```
# Install Conda and set up the environment
!pip install -q condacolab
import condacolab
condacolab.install()

 Downloading
https://github.com/conda-forge/miniforge/releases/download/23.11.0-0/
Mambaforge-23.11.0-0-Linux-x86_64.sh...
 Installing...
 Adjusting configuration...
 Patching environment...
 Done in 0:00:15
 Restarting kernel...

# Install the necessary libraries for financial analysis
!pip install wrds swig

# Install additional system dependencies
!apt-get update -y -qq && apt-get install -y -qq cmake libopenmpi-dev
python3-dev zlib1g-dev libgl1-mesa-glx

# Install the FinRL library from GitHub
!pip install git+https://github.com/AI4Finance-Foundation/FinRL.git

Collecting wrds
  Downloading wrds-3.2.0-py3-none-any.whl.metadata (5.8 kB)
Collecting swig
  Downloading swig-4.2.1.post0-py2.py3-none-
manylinux_2_5_x86_64.manylinux1_x86_64.whl.metadata (3.5 kB)
Collecting numpy<1.27,>=1.26 (from wrds)
  Downloading numpy-1.26.4-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (61 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 61.0/61.0 kB 3.0 MB/s eta
0:00:00
ent already satisfied: packaging<23.3 in
/usr/local/lib/python3.10/site-packages (from wrds) (23.2)
Collecting pandas<2.3,>=2.2 (from wrds)
  Downloading pandas-2.2.3-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (89 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 89.9/89.9 kB 4.4 MB/s eta
0:00:00
 wrds)
  Downloading psycopg2_binary-2.9.10-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (4.9 kB)
Collecting scipy<1.13,>=1.12 (from wrds)
  Downloading scipy-1.12.0-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (60 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 60.4/60.4 kB 4.3 MB/s eta
0:00:00
y<2.1,>=2 (from wrds)
```

```
  Downloading SQLAlchemy-2.0.36-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (9.7 kB)
Collecting python-dateutil>=2.8.2 (from pandas<2.3,>=2.2->wrds)
  Downloading python_dateutil-2.9.0.post0-py2.py3-none-
any.whl.metadata (8.4 kB)
Collecting pytz>=2020.1 (from pandas<2.3,>=2.2->wrds)
  Downloading pytz-2024.2-py2.py3-none-any.whl.metadata (22 kB)
Collecting tzdata>=2022.7 (from pandas<2.3,>=2.2->wrds)
  Downloading tzdata-2024.2-py2.py3-none-any.whl.metadata (1.4 kB)
Collecting typing-extensions>=4.6.0 (from sqlalchemy<2.1,>=2->wrds)
  Downloading typing_extensions-4.12.2-py3-none-any.whl.metadata (3.0
kB)
Collecting greenlet!=0.4.17 (from sqlalchemy<2.1,>=2->wrds)
  Downloading greenlet-3.1.1-cp310-cp310-
manylinux_2_24_x86_64.manylinux_2_28_x86_64.whl.metadata (3.8 kB)
Collecting six>=1.5 (from python-dateutil>=2.8.2->pandas<2.3,>=2.2-
>wrds)
  Downloading six-1.16.0-py2.py3-none-any.whl.metadata (1.8 kB)
Downloading wrds-3.2.0-py3-none-any.whl (13 kB)
Downloading swig-4.2.1.post0-py2.py3-none-
manylinux_2_5_x86_64.manylinux1_x86_64.whl (1.8 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.8/1.8 MB 31.4 MB/s eta
0:00:00
py-1.26.4-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl
(18.2 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 18.2/18.2 MB 72.3 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (13.1 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 13.1/13.1 MB 90.9 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (3.0 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 3.0/3.0 MB 72.7 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (38.4 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 38.4/38.4 MB 19.8 MB/s eta
0:00:00
y-2.0.36-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl
(3.1 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 3.1/3.1 MB 82.1 MB/s eta
0:00:00
anylinux_2_24_x86_64.manylinux_2_28_x86_64.whl (599 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 599.5/599.5 kB 34.6 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 229.9/229.9 kB 15.1 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 508.0/508.0 kB 27.8 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 346.6/346.6 kB 24.4 MB/s eta
0:00:00
```

```
py, greenlet, sqlalchemy, scipy, python-dateutil, pandas, wrds
Successfully installed greenlet-3.1.1 numpy-1.26.4 pandas-2.2.3
psycopg2-binary-2.9.10 python-dateutil-2.9.0.post0 pytz-2024.2 scipy-
1.12.0 six-1.16.0 sqlalchemy-2.0.36 swig-4.2.1.post0 typing-
extensions-4.12.2 tzdata-2024.2 wrds-3.2.0

{"id":"fdba30ae63b6426c990650031f5d6e76","pip_warning":{"packages":
["six"]}}

W: Skipping acquire of configured file 'main/source/Sources' as
repository 'https://r2u.stat.illinois.edu/ubuntu jammy InRelease' does
not seem to provide it (sources.list entry misspelt?)
Selecting previously unselected package libgl1-mesa-glx:amd64.
(Reading database ... 123623 files and directories currently
installed.)
Preparing to unpack .../libgl1-mesa-glx_23.0.4-
0ubuntu1~22.04.1_amd64.deb ...
Unpacking libgl1-mesa-glx:amd64 (23.0.4-0ubuntu1~22.04.1) ...
Setting up libgl1-mesa-glx:amd64 (23.0.4-0ubuntu1~22.04.1) ...
Collecting git+https://github.com/AI4Finance-Foundation/FinRL.git
  Cloning https://github.com/AI4Finance-Foundation/FinRL.git to
/tmp/pip-req-build-nplauypi
  Running command git clone --filter=blob:none --quiet
https://github.com/AI4Finance-Foundation/FinRL.git /tmp/pip-req-build-
nplauypi
  Resolved https://github.com/AI4Finance-Foundation/FinRL.git to
commit 0496601ee2824ca675beb5a220afd9109ac02ffa
  Installing build dependencies ... ents to build wheel ... etadata
(pyproject.toml) ...
/AI4Finance-Foundation/ElegantRL.git#egg=elegantrl (from finrl==0.3.6)
  Cloning https://github.com/AI4Finance-Foundation/ElegantRL.git to
/tmp/pip-install-3renqofl/elegantrl_600d50880f274b74a9793bcb08b354cc
  Running command git clone --filter=blob:none --quiet
https://github.com/AI4Finance-Foundation/ElegantRL.git /tmp/pip-
install-3renqofl/elegantrl_600d50880f274b74a9793bcb08b354cc
  Resolved https://github.com/AI4Finance-Foundation/ElegantRL.git to
commit 6a016b12a8fef7d50305510f906abef05f558784
  Preparing metadata (setup.py) ...  finrl==0.3.6)
  Downloading alpaca_trade_api-3.2.0-py3-none-any.whl.metadata (29 kB)
Collecting ccxt<4,>=3 (from finrl==0.3.6)
  Downloading ccxt-3.1.60-py2.py3-none-any.whl.metadata (108 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 108.7/108.7 kB 615.0 kB/s eta
0:00:00
 finrl==0.3.6)
  Downloading exchange_calendars-4.5.7-py3-none-any.whl.metadata (37
kB)
Collecting jqdatasdk<2,>=1 (from finrl==0.3.6)
  Downloading jqdatasdk-1.9.6-py3-none-any.whl.metadata (5.8 kB)
Collecting pyfolio<0.10,>=0.9 (from finrl==0.3.6)
  Downloading pyfolio-0.9.2.tar.gz (91 kB)
```

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━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 91.1/91.1 kB 7.6 MB/s eta
0:00:00
etadata (setup.py) ...  finrl==0.3.6)
  Downloading pyportfolioopt-1.5.5-py3-none-any.whl.metadata (23 kB)
Collecting ray<3,>=2 (from ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading ray-2.38.0-cp310-cp310-manylinux2014_x86_64.whl.metadata
(17 kB)
Collecting scikit-learn<2,>=1 (from finrl==0.3.6)
  Downloading scikit_learn-1.5.2-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (13 kB)
Collecting stable-baselines3>=2.0.0a5 (from stable-
baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading stable_baselines3-2.4.0a11-py3-none-any.whl.metadata
(4.5 kB)
Collecting stockstats<0.6,>=0.5 (from finrl==0.3.6)
  Downloading stockstats-0.5.4-py2.py3-none-any.whl.metadata (26 kB)
Requirement already satisfied: wrds<4,>=3 in
/usr/local/lib/python3.10/site-packages (from finrl==0.3.6) (3.2.0)
Collecting yfinance<0.3,>=0.2 (from finrl==0.3.6)
  Downloading yfinance-0.2.48-py2.py3-none-any.whl.metadata (13 kB)
Requirement already satisfied: pandas>=0.18.1 in
/usr/local/lib/python3.10/site-packages (from alpaca-trade-api<4,>=3-
>finrl==0.3.6) (2.2.3)
Requirement already satisfied: numpy>=1.11.1 in
/usr/local/lib/python3.10/site-packages (from alpaca-trade-api<4,>=3-
>finrl==0.3.6) (1.26.4)
Requirement already satisfied: requests<3,>2 in
/usr/local/lib/python3.10/site-packages (from alpaca-trade-api<4,>=3-
>finrl==0.3.6) (2.31.0)
Collecting urllib3<2,>1.24 (from alpaca-trade-api<4,>=3->finrl==0.3.6)
  Downloading urllib3-1.26.20-py2.py3-none-any.whl.metadata (50 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 50.1/50.1 kB 3.3 MB/s eta
0:00:00
 alpaca-trade-api<4,>=3->finrl==0.3.6)
  Downloading websocket_client-1.8.0-py3-none-any.whl.metadata (8.0
kB)
Collecting websockets<11,>=9.0 (from alpaca-trade-api<4,>=3-
>finrl==0.3.6)
  Downloading websockets-10.4-cp310-cp310-
manylinux_2_5_x86_64.manylinux1_x86_64.manylinux_2_17_x86_64.manylinux
2014_x86_64.whl.metadata (6.4 kB)
Collecting msgpack==1.0.3 (from alpaca-trade-api<4,>=3->finrl==0.3.6)
  Downloading msgpack-1.0.3-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (8.7 kB)
Collecting aiohttp<4,>=3.8.3 (from alpaca-trade-api<4,>=3-
>finrl==0.3.6)
  Downloading aiohttp-3.10.10-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (7.6 kB)
Collecting PyYAML==6.0.1 (from alpaca-trade-api<4,>=3->finrl==0.3.6)
```

```
  Downloading PyYAML-6.0.1-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (2.1 kB)
Collecting deprecation==2.1.0 (from alpaca-trade-api<4,>=3-
>finrl==0.3.6)
  Downloading deprecation-2.1.0-py2.py3-none-any.whl.metadata (4.6 kB)
Requirement already satisfied: packaging in
/usr/local/lib/python3.10/site-packages (from deprecation==2.1.0-
>alpaca-trade-api<4,>=3->finrl==0.3.6) (23.2)
Requirement already satisfied: setuptools>=60.9.0 in
/usr/local/lib/python3.10/site-packages (from ccxt<4,>=3-
>finrl==0.3.6) (68.2.2)
Requirement already satisfied: certifi>=2018.1.18 in
/usr/local/lib/python3.10/site-packages (from ccxt<4,>=3-
>finrl==0.3.6) (2023.11.17)
Collecting cryptography>=2.6.1 (from ccxt<4,>=3->finrl==0.3.6)
  Downloading cryptography-43.0.3-cp39-abi3-
manylinux_2_28_x86_64.whl.metadata (5.4 kB)
Collecting aiodns>=1.1.1 (from ccxt<4,>=3->finrl==0.3.6)
  Downloading aiodns-3.2.0-py3-none-any.whl.metadata (4.0 kB)
Collecting yarl>=1.7.2 (from ccxt<4,>=3->finrl==0.3.6)
  Downloading yarl-1.17.1-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (64 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 64.8/64.8 kB 5.0 MB/s eta
0:00:00
 exchange-calendars<5,>=4->finrl==0.3.6)
  Downloading pyluach-2.2.0-py3-none-any.whl.metadata (4.3 kB)
Collecting toolz (from exchange-calendars<5,>=4->finrl==0.3.6)
  Downloading toolz-1.0.0-py3-none-any.whl.metadata (5.1 kB)
Requirement already satisfied: tzdata in
/usr/local/lib/python3.10/site-packages (from exchange-
calendars<5,>=4->finrl==0.3.6) (2024.2)
Collecting korean-lunar-calendar (from exchange-calendars<5,>=4-
>finrl==0.3.6)
  Downloading korean_lunar_calendar-0.3.1-py3-none-any.whl.metadata
(2.8 kB)
Requirement already satisfied: six in /usr/local/lib/python3.10/site-
packages (from jqdatasdk<2,>=1->finrl==0.3.6) (1.16.0)
Requirement already satisfied: SQLAlchemy>=1.2.8 in
/usr/local/lib/python3.10/site-packages (from jqdatasdk<2,>=1-
>finrl==0.3.6) (2.0.36)
Collecting pymysql>=0.7.6 (from jqdatasdk<2,>=1->finrl==0.3.6)
  Downloading PyMySQL-1.1.1-py3-none-any.whl.metadata (4.4 kB)
Collecting thriftpy2!=0.5.1,>=0.3.9 (from jqdatasdk<2,>=1-
>finrl==0.3.6)
  Downloading thriftpy2-0.5.2.tar.gz (782 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 782.3/782.3 kB 20.0 MB/s eta
0:00:00
ents to build wheel ... etadata (pyproject.toml) ...
pyfolio<0.10,>=0.9->finrl==0.3.6)
```

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  Downloading ipython-8.29.0-py3-none-any.whl.metadata (5.0 kB)
Collecting matplotlib>=1.4.0 (from pyfolio<0.10,>=0.9->finrl==0.3.6)
  Downloading matplotlib-3.9.2-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (11 kB)
Requirement already satisfied: pytz>=2014.10 in
/usr/local/lib/python3.10/site-packages (from pyfolio<0.10,>=0.9-
>finrl==0.3.6) (2024.2)
Requirement already satisfied: scipy>=0.14.0 in
/usr/local/lib/python3.10/site-packages (from pyfolio<0.10,>=0.9-
>finrl==0.3.6) (1.12.0)
Collecting seaborn>=0.7.1 (from pyfolio<0.10,>=0.9->finrl==0.3.6)
  Downloading seaborn-0.13.2-py3-none-any.whl.metadata (5.4 kB)
Collecting empyrical>=0.5.0 (from pyfolio<0.10,>=0.9->finrl==0.3.6)
  Downloading empyrical-0.5.5.tar.gz (52 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 52.8/52.8 kB 4.5 MB/s eta
0:00:00
etadata (setup.py) ...  pyportfolioopt<2,>=1->finrl==0.3.6)
  Downloading cvxpy-1.5.3-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (8.8 kB)
Collecting click>=7.0 (from ray<3,>=2->ray[default,tune]<3,>=2-
>finrl==0.3.6)
  Downloading click-8.1.7-py3-none-any.whl.metadata (3.0 kB)
Collecting filelock (from ray<3,>=2->ray[default,tune]<3,>=2-
>finrl==0.3.6)
  Downloading filelock-3.16.1-py3-none-any.whl.metadata (2.9 kB)
Collecting jsonschema (from ray<3,>=2->ray[default,tune]<3,>=2-
>finrl==0.3.6)
  Downloading jsonschema-4.23.0-py3-none-any.whl.metadata (7.9 kB)
Collecting protobuf!=3.19.5,>=3.15.3 (from ray<3,>=2-
>ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading protobuf-5.28.3-cp38-abi3-
manylinux2014_x86_64.whl.metadata (592 bytes)
Collecting aiosignal (from ray<3,>=2->ray[default,tune]<3,>=2-
>finrl==0.3.6)
  Downloading aiosignal-1.3.1-py3-none-any.whl.metadata (4.0 kB)
Collecting frozenlist (from ray<3,>=2->ray[default,tune]<3,>=2-
>finrl==0.3.6)
  Downloading frozenlist-1.5.0-cp310-cp310-
manylinux_2_5_x86_64.manylinux1_x86_64.manylinux_2_17_x86_64.manylinux
2014_x86_64.whl.metadata (13 kB)
Collecting tensorboardX>=1.9 (from ray[default,tune]<3,>=2-
>finrl==0.3.6)
  Downloading tensorboardX-2.6.2.2-py2.py3-none-any.whl.metadata (5.8
kB)
Collecting pyarrow>=6.0.1 (from ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading pyarrow-18.0.0-cp310-cp310-
manylinux_2_28_x86_64.whl.metadata (3.3 kB)
Collecting fsspec (from ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading fsspec-2024.10.0-py3-none-any.whl.metadata (11 kB)
```

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Collecting aiohttp-cors (from ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading aiohttp_cors-0.7.0-py3-none-any.whl.metadata (20 kB)
Collecting colorful (from ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading colorful-0.5.6-py2.py3-none-any.whl.metadata (16 kB)
Collecting py-spy>=0.2.0 (from ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading py_spy-0.4.0-py2.py3-none-
manylinux_2_5_x86_64.manylinux1_x86_64.whl.metadata (16 kB)
Collecting opencensus (from ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading opencensus-0.11.4-py2.py3-none-any.whl.metadata (12 kB)
Collecting pydantic!=2.0.*,!=2.1.*,!=2.2.*,!=2.3.*,!=2.4.*,<3 (from
ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading pydantic-2.9.2-py3-none-any.whl.metadata (149 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 149.4/149.4 kB 10.7 MB/s eta
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etheus-client>=0.7.1 (from ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading prometheus_client-0.21.0-py3-none-any.whl.metadata (1.8
kB)
Collecting smart-open (from ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading smart_open-7.0.5-py3-none-any.whl.metadata (24 kB)
Collecting virtualenv!=20.21.1,>=20.0.24 (from
ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading virtualenv-20.27.1-py3-none-any.whl.metadata (4.5 kB)
Collecting grpcio>=1.42.0 (from ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading grpcio-1.67.1-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (3.9 kB)
Collecting memray (from ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading memray-1.14.0-cp310-cp310-
manylinux_2_12_x86_64.manylinux2010_x86_64.whl.metadata (19 kB)
Collecting joblib>=1.2.0 (from scikit-learn<2,>=1->finrl==0.3.6)
  Downloading joblib-1.4.2-py3-none-any.whl.metadata (5.4 kB)
Collecting threadpoolctl>=3.1.0 (from scikit-learn<2,>=1-
>finrl==0.3.6)
  Downloading threadpoolctl-3.5.0-py3-none-any.whl.metadata (13 kB)
Collecting gymnasium<1.1.0,>=0.29.1 (from stable-baselines3>=2.0.0a5-
>stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading gymnasium-1.0.0-py3-none-any.whl.metadata (9.5 kB)
Collecting torch>=1.13 (from stable-baselines3>=2.0.0a5->stable-
baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading torch-2.5.1-cp310-cp310-manylinux1_x86_64.whl.metadata
(28 kB)
Collecting cloudpickle (from stable-baselines3>=2.0.0a5->stable-
baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading cloudpickle-3.1.0-py3-none-any.whl.metadata (7.0 kB)
Collecting opencv-python (from stable-baselines3[extra]>=2.0.0a5-
>finrl==0.3.6)
  Downloading opencv_python-4.10.0.84-cp37-abi3-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (20 kB)
Collecting pygame (from stable-baselines3[extra]>=2.0.0a5-
>finrl==0.3.6)
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  Downloading pygame-2.6.1-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (12 kB)
Collecting tensorboard>=2.9.1 (from stable-baselines3[extra]>=2.0.0a5-
>finrl==0.3.6)
  Downloading tensorboard-2.18.0-py3-none-any.whl.metadata (1.6 kB)
Collecting psutil (from stable-baselines3[extra]>=2.0.0a5-
>finrl==0.3.6)
  Downloading psutil-6.1.0-cp36-abi3-
manylinux_2_12_x86_64.manylinux2010_x86_64.manylinux_2_17_x86_64.manyl
inux2014_x86_64.whl.metadata (22 kB)
Requirement already satisfied: tqdm in /usr/local/lib/python3.10/site-
packages (from stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
(4.66.1)
Collecting rich (from stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading rich-13.9.4-py3-none-any.whl.metadata (18 kB)
Collecting ale-py>=0.9.0 (from stable-baselines3[extra]>=2.0.0a5-
>finrl==0.3.6)
  Downloading ale_py-0.10.1-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (7.6 kB)
Collecting pillow (from stable-baselines3[extra]>=2.0.0a5-
>finrl==0.3.6)
  Downloading pillow-11.0.0-cp310-cp310-
manylinux_2_28_x86_64.whl.metadata (9.1 kB)
Requirement already satisfied: psycopg2-binary<2.10,>=2.9 in
/usr/local/lib/python3.10/site-packages (from wrds<4,>=3-
>finrl==0.3.6) (2.9.10)
Collecting multitasking>=0.0.7 (from yfinance<0.3,>=0.2->finrl==0.3.6)
  Downloading multitasking-0.0.11-py3-none-any.whl.metadata (5.5 kB)
Collecting lxml>=4.9.1 (from yfinance<0.3,>=0.2->finrl==0.3.6)
  Downloading lxml-5.3.0-cp310-cp310-
manylinux_2_28_x86_64.whl.metadata (3.8 kB)
Requirement already satisfied: platformdirs>=2.0.0 in
/usr/local/lib/python3.10/site-packages (from yfinance<0.3,>=0.2-
>finrl==0.3.6) (4.1.0)
Collecting frozendict>=2.3.4 (from yfinance<0.3,>=0.2->finrl==0.3.6)
  Downloading frozendict-2.4.6-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (23 kB)
Collecting peewee>=3.16.2 (from yfinance<0.3,>=0.2->finrl==0.3.6)
  Downloading peewee-3.17.7.tar.gz (939 kB)
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ents to build wheel ... etadata (pyproject.toml) ...
