

## ✓ Predict Bike Sharing Demand with AutoGluon Template

### Project: Predict Bike Sharing Demand with AutoGluon

This notebook is a template with each step that you need to complete for the project.

Please fill in your code where there are explicit ? markers in the notebook. You are welcome to add more cells and code as you see fit.

Once you have completed all the code implementations, please export your notebook as a HTML file so the reviews can view your code. Make sure you have all outputs correctly outputted.

File-> Export Notebook As... -> Export Notebook as HTML

There is a writeup to complete as well after all code implementation is done. Please answer all questions and attach the necessary tables and charts. You can complete the writeup in either markdown or PDF.

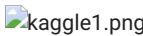

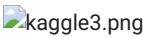
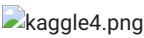
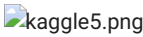
Completing the code template and writeup template will cover all of the rubric points for this project.

The rubric contains "Stand Out Suggestions" for enhancing the project beyond the minimum requirements. The stand out suggestions are optional. If you decide to pursue the "stand out suggestions", you can include the code in this notebook and also discuss the results in the writeup file.

## ✓ Step 1: Create an account with Kaggle

### ✓ Create Kaggle Account and download API key

Below is example of steps to get the API username and key. Each student will have their own username and key.

1. Open account settings.  
2. Scroll down to API and click Create New API Token.  
3. Open up kaggle.json and use the username and key. 

## ✓ Step 2: Download the Kaggle dataset using the kaggle python library

### ✓ Open up Sagemaker Studio and use starter template

1. Notebook should be using a ml.t3.medium instance (2 vCPU + 4 GiB)
2. Notebook should be using kernel: Python 3 (MXNet 1.8 Python 3.7 CPU Optimized)

### ✓ Install packages

```
!pip install -U pip
!pip install -U setuptools wheel
!pip install -U "mxnet<2.0.0" bokeh==2.0.1
!pip install autogluon #--no-cache-dir
# Without --no-cache-dir, smaller aws instances may have trouble installing
```

Requirement already satisfied: pip in /usr/local/lib/python3.10/dist-packages (24.1.2)  
Collecting pip  
Using cached pip-24.2-py3-none-any.whl.metadata (3.6 kB)  
Using cached pip-24.2-py3-none-any.whl (1.8 MB)  
Installing collected packages: pip  
Attempting uninstall: pip  
Found existing installation: pip 24.1.2  
Uninstalling pip-24.1.2:  
Successfully uninstalled pip-24.1.2  
Successfully installed pip-24.2  
Requirement already satisfied: setuptools in /usr/local/lib/python3.10/dist-packages (71.0.4)  
Collecting setuptools  
Using cached setuptools-75.1.0-py3-none-any.whl.metadata (6.9 kB)  
Requirement already satisfied: wheel in /usr/local/lib/python3.10/dist-packages (0.44.0)  
Using cached setuptools-75.1.0-py3-none-any.whl (1.2 MB)  
Installing collected packages: setuptools  
Attempting uninstall: setuptools  
Found existing installation: setuptools 71.0.4  
Uninstalling setuptools-71.0.4:  
Successfully uninstalled setuptools-71.0.4  
**ERROR: pip's dependency resolver does not currently take into account all the packages that are installed. This behaviour is deprecated. pip 24.1.2 requires packages that you have already installed. This is currently normal, but this behaviour may change in the future.**  
Successfully installed setuptools-75.1.0  
**WARNING: The following packages were previously imported in this runtime:**  
**[\_distutils\_hack, pkg\_resources, setuptools]**  
**You must restart the runtime in order to use newly installed versions.**

RESTART SESSION

Collecting mxnet<2.0.0  
Downloading mxnet-1.9.1-py3-none-manylinux2014\_x86\_64.whl.metadata (3.4 kB)  
Collecting bokeh==2.0.1  
Downloading bokeh-2.0.1.tar.gz (8.6 MB)  
8.6/8.6 MB 18.6 MB/s eta 0:00:00  
Preparing metadata (setup.py) ... done  
Requirement already satisfied: PyYAML>=3.10 in /usr/local/lib/python3.10/dist-packages (from bokeh==2.0.1) (6.0.2)  
Requirement already satisfied: python-dateutil>=2.1 in /usr/local/lib/python3.10/dist-packages (from bokeh==2.0.1) (2.8.2)  
Requirement already satisfied: Jinja2>=2.7 in /usr/local/lib/python3.10/dist-packages (from bokeh==2.0.1) (3.1.4)  
Requirement already satisfied: numpy>=1.11.3 in /usr/local/lib/python3.10/dist-packages (from bokeh==2.0.1) (1.26.4)  
Requirement already satisfied: pillow>=4.0 in /usr/local/lib/python3.10/dist-packages (from bokeh==2.0.1) (10.4.0)  
Requirement already satisfied: packaging>=16.8 in /usr/local/lib/python3.10/dist-packages (from bokeh==2.0.1) (24.1)  
Requirement already satisfied: tornado>=5 in /usr/local/lib/python3.10/dist-packages (from bokeh==2.0.1) (6.3.3)  
Requirement already satisfied: typing\_extensions>=3.7.4 in /usr/local/lib/python3.10/dist-packages (from bokeh==2.0.1) (4)  
Requirement already satisfied: requests<3, >=2.20.0 in /usr/local/lib/python3.10/dist-packages (from mxnet<2.0.0) (2.32.3)  
Collecting graphviz<0.9.0, >=0.8.1 (from mxnet<2.0.0)  
Downloading graphviz-0.8.4-py2.py3-none-any.whl.metadata (6.4 kB)  
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.10/dist-packages (from Jinja2>=2.7->bokeh==2.0.1)  
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.1->bokeh==2.0.1)  
Requirement already satisfied: charset-normalizer<4, >=2 in /usr/local/lib/python3.10/dist-packages (from requests<3, >=2.20.0->mxnet<2.0.0)  
Requirement already satisfied: idna<4, >=2.5 in /usr/local/lib/python3.10/dist-packages (from requests<3, >=2.20.0->mxnet<2.0.0)  
Requirement already satisfied: urllib3<3, >=1.21.1 in /usr/local/lib/python3.10/dist-packages (from requests<3, >=2.20.0->mxnet<2.0.0)  
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests<3, >=2.20.0->mxnet<2.0.0)  
Downloading mxnet-1.9.1-py3-none-manylinux2014\_x86\_64.whl (49.1 MB)  
49.1/49.1 MB 42.6 MB/s eta 0:00:00  
Downloading graphviz-0.8.4-py2.py3-none-any.whl (16 kB)  
Building wheels for collected packages: bokeh  
Building wheel for bokeh (setup.py) ... done  
Created wheel for bokeh: filename=bokeh-2.0.1-py3-none-any.whl size=9080017 sha256=304db20fb837bb99cf784f9275fe10b47bc6:  
Stored in directory: /root/.cache/pip/wheels/be/b4/d8/7ce778fd6e637bea03a561223a77ba6649aff8168e3c613754  
Successfully built bokeh  
Installing collected packages: graphviz, mxnet, bokeh  
Attempting uninstall: graphviz  
Found existing installation: graphviz 0.20.3  
Uninstalling graphviz-0.20.3:  
Successfully uninstalled graphviz-0.20.3  
Attempting uninstall: bokeh  
Found existing installation: bokeh 3.4.3  
Uninstalling bokeh-3.4.3:  
Successfully uninstalled bokeh-3.4.3  
**ERROR: pip's dependency resolver does not currently take into account all the packages that are installed. This behaviour is deprecated. pip 24.1.2 requires packages that you have already installed. This is currently normal, but this behaviour may change in the future.**  
holoviews 1.19.1 requires bokeh>=3.1, but you have bokeh 2.0.1 which is incompatible.  
panel 1.4.5 requires bokeh<3.5.0, >=3.4.0, but you have bokeh 2.0.1 which is incompatible.  
Successfully installed bokeh-2.0.1 graphviz-0.8.4 mxnet-1.9.1  
Collecting autogluon  
Downloading autogluon-1.1.1-py3-none-any.whl.metadata (11 kB)  
Collecting autogluon.core==1.1.1 (from autogluon.core[all]==1.1.1->autogluon)  
Downloading autogluon.core-1.1.1-py3-none-any.whl.metadata (11 kB)  
Collecting autogluon.features==1.1.1 (from autogluon)  
Downloading autogluon.features-1.1.1-py3-none-any.whl.metadata (11 kB)  
Collecting autogluon.tabular==1.1.1 (from autogluon.tabular[all]==1.1.1->autogluon)  
Downloading autogluon.tabular-1.1.1-py3-none-any.whl.metadata (13 kB)  
Collecting autogluon.multimodal==1.1.1 (from autogluon)  
Downloading autogluon.multimodal-1.1.1-py3-none-any.whl.metadata (12 kB)

