```
 1 C:\Users\Alex\Anaconda3\python.exe "C:/Users/Zihang
   Guan/Desktop/Deep-Reinforcement-Learning-for-
   Automated-Stock-Trading-Ensemble-Strategy-ICAIF-2020-
   master/run_DRL.py"
 2 2022-04-15 14:49:35.916041: W tensorflow/
   stream_executor/platform/default/dso_loader.cc:59]
   Could not load dynamic library 'cudart64_101.dll';
   dlerror: cudart64_101.dll not found
 3 2022-04-15 14:49:35.918493: I tensorflow/
   stream_executor/cuda/cudart_stub.cc:29] Ignore above
   cudart dlerror if you do not have a GPU set up on
   your machine.
 4 C:\Users\Alex\Anaconda3\lib\site-packages\
   stable_baselines\__init__.py:33: UserWarning: stable-
   baselines is in maintenance mode, please use [Stable-
   Baselines3 (SB3)](https://github.com/DLR-RM/stable-
   baselines3) for an up-to-date version. You can find a
   [migration guide](https://stable-baselines3.
   readthedocs.io/en/master/guide/migration.html) in SB3
   documentation.
 5   warnings.warn(
 6     datadate    tic     adjcp       open ...     rsi
          cci     adx   turbulence
 7 0  20090102   AAPL  12.964286  12.268571  ...   100.0
   66.666667  100.0        0.0
 8 1  20090102    AXP  19.330000  18.570000  ...   100.0
   66.666667  100.0        0.0
 9 2  20090102     BA  45.250000  42.800000  ...   100.0
   66.666667  100.0        0.0
10 3  20090102    CAT  46.910000  44.910000  ...     0.0
   66.666667  100.0        0.0
11 4  20090102   CSCO  16.960000  16.410000  ...   100.0
   66.666667  100.0        0.0
12
13 [5 rows x 12 columns]
14 1053360
15 [20151002 20151005 20151006 ... 20200702 20200706
   20200707]
16 ============Start Ensemble Strategy============
17 ===============================================
18 turbulence_threshold:  171.0940715631016
```

```
19 ======Model training from:  20090000 to  20151002
20 ======A2C Training========
21 2022-04-15 14:50:16.797122: I tensorflow/core/
   platform/cpu_feature_guard.cc:142] This TensorFlow
   binary is optimized with oneAPI Deep Neural Network
   Library (oneDNN)to use the following CPU instructions
    in performance-critical operations:  AVX2
22 To enable them in other operations, rebuild
   TensorFlow with the appropriate compiler flags.
23 2022-04-15 14:50:16.975953: I tensorflow/compiler/xla
   /service/service.cc:168] XLA service 0x17f9f026c30
   initialized for platform Host (this does not
   guarantee that XLA will be used). Devices:
24 2022-04-15 14:50:16.978349: I tensorflow/compiler/xla
   /service/service.cc:176]  StreamExecutor device (0
   ): Host, Default Version
25 2022-04-15 14:50:16.994279: W tensorflow/
   stream_executor/platform/default/dso_loader.cc:59]
   Could not load dynamic library 'nvcuda.dll'; dlerror
   : nvcuda.dll not found
26 2022-04-15 14:50:16.995600: W tensorflow/
   stream_executor/cuda/cuda_driver.cc:312] failed call
   to cuInit: UNKNOWN ERROR (303)
27 2022-04-15 14:50:16.999920: I tensorflow/
   stream_executor/cuda/cuda_diagnostics.cc:169]
   retrieving CUDA diagnostic information for host:
   LAPTOP-FJQ3PEHG
28 2022-04-15 14:50:17.001683: I tensorflow/
   stream_executor/cuda/cuda_diagnostics.cc:176]
   hostname: LAPTOP-FJQ3PEHG
29 WARNING:tensorflow:From C:\Users\Alex\Anaconda3\lib\
   site-packages\tensorflow\python\training\rmsprop.py:
   123: calling Ones.__init__ (from tensorflow.python.
   ops.init_ops) with dtype is deprecated and will be
   removed in a future version.