yfinance<0.3,>=0.2->finrl==0.3.6)
  Downloading beautifulsoup4-4.12.3-py3-none-any.whl.metadata (3.8 kB)
Collecting html5lib>=1.1 (from yfinance<0.3,>=0.2->finrl==0.3.6)
  Downloading html5lib-1.1-py2.py3-none-any.whl.metadata (16 kB)
Collecting th (from elegantrl@ git+https://github.com/AI4Finance-
Foundation/ElegantRL.git#egg=elegantrl->finrl==0.3.6)
  Downloading th-0.4.1-py3-none-any.whl.metadata (3.4 kB)
```

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Collecting pycares>=4.0.0 (from aiodns>=1.1.1->ccxt<4,>=3-
>finrl==0.3.6)
  Downloading pycares-4.4.0-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (4.1 kB)
Collecting aiohappyeyeballs>=2.3.0 (from aiohttp<4,>=3.8.3->alpaca-
trade-api<4,>=3->finrl==0.3.6)
  Downloading aiohappyeyeballs-2.4.3-py3-none-any.whl.metadata (6.1
kB)
Collecting attrs>=17.3.0 (from aiohttp<4,>=3.8.3->alpaca-trade-
api<4,>=3->finrl==0.3.6)
  Downloading attrs-24.2.0-py3-none-any.whl.metadata (11 kB)
Collecting multidict<7.0,>=4.5 (from aiohttp<4,>=3.8.3->alpaca-trade-
api<4,>=3->finrl==0.3.6)
  Downloading multidict-6.1.0-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (5.0 kB)
Collecting async-timeout<5.0,>=4.0 (from aiohttp<4,>=3.8.3->alpaca-
trade-api<4,>=3->finrl==0.3.6)
  Downloading async_timeout-4.0.3-py3-none-any.whl.metadata (4.2 kB)
Requirement already satisfied: typing-extensions in
/usr/local/lib/python3.10/site-packages (from ale-py>=0.9.0->stable-
baselines3[extra]>=2.0.0a5->finrl==0.3.6) (4.12.2)
Collecting soupsieve>1.2 (from beautifulsoup4>=4.11.1-
>yfinance<0.3,>=0.2->finrl==0.3.6)
  Downloading soupsieve-2.6-py3-none-any.whl.metadata (4.6 kB)
Requirement already satisfied: cffi>=1.12 in
/usr/local/lib/python3.10/site-packages (from cryptography>=2.6.1-
>ccxt<4,>=3->finrl==0.3.6) (1.16.0)
Collecting osqp>=0.6.2 (from cvxpy<2.0.0,>=1.1.19-
>pyportfolioopt<2,>=1->finrl==0.3.6)
  Downloading osqp-0.6.7.post3-cp310-cp310-
manylinux_2_5_x86_64.manylinux1_x86_64.manylinux_2_17_x86_64.manylinux
2014_x86_64.whl.metadata (1.9 kB)
Collecting ecos>=2 (from cvxpy<2.0.0,>=1.1.19->pyportfolioopt<2,>=1-
>finrl==0.3.6)
  Downloading ecos-2.0.14-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (8.0 kB)
Collecting clarabel>=0.5.0 (from cvxpy<2.0.0,>=1.1.19-
>pyportfolioopt<2,>=1->finrl==0.3.6)
  Downloading clarabel-0.9.0-cp37-abi3-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (4.8 kB)
Collecting scs>=3.2.4.post1 (from cvxpy<2.0.0,>=1.1.19-
>pyportfolioopt<2,>=1->finrl==0.3.6)
  Downloading scs-3.2.7-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (2.1 kB)
Collecting pandas-datareader>=0.2 (from empyrical>=0.5.0-
>pyfolio<0.10,>=0.9->finrl==0.3.6)
  Downloading pandas_datareader-0.10.0-py3-none-any.whl.metadata (2.9
kB)
Collecting farama-notifications>=0.0.1 (from gymnasium<1.1.0,>=0.29.1-
```

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>stable-baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5-
>finrl==0.3.6)
  Downloading Farama_Notifications-0.0.4-py3-none-any.whl.metadata
(558 bytes)
Collecting webencodings (from html5lib>=1.1->yfinance<0.3,>=0.2-
>finrl==0.3.6)
  Downloading webencodings-0.5.1-py2.py3-none-any.whl.metadata (2.1
kB)
Collecting decorator (from ipython>=3.2.3->pyfolio<0.10,>=0.9-
>finrl==0.3.6)
  Downloading decorator-5.1.1-py3-none-any.whl.metadata (4.0 kB)
Collecting jedi>=0.16 (from ipython>=3.2.3->pyfolio<0.10,>=0.9-
>finrl==0.3.6)
  Downloading jedi-0.19.1-py2.py3-none-any.whl.metadata (22 kB)
Collecting matplotlib-inline (from ipython>=3.2.3->pyfolio<0.10,>=0.9-
>finrl==0.3.6)
  Downloading matplotlib_inline-0.1.7-py3-none-any.whl.metadata (3.9
kB)
Collecting prompt-toolkit<3.1.0,>=3.0.41 (from ipython>=3.2.3-
>pyfolio<0.10,>=0.9->finrl==0.3.6)
  Downloading prompt_toolkit-3.0.48-py3-none-any.whl.metadata (6.4 kB)
Collecting pygments>=2.4.0 (from ipython>=3.2.3->pyfolio<0.10,>=0.9-
>finrl==0.3.6)
  Downloading pygments-2.18.0-py3-none-any.whl.metadata (2.5 kB)
Collecting stack-data (from ipython>=3.2.3->pyfolio<0.10,>=0.9-
>finrl==0.3.6)
  Downloading stack_data-0.6.3-py3-none-any.whl.metadata (18 kB)
Collecting traitlets>=5.13.0 (from ipython>=3.2.3->pyfolio<0.10,>=0.9-
>finrl==0.3.6)
  Downloading traitlets-5.14.3-py3-none-any.whl.metadata (10 kB)
Collecting exceptiongroup (from ipython>=3.2.3->pyfolio<0.10,>=0.9-
>finrl==0.3.6)
  Downloading exceptiongroup-1.2.2-py3-none-any.whl.metadata (6.6 kB)
Collecting pexpect>4.3 (from ipython>=3.2.3->pyfolio<0.10,>=0.9-
>finrl==0.3.6)
  Downloading pexpect-4.9.0-py2.py3-none-any.whl.metadata (2.5 kB)
Collecting contourpy>=1.0.1 (from matplotlib>=1.4.0-
>pyfolio<0.10,>=0.9->finrl==0.3.6)
  Downloading contourpy-1.3.0-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (5.4 kB)
Collecting cycler>=0.10 (from matplotlib>=1.4.0->pyfolio<0.10,>=0.9-
>finrl==0.3.6)
  Downloading cycler-0.12.1-py3-none-any.whl.metadata (3.8 kB)
Collecting fonttools>=4.22.0 (from matplotlib>=1.4.0-
>pyfolio<0.10,>=0.9->finrl==0.3.6)
  Downloading fonttools-4.54.1-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (163 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 163.7/163.7 kB 11.8 MB/s eta
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 matplotlib>=1.4.0->pyfolio<0.10,>=0.9->finrl==0.3.6)
  Downloading kiwisolver-1.4.7-cp310-cp310-
manylinux_2_12_x86_64.manylinux2010_x86_64.whl.metadata (6.3 kB)
Collecting pyparsing>=2.3.1 (from matplotlib>=1.4.0-
>pyfolio<0.10,>=0.9->finrl==0.3.6)
  Downloading pyparsing-3.2.0-py3-none-any.whl.metadata (5.0 kB)
Requirement already satisfied: python-dateutil>=2.7 in
/usr/local/lib/python3.10/site-packages (from matplotlib>=1.4.0-
>pyfolio<0.10,>=0.9->finrl==0.3.6) (2.9.0.post0)
Collecting annotated-types>=0.6.0 (from pydantic!=2.0.*,!=2.1.*,!
=2.2.*,!=2.3.*,!=2.4.*,<3->ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading annotated_types-0.7.0-py3-none-any.whl.metadata (15 kB)
Collecting pydantic-core==2.23.4 (from pydantic!=2.0.*,!=2.1.*,!
=2.2.*,!=2.3.*,!=2.4.*,<3->ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading pydantic_core-2.23.4-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (6.6 kB)
Requirement already satisfied: charset-normalizer<4,>=2 in
/usr/local/lib/python3.10/site-packages (from requests<3,>2->alpaca-
trade-api<4,>=3->finrl==0.3.6) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in
/usr/local/lib/python3.10/site-packages (from requests<3,>2->alpaca-
trade-api<4,>=3->finrl==0.3.6) (3.6)
Requirement already satisfied: greenlet!=0.4.17 in
/usr/local/lib/python3.10/site-packages (from SQLAlchemy>=1.2.8-
>jqdatasdk<2,>=1->finrl==0.3.6) (3.1.1)
Collecting absl-py>=0.4 (from tensorboard>=2.9.1->stable-
baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading absl_py-2.1.0-py3-none-any.whl.metadata (2.3 kB)
Collecting markdown>=2.6.8 (from tensorboard>=2.9.1->stable-
baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading Markdown-3.7-py3-none-any.whl.metadata (7.0 kB)
Collecting tensorboard-data-server<0.8.0,>=0.7.0 (from
tensorboard>=2.9.1->stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading tensorboard_data_server-0.7.2-py3-none-
manylinux_2_31_x86_64.whl.metadata (1.1 kB)
Collecting werkzeug>=1.0.1 (from tensorboard>=2.9.1->stable-
baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading werkzeug-3.1.2-py3-none-any.whl.metadata (3.7 kB)
Collecting Cython>=3.0.10 (from thriftpy2!=0.5.1,>=0.3.9-
>jqdatasdk<2,>=1->finrl==0.3.6)
  Using cached Cython-3.0.11-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (3.2 kB)
Collecting ply<4.0,>=3.4 (from thriftpy2!=0.5.1,>=0.3.9-
>jqdatasdk<2,>=1->finrl==0.3.6)
  Downloading ply-3.11-py2.py3-none-any.whl.metadata (844 bytes)
Collecting networkx (from torch>=1.13->stable-baselines3>=2.0.0a5-
>stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading networkx-3.4.2-py3-none-any.whl.metadata (6.3 kB)
Collecting jinja2 (from torch>=1.13->stable-baselines3>=2.0.0a5-
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>stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading jinja2-3.1.4-py3-none-any.whl.metadata (2.6 kB)
Collecting nvidia-cuda-nvrtc-cu12==12.4.127 (from torch>=1.13->stable-
baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading nvidia_cuda_nvrtc_cu12-12.4.127-py3-none-
manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cuda-runtime-cu12==12.4.127 (from torch>=1.13-
>stable-baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5-
>finrl==0.3.6)
  Downloading nvidia_cuda_runtime_cu12-12.4.127-py3-none-
manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cuda-cupti-cu12==12.4.127 (from torch>=1.13->stable-
baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading nvidia_cuda_cupti_cu12-12.4.127-py3-none-
manylinux2014_x86_64.whl.metadata (1.6 kB)
Collecting nvidia-cudnn-cu12==9.1.0.70 (from torch>=1.13->stable-
baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading nvidia_cudnn_cu12-9.1.0.70-py3-none-
manylinux2014_x86_64.whl.metadata (1.6 kB)
Collecting nvidia-cublas-cu12==12.4.5.8 (from torch>=1.13->stable-
baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading nvidia_cublas_cu12-12.4.5.8-py3-none-
manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cufft-cu12==11.2.1.3 (from torch>=1.13->stable-
baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading nvidia_cufft_cu12-11.2.1.3-py3-none-
manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-curand-cu12==10.3.5.147 (from torch>=1.13->stable-
baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading nvidia_curand_cu12-10.3.5.147-py3-none-
manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cusolver-cu12==11.6.1.9 (from torch>=1.13->stable-
baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading nvidia_cusolver_cu12-11.6.1.9-py3-none-
manylinux2014_x86_64.whl.metadata (1.6 kB)
Collecting nvidia-cusparse-cu12==12.3.1.170 (from torch>=1.13->stable-
baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading nvidia_cusparse_cu12-12.3.1.170-py3-none-
manylinux2014_x86_64.whl.metadata (1.6 kB)
Collecting nvidia-nccl-cu12==2.21.5 (from torch>=1.13->stable-
baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading nvidia_nccl_cu12-2.21.5-py3-none-
manylinux2014_x86_64.whl.metadata (1.8 kB)
Collecting nvidia-nvtx-cu12==12.4.127 (from torch>=1.13->stable-
baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading nvidia_nvtx_cu12-12.4.127-py3-none-
manylinux2014_x86_64.whl.metadata (1.7 kB)
Collecting nvidia-nvjitlink-cu12==12.4.127 (from torch>=1.13->stable-
baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
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  Downloading nvidia_nvjitlink_cu12-12.4.127-py3-none-
manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting triton==3.1.0 (from torch>=1.13->stable-
baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading triton-3.1.0-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (1.3 kB)
Collecting sympy==1.13.1 (from torch>=1.13->stable-
baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading sympy-1.13.1-py3-none-any.whl.metadata (12 kB)
Collecting mpmath<1.4,>=1.1.0 (from sympy==1.13.1->torch>=1.13-
>stable-baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5-
>finrl==0.3.6)
  Downloading mpmath-1.3.0-py3-none-any.whl.metadata (8.6 kB)
Collecting distlib<1,>=0.3.7 (from virtualenv!=20.21.1,>=20.0.24-
>ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading distlib-0.3.9-py2.py3-none-any.whl.metadata (5.2 kB)
Collecting propcache>=0.2.0 (from yarl>=1.7.2->ccxt<4,>=3-
>finrl==0.3.6)
  Downloading propcache-0.2.0-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (7.7 kB)
Collecting jsonschema-specifications>=2023.03.6 (from jsonschema-
>ray<3,>=2->ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading jsonschema_specifications-2024.10.1-py3-none-
any.whl.metadata (3.0 kB)
Collecting referencing>=0.28.4 (from jsonschema->ray<3,>=2-
>ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading referencing-0.35.1-py3-none-any.whl.metadata (2.8 kB)
Collecting rpds-py>=0.7.1 (from jsonschema->ray<3,>=2-
>ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading rpds_py-0.20.1-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (4.2 kB)
Collecting textual>=0.41.0 (from memray->ray[default,tune]<3,>=2-
>finrl==0.3.6)
  Downloading textual-0.85.2-py3-none-any.whl.metadata (5.6 kB)
Collecting markdown-it-py>=2.2.0 (from rich->stable-
baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading markdown_it_py-3.0.0-py3-none-any.whl.metadata (6.9 kB)
Collecting opencensus-context>=0.1.3 (from opencensus-
>ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading opencensus_context-0.1.3-py2.py3-none-any.whl.metadata
(3.3 kB)
Collecting google-api-core<3.0.0,>=1.0.0 (from opencensus-
>ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading google_api_core-2.22.0-py3-none-any.whl.metadata (2.9
kB)
Collecting wrapt (from smart-open->ray[default,tune]<3,>=2-
>finrl==0.3.6)
  Downloading wrapt-1.16.0-cp310-cp310-
manylinux_2_5_x86_64.manylinux1_x86_64.manylinux_2_17_x86_64.manylinux
2014_x86_64.whl.metadata (6.6 kB)
```

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Collecting niltype<2.0,>=0.3 (from th->elegantrl@
git+https://github.com/AI4Finance-Foundation/ElegantRL.git#egg=elegant
rl->finrl==0.3.6)
  Downloading niltype-1.0.2-py3-none-any.whl.metadata (4.3 kB)
Requirement already satisfied: pycparser in
/usr/local/lib/python3.10/site-packages (from cffi>=1.12-
>cryptography>=2.6.1->ccxt<4,>=3->finrl==0.3.6) (2.21)
Collecting googleapis-common-protos<2.0.dev0,>=1.56.2 (from google-
api-core<3.0.0,>=1.0.0->opencensus->ray[default,tune]<3,>=2-
>finrl==0.3.6)
  Downloading googleapis_common_protos-1.65.0-py2.py3-none-
any.whl.metadata (1.5 kB)
Collecting proto-plus<2.0.0dev,>=1.22.3 (from google-api-
core<3.0.0,>=1.0.0->opencensus->ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading proto_plus-1.25.0-py3-none-any.whl.metadata (2.2 kB)
Collecting google-auth<3.0.dev0,>=2.14.1 (from google-api-
core<3.0.0,>=1.0.0->opencensus->ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading google_auth-2.35.0-py2.py3-none-any.whl.metadata (4.7
kB)
Collecting parso<0.9.0,>=0.8.3 (from jedi>=0.16->ipython>=3.2.3-
>pyfolio<0.10,>=0.9->finrl==0.3.6)
  Downloading parso-0.8.4-py2.py3-none-any.whl.metadata (7.7 kB)
Collecting MarkupSafe>=2.0 (from jinja2->torch>=1.13->stable-
baselines3>=2.0.0a5->stable-baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading MarkupSafe-3.0.2-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (4.0 kB)
Collecting mdurl~=0.1 (from markdown-it-py>=2.2.0->rich->stable-
baselines3[extra]>=2.0.0a5->finrl==0.3.6)
  Downloading mdurl-0.1.2-py3-none-any.whl.metadata (1.6 kB)
Collecting qdldl (from osqp>=0.6.2->cvxpy<2.0.0,>=1.1.19-
>pyportfolioopt<2,>=1->finrl==0.3.6)
  Downloading qdldl-0.1.7.post4-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (1.7 kB)
Collecting ptyprocess>=0.5 (from pexpect>4.3->ipython>=3.2.3-
>pyfolio<0.10,>=0.9->finrl==0.3.6)
  Downloading ptyprocess-0.7.0-py2.py3-none-any.whl.metadata (1.3 kB)
Collecting wcwidth (from prompt-toolkit<3.1.0,>=3.0.41-
>ipython>=3.2.3->pyfolio<0.10,>=0.9->finrl==0.3.6)
  Downloading wcwidth-0.2.13-py2.py3-none-any.whl.metadata (14 kB)
Collecting executing>=1.2.0 (from stack-data->ipython>=3.2.3-
>pyfolio<0.10,>=0.9->finrl==0.3.6)
  Downloading executing-2.1.0-py2.py3-none-any.whl.metadata (8.9 kB)
Collecting asttokens>=2.1.0 (from stack-data->ipython>=3.2.3-
>pyfolio<0.10,>=0.9->finrl==0.3.6)
  Downloading asttokens-2.4.1-py2.py3-none-any.whl.metadata (5.2 kB)
Collecting pure-eval (from stack-data->ipython>=3.2.3-
>pyfolio<0.10,>=0.9->finrl==0.3.6)
  Downloading pure_eval-0.2.3-py3-none-any.whl.metadata (6.3 kB)
Collecting cachetools<6.0,>=2.0.0 (from google-auth<3.0.dev0,>=2.14.1-
```

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>google-api-core<3.0.0,>=1.0.0->opencensus->ray[default,tune]<3,>=2-
>finrl==0.3.6)
  Downloading cachetools-5.5.0-py3-none-any.whl.metadata (5.3 kB)
Collecting pyasn1-modules>=0.2.1 (from google-auth<3.0.dev0,>=2.14.1-
>google-api-core<3.0.0,>=1.0.0->opencensus->ray[default,tune]<3,>=2-
>finrl==0.3.6)
  Downloading pyasn1_modules-0.4.1-py3-none-any.whl.metadata (3.5 kB)
Collecting rsa<5,>=3.1.4 (from google-auth<3.0.dev0,>=2.14.1->google-
api-core<3.0.0,>=1.0.0->opencensus->ray[default,tune]<3,>=2-
>finrl==0.3.6)
  Downloading rsa-4.9-py3-none-any.whl.metadata (4.2 kB)
Collecting linkify-it-py<3,>=1 (from markdown-it-
py[linkify,plugins]>=2.1.0->textual>=0.41.0->memray-
>ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading linkify_it_py-2.0.3-py3-none-any.whl.metadata (8.5 kB)
Collecting mdit-py-plugins (from markdown-it-
py[linkify,plugins]>=2.1.0->textual>=0.41.0->memray-
>ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading mdit_py_plugins-0.4.2-py3-none-any.whl.metadata (2.8 kB)
Collecting uc-micro-py (from linkify-it-py<3,>=1->markdown-it-
py[linkify,plugins]>=2.1.0->textual>=0.41.0->memray-
>ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading uc_micro_py-1.0.3-py3-none-any.whl.metadata (2.0 kB)
Collecting pyasn1<0.7.0,>=0.4.6 (from pyasn1-modules>=0.2.1->google-
auth<3.0.dev0,>=2.14.1->google-api-core<3.0.0,>=1.0.0->opencensus-
>ray[default,tune]<3,>=2->finrl==0.3.6)
  Downloading pyasn1-0.6.1-py3-none-any.whl.metadata (8.4 kB)
Downloading alpaca_trade_api-3.2.0-py3-none-any.whl (34 kB)
Downloading deprecation-2.1.0-py2.py3-none-any.whl (11 kB)
Downloading msgpack-1.0.3-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl (323 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 323.7/323.7 kB 22.4 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (705 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 705.5/705.5 kB 41.8 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 4.0/4.0 MB 75.3 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 196.7/196.7 kB 14.3 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 77.3/77.3 kB 6.0 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 61.9/61.9 kB 3.3 MB/s eta
0:00:00
anylinux2014_x86_64.whl (66.0 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 66.0/66.0 MB 9.9 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (13.3 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 13.3/13.3 MB 90.5 MB/s eta
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0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 183.9/183.9 kB 15.3 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 101.1/101.1 kB 8.6 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (1.2 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.2/1.2 MB 43.9 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (2.1 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 2.1/2.1 MB 51.3 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 147.9/147.9 kB 11.2 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 97.9/97.9 kB 8.1 MB/s eta
0:00:00
anylinux_2_28_x86_64.whl (4.0 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 4.0/4.0 MB 52.8 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (1.2 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.2/1.2 MB 44.3 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (117 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 117.4/117.4 kB 9.1 MB/s eta
0:00:00
anylinux_2_5_x86_64.manylinux1_x86_64.manylinux_2_17_x86_64.manylinux2
014_x86_64.whl (241 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 241.9/241.9 kB 17.2 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (5.9 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 5.9/5.9 MB 62.3 MB/s eta
0:00:00
nasium-1.0.0-py3-none-any.whl (958 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 958.1/958.1 kB 45.5 MB/s eta
0:00:00
l5lib-1.1-py2.py3-none-any.whl (112 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 112.2/112.2 kB 8.8 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 819.9/819.9 kB 39.8 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 301.8/301.8 kB 20.1 MB/s eta
0:00:00
l-5.3.0-cp310-cp310-manylinux_2_28_x86_64.whl (5.0 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 5.0/5.0 MB 56.0 MB/s eta
0:00:00
atplotlib-3.9.2-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl (8.3 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 8.3/8.3 MB 70.8 MB/s eta
0:00:00
ultitasking-0.0.11-py3-none-any.whl (8.5 kB)
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Downloading pillow-11.0.0-cp310-cp310-manylinux_2_28_x86_64.whl (4.4
MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 4.4/4.4 MB 64.7 MB/s eta
0:00:00
etheus_client-0.21.0-py3-none-any.whl (54 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 54.7/54.7 kB 4.1 MB/s eta
0:00:00
anylinux2014_x86_64.whl (316 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 316.6/316.6 kB 21.8 MB/s eta
0:00:00
anylinux_2_5_x86_64.manylinux1_x86_64.whl (2.7 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 2.7/2.7 MB 52.4 MB/s eta
0:00:00
anylinux_2_28_x86_64.whl (40.0 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 40.0/40.0 MB 16.2 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 434.9/434.9 kB 27.6 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (2.1 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 2.1/2.1 MB 53.1 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 45.0/45.0 kB 3.4 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 294.9/294.9 kB 21.3 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 5.5/5.5 MB 68.2 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 101.7/101.7 kB 7.5 MB/s eta
0:00:00
anylinux1_x86_64.whl (906.4 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 906.4/906.4 MB 2.0 MB/s eta
0:00:00
anylinux2014_x86_64.whl (363.4 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 363.4/363.4 MB 4.1 MB/s eta
0:00:00
anylinux2014_x86_64.whl (13.8 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 13.8/13.8 MB 91.3 MB/s eta
0:00:00
anylinux2014_x86_64.whl (24.6 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 24.6/24.6 MB 71.5 MB/s eta
0:00:00
e_cu12-12.4.127-py3-none-manylinux2014_x86_64.whl (883 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 883.7/883.7 kB 42.7 MB/s eta
0:00:00
anylinux2014_x86_64.whl (664.8 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 664.8/664.8 MB 2.8 MB/s eta
0:00:00
anylinux2014_x86_64.whl (211.5 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 211.5/211.5 MB 4.8 MB/s eta
```

```
0:00:00
anylinux2014_x86_64.whl (56.3 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 56.3/56.3 MB 12.2 MB/s eta
0:00:00
anylinux2014_x86_64.whl (127.9 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 127.9/127.9 MB 7.9 MB/s eta
0:00:00
anylinux2014_x86_64.whl (207.5 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 207.5/207.5 MB 6.2 MB/s eta
0:00:00
anylinux2014_x86_64.whl (188.7 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 188.7/188.7 MB 5.9 MB/s eta
0:00:00
anylinux2014_x86_64.whl (21.1 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 21.1/21.1 MB 51.9 MB/s eta
0:00:00
anylinux2014_x86_64.whl (99 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 99.1/99.1 kB 7.6 MB/s eta
0:00:00
py-1.13.1-py3-none-any.whl (6.2 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 6.2/6.2 MB 55.4 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (209.5 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 209.5/209.5 MB 5.2 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 144.2/144.2 kB 10.3 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 3.1/3.1 MB 82.2 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 58.8/58.8 kB 4.6 MB/s eta
0:00:00
anylinux_2_5_x86_64.manylinux1_x86_64.manylinux_2_17_x86_64.manylinux2
014_x86_64.whl (106 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 106.8/106.8 kB 8.8 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (318 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 318.7/318.7 kB 17.5 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 201.4/201.4 kB 15.8 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 179.6/179.6 kB 9.2 MB/s eta
0:00:00
a-4.23.0-py3-none-any.whl (88 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 88.5/88.5 kB 6.7 MB/s eta
0:00:00
emray-1.14.0-cp310-cp310-
manylinux_2_12_x86_64.manylinux2010_x86_64.whl (8.3 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 8.3/8.3 MB 93.3 MB/s eta
0:00:00
```

```
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 242.4/242.4 kB 13.6 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 128.2/128.2 kB 10.4 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (62.5 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 62.5/62.5 MB 11.4 MB/s eta
0:00:00
anylinux_2_12_x86_64.manylinux2010_x86_64.manylinux_2_17_x86_64.manyli
nux2014_x86_64.whl (287 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 287.3/287.3 kB 19.7 MB/s eta
0:00:00
e-2.6.1-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl
(14.0 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 14.0/14.0 MB 82.0 MB/s eta
0:00:00
art_open-7.0.5-py3-none-any.whl (61 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 61.4/61.4 kB 4.7 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 56.4/56.4 kB 4.2 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 133.7/133.7 kB 10.1 MB/s eta