Collecting autogluon.timeseries==1.1.1 (from autogluon.timeseries[all]==1.1.1->autogluon)  
Downloading autogluon.timeseries-1.1.1-py3-none-any.whl.metadata (12 kB)  
Requirement already satisfied: numpy<1.29,>=1.21 in /usr/local/lib/python3.10/dist-packages (from autogluon.core==1.1.1->autogluon)  
Collecting scipy<1.13,>=1.5.4 (from autogluon.core==1.1.1->autogluon.core[all]==1.1.1->autogluon)  
Downloading scipy-1.12.0-cp310-cp310-manylinux\_2\_17\_x86\_64\_manylinux2014\_x86\_64.whl.metadata (60 kB)  
Requirement already satisfied: scikit-learn<1.4.1,>=1.3.0 in /usr/local/lib/python3.10/dist-packages (from autogluon.core==1.1.1->autogluon)  
Requirement already satisfied: networkx<4,>=3.0 in /usr/local/lib/python3.10/dist-packages (from autogluon.core==1.1.1->autogluon)  
Requirement already satisfied: pandas<2.3.0,>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from autogluon.core==1.1.1->autogluon)  
Requirement already satisfied: tqdm<5,>=4.38 in /usr/local/lib/python3.10/dist-packages (from autogluon.core==1.1.1->autogluon)  
Requirement already satisfied: requests in /usr/local/lib/python3.10/dist-packages (from autogluon.core==1.1.1->autogluon)  
Requirement already satisfied: matplotlib in /usr/local/lib/python3.10/dist-packages (from autogluon.core==1.1.1->autogluon)  
Collecting boto3<2,>=1.10 (from autogluon.core==1.1.1->autogluon.core[all]==1.1.1->autogluon)  
Downloading boto3-1.35.22-py3-none-any.whl.metadata (6.6 kB)  
Collecting autogluon.common==1.1.1 (from autogluon.core==1.1.1->autogluon.core[all]==1.1.1->autogluon)  
Downloading autogluon.common-1.1.1-py3-none-any.whl.metadata (11 kB)  
Collecting ray<2.11,>=2.10.0 (from ray[default,tune]<2.11,>=2.10.0; extra == "all"->autogluon.core[all]==1.1.1->autogluon)  
Downloading ray-2.10.0-cp310-cp310-manylinux2014\_x86\_64.whl.metadata (13 kB)  
Requirement already satisfied: hyperopt<0.2.8,>=0.2.7 in /usr/local/lib/python3.10/dist-packages (from autogluon.core[all]==1.1.1->autogluon)  
Requirement already satisfied: Pillow<11,>=10.0.1 in /usr/local/lib/python3.10/dist-packages (from autogluon.multimodal==1.1.1->autogluon)  
Collecting torch<2.4,>=2.2 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading torch-2.3.1-cp310-cp310-manylinux1\_x86\_64.whl.metadata (26 kB)  
Collecting lightning<2.4,>=2.2 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading lightning-2.3.3-py3-none-any.whl.metadata (35 kB)  
Collecting transformers<4.41.0,>=4.38.0 (from transformers[sentencepiece]<4.41.0,>=4.38.0->autogluon.multimodal==1.1.1->autogluon)  
Downloading transformers-4.40.2-py3-none-any.whl.metadata (137 kB)  
Collecting accelerate<0.22.0,>=0.21.0 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading accelerate-0.21.0-py3-none-any.whl.metadata (17 kB)  
Collecting jsonschema<4.22,>=4.18 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading jsonschema-4.21.1-py3-none-any.whl.metadata (7.8 kB)  
Collecting sequeval<1.3.0,>=1.2.2 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading sequeval-1.2.2.tar.gz (43 kB)  
Preparing metadata (setup.py) ... done  
Collecting evaluate<0.5.0,>=0.4.0 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading evaluate-0.4.3-py3-none-any.whl.metadata (9.2 kB)  
Collecting timm<0.10.0,>=0.9.5 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading timm-0.9.16-py3-none-any.whl.metadata (38 kB)  
Collecting torchvision<0.19.0,>=0.16.0 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading torchvision-0.18.1-cp310-cp310-manylinux1\_x86\_64.whl.metadata (6.6 kB)  
Collecting scikit-image<0.21.0,>=0.19.1 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading scikit\_image-0.20.0-cp310-cp310-manylinux\_2\_17\_x86\_64\_manylinux2014\_x86\_64.whl.metadata (16 kB)  
Requirement already satisfied: text-unidecode<1.4,>=1.3 in /usr/local/lib/python3.10/dist-packages (from autogluon.multimodal==1.1.1->autogluon)  
Collecting torchmetrics<1.3.0,>=1.2.0 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading torchmetrics-1.2.1-py3-none-any.whl.metadata (20 kB)  
Collecting nptyping<2.5.0,>=1.4.4 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading nptyping-2.4.1-py3-none-any.whl.metadata (7.7 kB)  
Collecting omegaconf<2.3.0,>=2.1.1 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading omegaconf-2.2.3-py3-none-any.whl.metadata (3.9 kB)  
Collecting pytorch-metric-learning<2.4,>=1.3.0 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading pytorch\_metric\_learning-2.3.0-py3-none-any.whl.metadata (17 kB)  
Collecting nlpaug<1.2.0,>=1.1.10 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading nlpaug-1.1.11-py3-none-any.whl.metadata (14 kB)  
Requirement already satisfied: nltk<4.0.0,>=3.4.5 in /usr/local/lib/python3.10/dist-packages (from autogluon.multimodal==1.1.1->autogluon)  
Collecting openmim<0.4.0,>=0.3.7 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading openmim-0.3.9-py2.py3-none-any.whl.metadata (16 kB)  
Requirement already satisfied: defusedxml<0.7.2,>=0.7.1 in /usr/local/lib/python3.10/dist-packages (from autogluon.multimodal==1.1.1->autogluon)  
Requirement already satisfied: Jinja2<3.2,>=3.0.3 in /usr/local/lib/python3.10/dist-packages (from autogluon.multimodal==1.1.1->autogluon)  
Requirement already satisfied: tensorboard<3,>=2.9 in /usr/local/lib/python3.10/dist-packages (from autogluon.multimodal==1.1.1->autogluon)  
Collecting pytesseract<0.3.11,>=0.3.9 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading pytesseract-0.3.10-py3-none-any.whl.metadata (11 kB)  
Collecting nvidia-ml-py3==7.352.0 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading nvidia-ml-py3-7.352.0.tar.gz (19 kB)  
Preparing metadata (setup.py) ... done  
Collecting pdf2image<1.19,>=1.17.0 (from autogluon.multimodal==1.1.1->autogluon)  
Downloading pdf2image-1.17.0-py3-none-any.whl.metadata (6.2 kB)  
Collecting xgboost<2.1,>=1.6 (from autogluon.tabular[all]==1.1.1->autogluon)  
Downloading xgboost-2.0.3-py3-none-manylinux2014\_x86\_64.whl.metadata (2.0 kB)  
Requirement already satisfied: fastai<2.8,>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from autogluon.tabular[all]==1.1.1->autogluon)  
Collecting lightgbm<4.4,>=3.3 (from autogluon.tabular[all]==1.1.1->autogluon)  
Downloading lightgbm-4.3.0-py3-none-manylinux\_2\_28\_x86\_64.whl.metadata (19 kB)  
Collecting catboost<1.3,>=1.1 (from autogluon.tabular[all]==1.1.1->autogluon)  
Downloading catboost-1.2.7-cp310-cp310-manylinux2014\_x86\_64.whl.metadata (1.2 kB)  
Requirement already satisfied: joblib<2,>=1.1 in /usr/local/lib/python3.10/dist-packages (from autogluon.timeseries==1.1.1->autogluon)  
Collecting pytorch-lightning<2.4,>=2.2 (from autogluon.timeseries==1.1.1->autogluon.timeseries[all]==1.1.1->autogluon)  
Downloading pytorch\_lightning-2.3.3-py3-none-any.whl.metadata (21 kB)  
Collecting gluonts==0.15.1 (from autogluon.timeseries==1.1.1->autogluon.timeseries[all]==1.1.1->autogluon)  
Downloading gluonts-0.15.1-py3-none-any.whl.metadata (9.9 kB)  
Collecting statsforecast<1.5,>=1.4.0 (from autogluon.timeseries==1.1.1->autogluon.timeseries[all]==1.1.1->autogluon)  
Downloading statsforecast-1.4.0-py3-none-any.whl.metadata (19 kB)  
Collecting mlforecast<0.10.1,>=0.10.0 (from autogluon.timeseries==1.1.1->autogluon.timeseries[all]==1.1.1->autogluon)  
Downloading mlforecast-0.10.0-py3-none-any.whl.metadata (11 kB)  
Collecting utilsforecast<0.0.11,>=0.0.10 (from autogluon.timeseries==1.1.1->autogluon.timeseries[all]==1.1.1->autogluon)  
Downloading utilsforecast-0.0.10-py3-none-any.whl.metadata (7.0 kB)  
Collecting orjson~3.9 (from autogluon.timeseries==1.1.1->autogluon.timeseries[all]==1.1.1->autogluon)

