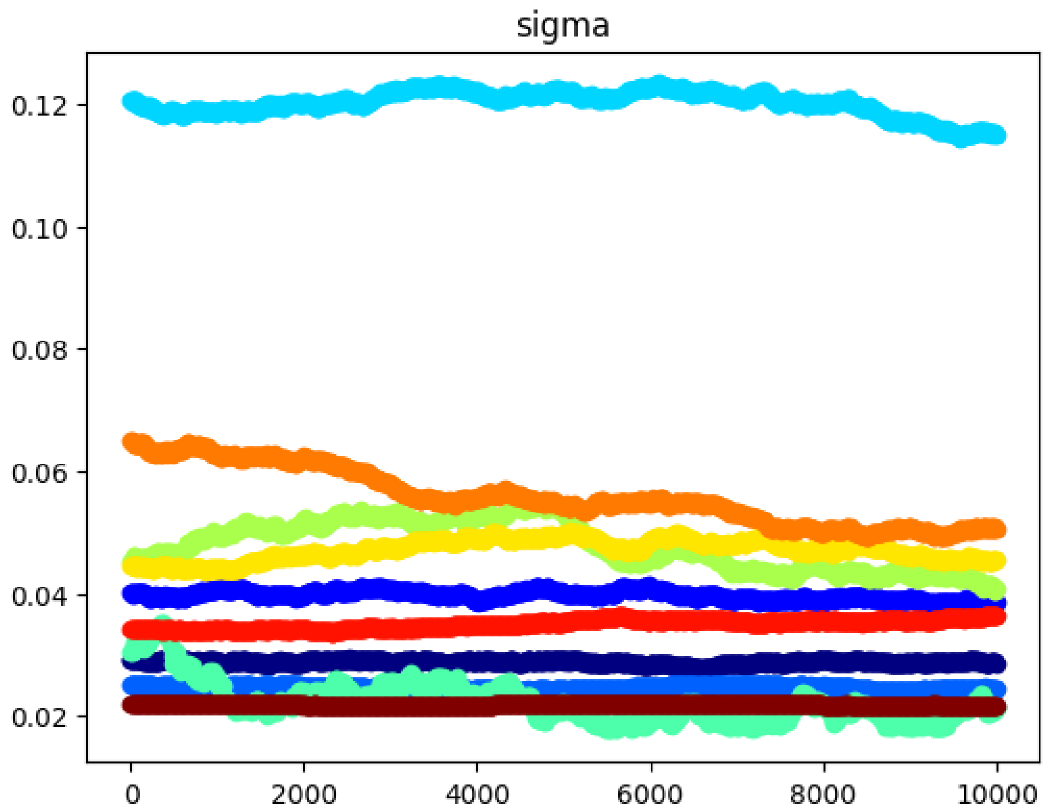

kG
0.25
0.20
0.15
0.10
0.05
0
2000
4000
6000
8000
10000

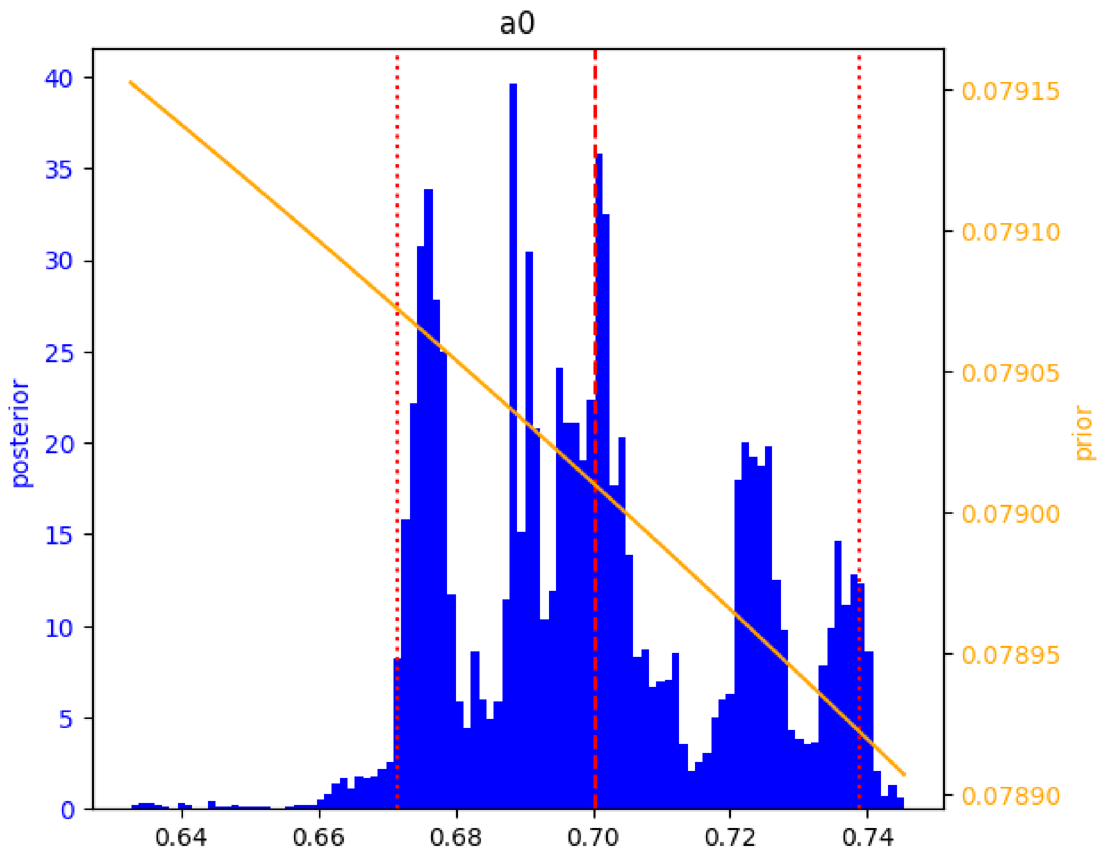

tauG
25
20
15
10
5
0
2000
4000
6000
8000
10000

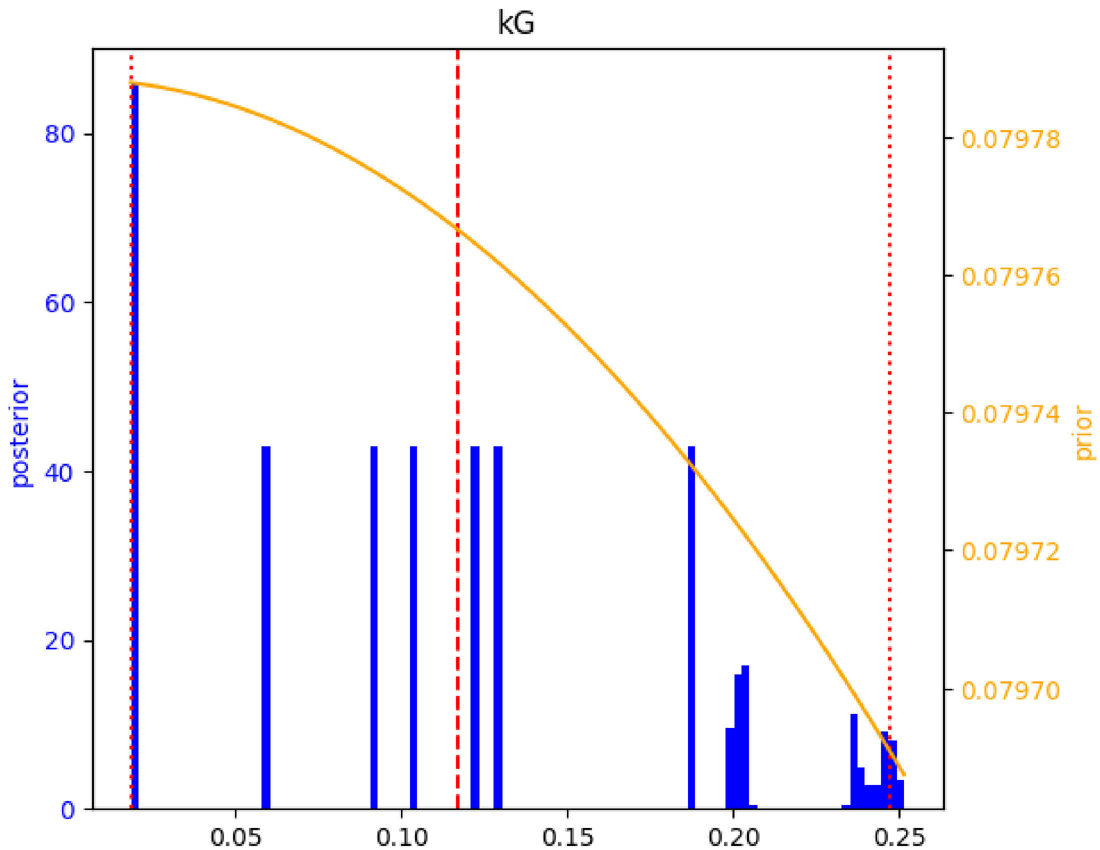


kH
0.25
0.20
0.15
0.10
0.05
0
2000
4000
6000
8000
10000