0:00:00
eout-4.0.3-py3-none-any.whl (5.7 kB)
Downloading attrs-24.2.0-py3-none-any.whl (63 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 63.0/63.0 kB 5.4 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (1.8 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.8/1.8 MB 56.6 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (322 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 322.0/322.0 kB 24.0 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (3.6 MB)
Downloading distlib-0.3.9-py2.py3-none-any.whl (468 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 469.0/469.0 kB 31.9 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (218 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 218.9/218.9 kB 15.5 MB/s eta
0:00:00
a_Notifications-0.0.4-py3-none-any.whl (2.5 kB)
Downloading fonttools-4.54.1-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl (4.6 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 4.6/4.6 MB 80.7 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 156.5/156.5 kB 12.0 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.6/1.6 MB 56.9 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 133.3/133.3 kB 10.4 MB/s eta
```

```
0:00:00
a_specifications-2024.10.1-py3-none-any.whl (18 kB)
Downloading kiwisolver-1.4.7-cp310-cp310-
manylinux_2_12_x86_64.manylinux2010_x86_64.whl (1.6 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.6/1.6 MB 60.6 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 106.3/106.3 kB 8.1 MB/s eta
0:00:00
arkdown_it_py-3.0.0-py3-none-any.whl (87 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 87.5/87.5 kB 6.6 MB/s eta
0:00:00
ultidict-6.1.0-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl (124 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 124.6/124.6 kB 9.5 MB/s eta
0:00:00
anylinux_2_5_x86_64.manylinux1_x86_64.manylinux_2_17_x86_64.manylinux2
014_x86_64.whl (297 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 297.5/297.5 kB 20.9 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 109.5/109.5 kB 7.6 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 63.8/63.8 kB 5.4 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 49.6/49.6 kB 3.9 MB/s eta
0:00:00
pt_toolkit-3.0.48-py3-none-any.whl (386 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 386.6/386.6 kB 25.7 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (208 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 208.9/208.9 kB 14.5 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (288 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 288.7/288.7 kB 20.4 MB/s eta
0:00:00
ents-2.18.0-py3-none-any.whl (1.2 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.2/1.2 MB 54.7 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 106.9/106.9 kB 8.1 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (360 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 360.6/360.6 kB 17.4 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (10.4 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 10.4/10.4 MB 64.1 MB/s eta
0:00:00
anylinux_2_31_x86_64.whl (6.6 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 6.6/6.6 MB 85.3 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 614.9/614.9 kB 37.0 MB/s eta
```

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0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 85.4/85.4 kB 6.8 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 224.4/224.4 kB 16.9 MB/s eta
0:00:00
atplotlib_inline-0.1.7-py3-none-any.whl (9.9 kB)
Downloading networkx-3.4.2-py3-none-any.whl (1.7 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.7/1.7 MB 56.7 MB/s eta
0:00:00
anylinux_2_5_x86_64.manylinux1_x86_64.manylinux_2_17_x86_64.manylinux2
014_x86_64.whl (80 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 80.3/80.3 kB 6.3 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 209.0/209.0 kB 15.8 MB/s eta
0:00:00
mon_protos-1.65.0-py2.py3-none-any.whl (220 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 220.9/220.9 kB 16.8 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (20 kB)
Downloading mdurl-0.1.2-py3-none-any.whl (10.0 kB)
Downloading mpmath-1.3.0-py3-none-any.whl (536 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 536.2/536.2 kB 34.1 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 103.7/103.7 kB 9.3 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 50.1/50.1 kB 4.2 MB/s eta
0:00:00
anylinux_2_17_x86_64.manylinux2014_x86_64.whl (1.1 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.1/1.1 MB 43.1 MB/s eta
0:00:00
odules-0.4.1-py3-none-any.whl (181 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 181.5/181.5 kB 14.6 MB/s eta
0:00:00
dit_py_plugins-0.4.2-py3-none-any.whl (55 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 55.3/55.3 kB 4.3 MB/s eta
0:00:00
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 83.1/83.1 kB 6.6 MB/s eta
0:00:00
icro_py-1.0.3-py3-none-any.whl (6.2 kB)
Building wheels for collected packages: finrl, pyfolio, elegantrl,
empyrical, peewee, thriftpy2
  Building wheel for finrl (pyproject.toml) ... e=finrl-0.3.6-py3-
none-any.whl size=4691755
sha256=3eda17b41326452cd26c735c3d8be4c6992e404366746fdf42d3e69aadd703a
4
  Stored in directory:
/tmp/pip-ephem-wheel-cache-jvw2nji8/wheels/72/3b/1a/0fc805a8cc65ecd5bf
e4f74a3c586b6075678b8ba53fd8f749
  Building wheel for pyfolio (setup.py) ... e=pyfolio-0.9.2-py3-none-
```

```
any.whl size=88650
sha256=cc832264ce3ba0dd48dde208fe67ff892c6f9fdaef008d70cbeb5e069ea0e69
8
  Stored in directory:
/root/.cache/pip/wheels/71/38/bc/e53700cfd8b0ad6b539d2fbaaf060ed8a299e
7622a5b86ef42
  Building wheel for elegantrl (setup.py) ... e=ElegantRL-0.3.10-py3-
none-any.whl size=408744
sha256=7324c474f0d5242d209babd26b6e67669b0ce23c0a0112980a711de177bec7d
a
  Stored in directory:
/tmp/pip-ephem-wheel-cache-jvw2nji8/wheels/c0/51/a5/b05f165548221bc570
f7223babd33e2992fa873cdcebe2d229
  Building wheel for empyrical (setup.py) ... pyrical:
filename=empyrical-0.5.5-py3-none-any.whl size=39754
sha256=53316b77d5897b900356be7586744ed0cd36bd234c4ac0e33c132954f914a90
7
  Stored in directory:
/root/.cache/pip/wheels/0e/2e/f2/d6d2d9a1eb8fbbd9949bb5d4c00f753e3b74e
5bd7ed10b1d36
  Building wheel for peewee (pyproject.toml) ... e=peewee-3.17.7-
cp310-cp310-linux_x86_64.whl size=300451
sha256=a5413d70bdcced1d1a6ccf1a11c5dfd210bbac76f7f96b0b6c5f3699dbf6aef
d
  Stored in directory:
/root/.cache/pip/wheels/8d/0e/f8/48eb93a200fca4c502d7590613616fa4d2c95
33f7308f9e28a
  Building wheel for thriftpy2 (pyproject.toml) ... e=thriftpy2-0.5.2-
cp310-cp310-linux_x86_64.whl size=841613
sha256=5ecc712e8366c2510c265ac02d81f6b90c2f42331dc57b7f71f680e1e678724
e
  Stored in directory:
/root/.cache/pip/wheels/90/28/5f/279788e86e2eaccb3edc73bde9c815a952760
2739a56344ff7
Successfully built finrl pyfolio elegantrl empyrical peewee thriftpy2
Installing collected packages: webencodings, wcwidth, py-spy, pure-
eval, ptyprocess, ply, peewee, opencensus-context, multitasking,
msgpack, mpmath, korean-lunar-calendar, farama-notifications, distlib,
colorful, wrapt, websockets, websocket-client, urllib3, uc-micro-py,
traitlets, toolz, threadpoolctl, tensorboard-data-server, sympy,
soupsieve, rpds-py, PyYAML, pyparsing, pymysql, pyluach, pygments,
pygame, pydantic-core, pyasn1, pyarrow, psutil, protobuf, propcache,
prompt-toolkit, prometheus-client, pillow, pexpect, parso, opencv-
python, nvidia-nvtx-cu12, nvidia-nvjitlink-cu12, nvidia-nccl-cu12,
nvidia-curand-cu12, nvidia-cufft-cu12, nvidia-cuda-runtime-cu12,
nvidia-cuda-nvrtc-cu12, nvidia-cuda-cupti-cu12, nvidia-cublas-cu12,
niltype, networkx, multidict, mdurl, MarkupSafe, markdown, lxml,
kiwisolver, joblib, html5lib, grpcio, fsspec, frozenlist, frozendict,
fonttools, filelock, executing, exceptiongroup, deprecation,
```

```
decorator, Cython, cycler, contourpy, cloudpickle, click, cachetools,
attrs, async-timeout, asttokens, annotated-types, ale-py,
aiohappyeyeballs, absl-py, yarl, werkzeug, virtualenv, triton,
thriftpy2, th, tensorboardX, stack-data, smart-open, scs, scikit-
learn, rsa, referencing, qdldl, pydantic, pycares, pyasn1-modules,
proto-plus, nvidia-cusparse-cu12, nvidia-cudnn-cu12, matplotlib-
inline, matplotlib, markdown-it-py, linkify-it-py, jinja2, jedi,
gymnasium, googleapis-common-protos, ecos, cryptography, clarabel,
beautifulsoup4, aiosignal, yfinance, tensorboard, stockstats, seaborn,
rich, pandas-datareader, osqp, nvidia-cusolver-cu12, mdit-py-plugins,
jsonschema-specifications, jqdatasdk, ipython, google-auth, exchange-
calendars, elegantrl, aiohttp, aiodns, torch, jsonschema, google-api-
core, empyrical, cvxpy, ccxt, alpaca-trade-api, aiohttp-cors, textual,
stable-baselines3, ray, pyportfolioopt, pyfolio, opencensus, memray,
finrl
  Attempting uninstall: urllib3
    Found existing installation: urllib3 2.1.0
    Uninstalling urllib3-2.1.0:
      Successfully uninstalled urllib3-2.1.0
Successfully installed Cython-3.0.11 MarkupSafe-3.0.2 PyYAML-6.0.1
absl-py-2.1.0 aiodns-3.2.0 aiohappyeyeballs-2.4.3 aiohttp-3.10.10
aiohttp-cors-0.7.0 aiosignal-1.3.1 ale-py-0.10.1 alpaca-trade-api-
3.2.0 annotated-types-0.7.0 asttokens-2.4.1 async-timeout-4.0.3 attrs-
24.2.0 beautifulsoup4-4.12.3 cachetools-5.5.0 ccxt-3.1.60 clarabel-
0.9.0 click-8.1.7 cloudpickle-3.1.0 colorful-0.5.6 contourpy-1.3.0
cryptography-43.0.3 cvxpy-1.5.3 cycler-0.12.1 decorator-5.1.1
deprecation-2.1.0 distlib-0.3.9 ecos-2.0.14 elegantrl-0.3.10
empyrical-0.5.5 exceptiongroup-1.2.2 exchange-calendars-4.5.7
executing-2.1.0 farama-notifications-0.0.4 filelock-3.16.1 finrl-0.3.6
fonttools-4.54.1 frozendict-2.4.6 frozenlist-1.5.0 fsspec-2024.10.0
google-api-core-2.22.0 google-auth-2.35.0 googleapis-common-protos-
1.65.0 grpcio-1.67.1 gymnasium-1.0.0 html5lib-1.1 ipython-8.29.0 jedi-
0.19.1 jinja2-3.1.4 joblib-1.4.2 jqdatasdk-1.9.6 jsonschema-4.23.0
jsonschema-specifications-2024.10.1 kiwisolver-1.4.7 korean-lunar-
calendar-0.3.1 linkify-it-py-2.0.3 lxml-5.3.0 markdown-3.7 markdown-
it-py-3.0.0 matplotlib-3.9.2 matplotlib-inline-0.1.7 mdit-py-plugins-
0.4.2 mdurl-0.1.2 memray-1.14.0 mpmath-1.3.0 msgpack-1.0.3 multidict-
6.1.0 multitasking-0.0.11 networkx-3.4.2 niltype-1.0.2 nvidia-cublas-
cu12-12.4.5.8 nvidia-cuda-cupti-cu12-12.4.127 nvidia-cuda-nvrtc-cu12-
12.4.127 nvidia-cuda-runtime-cu12-12.4.127 nvidia-cudnn-cu12-9.1.0.70
nvidia-cufft-cu12-11.2.1.3 nvidia-curand-cu12-10.3.5.147 nvidia-
cusolver-cu12-11.6.1.9 nvidia-cusparse-cu12-12.3.1.170 nvidia-nccl-
cu12-2.21.5 nvidia-nvjitlink-cu12-12.4.127 nvidia-nvtx-cu12-12.4.127
opencensus-0.11.4 opencensus-context-0.1.3 opencv-python-4.10.0.84
osqp-0.6.7.post3 pandas-datareader-0.10.0 parso-0.8.4 peewee-3.17.7
pexpect-4.9.0 pillow-11.0.0 ply-3.11 prometheus-client-0.21.0 prompt-
toolkit-3.0.48 propcache-0.2.0 proto-plus-1.25.0 protobuf-5.28.3
psutil-6.1.0 ptyprocess-0.7.0 pure-eval-0.2.3 py-spy-0.4.0 pyarrow-
18.0.0 pyasn1-0.6.1 pyasn1-modules-0.4.1 pycares-4.4.0 pydantic-2.9.2
```

```
pydantic-core-2.23.4 pyfolio-0.9.2 pygame-2.6.1 pygments-2.18.0
pyluach-2.2.0 pymysql-1.1.1 pyparsing-3.2.0 pyportfolioopt-1.5.5
qdldl-0.1.7.post4 ray-2.38.0 referencing-0.35.1 rich-13.9.4 rpds-py-
0.20.1 rsa-4.9 scikit-learn-1.5.2 scs-3.2.7 seaborn-0.13.2 smart-open-
7.0.5 soupsieve-2.6 stable-baselines3-2.4.0a11 stack-data-0.6.3
stockstats-0.5.4 sympy-1.13.1 tensorboard-2.18.0 tensorboard-data-
server-0.7.2 tensorboardX-2.6.2.2 textual-0.85.2 th-0.4.1
threadpoolctl-3.5.0 thriftpy2-0.5.2 toolz-1.0.0 torch-2.5.1 traitlets-
5.14.3 triton-3.1.0 uc-micro-py-1.0.3 urllib3-1.26.20 virtualenv-
20.27.1 wcwidth-0.2.13 webencodings-0.5.1 websocket-client-1.8.0
websockets-10.4 werkzeug-3.1.2 wrapt-1.16.0 yarl-1.17.1 yfinance-
0.2.48
```


```
{"id":"0297673910af4be6a000b0ad6ccf7377","pip_warning":{"packages":
["cycler","google","kiwisolver","matplotlib_inline","pexpect","prompt_
toolkit","wcwidth"]}}
```


```
import warnings
warnings.filterwarnings("ignore")
```

```
from finrl.meta.preprocessor.preprocessors import FeatureEngineer,
data_split
from finrl.meta.env_stock_trading.env_stocktrading import
StockTradingEnv
from finrl.agents.stablebaselines3.models import DRLAgent,
DRLEnsembleAgent
from finrl.plot import backtest_stats, backtest_plot,
get_daily_return, get_baseline
from stable_baselines3 import A2C, PPO, DDPG, SAC, TD3
```

```
import numpy as np
import matplotlib.pyplot as plt
import datetime
import pandas as pd
%matplotlib inline
```

```
from pprint import pprint
import itertools
import sys
sys.path.append("../FinRL-Library")
```

```
import os
from finrl.main import check_and_make_directories
from finrl.config import (
    DATA_SAVE_DIR,
    TRAINED_MODEL_DIR,
    TENSORBOARD_LOG_DIR,
    RESULTS_DIR,
    INDICATORS,
    TRAIN_START_DATE,
    TRAIN_END_DATE,
```

```
    TEST_START_DATE,
    TEST_END_DATE,
    TRADE_START_DATE,
    TRADE_END_DATE,
)

check_and_make_directories([DATA_SAVE_DIR, TRAINED_MODEL_DIR,
TENSORBOARD_LOG_DIR, RESULTS_DIR])

df= pd.read_csv("sp500_stocks.csv")
df.head()
```

	Date	Symbol	Adj Close	Close	High	Low	Open
0	2010-01-04	MMM	44.254017	69.414719	69.774246	69.122070	69.473244
1	2010-01-05	MMM	43.976837	68.979935	69.590302	68.311035	69.230766
2	2010-01-06	MMM	44.600502	69.958191	70.735786	69.824417	70.133781
3	2010-01-07	MMM	44.632484	70.008362	70.033447	68.662209	69.665550
4	2010-01-08	MMM	44.946964	70.501671	70.501671	69.648827	69.974915

	Volume
0	3640265.0
1	3405012.0
2	6301126.0
3	5346240.0
4	4073337.0

```
# Rename specific columns to lowercase
df.rename(columns={'Symbol': 'tic','Date': 'date','Volume': 'volume',
'Close': 'close', 'Adj Close': 'adj_close', 'High': 'high', 'Low':
'low', 'Open': 'open'}, inplace=True)

# Optional: Verify the change
print(df.columns)
```

```
Index(['date', 'tic', 'adj_close', 'close', 'high', 'low', 'open',
'volume'], dtype='object')
```

```
df.sort_values(['date','tic'],ignore_index=True).head()
```

	date	tic	adj_close	close	high	low	open
0	2010-01-04	A	20.084951	22.389128	22.625179	22.267525	22.453505
1	2010-01-04	AAL	4.496878	4.770000	4.940000	4.660000	4.840000

```
2  2010-01-04  AAPL   6.454506   7.643214   7.660714   7.585000
7.622500
3  2010-01-04  ABBV        NaN        NaN        NaN        NaN
NaN
4  2010-01-04  ABNB        NaN        NaN        NaN        NaN
NaN

        volume
0    3815561.0
1    9837300.0
2  493729600.0
3          NaN
4          NaN
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1852046 entries, 0 to 1852045
Data columns (total 8 columns):
 #   Column     Dtype
---  ------     -----
 0   date       object
 1   tic        object
 2   adj_close  float64
 3   close      float64
 4   high       float64
 5   low        float64
 6   open       float64
 7   volume     float64
dtypes: float64(6), object(2)
memory usage: 113.0+ MB
```

```
df.tail()
```

```
               date  tic   adj_close       close        high
low  \
1852041  2024-08-14  ZTS  183.380005  183.380005  188.500000
182.490005
1852042  2024-08-15  ZTS  184.080002  184.080002  186.169998
182.710007
1852043  2024-08-16  ZTS  183.710007  183.710007  184.610001
182.250000
1852044  2024-08-19  ZTS  184.479996  184.479996  184.520004
182.559998
1852045  2024-08-20  ZTS  183.600006  183.600006  184.759995
182.900101

               open     volume
1852041  188.050003  2153100.0
1852042  184.520004  1891900.0
```

```
1852043  183.720001  1588400.0
1852044  183.800003  1637000.0
1852045  184.479996  1186374.0
```

```
from pathlib import Path
from ydata_profiling import ProfileReport
from ydata_profiling.utils.cache import cache_file

if __name__ == "__main__":
    file_name = "/content/drive/MyDrive/Assets/sp500_stocks.csv"

    sp500 = pd.read_csv(file_name)

    profile = ProfileReport(sp500, title="S&P 500 Stocks",
explorative=True)
    profile.to_file(Path("sp500_stocks_report.html"))
```


```
{"model_id":"c4f31b8d49c24705bf929cae8995e341","version_major":2,"vers
ion_minor":0}

{"model_id":"afe3efa3d19e4e26aab5c202e2fa5d35","version_major":2,"vers
ion_minor":0}

{"model_id":"3f879989622e40d3912233212e08dcd0","version_major":2,"vers
ion_minor":0}

{"model_id":"0dc6f78aab5e43dba7b9d149f3ce0209","version_major":2,"vers
ion_minor":0}
```


```
profile
```

```
<IPython.core.display.HTML object>
```

```
unique_tickers = df['tic'].unique()

random_tickers = pd.Series(unique_tickers).sample(n=30,
random_state=42)

print(random_tickers)
```

```
268     JCI
73      BMY
289     LEN
155     DOV
104     CVX
280    KLAC
392     DGX
124     STZ
68       BX
244     HII
```

```
9         A
195     FIS
304     MMC
84      CPB
373      PM
390     PWR
498     XYL
30      AWK
317     MGM
407     RCL
493      WY
494     WMB
225     HIG
227     HCA
76      BRO
464     URI
473    VRTX
402    RVTY
101     CRL
335    NTAP
dtype: object
```

```
filtered_df = df[df['tic'].isin(random_tickers)]
print(filtered_df)
```

```
                date  tic   adj_close       close        high
low  \
33138    2010-01-04    A   20.084951   22.389128   22.625179
22.267525
33139    2010-01-05    A   19.866777   22.145924   22.331903
22.002861
33140    2010-01-06    A   19.796186   22.067240   22.174536
22.002861
33141    2010-01-07    A   19.770527   22.038628   22.045780
21.816881
33142    2010-01-08    A   19.764101   22.031473   22.067240
21.745352
...             ...  ...         ...         ...         ...
..
1837313  2024-08-14  XYL  131.490005  131.490005  132.229996
130.580002
1837314  2024-08-15  XYL  133.190002  133.190002  134.270004
131.779999
1837315  2024-08-16  XYL  132.800003  132.800003  133.630005
131.970001
1837316  2024-08-19  XYL  134.380005  134.380005  134.380005
132.580002
1837317  2024-08-20  XYL  134.149994  134.149994  135.600006
133.199997
```

```
                open     volume
33138     22.453505  3815561.0
33139     22.324751  4186031.0
33140     22.067240  3243779.0
33141     22.017166  3095172.0
33142     21.917025  3733918.0
...             ...        ...
1837313  131.720001   813400.0
1837314  132.949997   739000.0
1837315  133.000000  1956500.0
1837316  133.039993   751200.0
1837317  134.399994   761699.0

[110460 rows x 8 columns]
```

```
filtered_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 110460 entries, 33138 to 1837317
Data columns (total 8 columns):
 #   Column     Non-Null Count   Dtype  
---  ------     --------------   -----  
 0   date       110460 non-null  object 
 1   tic        110460 non-null  object 
 2   adj_close  109407 non-null  float64
 3   close      109407 non-null  float64
 4   high       109407 non-null  float64
 5   low        109407 non-null  float64
 6   open       109407 non-null  float64
 7   volume     109407 non-null  float64
dtypes: float64(6), object(2)
memory usage: 7.6+ MB
```

```
df.columns
```

```
Index(['date', 'tic', 'adj_close', 'close', 'high', 'low', 'open',
'volume'], dtype='object')
```

```
INDICATORS=['macd',
 'boll_ub',
 'boll_lb',
 'rsi_30',
 'cci_30',
 'dx_30',
 'close_30_sma',
 'close_60_sma']

TRAIN_START_DATE = '2010-01-04'
TRAIN_END_DATE = '2021-06-01'
TEST_START_DATE = '2022-01-01'
TEST_END_DATE = '2024-08-20'
```

```
fe = FeatureEngineer(
    use_technical_indicator=True,
    tech_indicator_list=INDICATORS,
    use_turbulence=True,
    user_defined_feature=False
)

processed = fe.preprocess_data(filtered_df)
```

```
Successfully added technical indicators
Successfully added turbulence index
```

```
train_data = processed[(processed['date'] >= TRAIN_START_DATE) &
(processed['date'] <= TRAIN_END_DATE)]
test_data = processed[(processed['date'] >= TEST_START_DATE) &
(processed['date'] <= TEST_END_DATE)]

train_data.reset_index(drop=True, inplace=True)
test_data.reset_index(drop=True, inplace=True)

print("Training data shape:", train_data.shape)
print("Testing data shape:", test_data.shape)

print("Processed data head:")
print(processed.head())
```

```
Training data shape: (77544, 17)
Testing data shape: (17847, 17)
Processed data head:
         date  tic  adj_close      close       high        low
open  \
0  2010-01-04    A  20.084951  22.389128  22.625179  22.267525
22.453505
1  2010-01-04  AWK  16.174004  22.650000  22.860001  22.410000
22.410000
2  2010-01-04  BMY  15.781889  25.629999  25.700001  25.299999
25.410000
3  2010-01-04  BRO   7.635339   9.005000   9.045000   8.930000
9.025000
4  2010-01-04   BX   6.540053  13.710000  13.750000  13.150000
13.250000

       volume  macd    boll_ub    boll_lb  rsi_30     cci_30  dx_30  \
0   3815561.0   0.0  22.611468  21.923583     0.0 -66.666667  100.0
1   2176100.0   0.0  22.611468  21.923583     0.0 -66.666667  100.0
2  14376100.0   0.0  22.611468  21.923583     0.0 -66.666667  100.0
3   1437600.0   0.0  22.611468  21.923583     0.0 -66.666667  100.0
4   3862700.0   0.0  22.611468  21.923583     0.0 -66.666667  100.0

   close_30_sma  close_60_sma  turbulence
```

```
0     22.389128     22.389128         0.0
1     22.650000     22.650000         0.0
2     25.629999     25.629999         0.0
3      9.005000      9.005000         0.0
4     13.710000     13.710000         0.0
```

```
print(processed.info())
print(processed.columns)
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 99414 entries, 0 to 99413
Data columns (total 17 columns):
 #   Column        Non-Null Count  Dtype  
---  ------        --------------  -----  
 0   date          99414 non-null  object 
 1   tic           99414 non-null  object 
 2   adj_close     99414 non-null  float64
 3   close         99414 non-null  float64
 4   high          99414 non-null  float64
 5   low           99414 non-null  float64
 6   open          99414 non-null  float64
 7   volume        99414 non-null  float64
 8   macd          99414 non-null  float64
 9   boll_ub       99414 non-null  float64
 10  boll_lb       99414 non-null  float64
 11  rsi_30        99414 non-null  float64
 12  cci_30        99414 non-null  float64
 13  dx_30         99414 non-null  float64
 14  close_30_sma  99414 non-null  float64
 15  close_60_sma  99414 non-null  float64
 16  turbulence    99414 non-null  float64
dtypes: float64(15), object(2)
memory usage: 12.9+ MB
None
Index(['date', 'tic', 'adj_close', 'close', 'high', 'low', 'open',
'volume',
       'macd', 'boll_ub', 'boll_lb', 'rsi_30', 'cci_30', 'dx_30',
       'close_30_sma', 'close_60_sma', 'turbulence'],
      dtype='object')
```

```
stock_dimension = len(processed.tic.unique())
state_space = 1 + 2*stock_dimension + len(INDICATORS)*stock_dimension
print(f"Stock Dimension: {stock_dimension}, State Space:
{state_space}")
```

```
Stock Dimension: 27, State Space: 271
```

```
env_kwargs = {
    "hmax": 100,
    "initial_amount": 10000000,
```

```
    "buy_cost_pct": 0.001,
    "sell_cost_pct": 0.001,
    "state_space": state_space,
    "stock_dim": stock_dimension,
    "tech_indicator_list": INDICATORS,
    "action_space": stock_dimension,
    "reward_scaling": 1e-4,
    "print_verbosity":5
}

rebalance_window = 20 # rebalance_window is the number of days to
retrain the model
validation_window = 20 # validation_window is the number of days to do
validation and trading (e.g. if validation_window=63, then both
validation and trading period will be 63 days)

ensemble_agent = DRLEnsembleAgent(df=processed,
                 train_period=(TRAIN_START_DATE,TRAIN_END_DATE),
                 val_test_period=(TEST_START_DATE,TEST_END_DATE),
                 rebalance_window=rebalance_window,
                 validation_window=validation_window,
                 **env_kwargs)

ensemble_agent
```

```
<finrl.agents.stablebaselines3.models.DRLEnsembleAgent at
0x7f1b367bfe50>
```

```
A2C_model_kwargs = {
    'n_steps': 5,  # Number of steps to run for each environment
before updating
    'ent_coef': 0.005,  # Entropy coefficient for exploration
    'learning_rate': 0.0007,  # Learning rate for the agent
}

PPO_model_kwargs = {
    "ent_coef": 0.01,  # Entropy coefficient to ensure exploration
    "n_steps": 2048,  # Number of steps per environment update
    "learning_rate": 0.00025,  # Learning rate for the optimizer
    "batch_size": 128,  # Batch size for each training step
}

SAC_model_kwargs = {
    "buffer_size": 10_00,  # Size of the replay buffer
    "learning_rate": 0.0003,  # Learning rate for SAC agent
    "batch_size": 256,  # Batch size for the optimizer
    "ent_coef": 'auto',  # Entropy coefficient (auto-tuned by default)
}

timesteps_dict = {
    'a2c': 5_00,  # A2C agent timesteps
```

```
    'ppo': 5_00,  # PPO agent timesteps
    'sac': 5_00  # SAC agent timesteps
}

from tqdm import tqdm

# Define the model kwargs and timesteps for the ensemble strategy
model_kwargs_dict = {
    'A2C': A2C_model_kwargs,
    'PPO': PPO_model_kwargs,
    'SAC': SAC_model_kwargs
}

# Use tqdm to track the progress of model training
ensemble_models_summary = {}

# Added total=len(model_kwargs_dict) to tqdm to indicate 5 models are
being trained
for model_name in tqdm(model_kwargs_dict, desc="Training Ensemble
Models", total=len(model_kwargs_dict)):
    print(f"\nRunning {model_name}...")