Downloading orjson-3.10.-cp310-cp310-manylinux\_2\_17\_x86\_64.manylinux2014\_x86\_64.whl.metadata (50 kB)  
Collecting optimum<1.19,>=1.17 (from optimum[onnxruntime]<1.19,>=1.17; extra == "all"-->autogluon.timeseries[all]==1.1.1->autogluon)  
Downloading optimum-1.18.1-py3-none-any.whl.metadata (18 kB)  
Requirement already satisfied: psutil<6,>=5.7.3 in /usr/local/lib/python3.10/dist-packages (from autogluon.common==1.1.1->autogluon)  
Requirement already satisfied: setuptools in /usr/local/lib/python3.10/dist-packages (from autogluon.common==1.1.1->autogluon)  
Requirement already satisfied: pydantic<3,>=1.7 in /usr/local/lib/python3.10/dist-packages (from gluonts==0.15.1->autogluon.timeseries[all]==1.1.1->autogluon)  
Requirement already satisfied: toolz~>0.10 in /usr/local/lib/python3.10/dist-packages (from gluonts==0.15.1->autogluon.timeseries[all]==1.1.1->autogluon)  
Requirement already satisfied: typing-extensions~>4.0 in /usr/local/lib/python3.10/dist-packages (from gluonts==0.15.1->autogluon.timeseries[all]==1.1.1->autogluon)  
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from accelerate<0.22.0,>=0.21.0->autogluon.timeseries[all]==1.1.1->autogluon)  
Requirement already satisfied: pyyaml in /usr/local/lib/python3.10/dist-packages (from accelerate<0.22.0,>=0.21.0->autogluon.timeseries[all]==1.1.1->autogluon)  
Collecting boto3<1.36.0,>=1.35.22 (from boto3<2,>=1.10->autogluon.core==1.1.1->autogluon.core[all]==1.1.1->autogluon)  
Downloading boto3-1.35.22-py3-none-any.whl.metadata (5.7 kB)  
Collecting jmespath<2.0.0,>=0.7.1 (from boto3<2,>=1.10->autogluon.core==1.1.1->autogluon.core[all]==1.1.1->autogluon)  
Downloading jmespath-1.0.1-py3-none-any.whl.metadata (7.6 kB)  
Collecting s3transfer<0.11.0,>=0.10.0 (from boto3<2,>=1.10->autogluon.core==1.1.1->autogluon.core[all]==1.1.1->autogluon)  
Downloading s3transfer-0.10.2-py3-none-any.whl.metadata (1.7 kB)  
Requirement already satisfied: graphviz in /usr/local/lib/python3.10/dist-packages (from catboost<1.3,>=1.1->autogluon.tabular)  
Requirement already satisfied: plotly in /usr/local/lib/python3.10/dist-packages (from catboost<1.3,>=1.1->autogluon.tabular)  
Requirement already satisfied: six in /usr/local/lib/python3.10/dist-packages (from catboost<1.3,>=1.1->autogluon.tabular)  
Collecting datasets>=2.0.0 (from evaluate<0.5.0,>=0.4.0->autogluon.multimodal==1.1.1->autogluon)  
Downloading datasets-3.0.0-py3-none-any.whl.metadata (19 kB)  
Collecting dill (from evaluate<0.5.0,>=0.4.0->autogluon.multimodal==1.1.1->autogluon)  
Downloading dill-0.3.8-py3-none-any.whl.metadata (10 kB)  
Collecting xxhash (from evaluate<0.5.0,>=0.4.0->autogluon.multimodal==1.1.1->autogluon)  
Downloading xxhash-3.5.0-cp310-cp310-manylinux\_2\_17\_x86\_64.manylinux2014\_x86\_64.whl.metadata (12 kB)  
Collecting multiprocessing (from evaluate<0.5.0,>=0.4.0->autogluon.multimodal==1.1.1->autogluon)  
Downloading multiprocessing-0.70.16-py310-none-any.whl.metadata (7.2 kB)  
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Requirement already satisfied: typer<1.0.0,>=0.3.0 in /usr/local/lib/python3.10/dist-packages (from spacy<4->fastai<2.8,>=1.0.0)
```

Requirement already satisfied: typer<2.0.0,>=0.3.0 in /usr/local/lib/python3.10/dist-packages (from spacy<4->fastai<2.0,=

Requirement already satisfied: langcodes<4.0.0,>=3.2.0 in /usr/local/lib/python3.10/dist-packages (from spacy<4->fastai<2

Requirement already satisfied: patsy==0.5.6 in /usr/local/lib/python3.10/dist-packages (from statsmodels>=0.13.2->statsfo

Collecting distlib<1,>=0.3.7 (from virtualenv!=20.21.1,>=20.0.24->ray[default,tune]<2.11,>=2.10.0; extra == "all"->autoglu

Downloading distlib-0.3.8-py2.py3-none-any.whl.metadata (5.1 kB)

Requirement already satisfied: platformdirs<5,>=3.9.1 in /usr/local/lib/python3.10/dist-packages (from virtualenv!=20.21.:

Collecting humanfriendly>=9.1 (from coloredlogs->optimum<1.19,>=1.17->optimum[onnxruntime]<1.19,>=1.17; extra == "all"->ai

Downloading humanfriendly-10.0-py2.py3-none-any.whl.metadata (9.2 kB)

Collecting ordered-set (from model-index->openmm<0.4.0,>=0.3.7->autogluon.multimodal==1.1.1->autogluon)

Downloading ordered\_set-4.1.0-py3-none-any.whl.metadata (5.3 kB)

Collecting opencensus-context==0.1.3 (from opencensus->ray[default,tune]<2.11,>=2.10.0; extra == "all"->autogluon.core[all

Downloading opencensus\_context-0.1.3-py2.py3-none-any.whl.metadata (3.3 kB)

Requirement already satisfied: google-api-core<3.0.0,>=1.0.0 in /usr/local/lib/python3.10/dist-packages (from opencensus-

Collecting pycryptodome (from opendatalab->openmm<0.4.0,>=0.3.7->autogluon.multimodal==1.1.1->autogluon)

Downloading pycryptodome-3.20.0-cp35-abi3-manylinux\_2\_17\_x86\_64.manylinux2014\_x86\_64.whl.metadata (3.4 kB)

Collecting openxlab (from opendatalab->openmm<0.4.0,>=0.3.7->autogluon.multimodal==1.1.1->autogluon)

Downloading openxlab-0.1.1-py3-none-any.whl.metadata (3.8 kB)

Requirement already satisfied: tenacity>=6.2.0 in /usr/local/lib/python3.10/dist-packages (from plotly->catboost<1.3,>=1.:

Requirement already satisfied: markdown-it-py>=2.2.0 in /usr/local/lib/python3.10/dist-packages (from rich->openmm<0.4.0

Requirement already satisfied: pygments<3.0.0,>=2.13.0 in /usr/local/lib/python3.10/dist-packages (from rich->openmm<0.4

Requirement already satisfied: wrapt in /usr/local/lib/python3.10/dist-packages (from smart-open->ray[default,tune]<2.11,

Requirement already satisfied: mpmath<1.4,>=1.1.0 in /usr/local/lib/python3.10/dist-packages (from sympy->optimum<1.19,>=:

Requirement already satisfied: googleapis-common-protos<2.0.dev0,>=1.56.2 in /usr/local/lib/python3.10/dist-packages (from

Requirement already satisfied: proto-plus<2.0.0dev,>=1.22.3 in /usr/local/lib/python3.10/dist-packages (from google-api-c

Requirement already satisfied: google-auth<3.0.dev0,>=2.14.1 in /usr/local/lib/python3.10/dist-packages (from google-api-

Requirement already satisfied: language-data==1.2 in /usr/local/lib/python3.10/dist-packages (from langcodes<4.0.0,>=3.2.0

Requirement already satisfied: mdurl==0.1 in /usr/local/lib/python3.10/dist-packages (from markdown-it-py>=2.2.0->rich->o

Requirement already satisfied: blis<0.8.0,>=0.7.8 in /usr/local/lib/python3.10/dist-packages (from thinc<8.3.0,>=8.2.2->s

Requirement already satisfied: confection<1.0.0,>=0.0.1 in /usr/local/lib/python3.10/dist-packages (from thinc<8.3.0,>=8.:

Requirement already satisfied: shellingham>=1.3.0 in /usr/local/lib/python3.10/dist-packages (from typer<1.0.0,>=0.3.0->s

Requirement already satisfied: cloudpathlib<1.0.0,>=0.7.0 in /usr/local/lib/python3.10/dist-packages (from weasel<0.5.0,>=

Requirement already satisfied: soupsieve>1.2 in /usr/local/lib/python3.10/dist-packages (from beautifulsoup4->gdown>=4.0.0

Collecting filelock (from ray<2.11,>=2.10.0->ray[default,tune]<2.11,>=2.10.0; extra == "all"->autogluon.core[all]==1.1.1-

Downloading filelock-3.14.0-py3-none-any.whl.metadata (2.8 kB)

Collecting oss2==2.17.0 (from openxlab->opendatalab->openmm<0.4.0,>=0.3.7->autogluon.multimodal==1.1.1->autogluon)

Downloading oss2-2.17.0.tar.gz (259 kB)

Preparing metadata (setup.py) ... done

Collecting pytz>=2020.1 (from pandas<2.3.0,>=2.0.0->autogluon.core==1.1.1->autogluon.core[all]==1.1.1->autogluon)

Downloading pytz-2023.4-py2.py3-none-any.whl.metadata (22 kB)

INFO: pip is looking at multiple versions of openxlab to determine which version is compatible with other requirements. TI

Collecting openxlab (from opendatalab->openmm<0.4.0,>=0.3.7->autogluon.multimodal==1.1.1->autogluon)

Downloading openxlab-0.1.0-py3-none-any.whl.metadata (3.8 kB)

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Downloading openxlab-0.0.33-py3-none-any.whl.metadata (3.8 kB)

INFO: pip is still looking at multiple versions of openxlab to determine which version is compatible with other requireme

Downloading openxlab-0.0.32-py3-none-any.whl.metadata (3.8 kB)

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INFO: This is taking longer than usual. You might need to provide the dependency resolver with stricter constraints to re

Downloading openxlab-0.0.27-py3-none-any.whl.metadata (3.7 kB)

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Downloading openxlab-0.0.12-py3-none-any.whl.metadata (4.5 kB)

Downloading openxlab-0.0.11-py3-none-any.whl.metadata (4.3 kB)

Requirement already satisfied: PySocks!=1.5.7,>=1.5.6 in /usr/local/lib/python3.10/dist-packages (from requests[socks]->g

Requirement already satisfied: cachetools<6.0,>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from google-auth<3.0.dev

Requirement already satisfied: pyasn1-modules>=0.2.1 in /usr/local/lib/python3.10/dist-packages (from google-auth<3.0.dev

Requirement already satisfied: rsa<5,>=3.1.4 in /usr/local/lib/python3.10/dist-packages (from google-auth<3.0.dev0,>=2.14

Requirement already satisfied: marisa-trie>=0.7.7 in /usr/local/lib/python3.10/dist-packages (from language-data==1.2->la