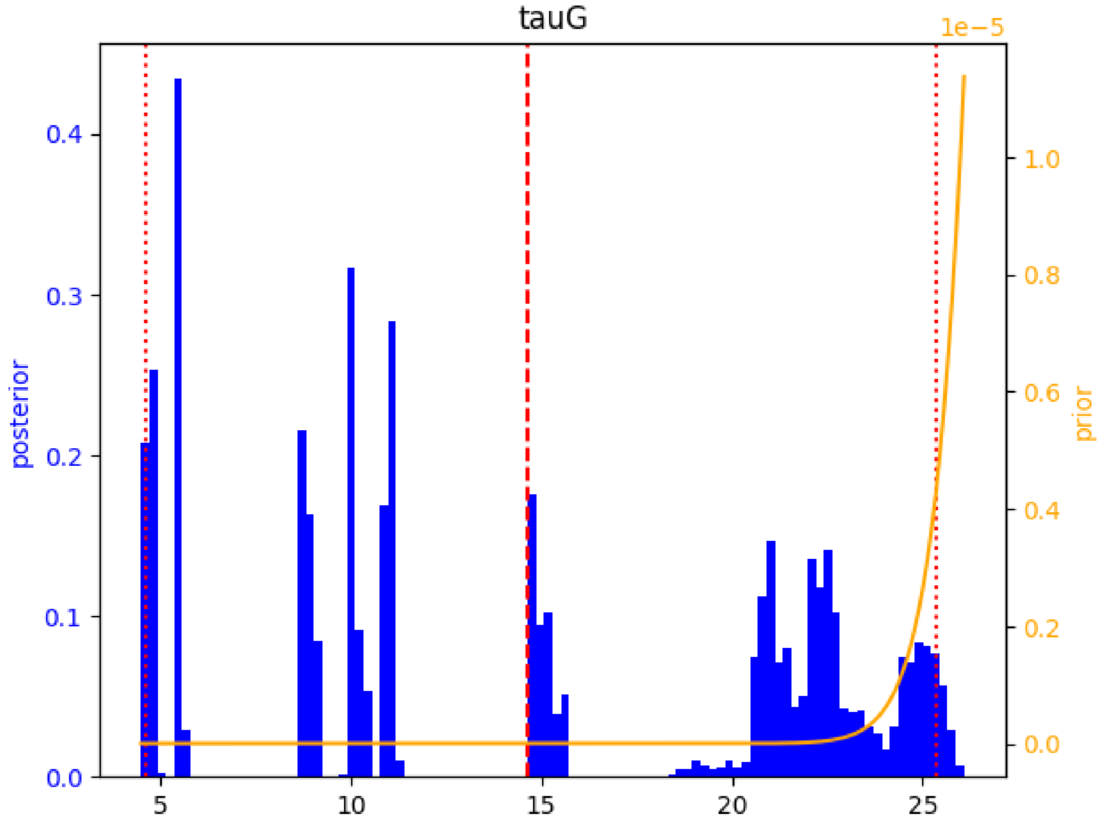

tauH
25
20
15
10
5
0
2000
4000
6000
8000
10000

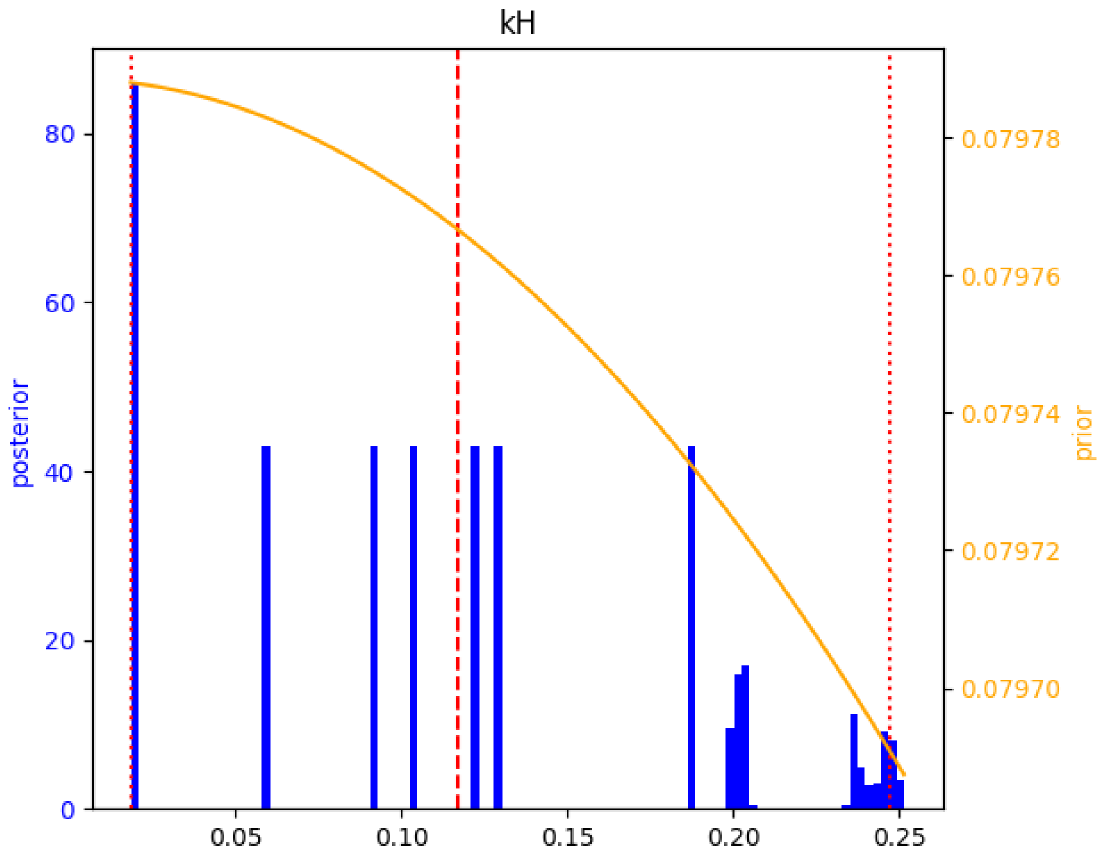

sigma
0.12
0.10
0.08
0.06
0.04
0.02
0
2000
4000
6000
8000
10000

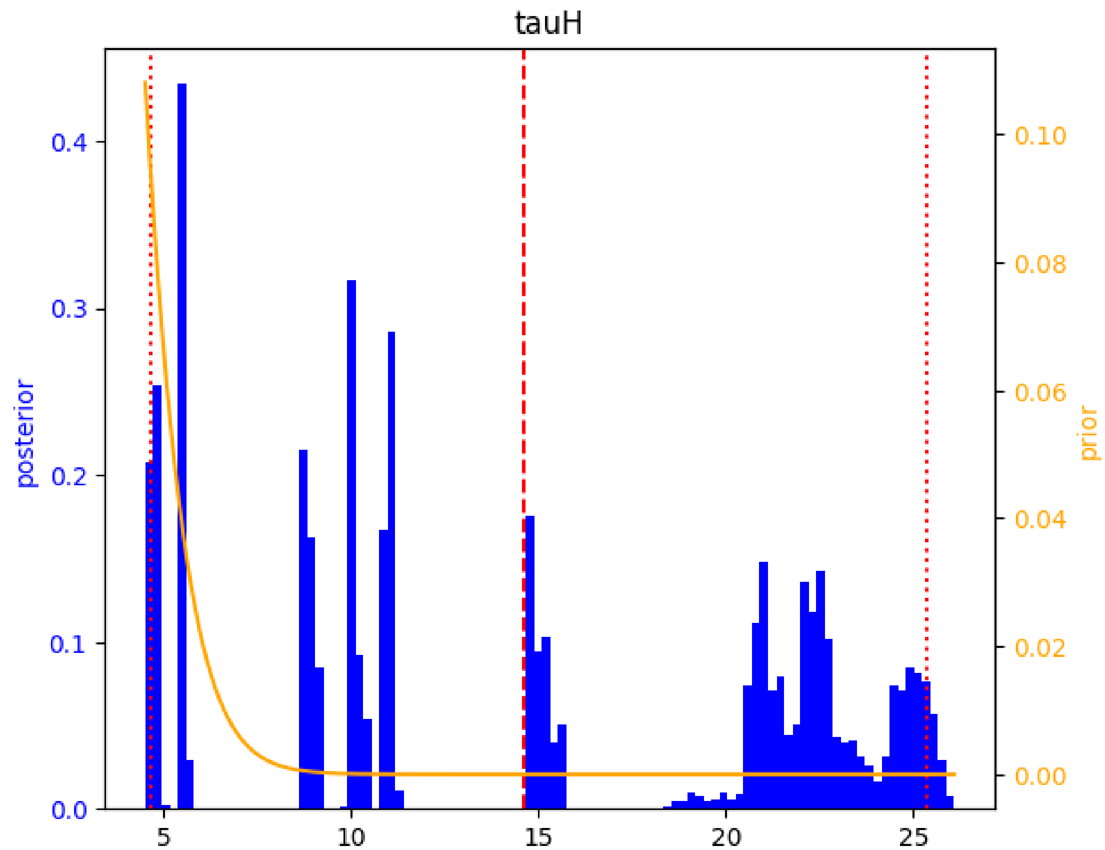

a0
posterior
prior
0
5
10
15
20
25
30
35
40
0.07890
0.07895
0.07900
0.07905
0.07910