    # Simulate some progress or steps within each model training
    # For actual models, it may take time
    ensemble_models_summary[model_name] =
ensemble_agent.run_ensemble_strategy(
        A2C_model_kwargs=A2C_model_kwargs,
        PPO_model_kwargs=PPO_model_kwargs,
        SAC_model_kwargs=SAC_model_kwargs,
        DDPG_model_kwargs=None,
        TD3_model_kwargs=None,
        timesteps_dict=timesteps_dict
    )

    # Print after each model is trained
    print(f"{model_name} training completed!")
```

```
Training Ensemble Models:   0%|          | 0/3 [00:00<?, ?it/s]


Running A2C...
============Start Ensemble Strategy============
============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-01-03
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_40_9
-----------------------------------
| time/                 |           |
```

```
|    fps                 | 147       |
|    iterations          | 100       |
|    time_elapsed        | 3         |
|    total_timesteps     | 500       |
| train/                 |           |
|    entropy_loss        | -38.4     |
|    explained_variance | 0          |
|    learning_rate       | 0.0007    |
|    n_updates           | 99        |
|    policy_loss         | -290      |
|    reward              | 1.7664002 |
|    std                 | 1         |
|    value_loss          | 90.1      |
-------------------------------------
======a2c Validation from:  2022-01-03 to  2022-02-01
a2c Sharpe Ratio:  -0.4239222070975703
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_40_8
======sac Validation from:  2022-01-03 to  2022-02-01
sac Sharpe Ratio:  -0.1606888934303123
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_40_8
-------------------------------------
| time/              |              |
|    fps             | 175          |
|    iterations      | 1            |
|    time_elapsed    | 11           |
|    total_timesteps | 2048         |
| train/             |              |
|    reward          | -0.28363752 |
-------------------------------------
======ppo Validation from:  2022-01-03 to  2022-02-01
ppo Sharpe Ratio:  -0.27343880394015974
======Best Model Retraining from:  2010-01-04 to  2022-02-01
======Trading from:  2022-02-01 to  2022-03-02
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-02-01
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_60_7
-------------------------------------
```

```
| time/                 |           |
|    fps                | 146       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.6     |
|    explained_variance | -1.19e-07 |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -532      |
|    reward             | 2.048322  |
|    std                | 1.01      |
|    value_loss         | 244       |
-------------------------------------
======a2c Validation from:  2022-02-01 to  2022-03-02
a2c Sharpe Ratio:  -0.4533450444127557
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_60_7
======sac Validation from:  2022-02-01 to  2022-03-02
sac Sharpe Ratio:  -0.4543244152324558
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_60_7
-----------------------------------
| time/              |            |
|    fps             | 173        |
|    iterations      | 1          |
|    time_elapsed    | 11         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -0.17826746 |
-----------------------------------
======ppo Validation from:  2022-02-01 to  2022-03-02
ppo Sharpe Ratio:  -0.6577181389067889
======Best Model Retraining from:  2010-01-04 to  2022-03-02
======Trading from:  2022-03-02 to  2022-03-30
============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-03-02
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_80_7
```

```
-------------------------------------
| time/                 |           |
|    fps                | 152       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.1     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -154      |
|    reward             | 1.1114376 |
|    std                | 0.991     |
|    value_loss         | 29.1      |
-------------------------------------
======a2c Validation from:  2022-03-02 to  2022-03-30
a2c Sharpe Ratio:  0.8648916178541377
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_80_7
======sac Validation from:  2022-03-02 to  2022-03-30
sac Sharpe Ratio:  0.9277441563223704
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_80_7
---------------------------------
| time/              |          |
|    fps             | 172      |
|    iterations      | 1        |
|    time_elapsed    | 11       |
|    total_timesteps | 2048     |
| train/             |          |
|    reward          | 2.566823 |
---------------------------------
======ppo Validation from:  2022-03-02 to  2022-03-30
ppo Sharpe Ratio:  0.684604772329929
======Best Model Retraining from:  2010-01-04 to  2022-03-30
======Trading from:  2022-03-30 to  2022-04-28
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-03-30
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
```

```
Logging to tensorboard_log/a2c/a2c_100_7
-------------------------------------
| time/                 |           |
|    fps                | 148       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.4     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -21       |
|    reward             | 0.8680809 |
|    std                | 1         |
|    value_loss         | 2.42      |
-------------------------------------
======a2c Validation from:  2022-03-30 to  2022-04-28
a2c Sharpe Ratio:  -0.3425299661742234
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_100_7
======sac Validation from:  2022-03-30 to  2022-04-28
sac Sharpe Ratio:  -0.5635180096624839
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_100_7
----------------------------------
| time/              |           |
|    fps             | 173       |
|    iterations      | 1         |
|    time_elapsed    | 11        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 0.14253771 |
----------------------------------
======ppo Validation from:  2022-03-30 to  2022-04-28
ppo Sharpe Ratio:  -0.49071243438413437
======Best Model Retraining from:  2010-01-04 to  2022-04-28
======Trading from:  2022-04-28 to  2022-05-26
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-04-28
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
```

```
Using cpu device
Logging to tensorboard_log/a2c/a2c_120_7
-------------------------------------
| time/                 |           |
|    fps                | 147       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.4     |
|    explained_variance | 5.96e-08  |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | 186       |
|    reward             | 1.4454784 |
|    std                | 1         |
|    value_loss         | 50.7      |
-------------------------------------
======a2c Validation from:  2022-04-28 to  2022-05-26
a2c Sharpe Ratio:  0.5194515329221369
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_120_7
======sac Validation from:  2022-04-28 to  2022-05-26
sac Sharpe Ratio:  0.1860952923312625
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_120_7
-------------------------------------
| time/              |             |
|    fps             | 169         |
|    iterations      | 1           |
|    time_elapsed    | 12          |
|    total_timesteps | 2048        |
| train/             |             |
|    reward          | 0.024773166 |
-------------------------------------
======ppo Validation from:  2022-04-28 to  2022-05-26
ppo Sharpe Ratio:  0.15358212504806343
======Best Model Retraining from:  2010-01-04 to  2022-05-26
======Trading from:  2022-05-26 to  2022-06-27
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-05-26
======a2c Training========
```

```
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_140_7
-------------------------------------
| time/                 |           |
|    fps                | 140       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.4     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -87.3     |
|    reward             | 0.9521253 |
|    std                | 1.01      |
|    value_loss         | 8.55      |
-------------------------------------
======a2c Validation from:  2022-05-26 to  2022-06-27
a2c Sharpe Ratio:  -0.26014663912226876
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_140_7
======sac Validation from:  2022-05-26 to  2022-06-27
sac Sharpe Ratio:  -0.09183467292197314
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_140_7
----------------------------------
| time/              |           |
|    fps             | 170       |
|    iterations      | 1         |
|    time_elapsed    | 12        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | -1.1395988 |
----------------------------------
======ppo Validation from:  2022-05-26 to  2022-06-27
ppo Sharpe Ratio:  -0.22271236672187847
======Best Model Retraining from:  2010-01-04 to  2022-06-27
======Trading from:  2022-06-27 to  2022-07-26
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-06-27
```

```
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_160_7
-------------------------------------
| time/                 |           |
|    fps                | 153       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.3     |
|    explained_variance | 1.19e-07  |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | 14.3      |
|    reward             | 1.6082815 |
|    std                | 1         |
|    value_loss         | 37.7      |
-------------------------------------
======a2c Validation from:  2022-06-27 to  2022-07-26
a2c Sharpe Ratio:  0.3328580326672359
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_160_7
======sac Validation from:  2022-06-27 to  2022-07-26
sac Sharpe Ratio:  0.46171859260682646
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_160_7
----------------------------------
| time/              |           |
|    fps             | 166       |
|    iterations      | 1         |
|    time_elapsed    | 12        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 1.0996473 |
----------------------------------
======ppo Validation from:  2022-06-27 to  2022-07-26
ppo Sharpe Ratio:  0.2586519091388897
======Best Model Retraining from:  2010-01-04 to  2022-07-26
======Trading from:  2022-07-26 to  2022-08-23
==========================================
turbulence_threshold:  227.87028410067566
```

```
======Model training from:  2010-01-04 to  2022-07-26
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_180_7
-------------------------------------
| time/                 |           |
|    fps                | 153       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.4     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -474      |
|    reward             | 0.76817995 |
|    std                | 1         |
|    value_loss         | 180       |
-------------------------------------
======a2c Validation from:  2022-07-26 to  2022-08-23
a2c Sharpe Ratio:  -0.26217104991640383
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_180_7
======sac Validation from:  2022-07-26 to  2022-08-23
sac Sharpe Ratio:  -0.2559058029588138
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_180_7
-------------------------------------
| time/              |              |
|    fps             | 165          |
|    iterations      | 1            |
|    time_elapsed    | 12           |
|    total_timesteps | 2048         |
| train/             |              |
|    reward          | -0.068954915 |
-------------------------------------
======ppo Validation from:  2022-07-26 to  2022-08-23
ppo Sharpe Ratio:  -0.2911393739334291
======Best Model Retraining from:  2010-01-04 to  2022-08-23
======Trading from:  2022-08-23 to  2022-09-21
==========================================
```

```
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-08-23
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_200_7
-------------------------------------
| time/                 |           |
|    fps                | 153       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.5     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -90.9     |
|    reward             | 2.1152883 |
|    std                | 1.01      |
|    value_loss         | 47.2      |
-------------------------------------
======a2c Validation from:  2022-08-23 to  2022-09-21
a2c Sharpe Ratio:  -0.37293292596203065
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_200_7
======sac Validation from:  2022-08-23 to  2022-09-21
sac Sharpe Ratio:  -0.4922653739819897
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_200_7
-----------------------------------
| time/              |            |
|    fps             | 165        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | 0.20924889 |
-----------------------------------
======ppo Validation from:  2022-08-23 to  2022-09-21
ppo Sharpe Ratio:  -0.3609532389192027
======Best Model Retraining from:  2010-01-04 to  2022-09-21
======Trading from:  2022-09-21 to  2022-10-19
```

```
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-09-21
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_220_7
-------------------------------------
| time/                 |           |
|    fps                | 147       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.3     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -209      |
|    reward             | 0.10164115 |
|    std                | 1         |
|    value_loss         | 47.3      |
-------------------------------------
======a2c Validation from:  2022-09-21 to  2022-10-19
a2c Sharpe Ratio:  0.2093176078995755
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_220_7
======sac Validation from:  2022-09-21 to  2022-10-19
sac Sharpe Ratio:  0.3147633456698607
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_220_7
----------------------------------
| time/              |           |
|    fps             | 162       |
|    iterations      | 1         |
|    time_elapsed    | 12        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 0.04104819 |
----------------------------------
======ppo Validation from:  2022-09-21 to  2022-10-19
ppo Sharpe Ratio:  0.2618679219900995
======Best Model Retraining from:  2010-01-04 to  2022-10-19
======Trading from:  2022-10-19 to  2022-11-16
```

```
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-10-19
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_240_7
------------------------------------
| time/                 |          |
|    fps                | 145      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.2    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -245     |
|    reward             | 1.3768109 |
|    std                | 0.995    |
|    value_loss         | 45       |
------------------------------------
======a2c Validation from:  2022-10-19 to  2022-11-16
a2c Sharpe Ratio:  0.7555741924097998
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_240_7
======sac Validation from:  2022-10-19 to  2022-11-16
sac Sharpe Ratio:  0.6426211221766183
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_240_7
---------------------------------
| time/              |          |
|    fps             | 166      |
|    iterations      | 1        |
|    time_elapsed    | 12       |
|    total_timesteps | 2048     |
| train/             |          |
|    reward          | 2.5161564 |
---------------------------------
======ppo Validation from:  2022-10-19 to  2022-11-16
ppo Sharpe Ratio:  0.5068425130039071
======Best Model Retraining from:  2010-01-04 to  2022-11-16
```

```
======Trading from:  2022-11-16 to  2022-12-15
=============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-11-16
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_260_7
------------------------------------
| time/                 |          |
|    fps                | 146      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.4    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -352     |
|    reward             | 3.1386695 |
|    std                | 1        |
|    value_loss         | 134      |
------------------------------------
======a2c Validation from:  2022-11-16 to  2022-12-15
a2c Sharpe Ratio:  0.01686659361619277
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_260_7
======sac Validation from:  2022-11-16 to  2022-12-15
sac Sharpe Ratio:  0.15765846442700004
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_260_7
---------------------------------
| time/              |          |
|    fps             | 165      |
|    iterations      | 1        |
|    time_elapsed    | 12       |
|    total_timesteps | 2048     |
| train/             |          |
|    reward          | 0.633922 |
---------------------------------
======ppo Validation from:  2022-11-16 to  2022-12-15
ppo Sharpe Ratio:  -0.10177756562463378
```

```
======Best Model Retraining from:  2010-01-04 to  2022-12-15
======Trading from:  2022-12-15 to  2023-01-17
=========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-12-15
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_280_7
------------------------------------
| time/                 |          |
|    fps                | 145      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.3    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -126     |
|    reward             | 0.7477155 |
|    std                | 1        |
|    value_loss         | 14.7     |
------------------------------------
======a2c Validation from:  2022-12-15 to  2023-01-17
a2c Sharpe Ratio:  0.4912245736256434
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_280_7
======sac Validation from:  2022-12-15 to  2023-01-17
sac Sharpe Ratio:  0.627456190033443
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_280_7
---------------------------------
| time/              |          |
|    fps             | 164      |
|    iterations      | 1        |
|    time_elapsed    | 12       |
|    total_timesteps | 2048     |
| train/             |          |
|    reward          | 1.141664 |
---------------------------------
======ppo Validation from:  2022-12-15 to  2023-01-17
```

```
ppo Sharpe Ratio:  0.4981771840299969
======Best Model Retraining from:  2010-01-04 to  2023-01-17
======Trading from:  2023-01-17 to  2023-02-14
=========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-01-17
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_300_7
-----------------------------------
| time/                 |          |
|    fps                | 148      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.4    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -83.5    |
|    reward             | 2.626683 |
|    std                | 1        |
|    value_loss         | 21.8     |
-----------------------------------
======a2c Validation from:  2023-01-17 to  2023-02-14
a2c Sharpe Ratio:  0.36399871041373366
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_300_7
======sac Validation from:  2023-01-17 to  2023-02-14
sac Sharpe Ratio:  -0.09887854975106665
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_300_7
----------------------------------
| time/              |           |
|    fps             | 162       |
|    iterations      | 1         |
|    time_elapsed    | 12        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 0.6997812 |
----------------------------------
```

```
======ppo Validation from:  2023-01-17 to  2023-02-14
ppo Sharpe Ratio:  0.2660080810727043
======Best Model Retraining from:  2010-01-04 to  2023-02-14
======Trading from:  2023-02-14 to  2023-03-15
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-02-14
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_320_7
-----------------------------------
| time/                 |           |
|    fps                | 148       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.4     |
|    explained_variance | 0.00637   |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -473      |
|    reward             | 3.086805  |
|    std                | 1.01      |
|    value_loss         | 212       |
-----------------------------------
======a2c Validation from:  2023-02-14 to  2023-03-15
a2c Sharpe Ratio:  -0.3796393999510418
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_320_7
======sac Validation from:  2023-02-14 to  2023-03-15
sac Sharpe Ratio:  -0.619906377330429
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_320_7
-----------------------------------
| time/                 |           |
|    fps                | 157       |
|    iterations         | 1         |
|    time_elapsed       | 13        |
|    total_timesteps    | 2048      |
| train/                |           |
|    reward             | -0.1296025 |
```

```
-----------------------------------
======ppo Validation from:  2023-02-14 to  2023-03-15
ppo Sharpe Ratio:  -0.3550101821831933
======Best Model Retraining from:  2010-01-04 to  2023-03-15
======Trading from:  2023-03-15 to  2023-04-13
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-03-15
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_340_7
------------------------------------
| time/                 |          |
|    fps                | 143      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.3    |
|    explained_variance | 0.0232   |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -234     |
|    reward             | 3.4686148 |
|    std                | 1        |
|    value_loss         | 57.7     |
------------------------------------
======a2c Validation from:  2023-03-15 to  2023-04-13
a2c Sharpe Ratio:  0.45873894373480495
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_340_7
======sac Validation from:  2023-03-15 to  2023-04-13
sac Sharpe Ratio:  0.5806979351334597
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_340_7
---------------------------------
| time/              |          |
|    fps             | 154      |
|    iterations      | 1        |
|    time_elapsed    | 13       |
|    total_timesteps | 2048     |
| train/             |          |
```

```
|    reward          | 2.4719942 |
---------------------------------
======ppo Validation from:  2023-03-15 to  2023-04-13
ppo Sharpe Ratio:  0.4381650526977873
======Best Model Retraining from:  2010-01-04 to  2023-04-13
======Trading from:  2023-04-13 to  2023-05-11
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-04-13
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_360_7
-------------------------------------
| time/                 |           |
|    fps                | 140       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.2     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -365      |
|    reward             | 4.0066724 |
|    std                | 0.997     |
|    value_loss         | 165       |
-------------------------------------
======a2c Validation from:  2023-04-13 to  2023-05-11
a2c Sharpe Ratio:  -0.15901927878576932
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_360_7
======sac Validation from:  2023-04-13 to  2023-05-11
sac Sharpe Ratio:  0.019134122911645665
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_360_7
---------------------------------
| time/              |          |
|    fps             | 155      |
|    iterations      | 1        |
|    time_elapsed    | 13       |
|    total_timesteps | 2048     |
```

```
| train/              |           |
|    reward           | 0.8010855 |
---------------------------------
======ppo Validation from:  2023-04-13 to  2023-05-11
ppo Sharpe Ratio:  -0.060664593441836466
======Best Model Retraining from:  2010-01-04 to  2023-05-11
======Trading from:  2023-05-11 to  2023-06-09
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-05-11
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_380_7
-----------------------------------
| time/                 |          |
|    fps                | 140      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.2    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | 39.1     |
|    reward             | 1.858794 |
|    std                | 0.996    |
|    value_loss         | 15.2     |
-----------------------------------
======a2c Validation from:  2023-05-11 to  2023-06-09
a2c Sharpe Ratio:  0.5703810054201461
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_380_7
======sac Validation from:  2023-05-11 to  2023-06-09
sac Sharpe Ratio:  0.13697371852414045
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_380_7
---------------------------------
| time/              |          |
|    fps             | 156      |
|    iterations      | 1        |
|    time_elapsed    | 13       |
```

```
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 0.3671338 |
----------------------------------
======ppo Validation from:  2023-05-11 to  2023-06-09
ppo Sharpe Ratio:  0.6009048579495265
======Best Model Retraining from:  2010-01-04 to  2023-06-09
======Trading from:  2023-06-09 to  2023-07-11
=============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-06-09
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_400_7
-----------------------------------
| time/                 |          |
|    fps                | 141      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.3    |
|    explained_variance | -0.0358  |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -285     |
|    reward             | 4.796846 |
|    std                | 1        |
|    value_loss         | 148      |
-----------------------------------
======a2c Validation from:  2023-06-09 to  2023-07-11
a2c Sharpe Ratio:  0.5131678125436792
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_400_7
======sac Validation from:  2023-06-09 to  2023-07-11
sac Sharpe Ratio:  0.20508076242241602
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_400_7
-----------------------------------
| time/              |            |
|    fps             | 159        |
|    iterations      | 1          |
```

```
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -2.6267786 |
-----------------------------------
======ppo Validation from:  2023-06-09 to  2023-07-11
ppo Sharpe Ratio:  0.3232017709752568
======Best Model Retraining from:  2010-01-04 to  2023-07-11
======Trading from:  2023-07-11 to  2023-08-08
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-07-11
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_420_7
-----------------------------------
| time/                 |           |
|    fps                | 144       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.3     |
|    explained_variance | 0.0143    |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -534      |
|    reward             | 1.585778  |
|    std                | 0.999     |
|    value_loss         | 236       |
-----------------------------------
======a2c Validation from:  2023-07-11 to  2023-08-08
a2c Sharpe Ratio:  -0.16195739140870916
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_420_7
======sac Validation from:  2023-07-11 to  2023-08-08
sac Sharpe Ratio:  0.005009480435611331
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_420_7
-----------------------------------
| time/              |            |
|    fps             | 157        |
```

```
|    iterations      | 1           |
|    time_elapsed    | 13          |
|    total_timesteps | 2048        |
| train/             |             |
|    reward          | 0.040767707 |
-----------------------------------
======ppo Validation from:  2023-07-11 to  2023-08-08
ppo Sharpe Ratio:  -0.11839774912620346
======Best Model Retraining from:  2010-01-04 to  2023-08-08
======Trading from:  2023-08-08 to  2023-09-06
=============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-08-08
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_440_7
------------------------------------
| time/                 |           |
|    fps                | 141       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.3     |
|    explained_variance | 1.19e-07  |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | 55.3      |
|    reward             | 1.1025249 |
|    std                | 1         |
|    value_loss         | 7         |
------------------------------------
======a2c Validation from:  2023-08-08 to  2023-09-06
a2c Sharpe Ratio:  -0.11093483019727261
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_440_7
======sac Validation from:  2023-08-08 to  2023-09-06
sac Sharpe Ratio:  -0.14747129236026188
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_440_7
------------------------------------
| time/              |             |
|    fps             | 151         |
```

```
|    iterations      | 1           |
|    time_elapsed    | 13          |
|    total_timesteps | 2048        |
| train/             |             |
|    reward          | -0.26759928 |
-----------------------------------
======ppo Validation from:  2023-08-08 to  2023-09-06
ppo Sharpe Ratio:  0.014180258412877065
======Best Model Retraining from:  2010-01-04 to  2023-09-06
======Trading from:  2023-09-06 to  2023-10-04
============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-09-06
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_460_7
-------------------------------------
| time/                 |           |
|    fps                | 143       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.5     |
|    explained_variance | 1.19e-07  |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -488      |
|    reward             | 1.2504898 |
|    std                | 1.01      |
|    value_loss         | 172       |
-------------------------------------
======a2c Validation from:  2023-09-06 to  2023-10-04
a2c Sharpe Ratio:  -0.9617620972345442
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_460_7
======sac Validation from:  2023-09-06 to  2023-10-04
sac Sharpe Ratio:  -0.9920687802922873
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_460_7
-----------------------------------
| time/              |            |
```

```
|    fps              | 155        |
|    iterations       | 1          |
|    time_elapsed     | 13         |
|    total_timesteps | 2048       |
| train/              |            |
|    reward           | 0.24773361 |
-----------------------------------
======ppo Validation from:  2023-09-06 to  2023-10-04
ppo Sharpe Ratio:  -1.3319017054272
======Best Model Retraining from:  2010-01-04 to  2023-10-04
======Trading from:  2023-10-04 to  2023-11-01
=========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-10-04
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_480_7
------------------------------------
| time/                 |            |
|    fps                | 138        |
|    iterations         | 100        |
|    time_elapsed       | 3          |
|    total_timesteps    | 500        |
| train/                |            |
|    entropy_loss       | -38.3      |
|    explained_variance | 0          |
|    learning_rate      | 0.0007     |
|    n_updates          | 99         |
|    policy_loss        | -40.6      |
|    reward             | 0.92286885 |
|    std                | 0.999      |
|    value_loss         | 5.15       |
------------------------------------
======a2c Validation from:  2023-10-04 to  2023-11-01
a2c Sharpe Ratio:  -0.5450368167071131
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_480_7
======sac Validation from:  2023-10-04 to  2023-11-01
sac Sharpe Ratio:  -0.5169561975138348
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_480_7
-----------------------------------
```

```
| time/              |             |
|    fps             | 154         |
|    iterations      | 1           |
|    time_elapsed    | 13          |
|    total_timesteps | 2048        |
| train/             |             |
|    reward          | -0.74272066 |
-----------------------------------
======ppo Validation from:  2023-10-04 to  2023-11-01
ppo Sharpe Ratio:  -0.5322698826914314
======Best Model Retraining from:  2010-01-04 to  2023-11-01
======Trading from:  2023-11-01 to  2023-11-30
============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-11-01
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_500_7
-------------------------------------
| time/                 |           |
|    fps                | 138       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.3     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | 204       |
|    reward             | 2.8629305 |
|    std                | 1         |
|    value_loss         | 70.7      |
-------------------------------------
======a2c Validation from:  2023-11-01 to  2023-11-30
a2c Sharpe Ratio:  -0.037628394170374065
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_500_7
======sac Validation from:  2023-11-01 to  2023-11-30
sac Sharpe Ratio:  0.7063754540866066
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_500_7
```

```
-----------------------------------
| time/              |            |
|    fps             | 152        |
|    iterations      | 1          |
|    time_elapsed    | 13         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | 0.13059996 |
-----------------------------------
======ppo Validation from:  2023-11-01 to  2023-11-30
ppo Sharpe Ratio:  0.7216389643811085
======Best Model Retraining from:  2010-01-04 to  2023-11-30
======Trading from:  2023-11-30 to  2023-12-29
============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-11-30
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_520_7
------------------------------------
| time/                 |          |
|    fps                | 139      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.3    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | 14.3     |
|    reward             | 1.9093802 |