30 Instructions for updating:
31 Call initializer instance with the dtype argument
   instead of passing it to the constructor
32 save intrinsic loss: Tensor("add_35:0", shape=(),
   dtype=float32)
33 Training time (A2C):  11.710176360607147  minutes
```

```
34 ======A2C Validation from:  20151002 to  20160104
35 A2C Sharpe Ratio:  -0.014015825866916598
36 ======Trading from:  20160104 to  20160405
37 Used Model:  <stable_baselines.a2c.a2c.A2C object at
   0x0000017FA02DD220>
38 previous_total_asset:1000000
39 end_total_asset:1080239.4554765767
40 total_reward:80239.4554765767
41 total_cost:  6475.95674850484
42 total trades:  1572
43 Sharpe:  0.28339238560665136
44 ============Trading Done============
45 ===========================================
46 turbulence_threshold:  96.08032158358223
47 ======Model training from:  20090000 to  20160104
48 ======A2C Training=======
49 save intrinsic loss: Tensor("add_35:0", shape=(),
   dtype=float32)
50 Training time (A2C):  9.111342831452687  minutes
51 ======A2C Validation from:  20160104 to  20160405
52 A2C Sharpe Ratio:  0.006245627292611217
53 ======Trading from:  20160405 to  20160705
54 Used Model:  <stable_baselines.a2c.a2c.A2C object at
   0x0000017FA9CB05E0>
55 previous_total_asset:1080239.4554765767
56 end_total_asset:1086948.8057700943
57 total_reward:6709.350293517578
58 total_cost:  5285.769958960763
59 total trades:  1512
60 Sharpe:  0.03224260135612371
61 ============Trading Done============
62 ===========================================
63 turbulence_threshold:  171.0940715631016
64 ======Model training from:  20090000 to  20160405
65 ======A2C Training=======
66 save intrinsic loss: Tensor("add_35:0", shape=(),
   dtype=float32)
67 Training time (A2C):  8.875537212689718  minutes
68 ======A2C Validation from:  20160405 to  20160705
69 A2C Sharpe Ratio:  -0.047680009513876014
70 ======Trading from:  20160705 to  20161003
```

```
71 Used Model:  <stable_baselines.a2c.a2c.A2C object at
     0x0000017FA9B2EA30>
72 previous_total_asset:1086948.8057700943
73 end_total_asset:1079912.54572857
74 total_reward:-7036.2600415241905
75 total_cost:  4648.457037153046
76 total trades:  1364
77 Sharpe:  -0.030509560337783435
78 ============Trading Done============
79 =========================================
80 turbulence_threshold:  171.0940715631016
81 ======Model training from:  20090000 to  20160705
82 ======A2C Training========
83 save intrinsic loss: Tensor("add_35:0", shape=(),
     dtype=float32)
84 Training time (A2C):  10.429125277201335  minutes
85 ======A2C Validation from:  20160705 to  20161003
86 A2C Sharpe Ratio:  -0.1183519243687729
87 ======Trading from:  20161003 to  20170103
88 Used Model:  <stable_baselines.a2c.a2c.A2C object at
     0x0000017FA718D280>
89 previous_total_asset:1079912.54572857
90 end_total_asset:1194036.4544105022
91 total_reward:114123.90868193214
92 total_cost:  2131.454454389856
93 total trades:  1261
94 Sharpe:  0.534224222180121
95 ============Trading Done============
96 =========================================
97 turbulence_threshold:  171.0940715631016
98 ======Model training from:  20090000 to  20161003
99 ======A2C Training========
100 save intrinsic loss: Tensor("add_35:0", shape=(),
     dtype=float32)
101 Training time (A2C):  12.660055430730184  minutes
102 ======A2C Validation from:  20161003 to  20170103
103 A2C Sharpe Ratio:  0.612707789571171
104 ======Trading from:  20170103 to  20170404
105 Used Model:  <stable_baselines.a2c.a2c.A2C object at
     0x0000017FA984E880>