0.07915
0.64
0.66
0.68
0.70
0.72
0.74

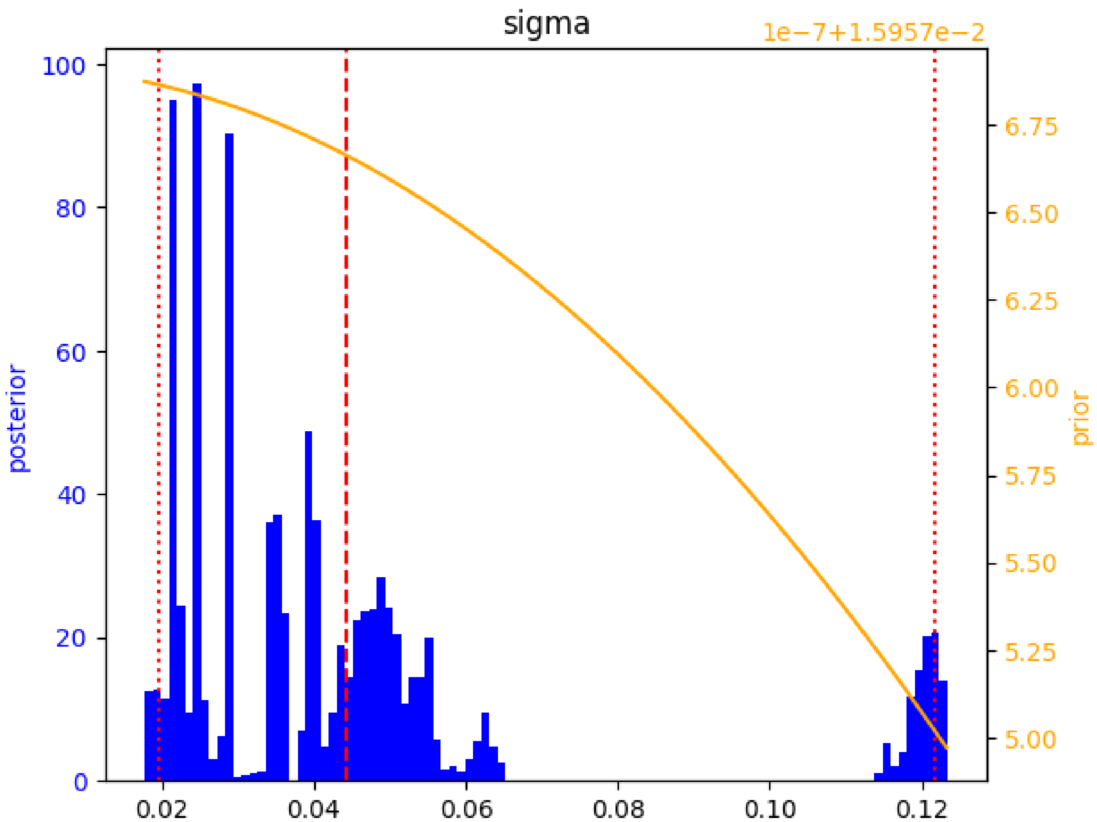


kG
posterior
prior
80
60
40
20
0
0.05
0.10
0.15
0.20
0.25
0.07978
0.07976
0.07974
0.07972
0.07970

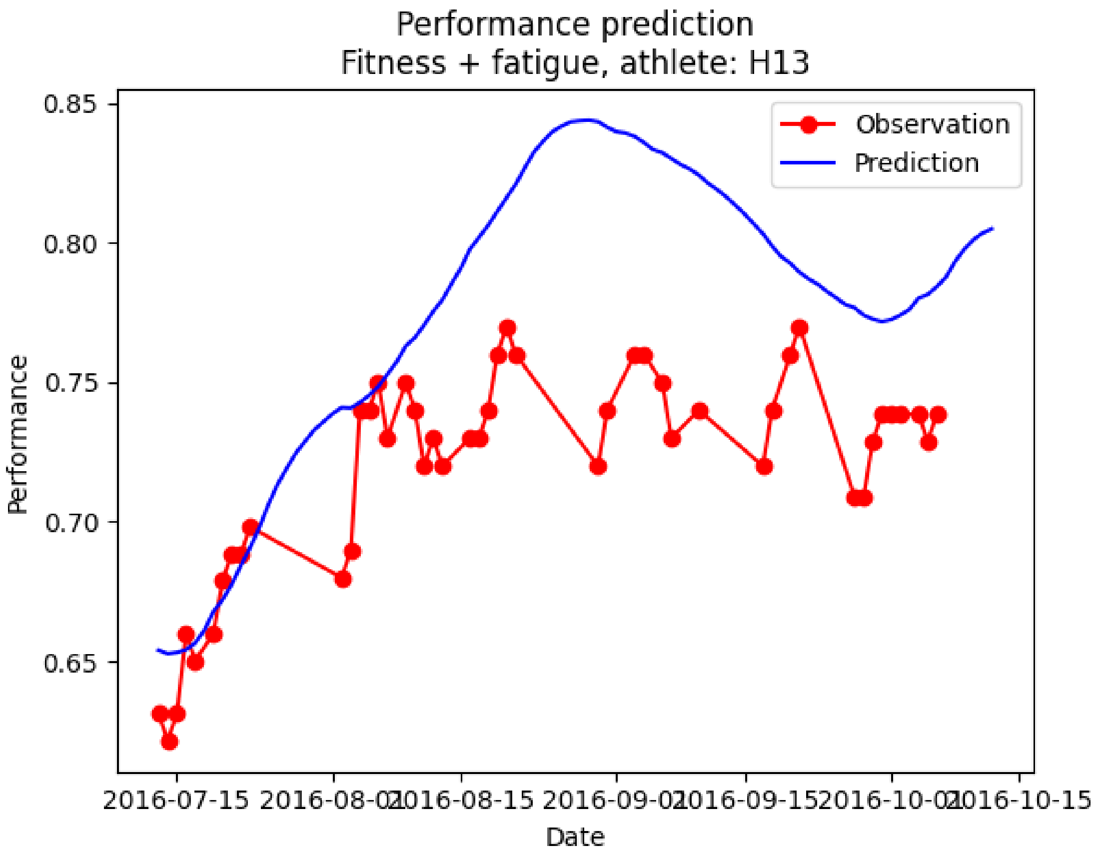

tauG
1e−5
posterior
prior
0.0
0.1
0.2
0.3
0.4
0.0
0.2
0.4
0.6
0.8
1.0
5
10
15
20
25