|    std                | 0.999    |
|    value_loss         | 13.2     |
------------------------------------
======a2c Validation from:  2023-11-30 to  2023-12-29
a2c Sharpe Ratio:  0.7654289259827723
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_520_7
======sac Validation from:  2023-11-30 to  2023-12-29
sac Sharpe Ratio:  0.6974681233349738
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
```

```
Logging to tensorboard_log/ppo/ppo_520_7
-----------------------------------
| time/              |            |
|    fps             | 155        |
|    iterations      | 1          |
|    time_elapsed    | 13         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -0.37526974 |
-----------------------------------
======ppo Validation from:  2023-11-30 to  2023-12-29
ppo Sharpe Ratio:  0.8509388575995951
======Best Model Retraining from:  2010-01-04 to  2023-12-29
======Trading from:  2023-12-29 to  2024-01-30
============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-12-29
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_540_7
------------------------------------
| time/                 |          |
|    fps                | 135      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.5    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -215     |
|    reward             | 3.003827 |
|    std                | 1.01     |
|    value_loss         | 48.7     |
------------------------------------
======a2c Validation from:  2023-12-29 to  2024-01-30
a2c Sharpe Ratio:  0.040377688057555844
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_540_7
======sac Validation from:  2023-12-29 to  2024-01-30
sac Sharpe Ratio:  0.40917601883220134
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
```

```
Using cpu device
Logging to tensorboard_log/ppo/ppo_540_7
----------------------------------
| time/              |           |
|    fps             | 155       |
|    iterations      | 1         |
|    time_elapsed    | 13        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 0.4627169 |
----------------------------------
======ppo Validation from:  2023-12-29 to  2024-01-30
ppo Sharpe Ratio:  -0.18946854194936086
======Best Model Retraining from:  2010-01-04 to  2024-01-30
======Trading from:  2024-01-30 to  2024-02-28
============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-01-30
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_560_7
-----------------------------------
| time/                 |          |
|    fps                | 143      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.5    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -229     |
|    reward             | 2.918898 |
|    std                | 1.01     |
|    value_loss         | 57       |
-----------------------------------
======a2c Validation from:  2024-01-30 to  2024-02-28
a2c Sharpe Ratio:  0.6401600913766964
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_560_7
======sac Validation from:  2024-01-30 to  2024-02-28
sac Sharpe Ratio:  0.34898654112195365
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
```

```
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_560_7
----------------------------------
| time/              |           |
|    fps             | 153       |
|    iterations      | 1         |
|    time_elapsed    | 13        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | -2.4348567 |
----------------------------------
======ppo Validation from:  2024-01-30 to  2024-02-28
ppo Sharpe Ratio:  0.5888472559134432
======Best Model Retraining from:  2010-01-04 to  2024-02-28
======Trading from:  2024-02-28 to  2024-03-27
============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-02-28
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_580_7
-----------------------------------
| time/                 |           |
|    fps                | 135       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.3     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -142      |
|    reward             | 0.3309329 |
|    std                | 0.999     |
|    value_loss         | 24.9      |
-----------------------------------
======a2c Validation from:  2024-02-28 to  2024-03-27
a2c Sharpe Ratio:  0.4144006011626133
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_580_7
======sac Validation from:  2024-02-28 to  2024-03-27
sac Sharpe Ratio:  0.22567327218581357
======ppo Training========
```

```
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_580_7
----------------------------------
| time/              |            |
|    fps             | 153        |
|    iterations      | 1          |
|    time_elapsed    | 13         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -1.0620995 |
----------------------------------
======ppo Validation from:  2024-02-28 to  2024-03-27
ppo Sharpe Ratio:  0.2065856355793313
======Best Model Retraining from:  2010-01-04 to  2024-03-27
======Trading from:  2024-03-27 to  2024-04-25
=============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-03-27
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_600_7
-------------------------------------
| time/                 |           |
|    fps                | 140       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.3     |
|    explained_variance | 0.0941    |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -329      |
|    reward             | 3.5824735 |
|    std                | 0.999     |
|    value_loss         | 127       |
-------------------------------------
======a2c Validation from:  2024-03-27 to  2024-04-25
a2c Sharpe Ratio:  -0.2878797139359455
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_600_7
======sac Validation from:  2024-03-27 to  2024-04-25
sac Sharpe Ratio:  -0.28118262424269425
```

```
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_600_7
-----------------------------------
| time/              |            |
|    fps             | 151        |
|    iterations      | 1          |
|    time_elapsed    | 13         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | 0.55891114 |
-----------------------------------
======ppo Validation from:  2024-03-27 to  2024-04-25
ppo Sharpe Ratio:  -0.2410078034889812
======Best Model Retraining from:  2010-01-04 to  2024-04-25
======Trading from:  2024-04-25 to  2024-05-23
=========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-04-25
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_620_7
------------------------------------
| time/                 |          |
|    fps                | 135      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.2    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -395     |
|    reward             | 3.5012217 |
|    std                | 0.996    |
|    value_loss         | 131      |
------------------------------------
======a2c Validation from:  2024-04-25 to  2024-05-23
a2c Sharpe Ratio:  0.7247563826923544
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_620_7
======sac Validation from:  2024-04-25 to  2024-05-23
```

```
sac Sharpe Ratio:  0.24071162817676037
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_620_7
-----------------------------------
| time/              |            |
|    fps             | 143        |
|    iterations      | 1          |
|    time_elapsed    | 14         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | 0.49886173 |
-----------------------------------
======ppo Validation from:  2024-04-25 to  2024-05-23
ppo Sharpe Ratio:  0.49763862639176365
======Best Model Retraining from:  2010-01-04 to  2024-05-23
======Trading from:  2024-05-23 to  2024-06-24
============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-05-23
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_640_7
------------------------------------
| time/                 |          |
|    fps                | 132      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.3    |
|    explained_variance | -1.19e-07 |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -36.6    |
|    reward             | 0.2621175 |
|    std                | 1        |
|    value_loss         | 2.04     |
------------------------------------
======a2c Validation from:  2024-05-23 to  2024-06-24
a2c Sharpe Ratio:  0.07214798831738484
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_640_7
```

```
======sac Validation from:  2024-05-23 to  2024-06-24
sac Sharpe Ratio:  0.5573855349708101
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_640_7
----------------------------------
| time/              |           |
|    fps             | 151       |
|    iterations      | 1         |
|    time_elapsed    | 13        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 0.7304851 |
----------------------------------
======ppo Validation from:  2024-05-23 to  2024-06-24
ppo Sharpe Ratio:  0.15259621904021836
======Best Model Retraining from:  2010-01-04 to  2024-06-24
======Trading from:  2024-06-24 to  2024-07-23
=========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-06-24
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_660_7
-----------------------------------
| time/                 |          |
|    fps                | 140      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.4    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -283     |
|    reward             | 4.014628 |
|    std                | 1        |
|    value_loss         | 69.1     |
-----------------------------------
======a2c Validation from:  2024-06-24 to  2024-07-23
a2c Sharpe Ratio:  0.4225245179659611
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_660_7
```

```
======sac Validation from:  2024-06-24 to  2024-07-23
sac Sharpe Ratio:  0.21769919531765136
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_660_7
----------------------------------
| time/              |           |
|    fps             | 149       |
|    iterations      | 1         |
|    time_elapsed    | 13        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | -1.107499 |
----------------------------------

Training Ensemble Models:  33%|███       | 1/3 [14:09<28:19,
849.55s/it]

======ppo Validation from:  2024-06-24 to  2024-07-23
ppo Sharpe Ratio:  0.2760073027690753
======Best Model Retraining from:  2010-01-04 to  2024-07-23
======Trading from:  2024-07-23 to  2024-08-20
Ensemble Strategy took:  14.158937911192575  minutes
A2C training completed!

Running PPO...
============Start Ensemble Strategy============
================================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-01-03
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_40_10
-----------------------------------
| time/                 |         |
|    fps                | 154     |
|    iterations         | 100     |
|    time_elapsed       | 3       |
|    total_timesteps    | 500     |
| train/                |         |
|    entropy_loss       | -38.4   |
|    explained_variance | 0       |
|    learning_rate      | 0.0007  |
|    n_updates          | 99      |
|    policy_loss        | 218     |
|    reward             | 2.499198 |
|    std                | 1.01    |
```

```
|    value_loss         | 99.3     |
-----------------------------------
======a2c Validation from:  2022-01-03 to  2022-02-01
a2c Sharpe Ratio:  0.06690532324365144
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_40_9
======sac Validation from:  2022-01-03 to  2022-02-01
sac Sharpe Ratio:  -0.02044940500387012
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_40_9
----------------------------------
| time/              |           |
|    fps             | 173       |
|    iterations      | 1         |
|    time_elapsed    | 11        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | -1.3610878 |
----------------------------------
======ppo Validation from:  2022-01-03 to  2022-02-01
ppo Sharpe Ratio:  -0.1564569302415366
======Best Model Retraining from:  2010-01-04 to  2022-02-01
======Trading from:  2022-02-01 to  2022-03-02
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-02-01
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_60_8
-------------------------------------
| time/                 |           |
|    fps                | 152       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.4     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -476      |
|    reward             | 3.5878506 |
```

```
|    std                | 1         |
|    value_loss         | 154       |
-----------------------------------
======a2c Validation from:  2022-02-01 to  2022-03-02
a2c Sharpe Ratio:  -0.5806404041174138
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_60_8
======sac Validation from:  2022-02-01 to  2022-03-02
sac Sharpe Ratio:  -0.6539967060245322
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_60_8
----------------------------------
| time/              |           |
|    fps             | 174       |
|    iterations      | 1         |
|    time_elapsed    | 11        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 0.28662267 |
----------------------------------
======ppo Validation from:  2022-02-01 to  2022-03-02
ppo Sharpe Ratio:  -0.6939764939946061
======Best Model Retraining from:  2010-01-04 to  2022-03-02
======Trading from:  2022-03-02 to  2022-03-30
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-03-02
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_80_8
-------------------------------------
| time/                 |           |
|    fps                | 152       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.4     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | 15.6      |
```

```
|    reward             | 0.94884616 |
|    std                | 1          |
|    value_loss         | 6.48       |
-------------------------------------
======a2c Validation from:  2022-03-02 to  2022-03-30
a2c Sharpe Ratio:  0.7558120204404786
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_80_8
======sac Validation from:  2022-03-02 to  2022-03-30
sac Sharpe Ratio:  0.8073210320889309
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_80_8
-------------------------------------
| time/              |              |
|    fps             | 171          |
|    iterations      | 1            |
|    time_elapsed    | 11           |
|    total_timesteps | 2048         |
| train/             |              |
|    reward          | 0.026066026 |
-------------------------------------
======ppo Validation from:  2022-03-02 to  2022-03-30
ppo Sharpe Ratio:  0.6819377885777826
======Best Model Retraining from:  2010-01-04 to  2022-03-30
======Trading from:  2022-03-30 to  2022-04-28
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-03-30
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_100_8
-------------------------------------
| time/                 |           |
|    fps                | 151       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.5     |
|    explained_variance | 5.96e-08  |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
```

```
|    policy_loss        | -55.8     |
|    reward             | 1.8377849 |
|    std                | 1.01      |
|    value_loss         | 23.6      |
-------------------------------------
======a2c Validation from:  2022-03-30 to  2022-04-28
a2c Sharpe Ratio:  -0.5390547266209992
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_100_8
======sac Validation from:  2022-03-30 to  2022-04-28
sac Sharpe Ratio:  -0.5287018162055941
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_100_8
----------------------------------
| time/              |           |
|    fps             | 171       |
|    iterations      | 1         |
|    time_elapsed    | 11        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 0.8925058 |
----------------------------------
======ppo Validation from:  2022-03-30 to  2022-04-28
ppo Sharpe Ratio:  -0.4106312663120139
======Best Model Retraining from:  2010-01-04 to  2022-04-28
======Trading from:  2022-04-28 to  2022-05-26
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-04-28
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_120_8
-----------------------------------
| time/                 |           |
|    fps                | 150       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.2     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
```

```
|    n_updates          | 99        |
|    policy_loss        | 12        |
|    reward             | 2.0747359 |
|    std                | 0.997     |
|    value_loss         | 12        |
-------------------------------------
======a2c Validation from:  2022-04-28 to  2022-05-26
a2c Sharpe Ratio:  0.0748593656946137
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_120_8
======sac Validation from:  2022-04-28 to  2022-05-26
sac Sharpe Ratio:  0.13502932860506137
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_120_8
-----------------------------------
| time/              |            |
|    fps             | 172        |
|    iterations      | 1          |
|    time_elapsed    | 11         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | 0.11080452 |
-----------------------------------
======ppo Validation from:  2022-04-28 to  2022-05-26
ppo Sharpe Ratio:  0.08199334813150708
======Best Model Retraining from:  2010-01-04 to  2022-05-26
======Trading from:  2022-05-26 to  2022-06-27
==============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-05-26
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_140_8
-----------------------------------
| time/                 |           |
|    fps                | 148       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.5     |
|    explained_variance | 0         |
```

```
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | 38.2      |
|    reward             | 2.2149398 |
|    std                | 1.01      |
|    value_loss         | 22.3      |
-------------------------------------
======a2c Validation from:  2022-05-26 to  2022-06-27
a2c Sharpe Ratio:  -0.1319117116252834
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_140_8
======sac Validation from:  2022-05-26 to  2022-06-27
sac Sharpe Ratio:  -0.17771526151020414
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_140_8
-----------------------------------
| time/              |            |
|    fps             | 168        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -1.0957401 |
-----------------------------------
======ppo Validation from:  2022-05-26 to  2022-06-27
ppo Sharpe Ratio:  -0.3229520764078126
======Best Model Retraining from:  2010-01-04 to  2022-06-27
======Trading from:  2022-06-27 to  2022-07-26
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-06-27
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_160_8
-----------------------------------
| time/                 |           |
|    fps                | 148       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.2     |
```

```
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -181      |
|    reward             | 1.0221664 |
|    std                | 0.996     |
|    value_loss         | 30.6      |
-------------------------------------
======a2c Validation from:  2022-06-27 to  2022-07-26
a2c Sharpe Ratio:  0.21632190871111107
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_160_8
======sac Validation from:  2022-06-27 to  2022-07-26
sac Sharpe Ratio:  0.4564304768094086
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_160_8
-----------------------------------
| time/              |            |
|    fps             | 169        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -0.5747138 |
-----------------------------------
======ppo Validation from:  2022-06-27 to  2022-07-26
ppo Sharpe Ratio:  0.37823412198235473
======Best Model Retraining from:  2010-01-04 to  2022-07-26
======Trading from:  2022-07-26 to  2022-08-23
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-07-26
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_180_8
-----------------------------------
| time/                 |          |
|    fps                | 151      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
```

```
|    entropy_loss       | -38.4     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | 14.9      |
|    reward             | 2.6874685 |
|    std                | 1.01      |
|    value_loss         | 54.5      |
-------------------------------------
======a2c Validation from:  2022-07-26 to  2022-08-23
a2c Sharpe Ratio:  -0.27007099378574456
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_180_8
======sac Validation from:  2022-07-26 to  2022-08-23
sac Sharpe Ratio:  -0.2960875500612118
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_180_8
-------------------------------------
| time/              |              |
|    fps             | 168          |
|    iterations      | 1            |
|    time_elapsed    | 12           |
|    total_timesteps | 2048         |
| train/             |              |
|    reward          | -0.04775619 |
-------------------------------------
======ppo Validation from:  2022-07-26 to  2022-08-23
ppo Sharpe Ratio:  -0.35853202647625076
======Best Model Retraining from:  2010-01-04 to  2022-08-23
======Trading from:  2022-08-23 to  2022-09-21
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-08-23
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_200_8
-------------------------------------
| time/                 |           |
|    fps                | 149       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
```

```
| train/                  |           |
|    entropy_loss         | -38.4     |
|    explained_variance   | 0.0927    |
|    learning_rate        | 0.0007    |
|    n_updates            | 99        |
|    policy_loss          | -320      |
|    reward               | 1.7469965 |
|    std                  | 1         |
|    value_loss           | 93.8      |
-------------------------------------
======a2c Validation from:  2022-08-23 to  2022-09-21
a2c Sharpe Ratio:  -0.4083804487132881
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_200_8
======sac Validation from:  2022-08-23 to  2022-09-21
sac Sharpe Ratio:  -0.42001513724612344
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_200_8
----------------------------------
| time/               |           |
|    fps              | 164       |
|    iterations       | 1         |
|    time_elapsed     | 12        |
|    total_timesteps  | 2048      |
| train/              |           |
|    reward           | -1.485466 |
----------------------------------
======ppo Validation from:  2022-08-23 to  2022-09-21
ppo Sharpe Ratio:  -0.4186683525678308
======Best Model Retraining from:  2010-01-04 to  2022-09-21
======Trading from:  2022-09-21 to  2022-10-19
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-09-21
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_220_8
-------------------------------------
| time/                 |           |
|    fps                | 152       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
```

```
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.3     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | 185       |
|    reward             | 2.7610364 |
|    std                | 1         |
|    value_loss         | 88.8      |
-------------------------------------
======a2c Validation from:  2022-09-21 to  2022-10-19
a2c Sharpe Ratio:  0.21314377549284239
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_220_8
======sac Validation from:  2022-09-21 to  2022-10-19
sac Sharpe Ratio:  0.12217074693410951
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_220_8
-----------------------------------
| time/              |            |
|    fps             | 166        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -1.3455435 |
-----------------------------------
======ppo Validation from:  2022-09-21 to  2022-10-19
ppo Sharpe Ratio:  -0.035511529474377884
======Best Model Retraining from:  2010-01-04 to  2022-10-19
======Trading from:  2022-10-19 to  2022-11-16
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-10-19
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_240_8
-----------------------------------
| time/                 |          |
|    fps                | 153      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
```

```
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.5    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -313     |
|    reward             | 1.326798 |
|    std                | 1.01     |
|    value_loss         | 80.6     |
-----------------------------------
======a2c Validation from:  2022-10-19 to  2022-11-16
a2c Sharpe Ratio:  0.458996158225884
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_240_8
======sac Validation from:  2022-10-19 to  2022-11-16
sac Sharpe Ratio:  0.448328425379857
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_240_8
-----------------------------------
| time/              |            |
|    fps             | 163        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | 0.05243024 |
-----------------------------------
======ppo Validation from:  2022-10-19 to  2022-11-16
ppo Sharpe Ratio:  0.4240075164706596
======Best Model Retraining from:  2010-01-04 to  2022-11-16
======Trading from:  2022-11-16 to  2022-12-15
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-11-16
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_260_8
-----------------------------------
| time/                 |           |
|    fps                | 142       |
|    iterations         | 100       |
```

```
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.4     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -0.0225   |
|    reward             | 2.9157188 |
|    std                | 1         |
|    value_loss         | 33.7      |
-------------------------------------
======a2c Validation from:  2022-11-16 to  2022-12-15
a2c Sharpe Ratio:  0.24996519627740882
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_260_8
======sac Validation from:  2022-11-16 to  2022-12-15
sac Sharpe Ratio:  0.29593910351021124
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_260_8
-----------------------------------
| time/              |            |
|    fps             | 164        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -0.84768456 |
-----------------------------------
======ppo Validation from:  2022-11-16 to  2022-12-15
ppo Sharpe Ratio:  0.1915305857781421
======Best Model Retraining from:  2010-01-04 to  2022-12-15
======Trading from:  2022-12-15 to  2023-01-17
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-12-15
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_280_8
-----------------------------------
| time/                 |          |
|    fps                | 145      |
```

```
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.3    |
|    explained_variance | 1.19e-07 |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -276     |
|    reward             | 1.357563 |
|    std                | 0.999    |
|    value_loss         | 49.1     |
-----------------------------------
======a2c Validation from:  2022-12-15 to  2023-01-17
a2c Sharpe Ratio:  0.5480446884621586
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_280_8
======sac Validation from:  2022-12-15 to  2023-01-17
sac Sharpe Ratio:  0.7104225549027511
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_280_8
-----------------------------------
| time/              |            |
|    fps             | 164        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | 0.21439715 |
-----------------------------------
======ppo Validation from:  2022-12-15 to  2023-01-17
ppo Sharpe Ratio:  0.4031250002426819
======Best Model Retraining from:  2010-01-04 to  2023-01-17
======Trading from:  2023-01-17 to  2023-02-14
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-01-17
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_300_8
-----------------------------------
| time/                 |          |
```

```
|    fps                 | 145       |
|    iterations          | 100       |
|    time_elapsed        | 3         |
|    total_timesteps     | 500       |
| train/                 |           |
|    entropy_loss        | -38.3     |
|    explained_variance | -1.19e-07 |
|    learning_rate       | 0.0007    |
|    n_updates           | 99        |
|    policy_loss         | -188      |
|    reward              | 1.8085659 |
|    std                 | 0.999     |
|    value_loss          | 30.7      |
-------------------------------------
======a2c Validation from:  2023-01-17 to  2023-02-14
a2c Sharpe Ratio:  0.3006302363881299
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_300_8
======sac Validation from:  2023-01-17 to  2023-02-14
sac Sharpe Ratio:  0.2974724197243113
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_300_8
-----------------------------------
| time/              |            |
|    fps             | 164        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | 0.44758737 |
-----------------------------------
======ppo Validation from:  2023-01-17 to  2023-02-14
ppo Sharpe Ratio:  0.25260094527581445
======Best Model Retraining from:  2010-01-04 to  2023-02-14
======Trading from:  2023-02-14 to  2023-03-15
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-02-14
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_320_8
-------------------------------------
```

```
| time/                 |           |
|    fps                | 147       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.2     |
|    explained_variance | 5.96e-08  |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | 75.7      |
|    reward             | 2.9870167 |
|    std                | 0.998     |
|    value_loss         | 27.9      |
-------------------------------------
======a2c Validation from:  2023-02-14 to  2023-03-15
a2c Sharpe Ratio:  -0.5380204850689558
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_320_8
======sac Validation from:  2023-02-14 to  2023-03-15
sac Sharpe Ratio:  -0.47594873253242714
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_320_8
-----------------------------------
| time/              |            |
|    fps             | 163        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -1.1139855 |
-----------------------------------
======ppo Validation from:  2023-02-14 to  2023-03-15
ppo Sharpe Ratio:  -0.43505414504601414
======Best Model Retraining from:  2010-01-04 to  2023-03-15
======Trading from:  2023-03-15 to  2023-04-13
============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-03-15
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_340_8
```

```
-------------------------------------
| time/                 |           |
|    fps                | 145       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.2     |
|    explained_variance | -2.38e-07 |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -220      |
|    reward             | 1.2184871 |
|    std                | 0.996     |
|    value_loss         | 38.7      |
-------------------------------------
======a2c Validation from:  2023-03-15 to  2023-04-13
a2c Sharpe Ratio:  0.38948244311412444
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_340_8
======sac Validation from:  2023-03-15 to  2023-04-13
sac Sharpe Ratio:  0.5372258157102852
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_340_8
----------------------------------
| time/              |           |
|    fps             | 161       |
|    iterations      | 1         |
|    time_elapsed    | 12        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | -0.3359371 |
----------------------------------
======ppo Validation from:  2023-03-15 to  2023-04-13
ppo Sharpe Ratio:  0.2321146190406004
======Best Model Retraining from:  2010-01-04 to  2023-04-13
======Trading from:  2023-04-13 to  2023-05-11
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-04-13
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
```

```
Logging to tensorboard_log/a2c/a2c_360_8
-------------------------------------
| time/                 |           |
|    fps                | 141       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.4     |
|    explained_variance | -0.0573   |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -451      |
|    reward             | 0.14034371 |
|    std                | 1         |
|    value_loss         | 137       |
-------------------------------------
======a2c Validation from:  2023-04-13 to  2023-05-11
a2c Sharpe Ratio:  -0.31856810541103797
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_360_8
======sac Validation from:  2023-04-13 to  2023-05-11
sac Sharpe Ratio:  -0.36393490359359065
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_360_8
----------------------------------
| time/              |           |
|    fps             | 159       |
|    iterations      | 1         |
|    time_elapsed    | 12        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | -0.5024036 |
----------------------------------
======ppo Validation from:  2023-04-13 to  2023-05-11
ppo Sharpe Ratio:  -0.32456928666090523
======Best Model Retraining from:  2010-01-04 to  2023-05-11
======Trading from:  2023-05-11 to  2023-06-09
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-05-11
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
```

```
Using cpu device
Logging to tensorboard_log/a2c/a2c_380_8
-------------------------------------
| time/                 |             |
|    fps                | 146         |
|    iterations         | 100         |
|    time_elapsed       | 3           |
|    total_timesteps    | 500         |
| train/                |             |
|    entropy_loss       | -38.5       |
|    explained_variance | -2.38e-07   |