Requirement already satisfied: pyasn1<0.7.0,>=0.4.6 in /usr/local/lib/python3.10/dist-packages (from pyasn1-modules>=0.2.:

Downloading autogluon-1.1.1-py3-none-any.whl (9.7 kB)

Downloading autogluon.core-1.1.1-py3-none-any.whl (234 kB)

Downloading autogluon.features-1.1.1-py3-none-any.whl (63 kB)

Downloading autogluon.multimodal-1.1.1-py3-none-any.whl (427 kB)

Downloading autogluon.tabular-1.1.1-py3-none-any.whl (312 kB)

Downloading autogluon.timeseries-1.1.1-py3-none-any.whl (148 kB)

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Downloading autogluon.common-1.1.1-py3-none-any.whl (110 kB)
Downloading gluonts-0.15.1-py3-none-any.whl (1.5 MB)
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Downloading accelerate-0.21.0-py3-none-any.whl (244 kB)
Downloading boto3-1.35.22-py3-none-any.whl (139 kB)
Downloading catboost-1.2.7-cp310-cp310-manylinux2014_x86_64.whl (98.7 MB)
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Downloading evaluate-0.4.3-py3-none-any.whl (84 kB)
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Downloading mlforecast-0.10.0-py3-none-any.whl (47 kB)
Downloading nlpaug-1.1.11-py3-none-any.whl (410 kB)
Downloading nptyping-2.4.1-py3-none-any.whl (36 kB)
Downloading omegaconf-2.2.3-py3-none-any.whl (79 kB)
Downloading openmim-0.3.9-py2.py3-none-any.whl (52 kB)
Downloading optimum-1.18.1-py3-none-any.whl (410 kB)
Downloading orjson-3.10.7-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (141 kB)
Downloading pdf2image-1.17.0-py3-none-any.whl (11 kB)
Downloading pytesseract-0.3.10-py3-none-any.whl (14 kB)
Downloading pytorch_lightning-2.3.3-py3-none-any.whl (812 kB)
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Downloading pytorch_metric_learning-2.3.0-py3-none-any.whl (115 kB)
Downloading ray-2.10.0-cp310-cp310-manylinux2014_x86_64.whl (65.1 MB)
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Downloading scikit_image-0.20.0-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (13.2 MB)
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Downloading scipy-1.12.0-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (38.4 MB)
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Downloading statsforecast-1.4.0-py3-none-any.whl (91 kB)
Downloading timm-0.9.16-py3-none-any.whl (2.2 MB)
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Downloading torch-2.3.1-cp310-cp310-manylinux1_x86_64.whl (779.1 MB)
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Downloading nvidia_cublas_cu12-12.1.3.1-py3-none-manylinux1_x86_64.whl (410.6 MB)
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Downloading nvidia_cuda_cupti_cu12-12.1.105-py3-none-manylinux1_x86_64.whl (14.1 MB)
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Downloading nvidia_cufft_cu12-11.0.2.54-py3-none-manylinux1_x86_64.whl (121.6 MB)
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Downloading nvidia_curand_cu12-10.3.2.106-py3-none-manylinux1_x86_64.whl (56.5 MB)
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Downloading nvidia_cusolver_cu12-11.4.5.107-py3-none-manylinux1_x86_64.whl (124.2 MB)
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Downloading nvidia_nvtx_cu12-12.1.105-py3-none-manylinux1_x86_64.whl (99 kB)
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Downloading torchvision-0.18.1-cp310-cp310-manylinux1_x86_64.whl (7.0 MB)
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Downloading transformers-4.39.3-py3-none-any.whl (8.8 MB)
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Downloading utilsforecast-0.0.10-py3-none-any.whl (30 kB)
Downloading xgboost-2.0.3-py3-none-manylinux2014_x86_64.whl (297.1 MB)
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Downloading botocore-1.35.22-py3-none-any.whl (12.6 MB)
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Downloading datasets-3.0.0-py3-none-any.whl (474 kB)
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Downloading jmespath-1.0.1-py3-none-any.whl (20 kB)
Downloading lightning_utilities-0.11.7-py3-none-any.whl (26 kB)
Downloading onnxruntime-1.19.2-cp310-cp310-manylinux_2_27_x86_64.manylinux_2_28_x86_64.whl (13.2 MB)
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Downloading py_spy-0.3.14-py2.py3-none-manylinux_2_5_x86_64.manylinux1_x86_64.whl (3.0 MB)
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Downloading pywavelets-1.7.0-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (4.5 MB)
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Downloading s3transfer-0.10.2-py3-none-any.whl (82 kB)
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Downloading tensorboardX-2.6.2.2-py2.py3-none-any.whl (101 kB)
Downloading tokenizers-0.15.2-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (3.6 MB)
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Downloading virtualenv-20.26.5-py3-none-any.whl (6.0 MB)
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Downloading aiohttp_cors-0.7.0-py3-none-any.whl (27 kB)
Downloading colorama-0.4.6-py2.py3-none-any.whl (25 kB)
Downloading coloredlogs-15.0.1-py2.py3-none-any.whl (46 kB)
Downloading colorful-0.5.6-py2.py3-none-any.whl (201 kB)
Downloading model_index-0.1.11-py3-none-any.whl (34 kB)
Downloading multiprocessing-0.70.16-py310-none-any.whl (134 kB)
Downloading onnx-1.16.2-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (15.9 MB)
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Downloading opencensus-0.11.4-py2.py3-none-any.whl (128 kB)
Downloading opendatalab-0.0.10-py3-none-any.whl (29 kB)
Downloading window_ops-0.0.15-py3-none-any.whl (15 kB)
Downloading xxhash-3.5.0-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (194 kB)
Downloading distlib-0.3.8-py2.py3-none-any.whl (468 kB)
Downloading humanfriendly-10.0-py2.py3-none-any.whl (86 kB)
Downloading opencensus_context-0.1.3-py2.py3-none-any.whl (5.1 kB)
Downloading nvidia_nvjitlink_cu12-12.6.68-py3-none-manylinux2014_x86_64.whl (19.7 MB)
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Downloading openxlab-0.0.11-py3-none-any.whl (55 kB)
Downloading ordered_set-4.1.0-py3-none-any.whl (7.6 kB)
Downloading pycryptodome-3.20.0-cp35-abi3-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (2.1 MB)
2.1/2.1 MB 64.0 MB/s eta 0:00:00
Building wheels for collected packages: nvidia-ml-py3, antlr4-python3-runtime, sequeval
Building wheel for nvidia-ml-py3 (setup.py) ... done
Created wheel for nvidia-ml-py3: filename=nvidia_ml_py3-7.352.0-py3-none-any.whl size=19173 sha256=d3368c140263daa386a4!
Stored in directory: /root/.cache/pip/wheels/5c/d8/c0/46899f8be7a75a2ffd197a23c8797700ea858b9b34819fbf9e
Building wheel for antlr4-python3-runtime (setup.py) ... done
Created wheel for antlr4-python3-runtime: filename=antlr4_python3_runtime-4.9.3-py3-none-any.whl size=144555 sha256=16f!
Stored in directory: /root/.cache/pip/wheels/12/93/dd/1f6a127edc45659556564c5730f6d4e300888f4bca2d4c5a88
Building wheel for sequeval (setup.py) ... done
Created wheel for sequeval: filename=sequeval-1.2.2-py3-none-any.whl size=16161 sha256=c6cb0dc9da724e3bab246efdfdc7aa73c2!
Stored in directory: /root/.cache/pip/wheels/1a/67/4a/ad4082dd7dfc30f2abfe4d80a2ed5926a506eb8a972b4767fa
Successfully built nvidia-ml-py3 antlr4-python3-runtime sequeval
Installing collected packages: py-spy, opencensus-context, nvidia-ml-py3, distlib, colorful, antlr4-python3-runtime, xxha:
Attempting uninstall: scipy
Found existing installation: scipy 1.13.1
Uninstalling scipy-1.13.1:
Successfully uninstalled scipy-1.13.1
Attempting uninstall: pyarrow
Found existing installation: pyarrow 14.0.2
Uninstalling pyarrow-14.0.2:
Successfully uninstalled pyarrow-14.0.2
Attempting uninstall: nvidia-nccl-cu12
Found existing installation: nvidia-nccl-cu12 2.23.4
Uninstalling nvidia-nccl-cu12-2.23.4:
Successfully uninstalled nvidia-nccl-cu12-2.23.4
Attempting uninstall: xgboost
Found existing installation: xgboost 2.1.1
Uninstalling xgboost-2.1.1:
Successfully uninstalled xgboost-2.1.1
Attempting uninstall: scikit-image
Found existing installation: scikit-image 0.23.2
Uninstalling scikit-image-0.23.2:
Successfully uninstalled scikit-image-0.23.2
Attempting uninstall: lightgbm
Found existing installation: lightgbm 4.5.0
Uninstalling lightgbm-4.5.0:
Successfully uninstalled lightgbm-4.5.0
Attempting uninstall: tokenizers
Found existing installation: tokenizers 0.19.1
Uninstalling tokenizers-0.19.1:
Successfully uninstalled tokenizers-0.19.1
Attempting uninstall: jsonschema
Found existing installation: jsonschema 4.23.0
Uninstalling jsonschema-4.23.0:
Successfully uninstalled jsonschema-4.23.0
Attempting uninstall: transformers
Found existing installation: transformers 4.44.2
Uninstalling transformers-4.44.2:
Successfully uninstalled transformers-4.44.2
Attempting uninstall: torch
Found existing installation: torch 2.4.0+cu121
Uninstalling torch-2.4.0+cu121:
Successfully uninstalled torch-2.4.0+cu121
Attempting uninstall: torchvision
Found existing installation: torchvision 0.19.0+cu121
Uninstalling torchvision-0.19.0+cu121:
Successfully uninstalled torchvision-0.19.0+cu121
Attempting uninstall: accelerate
```