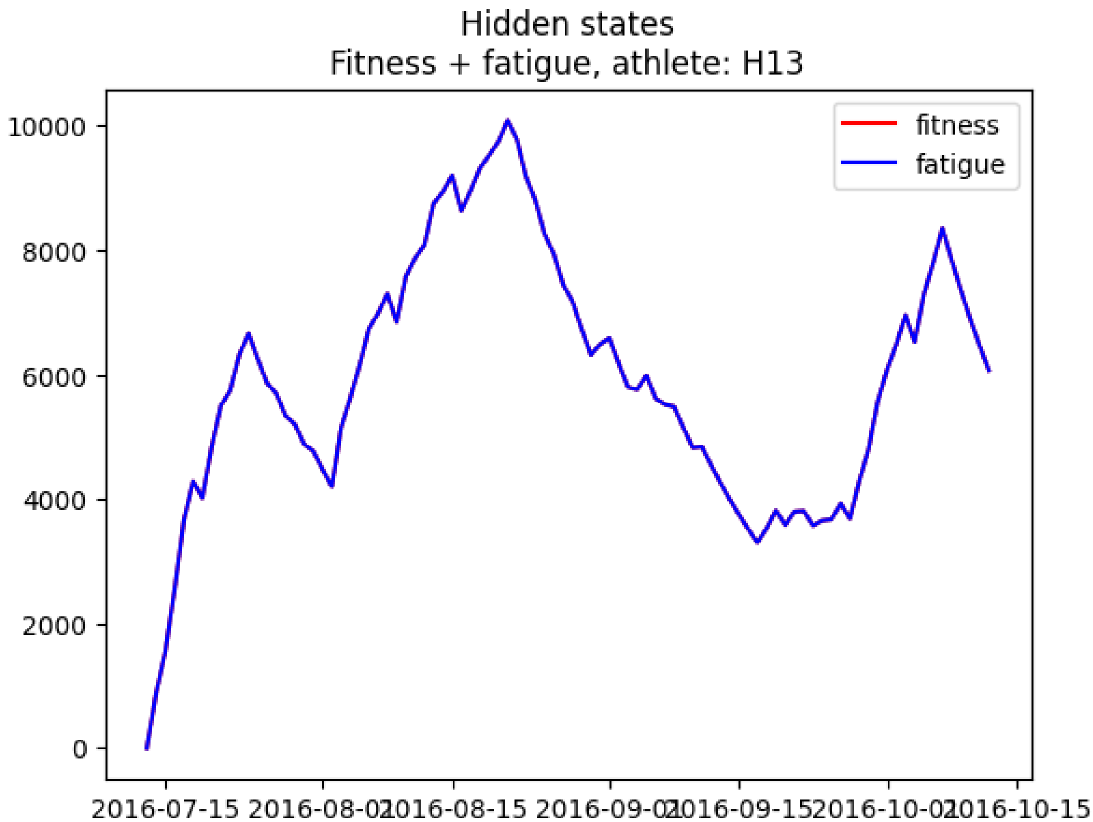

kH
posterior
prior
80
60
40
20
0
0.05
0.10
0.15
0.20
0.25
0.07978
0.07976
0.07974
0.07972
0.07970


tauH
posterior
prior
0.0
0.1
0.2
0.3
0.4
0.00
0.02
0.04
0.06
0.08
0.10
5
10
15
20
25



sigma
1e−7+1.5957e−2
posterior
prior
100
80
60
40
20
0
6.75
6.50
6.25
6.00
5.75
5.50
5.25
5.00
0.02
0.04
0.06
0.08
0.10
0.12


Performance prediction
Fitness + fatigue, athlete: H13
Observation
Prediction
Performance
0.85
0.80
0.75
0.70
0.65
Date
2016-07-15
2016-08-01
2016-08-15
2016-09-01
2016-09-15
2016-10-01
2016-10-15