106 previous_total_asset:1194036.4544105022
```

```
107 end_total_asset:1251894.6385543735
108 total_reward:57858.1841438713
109 total_cost:  5116.385303254258
110 total trades:  1421
111 Sharpe:  0.3915936919525903
112 ============Trading Done============
113 =========================================
114 turbulence_threshold:  96.08032158358223
115 ======Model training from:  20090000 to  20170103
116 ======A2C Training========
117 save intrinsic loss: Tensor("add_35:0", shape=(),
    dtype=float32)
118 Training time (A2C):  11.621712430318196  minutes
119 ======A2C Validation from:  20170103 to  20170404
120 A2C Sharpe Ratio:  0.34884460338596207
121 ======Trading from:  20170404 to  20170705
122 Used Model:  <stable_baselines.a2c.a2c.A2C object at
    0x0000017FA96B19D0>
123 previous_total_asset:1251894.6385543735
124 end_total_asset:1293149.044298091
125 total_reward:41254.40574371745
126 total_cost:  5960.920284590608
127 total trades:  1257
128 Sharpe:  0.2607125891147165
129 ============Trading Done============
130 =========================================
131 turbulence_threshold:  171.0940715631016
132 ======Model training from:  20090000 to  20170404
133 ======A2C Training========
134 save intrinsic loss: Tensor("add_35:0", shape=(),
    dtype=float32)
135 Training time (A2C):  8.867742888132732  minutes
136 ======A2C Validation from:  20170404 to  20170705
137 A2C Sharpe Ratio:  0.281561086677694
138 ======Trading from:  20170705 to  20171003
139 Used Model:  <stable_baselines.a2c.a2c.A2C object at
    0x0000017FA968EEE0>
140 previous_total_asset:1293149.044298091
141 end_total_asset:1313322.982167154
142 total_reward:20173.937869063113
143 total_cost:  6310.747777315032
```

```
144 total trades:  1498
145 Sharpe:  0.11984308802428009
146 ============Trading Done============
147 ==============================================
148 turbulence_threshold:  171.0940715631016
149 ======Model training from:  20090000 to  20170705
150 ======A2C Training========
151 save intrinsic loss: Tensor("add_35:0", shape=(),
    dtype=float32)
152 Training time (A2C):  12.037776160240174  minutes
153 ======A2C Validation from:  20170705 to  20171003
154 A2C Sharpe Ratio:  0.37767445621778
155 ======Trading from:  20171003 to  20180103
156 Used Model:  <stable_baselines.a2c.a2c.A2C object at
     0x0000017FA7ADE910>
157 previous_total_asset:1313322.982167154
158 end_total_asset:1487862.6125710218
159 total_reward:174539.6304038677
160 total_cost:  4102.7222772890555
161 total trades:  1263
162 Sharpe:  0.8714768403363684
163 ============Trading Done============
164 ==============================================
165 turbulence_threshold:  96.08032158358223
166 ======Model training from:  20090000 to  20171003
167 ======A2C Training========
168 save intrinsic loss: Tensor("add_35:0", shape=(),
    dtype=float32)
169 Training time (A2C):  13.467206799983979  minutes
170 ======A2C Validation from:  20171003 to  20180103
171 A2C Sharpe Ratio:  0.6139021844941627
172 ======Trading from:  20180103 to  20180405
173 Used Model:  <stable_baselines.a2c.a2c.A2C object at
     0x0000017FA9EE3280>
174 previous_total_asset:1487862.6125710218
175 end_total_asset:1528035.8411362916
176 total_reward:40173.22856526985
177 total_cost:  2409.7963651970954
178 total trades:  358
179 Sharpe:  0.21082980524821449
180 ============Trading Done============
```

```
181 =============================================
182 turbulence_threshold:  96.08032158358223
183 ======Model training from:  20090000 to  20180103