Found existing installation: accelerate 0.34.2

Uninstalling accelerate-0.34.2:

Successfully uninstalled accelerate-0.34.2

ERROR: pip's dependency resolver does not currently take into account all the packages that are installed. This behaviour is being removed from pip's default because of the difficulty of managing binary compatibility. albumentations 1.4.15 requires scikit-image>=0.21.0, but you have scikit-image 0.20.0 which is incompatible. cudf-cu12 24.4.1 requires pyarrow<15.0.0a0,>=14.0.1, but you have pyarrow 17.0.0 which is incompatible. ibis-framework 8.0.0 requires pyarrow<16,>=2, but you have pyarrow 17.0.0 which is incompatible. osqp 0.6.7.post0 requires scipy!=1.12.0,>=0.13.2, but you have scipy 1.12.0 which is incompatible. torchaudio 2.4.0+cu121 requires torch==2.4.0, but you have torch 2.3.1 which is incompatible.

Successfully installed PyWavelets-1.7.0 accelerate-0.21.0 aiohttp-cors-0.7.0 antlr4-python3-runtime-4.9.3 autogluon-1.1.1

**WARNING: The following packages were previously imported in this runtime:**

[pydevd\_plugins]

**You must restart the runtime in order to use newly installed versions.**

RESTART SESSION

## Setup Kaggle API Key

```
# create the .kaggle directory and an empty kaggle.json file
!mkdir -p /root/.kaggle
!touch /root/.kaggle/kaggle.json
!chmod 600 /root/.kaggle/kaggle.json

# Fill in your user name and key from creating the kaggle account and API token file
import json
kaggle_username = "sabaka2"
kaggle_key = "85d8d604804339013d8ca565fee9ec96"

# Save API token the kaggle.json file
with open("/root/.kaggle/kaggle.json", "w") as f:
    f.write(json.dumps({"username": kaggle_username, "key": kaggle_key}))
```

## Download and explore dataset

Go to the [bike sharing demand competition](#) and agree to the terms



```
# Download the dataset, it will be in a .zip file so you'll need to unzip it as well.
!kaggle competitions download -c bike-sharing-demand
# If you already downloaded it you can use the -o command to overwrite the file
!unzip -o bike-sharing-demand.zip
```

```
Downloading bike-sharing-demand.zip to /content
100% 189k/189k [00:00<00:00, 712kB/s]
100% 189k/189k [00:00<00:00, 711kB/s]
Archive: bike-sharing-demand.zip
  inflating: sampleSubmission.csv
  inflating: test.csv
  inflating: train.csv
```

```
import pandas as pd
from autogluon.tabular import TabularPredictor
```

```
# Create the train dataset in pandas by reading the csv
# Set the parsing of the datetime column so you can use some of the `dt` features in pandas later
train = pd.read_csv('train.csv', parse_dates=['datetime'])
train.head()
```

	datetime	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	casual	registered	count
0	2011-01-01 00:00:00	1	0	0	1	9.84	14.395	81	0.0	3	13	16
1	2011-01-01 01:00:00	1	0	0	1	9.02	13.635	80	0.0	8	32	40
2	2011-01-01 02:00:00	1	0	0	1	9.02	13.635	80	0.0	5	27	32
3	2011-01-01 03:00:00	1	0	0	1	9.84	14.395	75	0.0	3	10	13
4	2011-01-01 04:00:00	1	0	0	1	9.84	14.395	75	0.0	0	1	1