Hidden states
Fitness + fatigue, athlete: H13
fitness
fatigue
10000
8000
6000
4000
2000
0
2016-07-15
2016-08-01
2016-08-15
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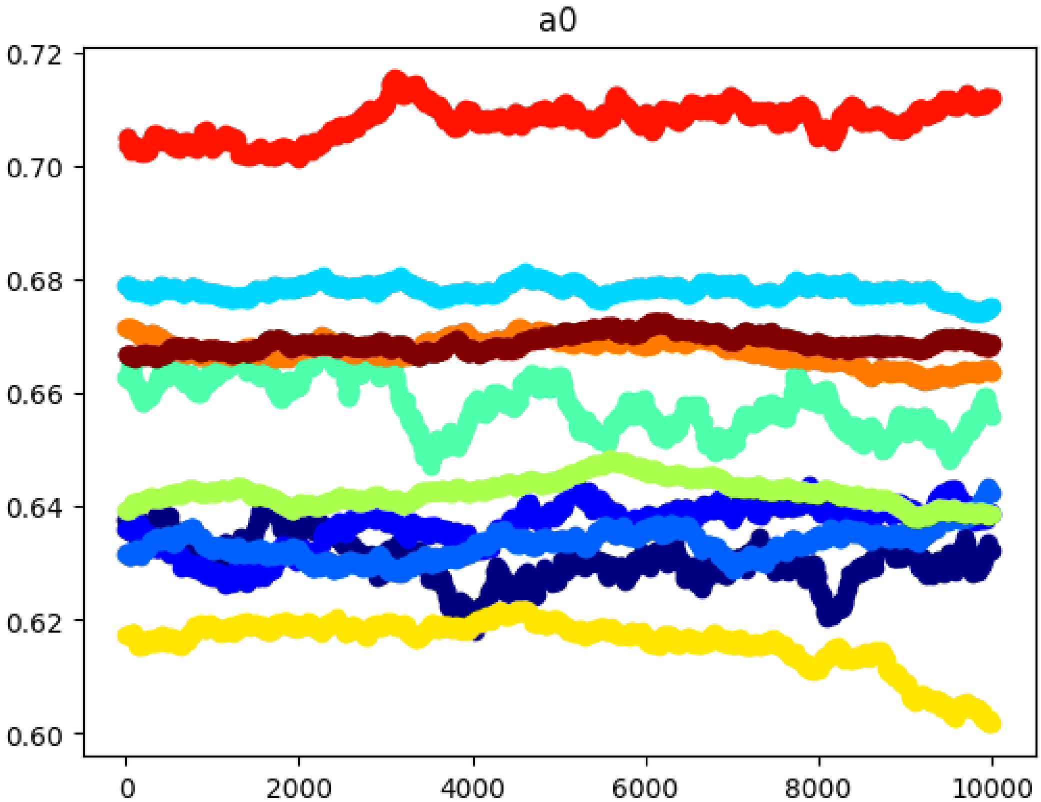
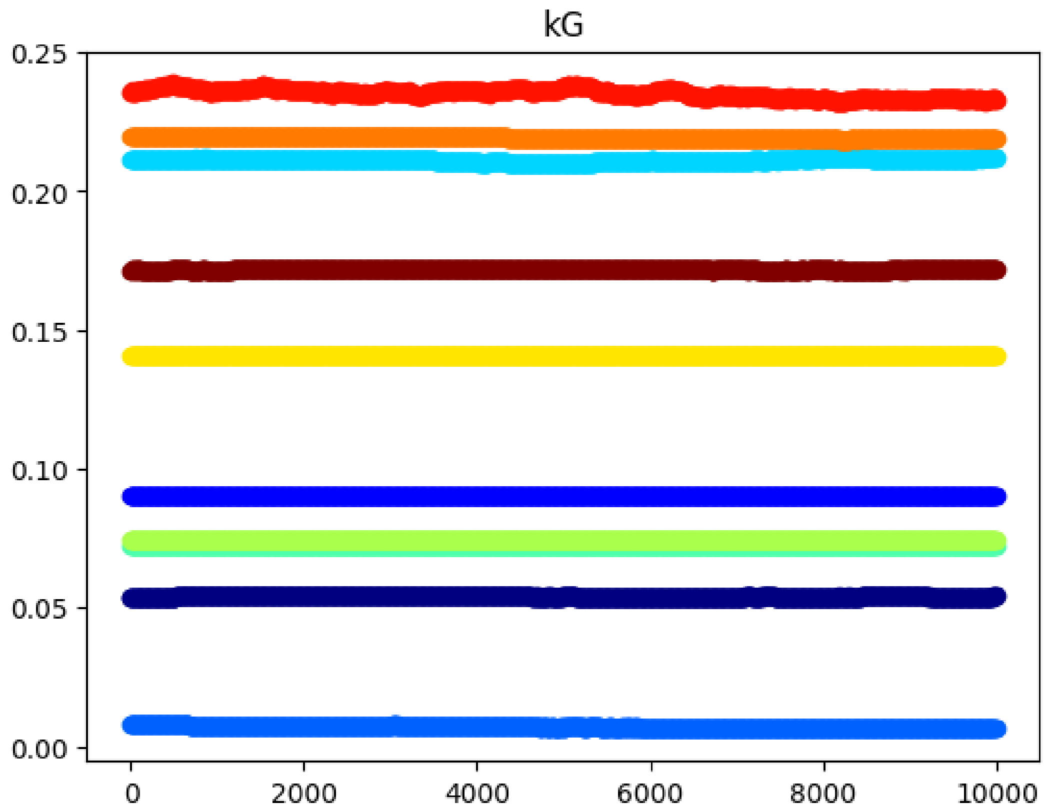
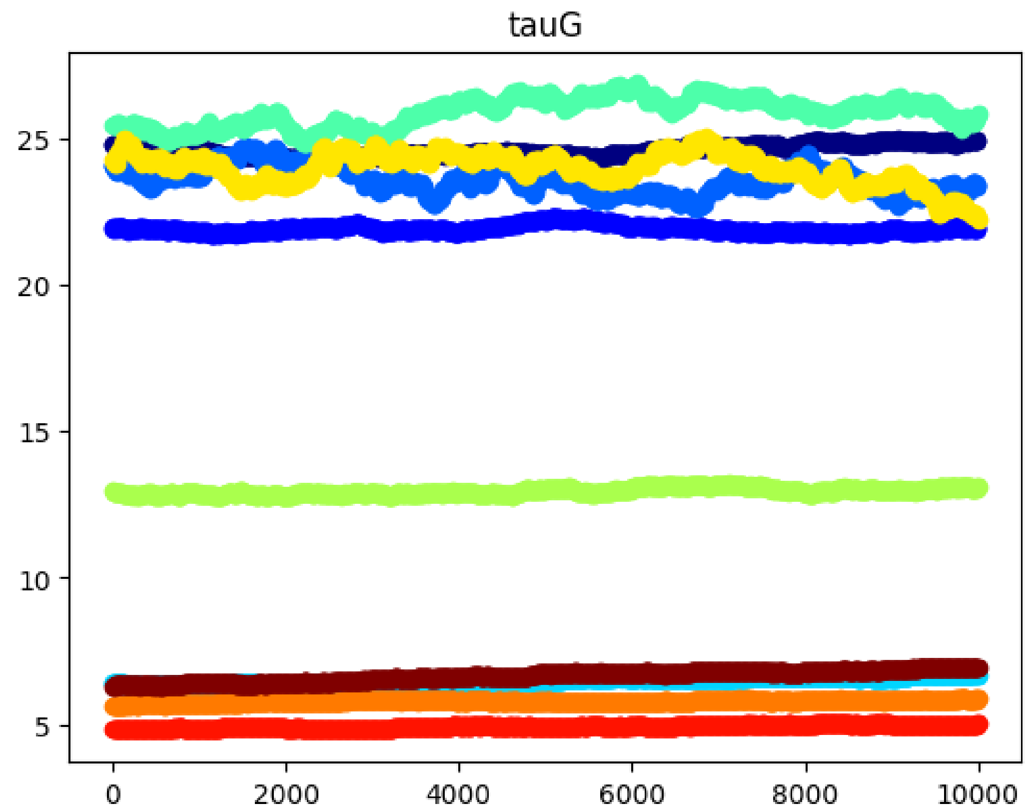
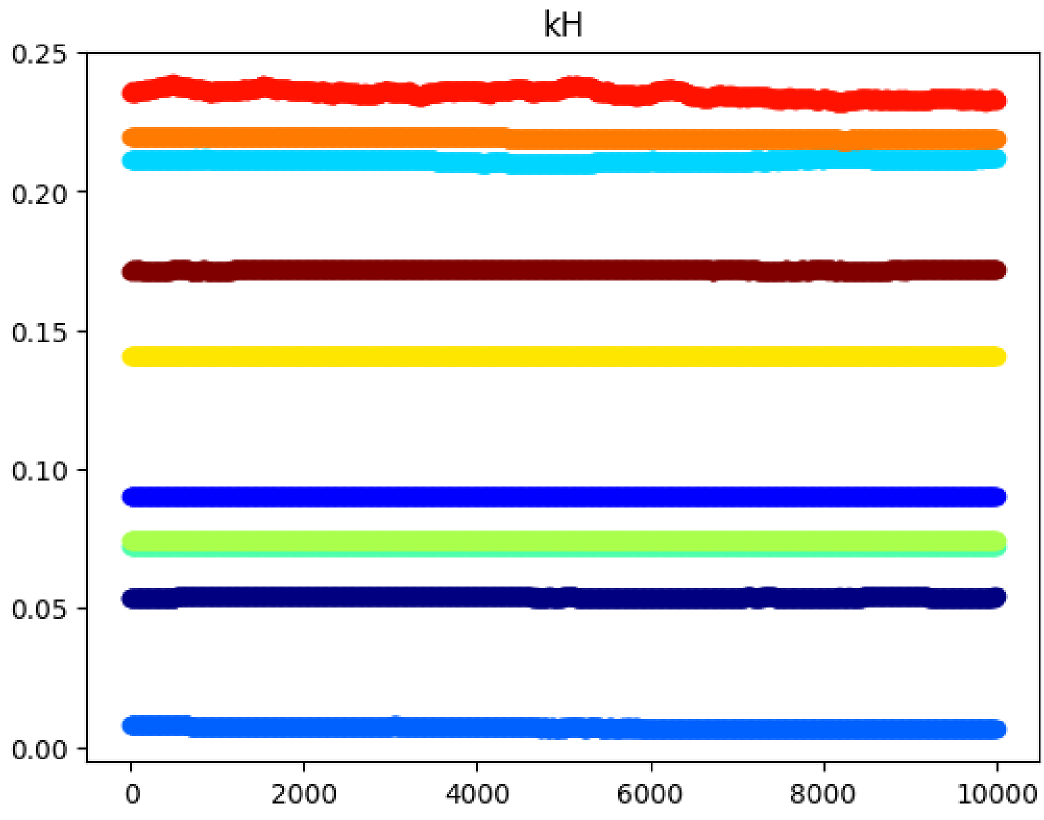
2016-10-01
2016-10-15