184 ======A2C Training========
185 save intrinsic loss: Tensor("add_35:0", shape=(),
    dtype=float32)
186 Training time (A2C):  10.864278169473012  minutes
187 ======A2C Validation from:  20180103 to  20180405
188 A2C Sharpe Ratio:  0.018038702665127273
189 ======Trading from:  20180405 to  20180705
190 Used Model:  <stable_baselines.a2c.a2c.A2C object at
    0x0000017FA9B015E0>
191 previous_total_asset:1528035.8411362916
192 end_total_asset:1506297.2509784345
193 total_reward:-21738.590157857165
194 total_cost:  6805.442470265674
195 total trades:  1050
196 Sharpe:  -0.09046064393628667
197 ============Trading Done============
198 =============================================
199 turbulence_threshold:  96.08032158358223
200 ======Model training from:  20090000 to  20180405
201 ======A2C Training========
202 save intrinsic loss: Tensor("add_35:0", shape=(),
    dtype=float32)
203 Training time (A2C):  11.722519036134084  minutes
204 ======A2C Validation from:  20180405 to  20180705
205 A2C Sharpe Ratio:  -0.011103772492406197
206 ======Trading from:  20180705 to  20181003
207 Used Model:  <stable_baselines.a2c.a2c.A2C object at
    0x0000017FAC8A4F10>
208 previous_total_asset:1506297.2509784345
209 end_total_asset:1521339.6717790798
210 total_reward:15042.42080064537
211 total_cost:  5083.543020537063
212 total trades:  862
213 Sharpe:  0.23795481815359412
214 ============Trading Done============
215 =============================================
216 turbulence_threshold:  96.08032158358223
217 ======Model training from:  20090000 to  20180705
```

```
218 ======A2C Training========
219 save intrinsic loss: Tensor("add_35:0", shape=(),
      dtype=float32)
220 Training time (A2C):  11.26732269525528  minutes
221 ======A2C Validation from:  20180705 to  20181003
222 A2C Sharpe Ratio:  0.08227019929865491
223 ======Trading from:  20181003 to  20190104
224 Used Model:  <stable_baselines.a2c.a2c.A2C object at
      0x0000017FAC8A43D0>
225 previous_total_asset:1521339.6717790798
226 end_total_asset:1530456.7197655768
227 total_reward:9117.047986496938
228 total_cost:  731.4187436804722
229 total trades:  132
230 Sharpe:  0.30471409459218024
231 ===========Trading Done===========
232 ===========================================
233 turbulence_threshold:  171.0940715631016
234 ======Model training from:  20090000 to  20181003
235 ======A2C Training========
236 save intrinsic loss: Tensor("add_35:0", shape=(),
      dtype=float32)
237 Training time (A2C):  13.086900198459626  minutes
238 ======A2C Validation from:  20181003 to  20190104
239 A2C Sharpe Ratio:  -0.3661292964276739
240 ======Trading from:  20190104 to  20190405
241 Used Model:  <stable_baselines.a2c.a2c.A2C object at
      0x0000017FA835DD60>
242 previous_total_asset:1530456.7197655768
243 end_total_asset:1656890.8740348597
244 total_reward:126434.15426928294
245 total_cost:  7136.26760075124
246 total trades:  1398
247 Sharpe:  0.4056921671670196
248 ===========Trading Done===========
249 ===========================================
250 turbulence_threshold:  96.08032158358223
251 ======Model training from:  20090000 to  20190104
252 ======A2C Training========
253 save intrinsic loss: Tensor("add_35:0", shape=(),
      dtype=float32)
```

```
254 Training time (A2C):  13.751258758703868  minutes
255 =====A2C Validation from:  20190104 to  20190405
256 A2C Sharpe Ratio:  0.0450616447307449
257 =====Trading from:  20190405 to  20190708
258 Used Model:  <stable_baselines.a2c.a2c.A2C object at