|    learning_rate      | 0.0007      |
|    n_updates          | 99          |
|    policy_loss        | -203        |
|    reward             | 0.87054217  |
|    std                | 1.01        |
|    value_loss         | 31.5        |
-------------------------------------
======a2c Validation from:  2023-05-11 to  2023-06-09
a2c Sharpe Ratio:  0.5505536422433295
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_380_8
======sac Validation from:  2023-05-11 to  2023-06-09
sac Sharpe Ratio:  0.5473927530925916
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_380_8
----------------------------------
| time/              |           |
|    fps             | 159       |
|    iterations      | 1         |
|    time_elapsed    | 12        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 0.43062064 |
----------------------------------
======ppo Validation from:  2023-05-11 to  2023-06-09
ppo Sharpe Ratio:  0.3640754139535865
======Best Model Retraining from:  2010-01-04 to  2023-06-09
======Trading from:  2023-06-09 to  2023-07-11
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-06-09
======a2c Training========
```

```
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_400_8
-----------------------------------
| time/                 |           |
|    fps                | 147       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.3     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -170      |
|    reward             | 3.038293  |
|    std                | 0.998     |
|    value_loss         | 43        |
-----------------------------------
======a2c Validation from:  2023-06-09 to  2023-07-11
a2c Sharpe Ratio:  0.38707153544441875
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_400_8
======sac Validation from:  2023-06-09 to  2023-07-11
sac Sharpe Ratio:  0.4677893002848949
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_400_8
-----------------------------------
| time/              |            |
|    fps             | 159        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -0.15942223 |
-----------------------------------
======ppo Validation from:  2023-06-09 to  2023-07-11
ppo Sharpe Ratio:  0.43539238798189384
======Best Model Retraining from:  2010-01-04 to  2023-07-11
======Trading from:  2023-07-11 to  2023-08-08
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-07-11
```

```
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_420_8
-------------------------------------
| time/                 |           |
|    fps                | 141       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.4     |
|    explained_variance | -1.19e-07 |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -254      |
|    reward             | 0.92542195 |
|    std                | 1         |
|    value_loss         | 68.7      |
-------------------------------------
======a2c Validation from:  2023-07-11 to  2023-08-08
a2c Sharpe Ratio:  -0.1954886136871692
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_420_8
======sac Validation from:  2023-07-11 to  2023-08-08
sac Sharpe Ratio:  0.21291450563883288
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_420_8
----------------------------------
| time/              |           |
|    fps             | 151       |
|    iterations      | 1         |
|    time_elapsed    | 13        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 0.34264624 |
----------------------------------
======ppo Validation from:  2023-07-11 to  2023-08-08
ppo Sharpe Ratio:  0.08082078741547298
======Best Model Retraining from:  2010-01-04 to  2023-08-08
======Trading from:  2023-08-08 to  2023-09-06
==========================================
turbulence_threshold:  227.87028410067566
```

```
======Model training from:  2010-01-04 to  2023-08-08
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_440_8
-------------------------------------
| time/                 |           |
|    fps                | 141       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.3     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -261      |
|    reward             | 3.0962822 |
|    std                | 1         |
|    value_loss         | 71.9      |
-------------------------------------
======a2c Validation from:  2023-08-08 to  2023-09-06
a2c Sharpe Ratio:  0.1059615765035796
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_440_8
======sac Validation from:  2023-08-08 to  2023-09-06
sac Sharpe Ratio:  0.1655665963609186
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_440_8
----------------------------------
| time/              |           |
|    fps             | 157       |
|    iterations      | 1         |
|    time_elapsed    | 12        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | -1.3147409 |
----------------------------------
======ppo Validation from:  2023-08-08 to  2023-09-06
ppo Sharpe Ratio:  -0.16348419311895815
======Best Model Retraining from:  2010-01-04 to  2023-09-06
======Trading from:  2023-09-06 to  2023-10-04
==========================================
turbulence_threshold:  227.87028410067566
```

```
======Model training from:  2010-01-04 to  2023-09-06
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_460_8
-------------------------------------
| time/                 |           |
|    fps                | 140       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.5     |
|    explained_variance | 5.96e-08  |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -398      |
|    reward             | 0.11880505 |
|    std                | 1.01      |
|    value_loss         | 132       |
-------------------------------------
======a2c Validation from:  2023-09-06 to  2023-10-04
a2c Sharpe Ratio:  -1.0600788213324894
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_460_8
======sac Validation from:  2023-09-06 to  2023-10-04
sac Sharpe Ratio:  -0.9378064577139144
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_460_8
----------------------------------
| time/              |           |
|    fps             | 156       |
|    iterations      | 1         |
|    time_elapsed    | 13        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | -1.138806 |
----------------------------------
======ppo Validation from:  2023-09-06 to  2023-10-04
ppo Sharpe Ratio:  -0.8696865889314375
======Best Model Retraining from:  2010-01-04 to  2023-10-04
======Trading from:  2023-10-04 to  2023-11-01
==========================================
```

```
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-10-04
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_480_8
-------------------------------------
| time/                 |           |
|    fps                | 140       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.5     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | 149       |
|    reward             | 1.8812566 |
|    std                | 1.01      |
|    value_loss         | 40.7      |
-------------------------------------
======a2c Validation from:  2023-10-04 to  2023-11-01
a2c Sharpe Ratio:  -0.5270538394027827
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_480_8
======sac Validation from:  2023-10-04 to  2023-11-01
sac Sharpe Ratio:  -0.8162350758505548
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_480_8
-----------------------------------
| time/              |            |
|    fps             | 157        |
|    iterations      | 1          |
|    time_elapsed    | 13         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -0.1110432 |
-----------------------------------
======ppo Validation from:  2023-10-04 to  2023-11-01
ppo Sharpe Ratio:  -0.5196765819237817
======Best Model Retraining from:  2010-01-04 to  2023-11-01
======Trading from:  2023-11-01 to  2023-11-30
```

```
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-11-01
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_500_8
------------------------------------
| time/                 |            |
|    fps                | 142        |
|    iterations         | 100        |
|    time_elapsed       | 3          |
|    total_timesteps    | 500        |
| train/                |            |
|    entropy_loss       | -38.5      |
|    explained_variance | 0          |
|    learning_rate      | 0.0007     |
|    n_updates          | 99         |
|    policy_loss        | -390       |
|    reward             | 0.77264285 |
|    std                | 1.01       |
|    value_loss         | 138        |
------------------------------------
======a2c Validation from:  2023-11-01 to  2023-11-30
a2c Sharpe Ratio:  1.1005108538894648
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_500_8
======sac Validation from:  2023-11-01 to  2023-11-30
sac Sharpe Ratio:  0.8553970570716987
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_500_8
-----------------------------------
| time/              |            |
|    fps             | 154        |
|    iterations      | 1          |
|    time_elapsed    | 13         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -1.2198234 |
-----------------------------------
======ppo Validation from:  2023-11-01 to  2023-11-30
ppo Sharpe Ratio:  0.8626956567404716
======Best Model Retraining from:  2010-01-04 to  2023-11-30
```

```
======Trading from:  2023-11-30 to  2023-12-29
=============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-11-30
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_520_8
------------------------------------
| time/                 |          |
|    fps                | 136      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.3    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -58.9    |
|    reward             | 2.5138872 |
|    std                | 1        |
|    value_loss         | 28.1     |
------------------------------------
======a2c Validation from:  2023-11-30 to  2023-12-29
a2c Sharpe Ratio:  0.6339900705252979
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_520_8
======sac Validation from:  2023-11-30 to  2023-12-29
sac Sharpe Ratio:  0.7397524567426513
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_520_8
-----------------------------------
| time/              |            |
|    fps             | 154        |
|    iterations      | 1          |
|    time_elapsed    | 13         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -1.3633145 |
-----------------------------------
======ppo Validation from:  2023-11-30 to  2023-12-29
ppo Sharpe Ratio:  1.1088719454062237
```

```
======Best Model Retraining from:  2010-01-04 to  2023-12-29
======Trading from:  2023-12-29 to  2024-01-30
=========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-12-29
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_540_8
-------------------------------------
| time/                 |           |
|    fps                | 137       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.3     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -112      |
|    reward             | 0.6126412 |
|    std                | 0.999     |
|    value_loss         | 11.8      |
-------------------------------------
======a2c Validation from:  2023-12-29 to  2024-01-30
a2c Sharpe Ratio:  0.3937211468972895
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_540_8
======sac Validation from:  2023-12-29 to  2024-01-30
sac Sharpe Ratio:  0.376272526955563
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_540_8
-----------------------------------
| time/              |            |
|    fps             | 152        |
|    iterations      | 1          |
|    time_elapsed    | 13         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -0.38131493 |
-----------------------------------
======ppo Validation from:  2023-12-29 to  2024-01-30
```

```
ppo Sharpe Ratio:  0.42070485385201334
======Best Model Retraining from:  2010-01-04 to  2024-01-30
======Trading from:  2024-01-30 to  2024-02-28
=============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-01-30
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_560_8
-----------------------------------
| time/                 |          |
|    fps                | 133      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.5    |
|    explained_variance | 1.79e-07 |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -118     |
|    reward             | 2.316006 |
|    std                | 1.01     |
|    value_loss         | 23.1     |
-----------------------------------
======a2c Validation from:  2024-01-30 to  2024-02-28
a2c Sharpe Ratio:  0.5694356379259715
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_560_8
======sac Validation from:  2024-01-30 to  2024-02-28
sac Sharpe Ratio:  0.2875168154858131
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_560_8
-----------------------------------
| time/              |             |
|    fps             | 155         |
|    iterations      | 1           |
|    time_elapsed    | 13          |
|    total_timesteps | 2048        |
| train/             |             |
|    reward          | -0.16032481 |
-----------------------------------
```

```
======ppo Validation from:  2024-01-30 to  2024-02-28
ppo Sharpe Ratio:  0.22585768091604064
======Best Model Retraining from:  2010-01-04 to  2024-02-28
======Trading from:  2024-02-28 to  2024-03-27
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-02-28
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_580_8
-------------------------------------
| time/                 |           |
|    fps                | 139       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.4     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -2.27     |
|    reward             | 1.2279879 |
|    std                | 1         |
|    value_loss         | 4.74      |
-------------------------------------
======a2c Validation from:  2024-02-28 to  2024-03-27
a2c Sharpe Ratio:  -0.012979695688310164
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_580_8
======sac Validation from:  2024-02-28 to  2024-03-27
sac Sharpe Ratio:  0.39649648454778824
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_580_8
-------------------------------------
| time/              |              |
|    fps             | 150          |
|    iterations      | 1            |
|    time_elapsed    | 13           |
|    total_timesteps | 2048         |
| train/             |              |
|    reward          | -0.046416663 |
```

```
-------------------------------------
======ppo Validation from:  2024-02-28 to  2024-03-27
ppo Sharpe Ratio:  0.4834654165668012
======Best Model Retraining from:  2010-01-04 to  2024-03-27
======Trading from:  2024-03-27 to  2024-04-25
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-03-27
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_600_8
------------------------------------
| time/                 |          |
|    fps                | 141      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.3    |
|    explained_variance | 1.19e-07 |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -330     |
|    reward             | 1.7837248 |
|    std                | 1        |
|    value_loss         | 95.5     |
------------------------------------
======a2c Validation from:  2024-03-27 to  2024-04-25
a2c Sharpe Ratio:  -0.11853485739919521
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_600_8
======sac Validation from:  2024-03-27 to  2024-04-25
sac Sharpe Ratio:  -0.2266142659329783
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_600_8
-----------------------------------
| time/              |            |
|    fps             | 151        |
|    iterations      | 1          |
|    time_elapsed    | 13         |
|    total_timesteps | 2048       |
| train/             |            |
```

```
|    reward           | -0.84688705 |
-----------------------------------
======ppo Validation from:  2024-03-27 to  2024-04-25
ppo Sharpe Ratio:  -0.3660663509655921
======Best Model Retraining from:  2010-01-04 to  2024-04-25
======Trading from:  2024-04-25 to  2024-05-23
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-04-25
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_620_8
------------------------------------
| time/                 |          |
|    fps                | 137      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.2    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -251     |
|    reward             | 1.1641676 |
|    std                | 0.995    |
|    value_loss         | 48.8     |
------------------------------------
======a2c Validation from:  2024-04-25 to  2024-05-23
a2c Sharpe Ratio:  1.1924217777890302
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_620_8
======sac Validation from:  2024-04-25 to  2024-05-23
sac Sharpe Ratio:  1.2949290768173918
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_620_8
---------------------------------
| time/              |          |
|    fps             | 153      |
|    iterations      | 1        |
|    time_elapsed    | 13       |
|    total_timesteps | 2048     |
```

```
| train/              |           |
|    reward           | 1.4214128 |
---------------------------------
======ppo Validation from:  2024-04-25 to  2024-05-23
ppo Sharpe Ratio:  0.4952585112161672
======Best Model Retraining from:  2010-01-04 to  2024-05-23
======Trading from:  2024-05-23 to  2024-06-24
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-05-23
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_640_8
-------------------------------------
| time/                 |             |
|    fps                | 133         |
|    iterations         | 100         |
|    time_elapsed       | 3           |
|    total_timesteps    | 500         |
| train/                |             |
|    entropy_loss       | -38.5       |
|    explained_variance | 0           |
|    learning_rate      | 0.0007      |
|    n_updates          | 99          |
|    policy_loss        | -102        |
|    reward             | 0.68221694  |
|    std                | 1.01        |
|    value_loss         | 15.1        |
-------------------------------------
======a2c Validation from:  2024-05-23 to  2024-06-24
a2c Sharpe Ratio:  -0.19865719572967722
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_640_8
======sac Validation from:  2024-05-23 to  2024-06-24
sac Sharpe Ratio:  -0.015517910797790274
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_640_8
---------------------------------
| time/              |          |
|    fps             | 146      |
|    iterations      | 1        |
|    time_elapsed    | 13       |
```

```
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 2.1389923 |
----------------------------------
======ppo Validation from:  2024-05-23 to  2024-06-24
ppo Sharpe Ratio:  0.08023325693542599
======Best Model Retraining from:  2010-01-04 to  2024-06-24
======Trading from:  2024-06-24 to  2024-07-23
=============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-06-24
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_660_8
---------------------------------------
| time/                 |             |
|    fps                | 132         |
|    iterations         | 100         |
|    time_elapsed       | 3           |
|    total_timesteps    | 500         |
| train/                |             |
|    entropy_loss       | -38.3       |
|    explained_variance | 0           |
|    learning_rate      | 0.0007      |
|    n_updates          | 99          |
|    policy_loss        | -188        |
|    reward             | 0.046553884 |
|    std                | 1           |
|    value_loss         | 23          |
---------------------------------------
======a2c Validation from:  2024-06-24 to  2024-07-23
a2c Sharpe Ratio:  0.6111814034574284
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_660_8
======sac Validation from:  2024-06-24 to  2024-07-23
sac Sharpe Ratio:  0.6699754953029071
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_660_8
----------------------------------
| time/              |           |
|    fps             | 149       |
|    iterations      | 1         |
|    time_elapsed    | 13        |
```

```
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -1.9444602 |
-----------------------------------
======ppo Validation from:  2024-06-24 to  2024-07-23
ppo Sharpe Ratio:  0.6287312737734205
======Best Model Retraining from:  2010-01-04 to  2024-07-23
======Trading from:  2024-07-23 to  2024-08-20

Training Ensemble Models:  67%|██████    | 2/3 [28:14<14:06,
846.79s/it]

Ensemble Strategy took:  14.080795526504517  minutes
PPO training completed!

Running SAC...
============Start Ensemble Strategy============
================================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-01-03
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_40_11
------------------------------------
| time/                 |          |
|    fps                | 151      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.4    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -329     |
|    reward             | -0.7496336 |
|    std                | 1        |
|    value_loss         | 91.1     |
------------------------------------
======a2c Validation from:  2022-01-03 to  2022-02-01
a2c Sharpe Ratio:  -0.277005744446282
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_40_10
======sac Validation from:  2022-01-03 to  2022-02-01
sac Sharpe Ratio:  -0.04405103505468476
======ppo Training========
```

```
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_40_10
----------------------------------
| time/              |           |
|    fps             | 171       |
|    iterations      | 1         |
|    time_elapsed    | 11        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | -0.8157077 |
----------------------------------
======ppo Validation from:  2022-01-03 to  2022-02-01
ppo Sharpe Ratio:  -0.36300204741126324
======Best Model Retraining from:  2010-01-04 to  2022-02-01
======Trading from:  2022-02-01 to  2022-03-02
============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-02-01
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_60_9
-------------------------------------
| time/                 |           |
|    fps                | 155       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.3     |
|    explained_variance | 1.79e-07  |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -355      |
|    reward             | 0.13307081 |
|    std                | 1         |
|    value_loss         | 105       |
-------------------------------------
======a2c Validation from:  2022-02-01 to  2022-03-02
a2c Sharpe Ratio:  -0.5611623945081106
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_60_9
======sac Validation from:  2022-02-01 to  2022-03-02
sac Sharpe Ratio:  -0.6246327525059233
```

```
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_60_9
----------------------------------
| time/              |           |
|    fps             | 173       |
|    iterations      | 1         |
|    time_elapsed    | 11        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 0.24973702 |
----------------------------------
======ppo Validation from:  2022-02-01 to  2022-03-02
ppo Sharpe Ratio:  -0.6073298004682655
======Best Model Retraining from:  2010-01-04 to  2022-03-02
======Trading from:  2022-03-02 to  2022-03-30
=========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-03-02
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_80_9
-----------------------------------
| time/                 |           |
|    fps                | 150       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.5     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -84.2     |
|    reward             | 0.7372144 |
|    std                | 1.01      |
|    value_loss         | 8.61      |
-----------------------------------
======a2c Validation from:  2022-03-02 to  2022-03-30
a2c Sharpe Ratio:  0.6717765041614653
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_80_9
======sac Validation from:  2022-03-02 to  2022-03-30
```

```
sac Sharpe Ratio:  0.7707561641662122
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_80_9
----------------------------------
| time/              |           |
|    fps             | 171       |
|    iterations      | 1         |
|    time_elapsed    | 11        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | -0.7151785 |
----------------------------------
======ppo Validation from:  2022-03-02 to  2022-03-30
ppo Sharpe Ratio:  0.6476868285575601
======Best Model Retraining from:  2010-01-04 to  2022-03-30
======Trading from:  2022-03-30 to  2022-04-28
============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-03-30
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_100_9
-------------------------------------
| time/                 |           |
|    fps                | 151       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.4     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -152      |
|    reward             | 1.0973939 |
|    std                | 1         |
|    value_loss         | 22.5      |
-------------------------------------
======a2c Validation from:  2022-03-30 to  2022-04-28
a2c Sharpe Ratio:  -0.7012396586827544
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_100_9
```

```
======sac Validation from:  2022-03-30 to  2022-04-28
sac Sharpe Ratio:  -0.5456923296988201
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_100_9
-----------------------------------
| time/              |              |
|    fps             | 170          |
|    iterations      | 1            |
|    time_elapsed    | 11           |
|    total_timesteps | 2048         |
| train/             |              |
|    reward          | -0.106442794 |
-----------------------------------
======ppo Validation from:  2022-03-30 to  2022-04-28
ppo Sharpe Ratio:  -0.6371146221640749
======Best Model Retraining from:  2010-01-04 to  2022-04-28
======Trading from:  2022-04-28 to  2022-05-26
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-04-28
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_120_9
------------------------------------
| time/                 |          |
|    fps                | 151      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.3    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -4.77    |
|    reward             | 1.3012835 |
|    std                | 1        |
|    value_loss         | 7.93     |
------------------------------------
======a2c Validation from:  2022-04-28 to  2022-05-26
a2c Sharpe Ratio:  0.10950351753123083
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
```

```
Logging to tensorboard_log/sac/sac_120_9
======sac Validation from:  2022-04-28 to  2022-05-26
sac Sharpe Ratio:  0.17590263634195025
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_120_9
----------------------------------
| time/              |           |
|    fps             | 168       |
|    iterations      | 1         |
|    time_elapsed    | 12        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 1.2745026 |
----------------------------------
======ppo Validation from:  2022-04-28 to  2022-05-26
ppo Sharpe Ratio:  0.11921424693918574
======Best Model Retraining from:  2010-01-04 to  2022-05-26
======Trading from:  2022-05-26 to  2022-06-27
=============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-05-26
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_140_9
-------------------------------------
| time/                 |           |
|    fps                | 149       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.3     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -290      |
|    reward             | 1.7171904 |
|    std                | 1         |
|    value_loss         | 64.4      |
-------------------------------------
======a2c Validation from:  2022-05-26 to  2022-06-27
a2c Sharpe Ratio:  -0.021113410559190415
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
```

```
Using cpu device
Logging to tensorboard_log/sac/sac_140_9
======sac Validation from:  2022-05-26 to  2022-06-27
sac Sharpe Ratio:  -0.07779444162788408
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_140_9
----------------------------------
| time/               |            |
|    fps              | 171        |
|    iterations       | 1          |
|    time_elapsed     | 11         |
|    total_timesteps | 2048       |
| train/              |            |
|    reward           | -1.4800094 |
----------------------------------
======ppo Validation from:  2022-05-26 to  2022-06-27
ppo Sharpe Ratio:  -0.19747880809142454
======Best Model Retraining from:  2010-01-04 to  2022-06-27
======Trading from:  2022-06-27 to  2022-07-26
============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-06-27
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_160_9
-----------------------------------
| time/                 |           |
|    fps                | 151       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.3     |
|    explained_variance | -1.19e-07 |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -294      |
|    reward             | 0.6305087 |
|    std                | 0.999     |
|    value_loss         | 64        |
-----------------------------------
======a2c Validation from:  2022-06-27 to  2022-07-26
a2c Sharpe Ratio:  0.1770778525131268
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
```

```
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_160_9
======sac Validation from:  2022-06-27 to  2022-07-26
sac Sharpe Ratio:  0.33772878334006995
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_160_9
-----------------------------------
| time/              |            |
|    fps             | 169        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -0.6801457 |
-----------------------------------
======ppo Validation from:  2022-06-27 to  2022-07-26
ppo Sharpe Ratio:  0.078897336723414
======Best Model Retraining from:  2010-01-04 to  2022-07-26
======Trading from:  2022-07-26 to  2022-08-23
=========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-07-26
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_180_9
------------------------------------
| time/                 |          |
|    fps                | 148      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.3    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -113     |
|    reward             | 0.841531 |
|    std                | 0.998    |
|    value_loss         | 12.3     |
------------------------------------
======a2c Validation from:  2022-07-26 to  2022-08-23
a2c Sharpe Ratio:  -0.11389820366636749
======sac Training========
```

```
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_180_9
======sac Validation from:  2022-07-26 to  2022-08-23
sac Sharpe Ratio:  -0.1328672894988044
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_180_9
---------------------------------
| time/              |          |
|    fps             | 170      |
|    iterations      | 1        |
|    time_elapsed    | 12       |
|    total_timesteps | 2048     |
| train/             |          |
|    reward          | 1.7382145 |
---------------------------------
======ppo Validation from:  2022-07-26 to  2022-08-23
ppo Sharpe Ratio:  -0.4070263009409465
======Best Model Retraining from:  2010-01-04 to  2022-08-23
======Trading from:  2022-08-23 to  2022-09-21
============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-08-23
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_200_9
-----------------------------------
| time/                 |          |
|    fps                | 150      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.4    |
|    explained_variance | -0.0167  |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -629     |
|    reward             | 1.510617 |
|    std                | 1        |
|    value_loss         | 308      |
-----------------------------------
======a2c Validation from:  2022-08-23 to  2022-09-21
a2c Sharpe Ratio:  -0.5089713173267698
```

```
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_200_9
======sac Validation from:  2022-08-23 to  2022-09-21
sac Sharpe Ratio:  -0.34645214826347487
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_200_9
-----------------------------------
| time/              |            |
|    fps             | 168        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -0.13645948 |
-----------------------------------
======ppo Validation from:  2022-08-23 to  2022-09-21
ppo Sharpe Ratio:  -0.4072454132371545
======Best Model Retraining from:  2010-01-04 to  2022-09-21
======Trading from:  2022-09-21 to  2022-10-19
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-09-21
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_220_9
------------------------------------
| time/                 |          |
|    fps                | 149      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.4    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -122     |
|    reward             | 4.3199925 |
|    std                | 1        |
|    value_loss         | 54.6     |
------------------------------------
======a2c Validation from:  2022-09-21 to  2022-10-19
```

```
a2c Sharpe Ratio:  0.25176531627969445
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_220_9
======sac Validation from:  2022-09-21 to  2022-10-19
sac Sharpe Ratio:  0.305725512438637
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_220_9
-----------------------------------
| time/              |            |
|    fps             | 155        |
|    iterations      | 1          |
|    time_elapsed    | 13         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -0.18776749 |
-----------------------------------