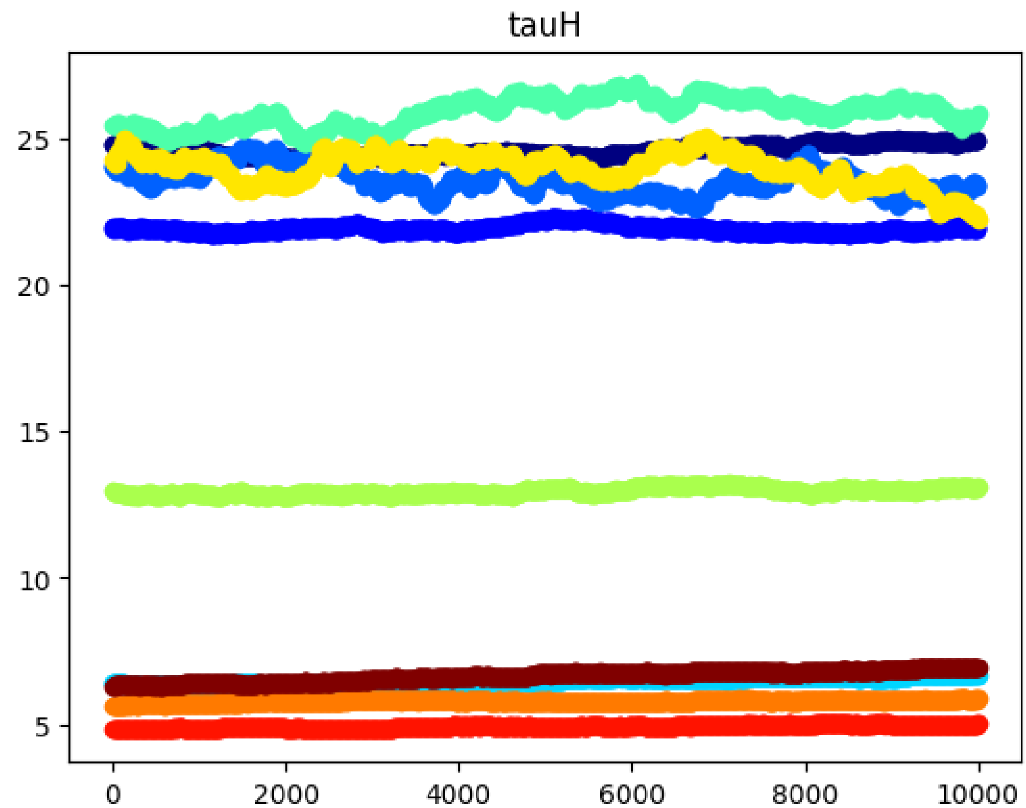

a0
0.72
0.70
0.68
0.66
0.64
0.62
0.60
0
2000
4000
6000
8000
10000


kG
0.25
0.20
0.15
0.10
0.05
0.00
0
2000
4000
6000
8000
10000

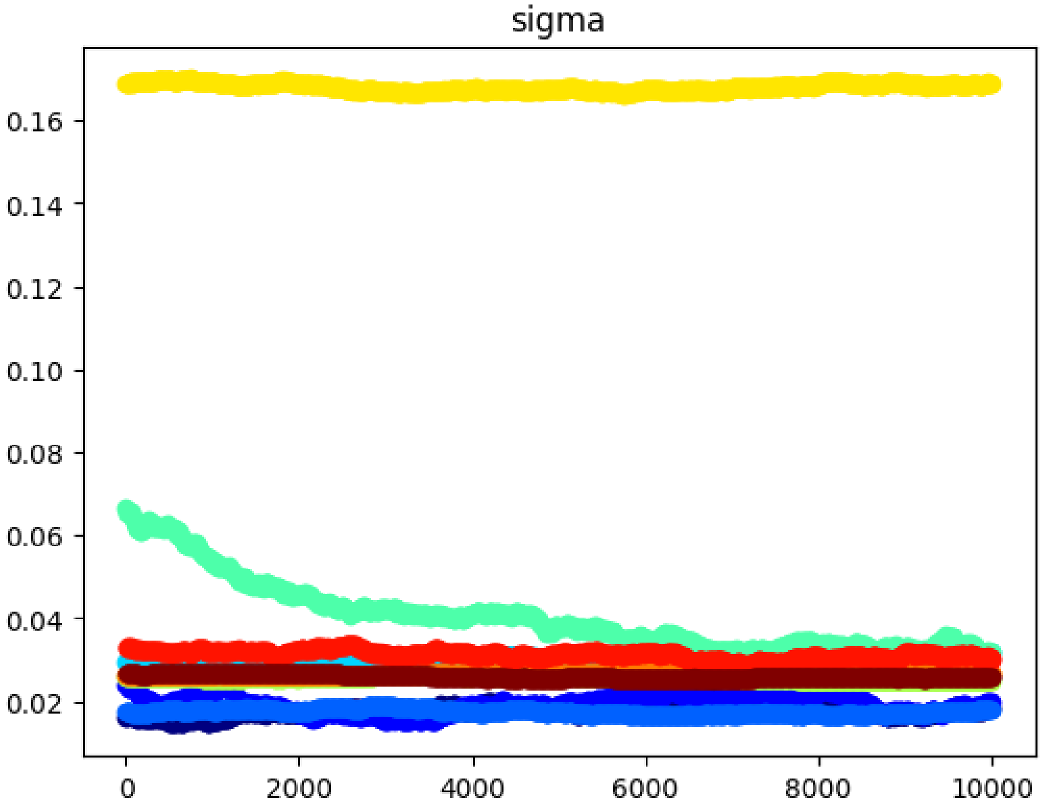


tauG
25
20
15
10
5
0
2000
4000
6000
8000
10000


kH
0.25
0.20
0.15
0.10
0.05
0.00
0
2000
4000
6000
8000
10000



tauH
25
20
15