Next steps: [Generate code with train](#) [View recommended plots](#) [New interactive sheet](#)

```
# Simple output of the train dataset to view some of the min/max/varition of the dataset features.
print(train.describe())
```

```
count      datetime      season      holiday  \
mean  2011-12-27 05:56:22.399411968      2.506614      0.028569
min      2011-01-01 00:00:00      1.000000      0.000000
25%      2011-07-02 07:15:00      2.000000      0.000000
50%      2012-01-01 20:30:00      3.000000      0.000000
75%      2012-07-01 12:45:00      4.000000      0.000000
max      2012-12-19 23:00:00      4.000000      1.000000
std                      NaN      1.116174      0.166599
```

	workingday	weather	temp	atemp	humidity \
count	10886.000000	10886.000000	10886.000000	10886.000000	10886.000000
mean	0.680875	1.418427	20.23086	23.655084	61.886460
min	0.000000	1.000000	0.82000	0.760000	0.000000
25%	0.000000	1.000000	13.94000	16.665000	47.000000
50%	1.000000	1.000000	20.50000	24.240000	62.000000
75%	1.000000	2.000000	26.24000	31.060000	77.000000
max	1.000000	4.000000	41.00000	45.455000	100.000000
std	0.466159	0.633839	7.79159	8.474601	19.245033

	windspeed	casual	registered	count
count	10886.000000	10886.000000	10886.000000	10886.000000
mean	12.799395	36.021955	155.552177	191.574132
min	0.000000	0.000000	0.000000	1.000000
25%	7.001500	4.000000	36.000000	42.000000
50%	12.998000	17.000000	118.000000	145.000000
75%	16.997900	49.000000	222.000000	284.000000
max	56.996900	367.000000	886.000000	977.000000
std	8.164537	49.960477	151.039033	181.144454

```
# Create the test pandas dataframe in pandas by reading the csv, remember to parse the datetime!
test = pd.read_csv('test.csv', parse_dates=['datetime'])
test.head()
```

	datetime	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	
0	2011-01-20 00:00:00	1	0	1	1	10.66	11.365	56	26.0027	
1	2011-01-20 01:00:00	1	0	1	1	10.66	13.635	56	0.0000	
2	2011-01-20 02:00:00	1	0	1	1	10.66	13.635	56	0.0000	
3	2011-01-20 03:00:00	1	0	1	1	10.66	12.880	56	11.0014	
4	2011-01-20 04:00:00	1	0	1	1	10.66	12.880	56	11.0014	

Next steps: [Generate code with test](#) [View recommended plots](#) [New interactive sheet](#)

```
# Same thing as train and test dataset
submission = pd.read_csv('sampleSubmission.csv', parse_dates=['datetime'])
submission.head()
```

	datetime	count	
0	2011-01-20 00:00:00	0	
1	2011-01-20 01:00:00	0	
2	2011-01-20 02:00:00	0	
3	2011-01-20 03:00:00	0	
4	2011-01-20 04:00:00	0	

Next steps: [Generate code with submission](#) [View recommended plots](#) [New interactive sheet](#)

### ✓ Step 3: Train a model using AutoGluon's Tabular Prediction

Requirements:

- We are predicting `count`, so it is the label we are setting.
- Ignore `casual` and `registered` columns as they are also not present in the test dataset.
- Use the `root_mean_squared_error` as the metric to use for evaluation.
- Set a time limit of 10 minutes (600 seconds).
- Use the preset `best_quality` to focus on creating the best model.

```
train = train.drop(columns=['casual', 'registered'])
```

```
predictor = TabularPredictor(label="count", eval_metric='root_mean_squared_error').fit(train_data=train, time_limit=600, pres
```

```

XGB': [{}, {'colsample_bytree': 0.6917311125174739, 'enable_categorical': False, 'learning_rate': 0.018063876087,
'FASTAI': [{}, {'bs': 256, 'emb_drop': 0.5411770367537934, 'epochs': 43, 'layers': [800, 400], 'lr': 0.0151984885,
'RF': [{'criterion': 'gini', 'ag_args': {'name_suffix': 'Gini', 'problem_types': ['binary', 'multiclass']}}, {'cr:
'XT': [{'criterion': 'gini', 'ag_args': {'name_suffix': 'Gini', 'problem_types': ['binary', 'multiclass']}}, {'cr:
'KNN': [{'weights': 'uniform', 'ag_args': {'name_suffix': 'Unif'}}, {'weights': 'distance', 'ag_args': {'name_suf:
}
AutoGluon will fit 2 stack levels (L1 to L2) ...
Fitting 108 L1 models ...
Fitting model: KNeighborsUnif_BAG_L1 ... Training model for up to 264.83s of the 397.31s of remaining time.
-101.5462 = Validation score (-root_mean_squared_error)
0.11s = Training runtime
0.11s = Validation runtime
Fitting model: KNeighborsDist_BAG_L1 ... Training model for up to 260.1s of the 392.58s of remaining time.
-84.1251 = Validation score (-root_mean_squared_error)
0.11s = Training runtime
0.1s = Validation runtime
Fitting model: LightGBMXT_BAG_L1 ... Training model for up to 259.8s of the 392.29s of remaining time.
Fitting 8 child models (S1F1 - S1F8) | Fitting with ParallelLocalFoldFittingStrategy (2 workers, per: cpus=1, gpu:
-131.4609 = Validation score (-root_mean_squared_error)
112.64s = Training runtime
29.05s = Validation runtime
Fitting model: LightGBM_BAG_L1 ... Training model for up to 135.46s of the 267.95s of remaining time.
Fitting 8 child models (S1F1 - S1F8) | Fitting with ParallelLocalFoldFittingStrategy (2 workers, per: cpus=1, gpu:
-131.0542 = Validation score (-root_mean_squared_error)
48.48s = Training runtime
2.34s = Validation runtime
Fitting model: RandomForestMSE_BAG_L1 ... Training model for up to 78.29s of the 210.77s of remaining time.
-116.5484 = Validation score (-root_mean_squared_error)
21.58s = Training runtime
0.84s = Validation runtime
Fitting model: CatBoost_BAG_L1 ... Training model for up to 54.29s of the 186.77s of remaining time.
Fitting 8 child models (S1F1 - S1F8) | Fitting with ParallelLocalFoldFittingStrategy (2 workers, per: cpus=1, gpu:
-132.3533 = Validation score (-root_mean_squared_error)
64.67s = Training runtime
0.23s = Validation runtime
Fitting model: WeightedEnsemble_L2 ... Training model for up to 360.0s of the 114.98s of remaining time.
Ensemble Weights: {'KNeighborsDist_BAG_L1': 1.0}
-84.1251 = Validation score (-root_mean_squared_error)
0.04s = Training runtime
0.0s = Validation runtime
Fitting 106 L2 models ...
Fitting model: LightGBMXT_BAG_L2 ... Training model for up to 114.9s of the 114.77s of remaining time.
Fitting 8 child models (S1F1 - S1F8) | Fitting with ParallelLocalFoldFittingStrategy (2 workers, per: cpus=1, gpu:
-60.8972 = Validation score (-root_mean_squared_error)
87.29s = Training runtime
13.44s = Validation runtime
Fitting model: LightGBM_BAG_L2 ... Training model for up to 20.95s of the 20.83s of remaining time.
Fitting 8 child models (S1F1 - S1F8) | Fitting with ParallelLocalFoldFittingStrategy (2 workers, per: cpus=1, gpu:
-55.1595 = Validation score (-root_mean_squared_error)
39.24s = Training runtime
0.45s = Validation runtime
Fitting model: WeightedEnsemble_L3 ... Training model for up to 360.0s of the -26.65s of remaining time.
Ensemble Weights: {'LightGBM_BAG_L2': 0.929, 'LightGBMXT_BAG_L2': 0.071}
-55.1237 = Validation score (-root_mean_squared_error)
0.06s = Training runtime
0.0s = Validation runtime
AutoGluon training complete, total runtime = 424.43s ... Best model: WeightedEnsemble_L3 | Estimated inference throughput
TabularPredictor saved. To load, use: predictor = TabularPredictor.load("AutogluonModels/ag-20240919_140434")

```

## ✓ Review AutoGluon's training run with ranking of models that did the best.

```

performance = predictor.evaluate(train)
print(performance)

```

```

/usr/local/lib/python3.10/dist-packages/dask/dataframe/__init__.py:42: FutureWarning:
Dask dataframe query planning is disabled because dask-expr is not installed.