======ppo Validation from:  2022-09-21 to  2022-10-19
ppo Sharpe Ratio:  0.0586091486833646
======Best Model Retraining from:  2010-01-04 to  2022-10-19
======Trading from:  2022-10-19 to  2022-11-16
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-10-19
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_240_9
------------------------------------
| time/                 |          |
|    fps                | 148      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.5    |
|    explained_variance | -2.81e-05 |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -216     |
|    reward             | 2.3132193 |
|    std                | 1.01     |
|    value_loss         | 36.5     |
------------------------------------
======a2c Validation from:  2022-10-19 to  2022-11-16
```

```
a2c Sharpe Ratio:  0.4609090177059267
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_240_9
======sac Validation from:  2022-10-19 to  2022-11-16
sac Sharpe Ratio:  0.17118324184310985
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_240_9
---------------------------------
| time/              |          |
|    fps             | 161      |
|    iterations      | 1        |
|    time_elapsed    | 12       |
|    total_timesteps | 2048     |
| train/             |          |
|    reward          | 0.5179037 |
---------------------------------
======ppo Validation from:  2022-10-19 to  2022-11-16
ppo Sharpe Ratio:  0.6231536551376474
======Best Model Retraining from:  2010-01-04 to  2022-11-16
======Trading from:  2022-11-16 to  2022-12-15
============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-11-16
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_260_9
-----------------------------------
| time/                 |          |
|    fps                | 143      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.2    |
|    explained_variance | 1.19e-07 |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -223     |
|    reward             | 3.1127691 |
|    std                | 0.995    |
|    value_loss         | 69.2     |
-----------------------------------
```

```
======a2c Validation from:  2022-11-16 to  2022-12-15
a2c Sharpe Ratio:  0.2565992575610972
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_260_9
======sac Validation from:  2022-11-16 to  2022-12-15
sac Sharpe Ratio:  0.0998137624501958
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_260_9
----------------------------------
| time/              |           |
|    fps             | 157       |
|    iterations      | 1         |
|    time_elapsed    | 13        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | -0.6490559 |
----------------------------------
======ppo Validation from:  2022-11-16 to  2022-12-15
ppo Sharpe Ratio:  0.23624924966179553
======Best Model Retraining from:  2010-01-04 to  2022-12-15
======Trading from:  2022-12-15 to  2023-01-17
=========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2022-12-15
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_280_9
-----------------------------------
| time/                 |           |
|    fps                | 145       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.5     |
|    explained_variance | -2.38e-07 |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | 214       |
|    reward             | 4.083568  |
|    std                | 1.01      |
|    value_loss         | 105       |
```

```
-------------------------------------
======a2c Validation from:  2022-12-15 to  2023-01-17
a2c Sharpe Ratio:  0.8022037680823477
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_280_9
======sac Validation from:  2022-12-15 to  2023-01-17
sac Sharpe Ratio:  0.7580717262514154
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_280_9
-----------------------------------
| time/              |            |
|    fps             | 160        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | 0.14893843 |
-----------------------------------
======ppo Validation from:  2022-12-15 to  2023-01-17
ppo Sharpe Ratio:  0.592535893431476
======Best Model Retraining from:  2010-01-04 to  2023-01-17
======Trading from:  2023-01-17 to  2023-02-14
==============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-01-17
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_300_9
------------------------------------
| time/                 |          |
|    fps                | 142      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.4    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -182     |
|    reward             | 1.4137645 |
|    std                | 1        |
```

```
|    value_loss         | 33.6      |
-----------------------------------
======a2c Validation from:  2023-01-17 to  2023-02-14
a2c Sharpe Ratio:  0.059161189833591366
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_300_9
======sac Validation from:  2023-01-17 to  2023-02-14
sac Sharpe Ratio:  0.23581382014680802
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_300_9
----------------------------------
| time/              |           |
|    fps             | 159       |
|    iterations      | 1         |
|    time_elapsed    | 12        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 0.30445197 |
----------------------------------
======ppo Validation from:  2023-01-17 to  2023-02-14
ppo Sharpe Ratio:  0.2664905238878775
======Best Model Retraining from:  2010-01-04 to  2023-02-14
======Trading from:  2023-02-14 to  2023-03-15
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-02-14
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_320_9
-----------------------------------
| time/                 |          |
|    fps                | 136      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.6    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -152     |
|    reward             | 2.520211 |
```

```
|    std                | 1.01     |
|    value_loss         | 29.3     |
-----------------------------------
======a2c Validation from:  2023-02-14 to  2023-03-15
a2c Sharpe Ratio:  -0.2646310749029866
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_320_9
======sac Validation from:  2023-02-14 to  2023-03-15
sac Sharpe Ratio:  -0.37729485660185924
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_320_9
-----------------------------------
| time/              |            |
|    fps             | 161        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -0.6530828 |
-----------------------------------
======ppo Validation from:  2023-02-14 to  2023-03-15
ppo Sharpe Ratio:  -0.49144147809832944
======Best Model Retraining from:  2010-01-04 to  2023-03-15
======Trading from:  2023-03-15 to  2023-04-13
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-03-15
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_340_9
------------------------------------
| time/                 |          |
|    fps                | 144      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.2    |
|    explained_variance | 0.0314   |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -287     |
```

```
|    reward             | 5.7479925 |
|    std                | 0.997     |
|    value_loss         | 114       |
-----------------------------------
======a2c Validation from:  2023-03-15 to  2023-04-13
a2c Sharpe Ratio:  0.6055789845633207
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_340_9
======sac Validation from:  2023-03-15 to  2023-04-13
sac Sharpe Ratio:  0.2574776236703614
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_340_9
-----------------------------------
| time/              |            |
|    fps             | 160        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -1.7497588 |
-----------------------------------
======ppo Validation from:  2023-03-15 to  2023-04-13
ppo Sharpe Ratio:  0.14880947373827697
======Best Model Retraining from:  2010-01-04 to  2023-04-13
======Trading from:  2023-04-13 to  2023-05-11
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-04-13
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_360_9
-----------------------------------
| time/                 |          |
|    fps                | 143      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.2    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
```

```
|    policy_loss        | -56.4     |
|    reward             | 1.7145574 |
|    std                | 0.996     |
|    value_loss         | 9.41      |
-------------------------------------
======a2c Validation from:  2023-04-13 to  2023-05-11
a2c Sharpe Ratio:  -0.1116394160180667
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_360_9
======sac Validation from:  2023-04-13 to  2023-05-11
sac Sharpe Ratio:  -0.24399012289546446
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_360_9
-----------------------------------
| time/              |            |
|    fps             | 161        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | 0.55784476 |
-----------------------------------
======ppo Validation from:  2023-04-13 to  2023-05-11
ppo Sharpe Ratio:  -0.2295441143093032
======Best Model Retraining from:  2010-01-04 to  2023-05-11
======Trading from:  2023-05-11 to  2023-06-09
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-05-11
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_380_9
-----------------------------------
| time/                 |          |
|    fps                | 141      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.3    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
```

```
|    n_updates          | 99       |
|    policy_loss        | -138     |
|    reward             | 1.566811 |
|    std                | 1        |
|    value_loss         | 17.9     |
-----------------------------------
======a2c Validation from:  2023-05-11 to  2023-06-09
a2c Sharpe Ratio:  0.34306720618677666
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_380_9
======sac Validation from:  2023-05-11 to  2023-06-09
sac Sharpe Ratio:  0.2578363874018719
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_380_9
-----------------------------------
| time/              |           |
|    fps             | 160       |
|    iterations      | 1         |
|    time_elapsed    | 12        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 0.3513223 |
-----------------------------------
======ppo Validation from:  2023-05-11 to  2023-06-09
ppo Sharpe Ratio:  0.23155890257892242
======Best Model Retraining from:  2010-01-04 to  2023-06-09
======Trading from:  2023-06-09 to  2023-07-11
==============================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-06-09
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_400_9
------------------------------------
| time/                 |           |
|    fps                | 145       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.1     |
|    explained_variance | 0         |
```

```
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -27.8     |
|    reward             | 1.0341798 |
|    std                | 0.992     |
|    value_loss         | 18.2      |
-------------------------------------
======a2c Validation from:  2023-06-09 to  2023-07-11
a2c Sharpe Ratio:  0.4390543165657006
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_400_9
======sac Validation from:  2023-06-09 to  2023-07-11
sac Sharpe Ratio:  0.28064924519821277
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_400_9
-----------------------------------
| time/              |            |
|    fps             | 158        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -0.4240753 |
-----------------------------------
======ppo Validation from:  2023-06-09 to  2023-07-11
ppo Sharpe Ratio:  0.3708796821634243
======Best Model Retraining from:  2010-01-04 to  2023-07-11
======Trading from:  2023-07-11 to  2023-08-08
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-07-11
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_420_9
-----------------------------------
| time/                 |           |
|    fps                | 141       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.4     |
```

```
|    explained_variance | -1.19e-07 |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | 77.2      |
|    reward             | 2.5170631 |
|    std                | 1         |
|    value_loss         | 24.5      |
-------------------------------------
======a2c Validation from:  2023-07-11 to  2023-08-08
a2c Sharpe Ratio:  0.11929494076766058
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_420_9
======sac Validation from:  2023-07-11 to  2023-08-08
sac Sharpe Ratio:  -0.11547549667423432
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_420_9
---------------------------------
| time/              |          |
|    fps             | 157      |
|    iterations      | 1        |
|    time_elapsed    | 12       |
|    total_timesteps | 2048     |
| train/             |          |
|    reward          | 1.1858159 |
---------------------------------
======ppo Validation from:  2023-07-11 to  2023-08-08
ppo Sharpe Ratio:  0.05202958408110215
======Best Model Retraining from:  2010-01-04 to  2023-08-08
======Trading from:  2023-08-08 to  2023-09-06
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-08-08
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_440_9
-----------------------------------
| time/                 |          |
|    fps                | 143      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
```

```
|    entropy_loss       | -38.1     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -88.1     |
|    reward             | 2.0726461 |
|    std                | 0.994     |
|    value_loss         | 17.3      |
-------------------------------------
======a2c Validation from:  2023-08-08 to  2023-09-06
a2c Sharpe Ratio:  -0.326462027375528
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_440_9
======sac Validation from:  2023-08-08 to  2023-09-06
sac Sharpe Ratio:  -0.09009202048377843
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_440_9
-------------------------------------
| time/              |              |
|    fps             | 154          |
|    iterations      | 1            |
|    time_elapsed    | 13           |
|    total_timesteps | 2048         |
| train/             |              |
|    reward          | 0.116301425 |
-------------------------------------
======ppo Validation from:  2023-08-08 to  2023-09-06
ppo Sharpe Ratio:  -0.19109430799463434
======Best Model Retraining from:  2010-01-04 to  2023-09-06
======Trading from:  2023-09-06 to  2023-10-04
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-09-06
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_460_9
-------------------------------------
| time/                 |           |
|    fps                | 141       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
```

```
|    entropy_loss       | -38.4     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -249      |
|    reward             | 1.8425769 |
|    std                | 1         |
|    value_loss         | 46.5      |
-------------------------------------
======a2c Validation from:  2023-09-06 to  2023-10-04
a2c Sharpe Ratio:  -0.7748721421325274
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_460_9
======sac Validation from:  2023-09-06 to  2023-10-04
sac Sharpe Ratio:  -0.9237468048585713
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_460_9
-----------------------------------
| time/              |            |
|    fps             | 157        |
|    iterations      | 1          |
|    time_elapsed    | 12         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -1.8436955 |
-----------------------------------
======ppo Validation from:  2023-09-06 to  2023-10-04
ppo Sharpe Ratio:  -1.1031002270561963
======Best Model Retraining from:  2010-01-04 to  2023-10-04
======Trading from:  2023-10-04 to  2023-11-01
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-10-04
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_480_9
-----------------------------------
| time/                 |          |
|    fps                | 144      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
```

```
| train/                  |           |
|    entropy_loss         | -38.4     |
|    explained_variance   | 0.152     |
|    learning_rate        | 0.0007    |
|    n_updates            | 99        |
|    policy_loss          | -96.4     |
|    reward               | 1.1691322 |
|    std                  | 1         |
|    value_loss           | 42.4      |
-------------------------------------
======a2c Validation from:  2023-10-04 to  2023-11-01
a2c Sharpe Ratio:  -0.7009656029491906
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_480_9
======sac Validation from:  2023-10-04 to  2023-11-01
sac Sharpe Ratio:  -0.45188856257308413
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_480_9
-------------------------------------
| time/               |             |
|    fps              | 156         |
|    iterations       | 1           |
|    time_elapsed     | 13          |
|    total_timesteps  | 2048        |
| train/              |             |
|    reward           | -0.71137464 |
-------------------------------------
======ppo Validation from:  2023-10-04 to  2023-11-01
ppo Sharpe Ratio:  -0.442711173362212
======Best Model Retraining from:  2010-01-04 to  2023-11-01
======Trading from:  2023-11-01 to  2023-11-30
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-11-01
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_500_9
-------------------------------------
| time/                   |           |
|    fps                  | 134       |
|    iterations           | 100       |
|    time_elapsed         | 3         |
```

```
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.4     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -195      |
|    reward             | 0.8058053 |
|    std                | 1         |
|    value_loss         | 33.9      |
-------------------------------------
======a2c Validation from:  2023-11-01 to  2023-11-30
a2c Sharpe Ratio:  0.7709295145749766
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_500_9
======sac Validation from:  2023-11-01 to  2023-11-30
sac Sharpe Ratio:  0.6256466975855252
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_500_9
-----------------------------------
| time/              |            |
|    fps             | 155        |
|    iterations      | 1          |
|    time_elapsed    | 13         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -0.1084854 |
-----------------------------------
======ppo Validation from:  2023-11-01 to  2023-11-30
ppo Sharpe Ratio:  0.7046735374871806
======Best Model Retraining from:  2010-01-04 to  2023-11-30
======Trading from:  2023-11-30 to  2023-12-29
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-11-30
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_520_9
------------------------------------
| time/                 |            |
|    fps                | 142        |
|    iterations         | 100        |
```

```
|    time_elapsed       | 3          |
|    total_timesteps    | 500        |
| train/                |            |
|    entropy_loss       | -38.3      |
|    explained_variance | 0.115      |
|    learning_rate      | 0.0007     |
|    n_updates          | 99         |
|    policy_loss        | -499       |
|    reward             | 0.89194405 |
|    std                | 0.999      |
|    value_loss         | 226        |
-------------------------------------
======a2c Validation from:  2023-11-30 to  2023-12-29
a2c Sharpe Ratio:  0.7198373613480614
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_520_9
======sac Validation from:  2023-11-30 to  2023-12-29
sac Sharpe Ratio:  0.658043805827739
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_520_9
-----------------------------------
| time/              |            |
|    fps             | 151        |
|    iterations      | 1          |
|    time_elapsed    | 13         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | 0.36050883 |
-----------------------------------
======ppo Validation from:  2023-11-30 to  2023-12-29
ppo Sharpe Ratio:  0.8155978054301785
======Best Model Retraining from:  2010-01-04 to  2023-12-29
======Trading from:  2023-12-29 to  2024-01-30
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2023-12-29
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_540_9
-----------------------------------
| time/                 |          |
|    fps                | 136      |
```

```
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.3    |
|    explained_variance | -0.0109  |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -326     |
|    reward             | 1.699114 |
|    std                | 1        |
|    value_loss         | 111      |
-------------------------------------
======a2c Validation from:  2023-12-29 to  2024-01-30
a2c Sharpe Ratio:  0.24050451831903708
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_540_9
======sac Validation from:  2023-12-29 to  2024-01-30
sac Sharpe Ratio:  0.2666580168221358
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_540_9
---------------------------------
| time/              |          |
|    fps             | 152      |
|    iterations      | 1        |
|    time_elapsed    | 13       |
|    total_timesteps | 2048     |
| train/             |          |
|    reward          | -1.233893 |
---------------------------------
======ppo Validation from:  2023-12-29 to  2024-01-30
ppo Sharpe Ratio:  0.3365675443796178
======Best Model Retraining from:  2010-01-04 to  2024-01-30
======Trading from:  2024-01-30 to  2024-02-28
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-01-30
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_560_9
-------------------------------------
| time/                 |          |
```

```
|    fps                | 134       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.5     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -88.2     |
|    reward             | 2.5109413 |
|    std                | 1.01      |
|    value_loss         | 24.7      |
-------------------------------------
======a2c Validation from:  2024-01-30 to  2024-02-28
a2c Sharpe Ratio:  0.555724643716136
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_560_9
======sac Validation from:  2024-01-30 to  2024-02-28
sac Sharpe Ratio:  0.48714309324674226
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_560_9
-------------------------------------
| time/              |             |
|    fps             | 153         |
|    iterations      | 1           |
|    time_elapsed    | 13          |
|    total_timesteps | 2048        |
| train/             |             |
|    reward          | -0.46166068 |
-------------------------------------
======ppo Validation from:  2024-01-30 to  2024-02-28
ppo Sharpe Ratio:  0.40821735092729156
======Best Model Retraining from:  2010-01-04 to  2024-02-28
======Trading from:  2024-02-28 to  2024-03-27
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-02-28
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_580_9
-------------------------------------
```

```
| time/                 |          |
|    fps                | 137      |
|    iterations         | 100      |
|    time_elapsed       | 3        |
|    total_timesteps    | 500      |
| train/                |          |
|    entropy_loss       | -38.3    |
|    explained_variance | 0        |
|    learning_rate      | 0.0007   |
|    n_updates          | 99       |
|    policy_loss        | -112     |
|    reward             | 2.4579809 |
|    std                | 0.998    |
|    value_loss         | 26.1     |
-------------------------------------
======a2c Validation from:  2024-02-28 to  2024-03-27
a2c Sharpe Ratio:  0.5279580322259226
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_580_9
======sac Validation from:  2024-02-28 to  2024-03-27
sac Sharpe Ratio:  0.492814972425472
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_580_9
---------------------------------
| time/              |          |
|    fps             | 147      |
|    iterations      | 1        |
|    time_elapsed    | 13       |
|    total_timesteps | 2048     |
| train/             |          |
|    reward          | 0.6383551 |
---------------------------------
======ppo Validation from:  2024-02-28 to  2024-03-27
ppo Sharpe Ratio:  0.4339630599170644
======Best Model Retraining from:  2010-01-04 to  2024-03-27
======Trading from:  2024-03-27 to  2024-04-25
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-03-27
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_600_9
```

```
-------------------------------------
| time/                 |           |
|    fps                | 124       |
|    iterations         | 100       |
|    time_elapsed       | 4         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.3     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -96.8     |
|    reward             | 1.1630917 |
|    std                | 0.999     |
|    value_loss         | 14.5      |
-------------------------------------
======a2c Validation from:  2024-03-27 to  2024-04-25
a2c Sharpe Ratio:  -0.3213152278324027
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_600_9
======sac Validation from:  2024-03-27 to  2024-04-25
sac Sharpe Ratio:  -0.08780048147965884
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_600_9
-------------------------------------
| time/              |              |
|    fps             | 150          |
|    iterations      | 1            |
|    time_elapsed    | 13           |
|    total_timesteps | 2048         |
| train/             |              |
|    reward          | -0.087406956 |
-------------------------------------
======ppo Validation from:  2024-03-27 to  2024-04-25
ppo Sharpe Ratio:  -0.3582461955713448
======Best Model Retraining from:  2010-01-04 to  2024-04-25
======Trading from:  2024-04-25 to  2024-05-23
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-04-25
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
```

```
Logging to tensorboard_log/a2c/a2c_620_9
-------------------------------------
| time/                 |           |
|    fps                | 138       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.4     |
|    explained_variance | 0         |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | -28.6     |
|    reward             | 3.054659  |
|    std                | 1         |
|    value_loss         | 46.6      |
-------------------------------------
======a2c Validation from:  2024-04-25 to  2024-05-23
a2c Sharpe Ratio:  0.9901954341111886
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_620_9
======sac Validation from:  2024-04-25 to  2024-05-23
sac Sharpe Ratio:  0.832316278786897
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_620_9
-----------------------------------
| time/              |            |
|    fps             | 146        |
|    iterations      | 1          |
|    time_elapsed    | 13         |
|    total_timesteps | 2048       |
| train/             |            |
|    reward          | -1.0277015 |
-----------------------------------
======ppo Validation from:  2024-04-25 to  2024-05-23
ppo Sharpe Ratio:  0.5816808784786365
======Best Model Retraining from:  2010-01-04 to  2024-05-23
======Trading from:  2024-05-23 to  2024-06-24
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-05-23
======a2c Training========
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
```

```
Using cpu device
Logging to tensorboard_log/a2c/a2c_640_9
-------------------------------------
| time/                 |             |
|    fps                | 133         |
|    iterations         | 100         |
|    time_elapsed       | 3           |
|    total_timesteps    | 500         |
| train/                |             |
|    entropy_loss       | -38.5       |
|    explained_variance | 0           |
|    learning_rate      | 0.0007      |
|    n_updates          | 99          |
|    policy_loss        | -274        |
|    reward             | 0.85620445  |
|    std                | 1.01        |
|    value_loss         | 50.6        |
-------------------------------------
======a2c Validation from:  2024-05-23 to  2024-06-24
a2c Sharpe Ratio:  0.13622863578058597
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_640_9
======sac Validation from:  2024-05-23 to  2024-06-24
sac Sharpe Ratio:  0.19449089123837904
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_640_9
----------------------------------
| time/              |           |
|    fps             | 149       |
|    iterations      | 1         |
|    time_elapsed    | 13        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 0.4756614 |
----------------------------------
======ppo Validation from:  2024-05-23 to  2024-06-24
ppo Sharpe Ratio:  0.4183942172623797
======Best Model Retraining from:  2010-01-04 to  2024-06-24
======Trading from:  2024-06-24 to  2024-07-23
==========================================
turbulence_threshold:  227.87028410067566
======Model training from:  2010-01-04 to  2024-06-24
======a2c Training========
```

```
{'n_steps': 5, 'ent_coef': 0.005, 'learning_rate': 0.0007}
Using cpu device
Logging to tensorboard_log/a2c/a2c_660_9
-------------------------------------
| time/                 |           |
|    fps                | 137       |
|    iterations         | 100       |
|    time_elapsed       | 3         |
|    total_timesteps    | 500       |
| train/                |           |
|    entropy_loss       | -38.3     |
|    explained_variance | -2.38e-07 |
|    learning_rate      | 0.0007    |
|    n_updates          | 99        |
|    policy_loss        | 106       |
|    reward             | 0.85311204 |
|    std                | 0.998     |
|    value_loss         | 43.3      |
-------------------------------------
======a2c Validation from:  2024-06-24 to  2024-07-23
a2c Sharpe Ratio:  0.5300401769588926
======sac Training========
{'buffer_size': 1000, 'learning_rate': 0.0003, 'batch_size': 256,
'ent_coef': 'auto'}
Using cpu device
Logging to tensorboard_log/sac/sac_660_9
======sac Validation from:  2024-06-24 to  2024-07-23
sac Sharpe Ratio:  0.3135970401477538
======ppo Training========
{'ent_coef': 0.01, 'n_steps': 2048, 'learning_rate': 0.00025,
'batch_size': 128}
Using cpu device
Logging to tensorboard_log/ppo/ppo_660_9
----------------------------------
| time/              |           |
|    fps             | 151       |
|    iterations      | 1         |
|    time_elapsed    | 13        |
|    total_timesteps | 2048      |
| train/             |           |
|    reward          | 1.4515013 |
----------------------------------
======ppo Validation from:  2024-06-24 to  2024-07-23
ppo Sharpe Ratio:  0.6447057670454595
======Best Model Retraining from:  2010-01-04 to  2024-07-23
======Trading from:  2024-07-23 to  2024-08-20

Training Ensemble Models: 100%|██████████| 3/3 [42:25<00:00,
848.35s/it]
```

```
Ensemble Strategy took:  14.176815529664358  minutes
SAC training completed!
```

```
import pickle
with open('PPO.pkl', 'wb') as f:
    pickle.dump(PPO, f)

with open('SAC.pkl', 'wb') as f:
    pickle.dump(SAC, f)

with open('A2C.pkl', 'wb') as f:
    pickle.dump(A2C, f)

data_risk_indicator = processed[(processed.date<TRAIN_END_DATE) &
(processed.date>=TRAIN_START_DATE)]
insample_risk_indicator =
data_risk_indicator.drop_duplicates(subset=['date'])

insample_risk_indicator
```

```
             date tic   adj_close       close        high         low
\
0      2010-01-04   A   20.084951   22.389128   22.625179   22.267525

27     2010-01-05   A   19.866777   22.145924   22.331903   22.002861

54     2010-01-06   A   19.796186   22.067240   22.174536   22.002861

81     2010-01-07   A   19.770527   22.038628   22.045780   21.816881

108    2010-01-08   A   19.764101   22.031473   22.067240   21.745352

...           ...  ..         ...         ...         ...         ...

77382  2021-05-24   A  130.549561  133.339996  134.410004  132.529999

77409  2021-05-25   A  130.441879  133.229996  134.800003  133.009995

77436  2021-05-26   A  130.500626  133.289993  138.000000  133.250000

77463  2021-05-27   A  134.661667  137.539993  138.139999  133.160004

77490  2021-05-28   A  135.239349  138.130005  139.210007  138.000000


             open     volume      macd     boll_ub     boll_lb
rsi_30  \
0       22.453505  3815561.0  0.000000   22.611468   21.923583
0.000000
27      22.324751  4186031.0 -0.005457   22.611468   21.923583
```

```
0.000000
54      22.067240  3243779.0 -0.009393   22.536374   21.865154
0.000000
81      22.017166  3095172.0 -0.011986   22.478628   21.841831
0.000000
108     21.917025  3733918.0 -0.013427   22.433302   21.835654
0.000000
...           ...        ...       ...         ...         ...
...
77382  133.509995  1312300.0  0.151901  136.208348  128.070649
55.343350
77409  133.410004  1890600.0  0.268181  135.544688  128.409309
55.185016
77436  136.300003  2498400.0  0.361014  135.276344  128.526652
55.257242
77463  133.320007  3699600.0  0.768664  136.181647  127.960348
59.983213
77490  138.600006  1264400.0  1.126354  137.183822  127.407174
60.581166

           cci_30       dx_30  close_30_sma  close_60_sma  turbulence

0      -66.666667  100.000000     22.389128     22.389128    0.000000

27     -66.666667  100.000000     22.267526     22.267526    0.000000

54     -69.260722  100.000000     22.200764     22.200764    0.000000

81     -94.985258  100.000000     22.160230     22.160230    0.000000

108    -79.514800  100.000000     22.134478     22.134478    0.000000

...           ...         ...           ...           ...         ...