10
5
0
2000
4000
6000
8000
10000


sigma
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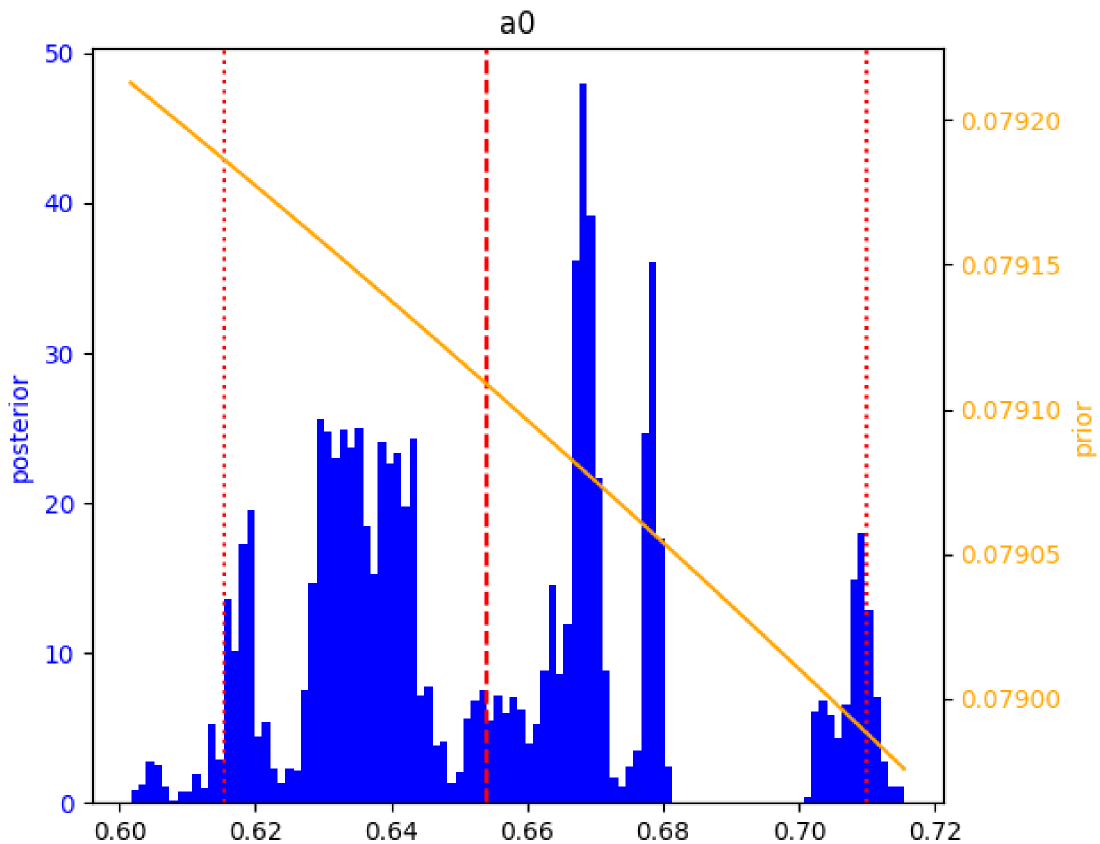
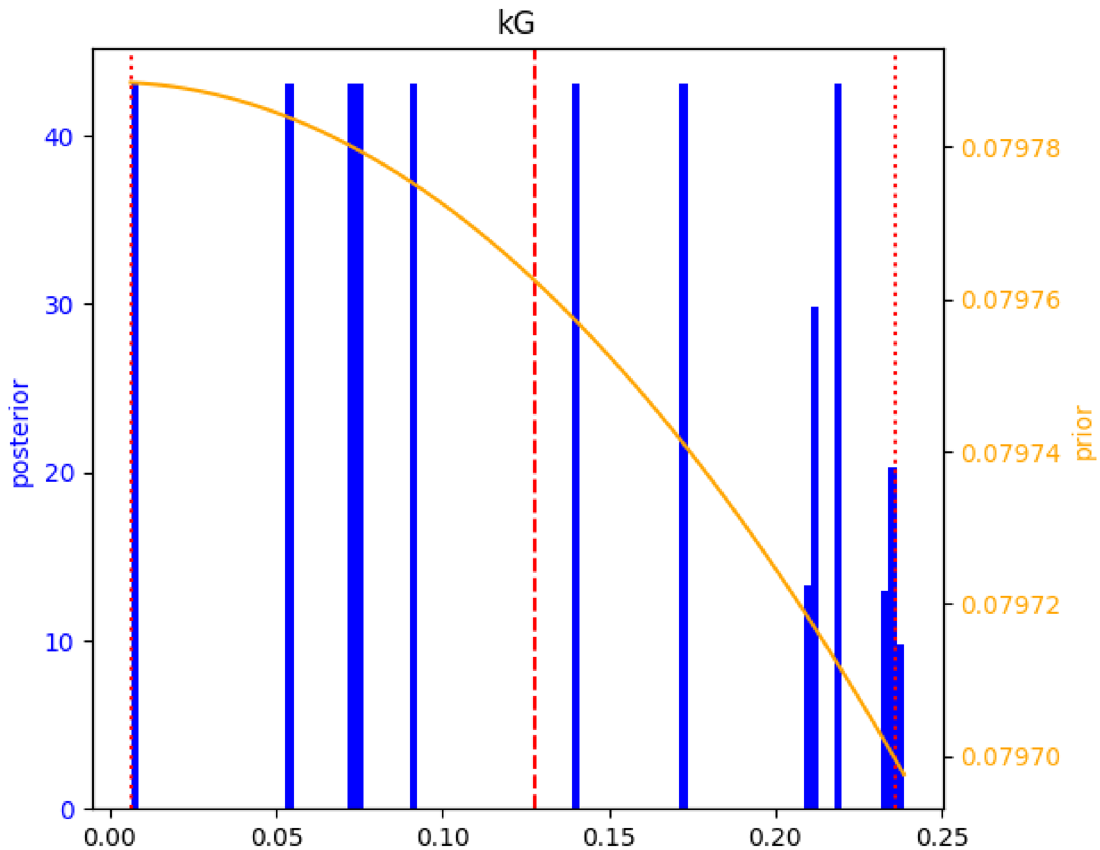
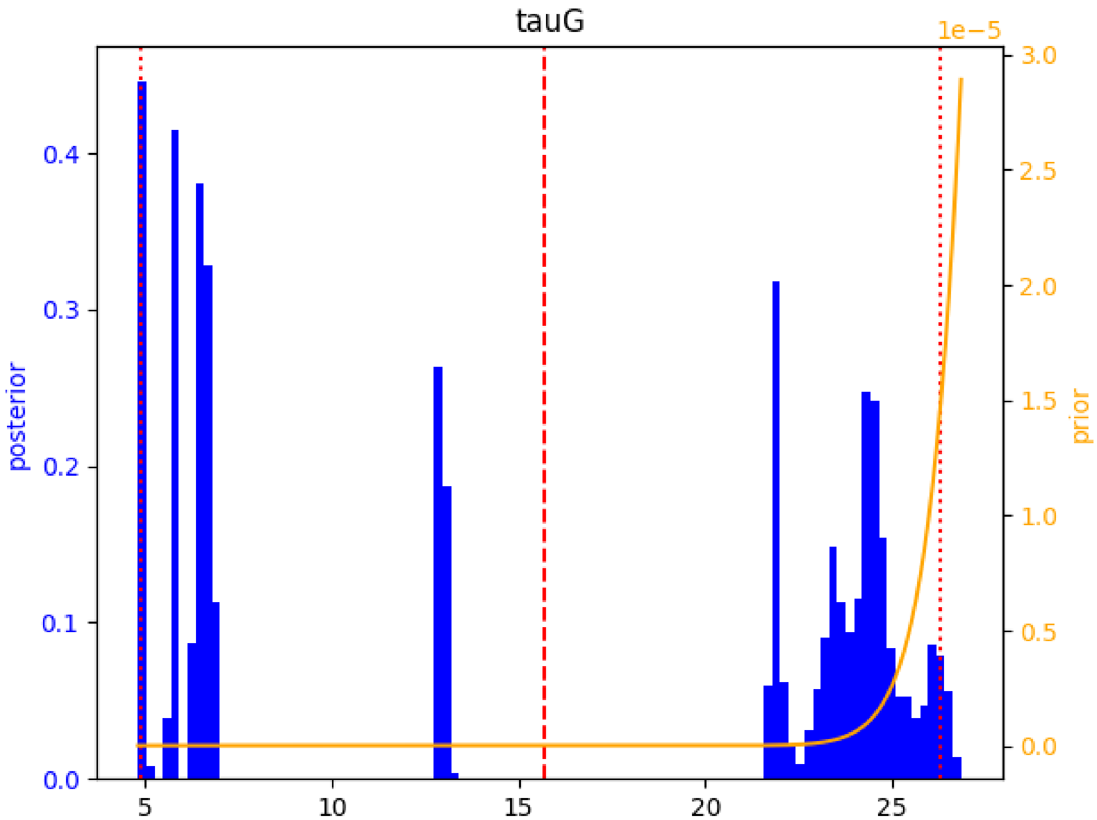
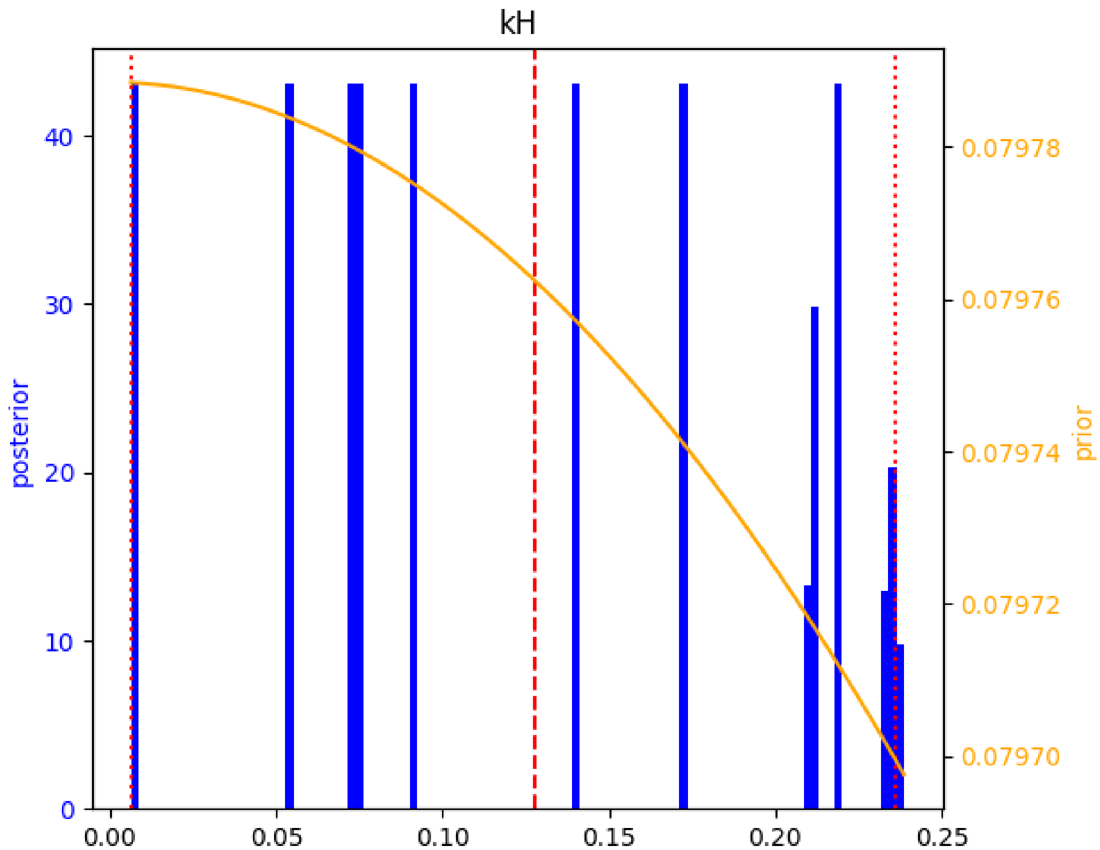
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0
2000
4000
6000
8000
10000