```

You can install it with `pip install dask[dataframe]` or `conda install dask`.  
This will raise in a future version.

```

warnings.warn(msg, FutureWarning)
{'root_mean_squared_error': -85.78142480758537, 'mean_squared_error': -7358.452842019422, 'mean_absolute_error': -55.32971

```

```

predictor.fit_summary()

```



```

    'max_base_models': 25,
    'max_base_models_per_type': 5,
    'save_bag_folds': True},
'WeightedEnsemble_L2': {'use_orig_features': False,
    'max_base_models': 25,
    'max_base_models_per_type': 5,
    'save_bag_folds': True},
'LightGBMXT_BAG_L2': {'use_orig_features': True,
    'max_base_models': 25,
    'max_base_models_per_type': 5,
    'save_bag_folds': True},
'LightGBM_BAG_L2': {'use_orig_features': True,
    'max_base_models': 25,
    'max_base_models_per_type': 5,
    'save_bag_folds': True},
'WeightedEnsemble_L3': {'use_orig_features': False,
    'max_base_models': 25,
    'max_base_models_per_type': 5,
    'save_bag_folds': True}},
'leaderboard':
    model    score_val    eval_metric    pred_time_val \
0    WeightedEnsemble_L3    -55.123669    root_mean_squared_error    46.554677
1    LightGBM_BAG_L2    -55.159472    root_mean_squared_error    33.113358
2    LightGBMXT_BAG_L2    -60.897195    root_mean_squared_error    46.106592
3    KNeighborsDist_BAG_L1    -84.125061    root_mean_squared_error    0.101436
4    WeightedEnsemble_L2    -84.125061    root_mean_squared_error    0.102985
5    KNeighborsUnif_BAG_L1    -101.546199    root_mean_squared_error    0.112823
6    RandomForestMSE_BAG_L1    -116.548359    root_mean_squared_error    0.838605
7    LightGBM_BAG_L1    -131.054162    root_mean_squared_error    2.338241
8    LightGBMXT_BAG_L1    -131.460909    root_mean_squared_error    29.046163
9    CatBoost_BAG_L1    -132.353281    root_mean_squared_error    0.230176

    fit_time    pred_time_val_marginal    fit_time_marginal    stack_level \
0    374.166624    0.002170    0.058821    3
1    286.815213    0.445915    39.235108    2
2    334.872695    13.439148    87.292590    2
3    0.105579    0.101436    0.105579    1
4    0.148080    0.001550    0.042501    2
5    0.107367    0.112823    0.107367    1
6    21.579986    0.838605    21.579986    1
7    48.483054    2.338241    48.483054    1
8    112.638537    29.046163    112.638537    1
9    64.665583    0.230176    64.665583    1

    can_infer    fit_order
0    True    10
1    True    9
2    True    8
3    True    2
4    True    7
5    True    1
6    True    5
7    True    4
8    True    3
9    True    6 }

```

Start coding or [generate](#) with AI.

## ▼ Create predictions from test dataset

```

predictions = predictor.predict(test)
predictions.head()

```

```

count
0    36.705181
1    43.758060
2    47.846897
3    52.561142
4    53.246292

dtype: float32

```

▼ NOTE: Kaggle will reject the submission if we don't set everything to be > 0.

```
# Describe the `predictions` series to see if there are any negative values
predictions_description = predictions.describe()
print(predictions_description)
```

```
count      6493.000000
mean       99.240425
std        89.459610
min        -3.421120
25%        16.177315
50%        63.820770
75%       171.560120
max       367.068390
Name: count, dtype: float64
```

```
num_negative_values = (predictions < 0).sum()
print(f"Number of negative values: {num_negative_values}")
```

```
Number of negative values: 2
```

```
predictions[predictions < 0] = 0
```

## Set predictions to submission dataframe, save, and submit

```
submission["count"] = predictions
print(submission["count"].head())
submission.to_csv("submission.csv", index=False)
```

```
0      36.705181
1      43.758060
2      47.846897
3      52.561142
4      53.246292
Name: count, dtype: float32
```

```
!kaggle competitions submit -c bike-sharing-demand -f submission.csv -m "original data submission1"
```

```
100% 188k/188k [00:00<00:00, 309kB/s]
Successfully submitted to Bike Sharing Demand
```

## View submission via the command line or in the web browser under the competition's page - My Submissions

```
!kaggle competitions submissions -c bike-sharing-demand | tail -n +1 | head -n 10
```

fileName	date	description	status	publicScore	privateScore
submission.csv	2024-09-19 14:29:24	original data submission1	complete	1.84061	1.84061
submission_new_hpo.csv	2024-09-18 23:05:44	new features with hyperparameters-2	complete	0.48480	0.48480
submission_new_hpo.csv	2024-09-18 22:46:12	new features with hyperparameters	complete	0.59355	0.59355
submission_new_hpo.csv	2024-09-18 22:06:45	new features with hyperparameters	complete	0.49050	0.49050
submission_new_hpo.csv	2024-09-18 21:36:14	new features with hyperparameters	complete	0.49050	0.49050
submission_new_features.csv	2024-09-18 15:41:15	new features	complete	0.67692	0.67692
submission_new_features.csv	2024-09-18 14:57:27	new features	complete	1.67733	1.67733
submission_new_features.csv	2024-09-18 02:19:01	new features	complete	1.67743	1.67743

Initial score of ?

## Step 4: Exploratory Data Analysis and Creating an additional feature

- Any additional feature will do, but a great suggestion would be to separate out the datetime into hour, day, or month parts.

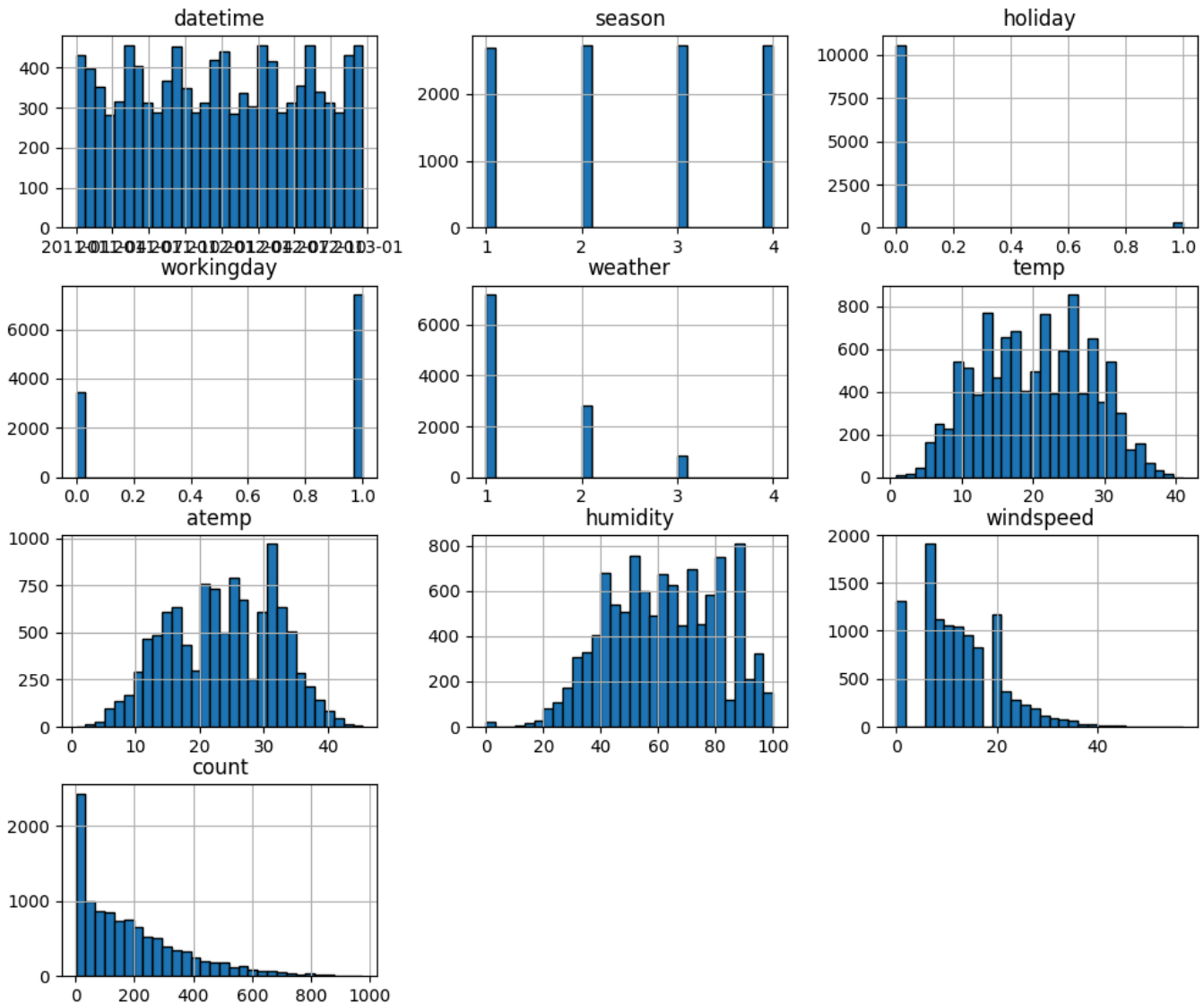
```
# Create a histogram of all features to show the distribution of each one relative to the data. This is part of the exploratory
train.hist(figsize=(12, 10), bins=30, edgecolor='black')
```



```

array([[<Axes: title={center: 'datetime'}>,
       <Axes: title={center: 'season'}>,
       <Axes: title={center: 'holiday'}>,
       <Axes: title={center: 'workingday'}>,
       <Axes: title={center: 'weather'}>,
       <Axes: title={center: 'temp'}>,
       <Axes: title={center: 'atemp'}>,
       <Axes: title={center: 'humidity'}>,
       <Axes: title={center: 'windspeed'}>],
      dtype=object)