77382   26.026642    2.659779    132.797665    128.330166    7.903010

77409   34.575480    4.863827    132.806332    128.475999    8.542653

77436   77.083471   20.627219    132.850332    128.636832   10.050386

77463  122.915437   21.237547    132.992331    128.940832   21.773050

77490  185.321637   25.893136    133.110665    129.326499   11.838870


[2871 rows x 17 columns]

insample_risk_indicator.describe()

         adj_close        close         high          low         open
\
```

```
count  2871.000000  2871.000000  2871.000000  2871.000000  2871.000000
mean     48.404036    51.249515    51.749015    50.729619    51.239579
std      25.964746    25.938871    26.192268    25.719282    25.952034
min      17.306425    19.291845    19.706724    19.084406    19.334764
25%      28.420526    31.541488    31.866953    31.119456    31.527182
50%      38.141766    41.344776    41.623749    41.022888    41.310001
75%      64.572243    67.540001    68.165001    66.900002    67.500000
max     135.239349   138.130005   139.210007   138.000000   138.600006


              volume         macd      boll_ub      boll_lb
rsi_30  \
count  2.871000e+03  2871.000000  2871.000000  2871.000000
2871.000000
mean   3.209902e+06     0.267835    53.501758    48.264174
53.230177
std    2.188438e+06     0.891018    26.731276    24.374863
8.098559
min    2.719000e+05    -4.673526    21.209599    18.619792
0.000000
25%    1.717750e+06    -0.229932    32.997811    29.585806
47.838797
50%    2.594100e+06     0.267917    42.808877    39.524896
53.549745
75%    4.118744e+06     0.704089    71.005960    63.988851
59.345005
max    2.536867e+07     3.478340   138.558282   130.510372
73.489382

            cci_30        dx_30  close_30_sma  close_60_sma
turbulence
count  2871.000000  2871.000000   2871.000000   2871.000000
2871.000000
mean     27.664638    23.474557     50.689741     50.118674
32.702407
std     108.937549    16.315274     25.291504     24.631983
52.894444
min    -330.668642     0.015052     20.245112     20.464592
0.000000
25%     -53.918302    10.308317     31.252027     30.838281
13.497704
50%      43.832910    20.661461     41.036958     40.670601
21.999442
```

```
75%     111.318698    34.552957     67.909833     67.403833
35.184550
max     424.656082   100.000000    133.110665    129.326499
1164.879747
```

```
insample_risk_indicator.turbulence.quantile(0.996)
```

```
409.8218417382907
```

```
insample_risk_indicator.turbulence.describe()
```

```
count    2871.000000
mean       32.702407
std        52.894444
min         0.000000
25%        13.497704
50%        21.999442
75%        35.184550
max      1164.879747
Name: turbulence, dtype: float64
```

```
ensemble_models_summary
```

```
{'A2C':    Iter   Val Start     Val End Model Used A2C Sharpe PPO
Sharpe DDPG Sharpe  \
 0    40  2022-01-03  2022-02-01        SAC  -0.423922  -0.273439
None
 1    60  2022-02-01  2022-03-02        A2C  -0.453345  -0.657718
None
 2    80  2022-03-02  2022-03-30        SAC   0.864892   0.684605
None
 3   100  2022-03-30  2022-04-28        A2C   -0.34253  -0.490712
None
 4   120  2022-04-28  2022-05-26        A2C   0.519452   0.153582
None
 5   140  2022-05-26  2022-06-27        SAC  -0.260147  -0.222712
None
 6   160  2022-06-27  2022-07-26        SAC   0.332858   0.258652
None
 7   180  2022-07-26  2022-08-23        SAC  -0.262171  -0.291139
None
 8   200  2022-08-23  2022-09-21        PPO  -0.372933  -0.360953
None
 9   220  2022-09-21  2022-10-19        SAC   0.209318   0.261868
None
 10  240  2022-10-19  2022-11-16        A2C   0.755574   0.506843
None
 11  260  2022-11-16  2022-12-15        SAC   0.016867  -0.101778
None
 12  280  2022-12-15  2023-01-17        SAC   0.491225   0.498177
None
```

```
 13  300  2023-01-17  2023-02-14        A2C   0.363999   0.266008
None
 14  320  2023-02-14  2023-03-15        PPO  -0.379639   -0.35501
None
 15  340  2023-03-15  2023-04-13        SAC   0.458739   0.438165
None
 16  360  2023-04-13  2023-05-11        SAC  -0.159019  -0.060665
None
 17  380  2023-05-11  2023-06-09        PPO   0.570381   0.600905
None
 18  400  2023-06-09  2023-07-11        A2C   0.513168   0.323202
None
 19  420  2023-07-11  2023-08-08        SAC  -0.161957  -0.118398
None
 20  440  2023-08-08  2023-09-06        PPO  -0.110935    0.01418
None
 21  460  2023-09-06  2023-10-04        A2C  -0.961762  -1.331902
None
 22  480  2023-10-04  2023-11-01        SAC  -0.545037   -0.53227
None
 23  500  2023-11-01  2023-11-30        PPO  -0.037628   0.721639
None
 24  520  2023-11-30  2023-12-29        PPO   0.765429   0.850939
None
 25  540  2023-12-29  2024-01-30        SAC   0.040378  -0.189469
None
 26  560  2024-01-30  2024-02-28        A2C    0.64016   0.588847
None
 27  580  2024-02-28  2024-03-27        A2C   0.414401   0.206586
None
 28  600  2024-03-27  2024-04-25        PPO   -0.28788  -0.241008
None
 29  620  2024-04-25  2024-05-23        A2C   0.724756   0.497639
None
 30  640  2024-05-23  2024-06-24        SAC   0.072148   0.152596
None
 31  660  2024-06-24  2024-07-23        A2C   0.422525   0.276007
None
```

```
    SAC Sharpe TD3 Sharpe
 0   -0.160689       None
 1   -0.454324       None
 2    0.927744       None
 3   -0.563518       None
 4    0.186095       None
 5   -0.091835       None
 6    0.461719       None
 7   -0.255906       None
 8   -0.492265       None
```

```
 9    0.314763       None
 10   0.642621       None
 11   0.157658       None
 12   0.627456       None
 13  -0.098879       None
 14  -0.619906       None
 15   0.580698       None
 16   0.019134       None
 17   0.136974       None
 18   0.205081       None
 19   0.005009       None
 20  -0.147471       None
 21  -0.992069       None
 22  -0.516956       None
 23   0.706375       None
 24   0.697468       None
 25   0.409176       None
 26   0.348987       None
 27   0.225673       None
 28  -0.281183       None
 29   0.240712       None
 30   0.557386       None
 31   0.217699       None  ,
 'PPO':    Iter   Val Start     Val End Model Used A2C Sharpe PPO
Sharpe DDPG Sharpe  \
 0    40  2022-01-03  2022-02-01        A2C   0.066905  -0.156457
None
 1    60  2022-02-01  2022-03-02        A2C   -0.58064  -0.693976
None
 2    80  2022-03-02  2022-03-30        SAC   0.755812   0.681938
None
 3   100  2022-03-30  2022-04-28        PPO  -0.539055  -0.410631
None
 4   120  2022-04-28  2022-05-26        SAC   0.074859   0.081993
None
 5   140  2022-05-26  2022-06-27        A2C  -0.131912  -0.322952
None
 6   160  2022-06-27  2022-07-26        SAC   0.216322   0.378234
None
 7   180  2022-07-26  2022-08-23        A2C  -0.270071  -0.358532
None
 8   200  2022-08-23  2022-09-21        A2C   -0.40838  -0.418668
None
 9   220  2022-09-21  2022-10-19        A2C   0.213144  -0.035512
None
 10  240  2022-10-19  2022-11-16        A2C   0.458996   0.424008
None
 11  260  2022-11-16  2022-12-15        SAC   0.249965   0.191531
None
```

```
 12  280  2022-12-15  2023-01-17         SAC   0.548045   0.403125
None
 13  300  2023-01-17  2023-02-14         A2C    0.30063   0.252601
None
 14  320  2023-02-14  2023-03-15         PPO   -0.53802  -0.435054
None
 15  340  2023-03-15  2023-04-13         SAC   0.389482   0.232115
None
 16  360  2023-04-13  2023-05-11         A2C  -0.318568  -0.324569
None
 17  380  2023-05-11  2023-06-09         A2C   0.550554   0.364075
None
 18  400  2023-06-09  2023-07-11         SAC   0.387072   0.435392
None
 19  420  2023-07-11  2023-08-08         SAC  -0.195489   0.080821
None
 20  440  2023-08-08  2023-09-06         SAC   0.105962  -0.163484
None
 21  460  2023-09-06  2023-10-04         PPO  -1.060079  -0.869687
None
 22  480  2023-10-04  2023-11-01         PPO  -0.527054  -0.519677
None
 23  500  2023-11-01  2023-11-30         A2C   1.100511   0.862696
None
 24  520  2023-11-30  2023-12-29         PPO    0.63399   1.108872
None
 25  540  2023-12-29  2024-01-30         PPO   0.393721   0.420705
None
 26  560  2024-01-30  2024-02-28         A2C   0.569436   0.225858
None
 27  580  2024-02-28  2024-03-27         PPO   -0.01298   0.483465
None
 28  600  2024-03-27  2024-04-25         A2C  -0.118535  -0.366066
None
 29  620  2024-04-25  2024-05-23         SAC   1.192422   0.495259
None
 30  640  2024-05-23  2024-06-24         PPO  -0.198657   0.080233
None
 31  660  2024-06-24  2024-07-23         SAC   0.611181   0.628731
None
```

```
    SAC Sharpe TD3 Sharpe
 0   -0.020449       None
 1   -0.653997       None
 2    0.807321       None
 3   -0.528702       None
 4    0.135029       None
 5   -0.177715       None
 6     0.45643       None
```

```
 7   -0.296088       None
 8   -0.420015       None
 9    0.122171       None
 10   0.448328       None
 11   0.295939       None
 12   0.710423       None
 13   0.297472       None
 14  -0.475949       None
 15   0.537226       None
 16  -0.363935       None
 17   0.547393       None
 18   0.467789       None
 19   0.212915       None
 20   0.165567       None
 21  -0.937806       None
 22  -0.816235       None
 23   0.855397       None
 24   0.739752       None
 25   0.376273       None
 26   0.287517       None
 27   0.396496       None
 28  -0.226614       None
 29   1.294929       None
 30  -0.015518       None
 31   0.669975       None  ,
 'SAC':    Iter   Val Start     Val End Model Used A2C Sharpe PPO
Sharpe DDPG Sharpe  \
 0    40  2022-01-03  2022-02-01        SAC  -0.277006  -0.363002
None
 1    60  2022-02-01  2022-03-02        A2C  -0.561162   -0.60733
None
 2    80  2022-03-02  2022-03-30        SAC   0.671777   0.647687
None
 3   100  2022-03-30  2022-04-28        SAC   -0.70124  -0.637115
None
 4   120  2022-04-28  2022-05-26        SAC   0.109504   0.119214
None
 5   140  2022-05-26  2022-06-27        A2C  -0.021113  -0.197479
None
 6   160  2022-06-27  2022-07-26        SAC   0.177078   0.078897
None
 7   180  2022-07-26  2022-08-23        A2C  -0.113898  -0.407026
None
 8   200  2022-08-23  2022-09-21        SAC  -0.508971  -0.407245
None
 9   220  2022-09-21  2022-10-19        SAC   0.251765   0.058609
None
 10  240  2022-10-19  2022-11-16        PPO   0.460909   0.623154
None
```

```
 11  260  2022-11-16  2022-12-15        A2C   0.256599   0.236249
None
 12  280  2022-12-15  2023-01-17        A2C   0.802204   0.592536
None
 13  300  2023-01-17  2023-02-14        PPO   0.059161   0.266491
None
 14  320  2023-02-14  2023-03-15        A2C  -0.264631  -0.491441
None
 15  340  2023-03-15  2023-04-13        A2C   0.605579   0.148809
None
 16  360  2023-04-13  2023-05-11        A2C  -0.111639  -0.229544
None
 17  380  2023-05-11  2023-06-09        A2C   0.343067   0.231559
None
 18  400  2023-06-09  2023-07-11        A2C   0.439054    0.37088
None
 19  420  2023-07-11  2023-08-08        A2C   0.119295    0.05203
None
 20  440  2023-08-08  2023-09-06        SAC  -0.326462  -0.191094
None
 21  460  2023-09-06  2023-10-04        A2C  -0.774872    -1.1031
None
 22  480  2023-10-04  2023-11-01        PPO  -0.700966  -0.442711
None
 23  500  2023-11-01  2023-11-30        A2C    0.77093   0.704674
None
 24  520  2023-11-30  2023-12-29        PPO   0.719837   0.815598
None
 25  540  2023-12-29  2024-01-30        PPO   0.240505   0.336568
None
 26  560  2024-01-30  2024-02-28        A2C   0.555725   0.408217
None
 27  580  2024-02-28  2024-03-27        A2C   0.527958   0.433963
None
 28  600  2024-03-27  2024-04-25        SAC  -0.321315  -0.358246
None
 29  620  2024-04-25  2024-05-23        A2C   0.990195   0.581681
None
 30  640  2024-05-23  2024-06-24        PPO   0.136229   0.418394
None
 31  660  2024-06-24  2024-07-23        PPO    0.53004   0.644706
None

    SAC Sharpe TD3 Sharpe
 0   -0.044051       None
 1   -0.624633       None
 2    0.770756       None
 3   -0.545692       None
 4    0.175903       None
```

```
 5   -0.077794        None
 6    0.337729        None
 7   -0.132867        None
 8   -0.346452        None
 9    0.305726        None
 10   0.171183        None
 11   0.099814        None
 12   0.758072        None
 13   0.235814        None
 14  -0.377295        None
 15   0.257478        None
 16   -0.24399        None
 17   0.257836        None
 18   0.280649        None
 19  -0.115475        None
 20  -0.090092        None
 21  -0.923747        None
 22  -0.451889        None
 23   0.625647        None
 24   0.658044        None
 25   0.266658        None
 26   0.487143        None
 27   0.492815        None
 28    -0.0878        None
 29   0.832316        None
 30   0.194491        None
 31   0.313597        None  }
```

```
unique_trade_date = processed[(processed.date >
TEST_START_DATE)&(processed.date <= TEST_END_DATE)].date.unique()

df_trade_date = pd.DataFrame({'datadate': unique_trade_date})

df_account_value = pd.DataFrame()
for i in range(rebalance_window + validation_window,
len(unique_trade_date) + 1, rebalance_window):
    temp =
pd.read_csv(f'results/account_value_trade_ensemble_{i}.csv')
    df_account_value = pd.concat([df_account_value, temp],
ignore_index=True)

sharpe = (252**0.5) *
df_account_value['account_value'].pct_change(1).mean() / \
         df_account_value['account_value'].pct_change(1).std()
print('Sharpe Ratio:', sharpe)

df_account_value =
df_account_value.join(df_trade_date[validation_window:].reset_index(dr
op=True))
```

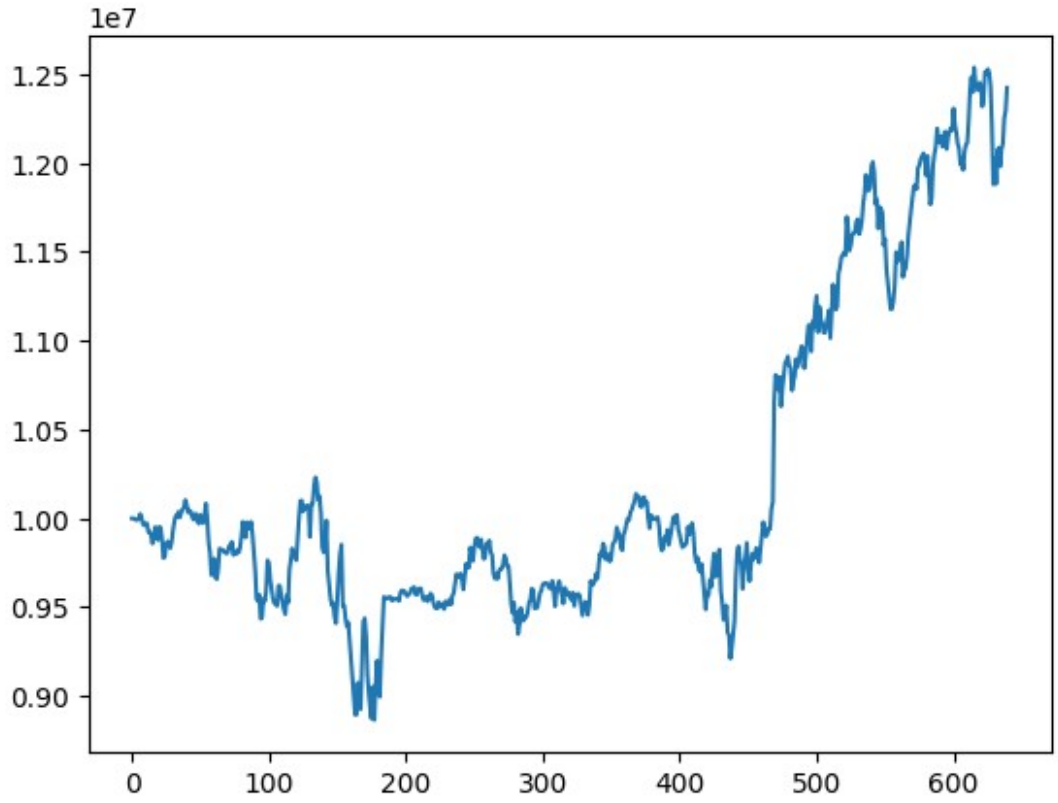
```
Sharpe Ratio: 0.7494608207778994
```

```
df_account_value.head()
```

	account_value	date	daily_return	datadate
0	1.000000e+07	2022-02-01	NaN	2022-02-01
1	1.000098e+07	2022-02-02	0.000098	2022-02-02
2	9.995799e+06	2022-02-03	-0.000518	2022-02-03
3	9.990878e+06	2022-02-04	-0.000492	2022-02-04
4	9.991408e+06	2022-02-07	0.000053	2022-02-07

```
df_account_value.account_value.plot()
```

```
<Axes: >
```




```
print("==============Get Backtest Results===========")
now = datetime.datetime.now().strftime('%Y%m%d-%Hh%M')

perf_stats_all = backtest_stats(account_value=df_account_value)
perf_stats_all = pd.DataFrame(perf_stats_all)
```

```
==============Get Backtest Results===========
Annual return          0.089159
Cumulative returns     0.242226
Annual volatility      0.124444
```

```
Sharpe ratio             0.749461
Calmar ratio             0.668633
Stability                0.543350
Max drawdown            -0.133346
Omega ratio              1.142323
Sortino ratio            1.126201
Skew                          NaN
Kurtosis                      NaN
Tail ratio               1.023071
Daily value at risk     -0.015308
dtype: float64
```

```
print("==============Get Baseline Stats===========")
df_dji_ = get_baseline(
        ticker="^DJI",
        start = df_account_value.loc[0,'date'],
        end = df_account_value.loc[len(df_account_value)-1,'date'])

stats = backtest_stats(df_dji_, value_col_name = 'close')
```

```
==============Get Baseline Stats===========

[**********************100%***********************]  1 of 1 completed

Shape of DataFrame:  (639, 8)
Annual return            0.057743
Cumulative returns       0.152978
Annual volatility        0.141982
Sharpe ratio             0.466963
Calmar ratio             0.299262
Stability                0.620934
Max drawdown            -0.192950
Omega ratio              1.082838
Sortino ratio            0.659416
Skew                          NaN
Kurtosis                      NaN
Tail ratio               0.978584
Daily value at risk     -0.017625
dtype: float64
```

```
df_dji = pd.DataFrame()
df_dji['date'] = df_account_value['date']
df_dji['dji'] = df_dji_['close'] / df_dji_['close'][0] *
env_kwargs["initial_amount"]
print("df_dji: ", df_dji)
df_dji.to_csv("df_dji.csv")
df_dji = df_dji.set_index(df_dji.columns[0])
print("df_dji: ", df_dji)
df_dji.to_csv("df_dji+.csv")

df_account_value.to_csv('df_account_value.csv')
```

```
df_dji:             date           dji
0    2022-02-01  1.000000e+07
1    2022-02-02  1.006450e+07
2    2022-02-03  1.010486e+07
3    2022-02-04  9.984146e+06
4    2022-02-07  9.987742e+06
..          ...           ...
635  2024-08-13  1.122151e+07
636  2024-08-14  1.132260e+07
637  2024-08-15  1.146346e+07
638  2024-08-16  1.152978e+07
639  2024-08-19           NaN

[640 rows x 2 columns]
df_dji:                        dji
date
2022-02-01  1.000000e+07
2022-02-02  1.006450e+07
2022-02-03  1.010486e+07
2022-02-04  9.984146e+06
2022-02-07  9.987742e+06
...                  ...
2024-08-13  1.122151e+07
2024-08-14  1.132260e+07
2024-08-15  1.146346e+07
2024-08-16  1.152978e+07
2024-08-19           NaN

[640 rows x 1 columns]
```

```python
df.to_csv("df.csv")

df_result_ensemble = pd.DataFrame({
    'date': df_account_value['date'],
    'ensemble': df_account_value['account_value']
})
df_result_ensemble = df_result_ensemble.set_index('date')

print("df_result_ensemble.columns:", df_result_ensemble.columns)
print("df_trade_date:", df_trade_date)

df_result_ensemble.to_csv("df_result_ensemble.csv")
print("df_result_ensemble:", df_result_ensemble)
```

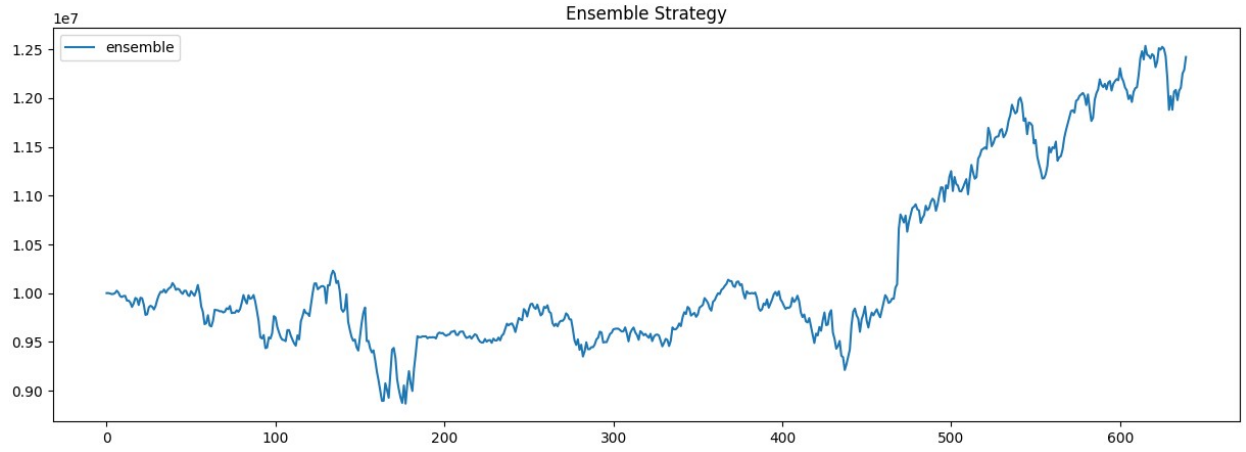
```
df_result_ensemble.columns: Index(['ensemble'], dtype='object')
df_trade_date:         datadate
0    2022-01-03
1    2022-01-04
2    2022-01-05
3    2022-01-06
```

```
4    2022-01-07
..          ...
656  2024-08-14
657  2024-08-15
658  2024-08-16
659  2024-08-19
660  2024-08-20

[661 rows x 1 columns]
df_result_ensemble:                  ensemble
date
2022-02-01  1.000000e+07
2022-02-02  1.000098e+07
2022-02-03  9.995799e+06
2022-02-04  9.990878e+06
2022-02-07  9.991408e+06
...                  ...
2024-08-13  1.207706e+07
2024-08-14  1.210727e+07
2024-08-15  1.225331e+07
2024-08-16  1.229087e+07
2024-08-19  1.242226e+07

[640 rows x 1 columns]
```

```
result=pd.read_csv("df_result_ensemble.csv")
plt.rcParams["figure.figsize"] = (15, 5)
result.plot(title="Ensemble Strategy")
plt.show()
```




```
df_result_ensemble = pd.read_csv("df_result_ensemble.csv",
parse_dates=['date']).set_index('date')
df_dji = pd.read_csv("df_dji.csv",
parse_dates=['date']).set_index('date')
```

```
plt.rcParams["figure.figsize"] = (15, 5)

plt.plot(df_result_ensemble.index, df_result_ensemble['ensemble'],
label='Ensemble Strategy')
plt.plot(df_dji.index, df_dji['dji'], label='DJIA', color='orange')

plt.xlabel("Date")
plt.ylabel("Account Value")
plt.title("Ensemble Strategy vs DJIA")
plt.legend()
plt.show()
```