a0
posterior
prior
0
10
20
30
40
50
0.60
0.62
0.64
0.66
0.68
0.70
0.72
0.07900
0.07905
0.07910
0.07915
0.07920

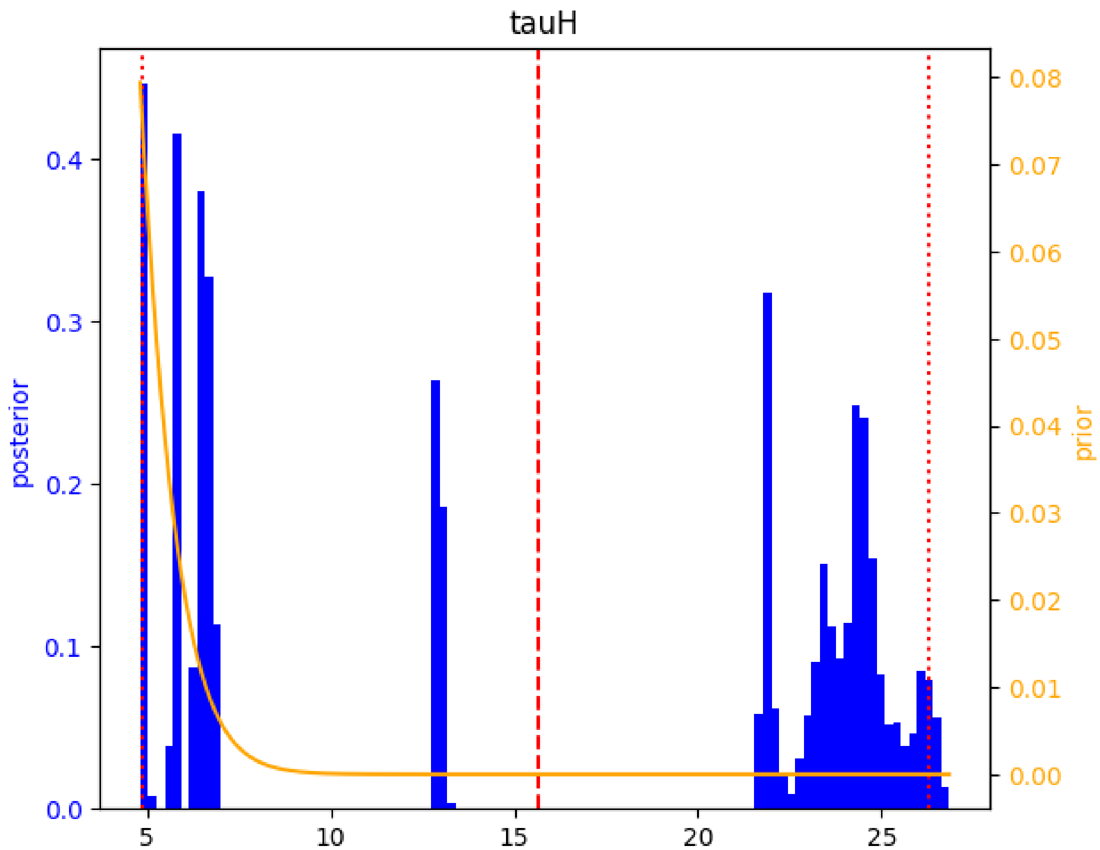


kG
posterior
prior
0
10
20
30
40
0.07970
0.07972
0.07974
0.07976
0.07978
0.00
0.05
0.10
0.15
0.20
0.25


tauG
1e−5
posterior
prior
0.0
0.1
0.2
0.3
0.4
0.0
0.5
1.0
1.5
2.0
2.5
3.0
5
10
15
20
25



kH
posterior
prior
0
10
20
30
40
0.07970
0.07972
0.07974
0.07976
0.07978
0.00
0.05
0.10
0.15
0.20
0.25


tauH
posterior
prior
0.0
0.1
0.2
0.3
0.4
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0.03
0.04
0.05
0.06
0.07
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10
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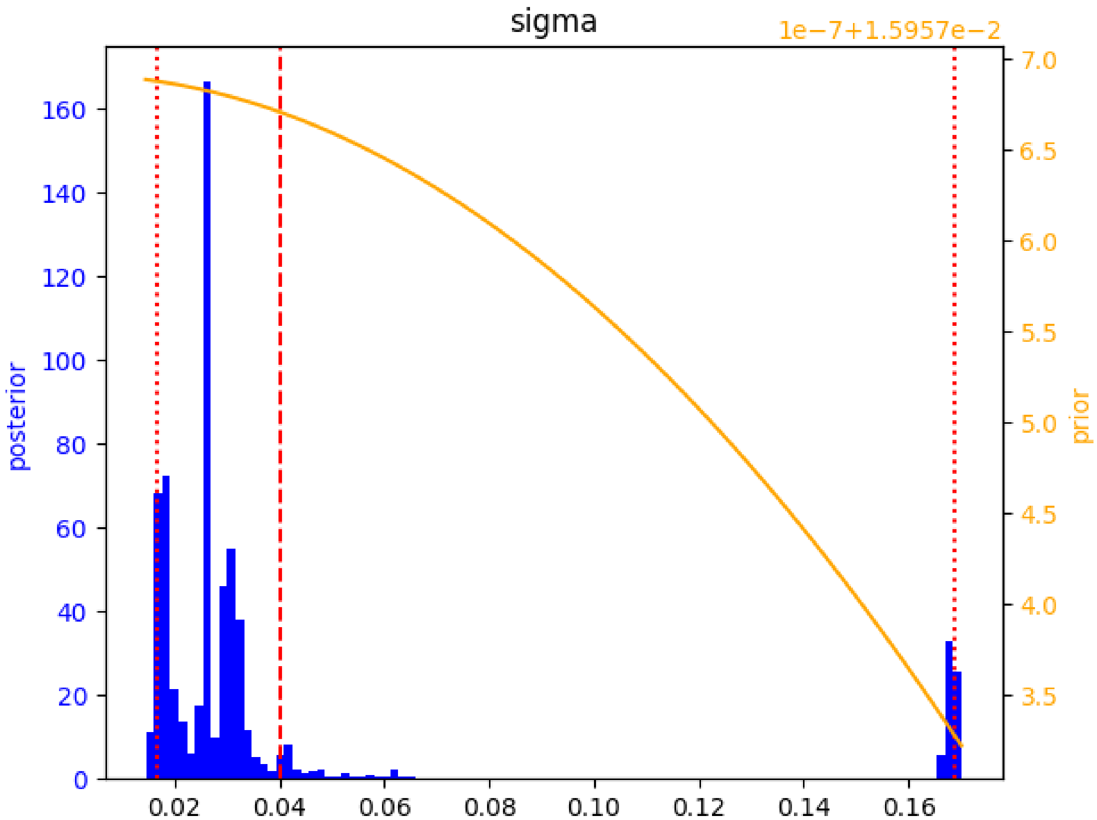
20
25



sigma
1e−7+1.5957e−2
posterior
prior
0
20
40
60
80
100
120
140
160
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16