      0x0000017FA939CA60>
259 previous_total_asset:1656890.8740348597
260 end_total_asset:1665616.233149693
261 total_reward:8725.359114833409
262 total_cost:  1090.4055766109564
263 total trades:  157
264 Sharpe:  0.42199490781561466
265 ============Trading Done============
266 ==============================================
267 turbulence_threshold:  96.08032158358223
268 =====Model training from:  20090000 to  20190405
269 =====A2C Training========
270 save intrinsic loss: Tensor("add_35:0", shape=(),
      dtype=float32)
271 Training time (A2C):  11.567809569835664  minutes
272 =====A2C Validation from:  20190405 to  20190708
273 A2C Sharpe Ratio:  0.2711903866799123
274 =====Trading from:  20190708 to  20191004
275 Used Model:  <stable_baselines.a2c.a2c.A2C object at
      0x0000017FA96DD610>
276 previous_total_asset:1665616.233149693
277 end_total_asset:1664696.1192757154
278 total_reward:-920.1138739776798
279 total_cost:  2022.6171167896644
280 total trades:  347
281 Sharpe:  -0.0197155453266631202
282 ============Trading Done============
283 ==============================================
284 turbulence_threshold:  96.08032158358223
285 =====Model training from:  20090000 to  20190708
286 =====A2C Training========
287 save intrinsic loss: Tensor("add_35:0", shape=(),
      dtype=float32)
288 Training time (A2C):  11.238942249615986  minutes
289 =====A2C Validation from:  20190708 to  20191004
290 A2C Sharpe Ratio:  0.10961432436857192
```

```
291 ======Trading from:  20191004 to  20200106
292 Used Model:  <stable_baselines.a2c.a2c.A2C object at
    0x0000017FAC97ED60>
293 previous_total_asset:1664696.1192757154
294 end_total_asset:1664002.9089581128
295 total_reward:-693.2103176026139
296 total_cost:  285.9588485543346
297 total trades:  60
298 Sharpe:  -0.3462268172541254
299 ============Trading Done============
300 ==========================================
301 turbulence_threshold:  96.08032158358223
302 ======Model training from:  20090000 to  20191004
303 ======A2C Training========
304 save intrinsic loss: Tensor("add_35:0", shape=(),
    dtype=float32)
305 Training time (A2C):  9.961884033679961  minutes
306 ======A2C Validation from:  20191004 to  20200106
307 A2C Sharpe Ratio:  0.008082766175382512
308 ======Trading from:  20200106 to  20200406
309 Used Model:  <stable_baselines.a2c.a2c.A2C object at
    0x0000017FA9F38C40>
310 previous_total_asset:1664002.9089581128
311 end_total_asset:1648856.598700742
312 total_reward:-15146.310257370817
313 total_cost:  1004.195542956474
314 total trades:  178
315 Sharpe:  -0.3774908759292504
316 ============Trading Done============
317 ==========================================
318 turbulence_threshold:  96.08032158358223
319 ======Model training from:  20090000 to  20200106
320 ======A2C Training========
321 save intrinsic loss: Tensor("add_35:0", shape=(),
    dtype=float32)
322 Training time (A2C):  9.85024973154068  minutes
323 ======A2C Validation from:  20200106 to  20200406
324 A2C Sharpe Ratio:  -0.37352513468916554
325 ======Trading from:  20200406 to  20200707
326 Used Model:  <stable_baselines.a2c.a2c.A2C object at
    0x0000017FA3B284F0>
```

```
327 previous_total_asset:1648856.598700742
328 end_total_asset:1652711.864591708
329 total_reward:3855.2658909659367
330 total_cost:  526.2143240319036
331 total trades:  120
332 Sharpe:  0.2683573908217165
333 ===========Trading Done===========
334 A2C Intrinsic Strategy took:  203.60281363328298
    minutes
335
336 Process finished with exit code 0
337
```