```



```

# create a new feature
train['hour'] = train['datetime'].dt.hour
test['hour'] = test['datetime'].dt.hour

```

## ✓ Make category types for these so models know they are not just numbers

- AutoGluon originally sees these as ints, but in reality they are int representations of a category.
- Setting the dtype to category will classify these as categories in AutoGluon.

```

def get_season(date):
    month = date.month
    if month in [12, 1, 2]:
        return 'Winter'
    elif month in [3, 4, 5]:
        return 'Spring'
    elif month in [6, 7, 8]:

```

```

        return 'Summer'
    elif month in [9, 10, 11]:
        return 'Fall'
    else:
        return 'Unknown'

def get_weather(atemp):
    if atemp < 10:
        return 'Cold'
    elif 10 <= atemp < 20:
        return 'Cool'
    elif 20 <= atemp < 30:
        return 'Warm'
    elif atemp >= 30:
        return 'Hot'
    else:
        return 'Unknown' # In case of invalid input

```

```


train['weather'] = train['atemp'].apply(get_weather)
train['weather'] = train['weather'].astype('category')
test['weather'] = test['atemp'].apply(get_weather)
test['weather'] = test['weather'].astype('category')
train['season'] = train['datetime'].apply(get_season)
train["season"] = train["season"].astype('category')
test["season"] = test['datetime'].apply(get_season)
test["season"] = test["season"].astype('category')
train['day_of_week'] = train['datetime'].dt.dayofweek
test['day_of_week'] = test['datetime'].dt.dayofweek

```

```

# View are new feature
train.head()

```



	datetime	season	holiday	workingday	weather	temp	atemp	humidity	windspeed	count	hour	day_of_week
0	2011-01-01 00:00:00	Winter	0	0	Cool	9.84	14.395	81	0.0	16	0	5
1	2011-01-01 01:00:00	Winter	0	0	Cool	9.02	13.635	80	0.0	40	1	5
2	2011-01-01 02:00:00	Winter	0	0	Cool	9.02	13.635	80	0.0	32	2	5
3	2011-01-01 03:00:00	Winter	0	0	Cool	9.84	14.395	75	0.0	13	3	5
4	2011-01-01 04:00:00	Winter	0	0	Cool	9.84	14.395	75	0.0	1	4	5

Next steps:

[Generate code with train](#)

 [View recommended plots](#)

[New interactive sheet](#)

```

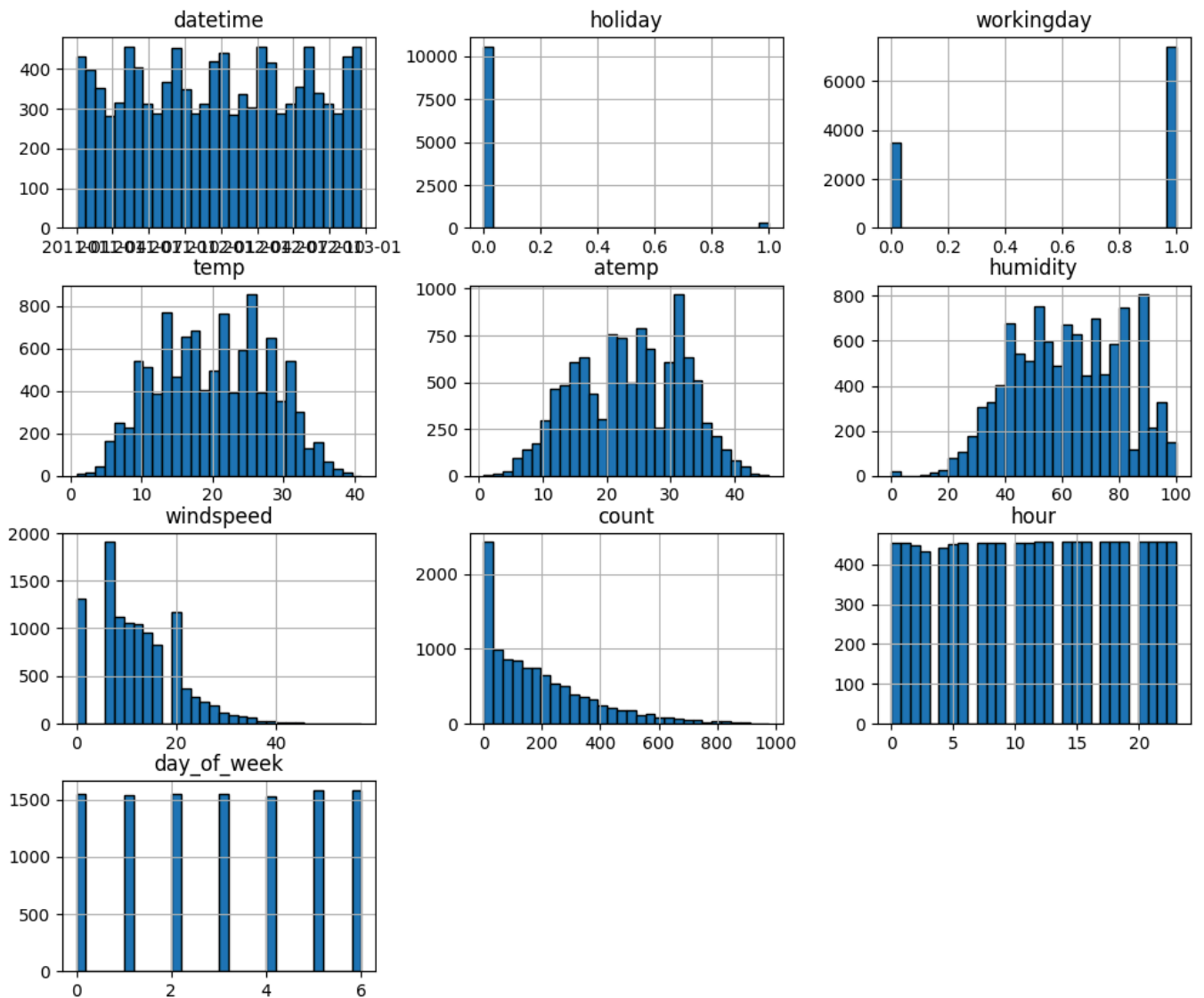
# View histogram of all features again now with the hour feature
train.hist(figsize=(12, 10), bins=30, edgecolor='black')

```

```

array([[<Axes: title={ 'center': 'datetime'>,<Axes: title={ 'center': 'holiday'>,<Axes: title={ 'center': 'workingday'>,<Axes: title={ 'center': 'temp'>,<Axes: title={ 'center': 'atemp'>,<Axes: title={ 'center': 'humidity'>,<Axes: title={ 'center': 'windspeed'>,<Axes: title={ 'center': 'count'>,<Axes: title={ 'center': 'hour'>,<Axes: title={ 'center': 'day_of_week'>,<Axes: >,<Axes: >]],
dtype=object)

```



✓ Step 5: Rerun the model with the same settings as before, just with more features

```

predictor_new_features = TabularPredictor(label="count", eval_metric='root_mean_squared_error').fit(train_data=train, time_li

```



```

Fitting model: KNeighborsDist_BAG_L1 ... Training model for up to 271.74s of the 407.79s of remaining time.
-84.1251 = Validation score (-root_mean_squared_error)
0.09s = Training runtime
0.11s = Validation runtime
Fitting model: LightGBMXT_BAG_L1 ... Training model for up to 271.45s of the 407.5s of remaining time.
Fitting 8 child models (S1F1 - S1F8) | Fitting with ParallelLocalFoldFittingStrategy (2 workers, per: cpus=1, gpu:
-36.1424 = Validation score (-root_mean_squared_error)
167.83s = Training runtime
58.55s = Validation runtime
Fitting model: LightGBM_BAG_L1 ... Training model for up to 86.82s of the 222.87s of remaining time.
Fitting 8 child models (S1F1 - S1F8) | Fitting with ParallelLocalFoldFittingStrategy (2 workers, per: cpus=1, gpu:
-35.3002 = Validation score (-root_mean_squared_error)
81.29s = Training runtime
9.73s = Validation runtime
Fitting model: RandomForestMSE_BAG_L1 ... Training model for up to 0.02s of the 136.06s of remaining time.
-40.7707 = Validation score (-root_mean_squared_error)
23.84s = Training runtime
1.1s = Validation runtime
Fitting model: WeightedEnsemble_L2 ... Training model for up to 360.0s of the 109.08s of remaining time.
Ensemble Weights: {'LightGBM_BAG_L1': 0.44, 'LightGBMXT_BAG_L1': 0.36, 'RandomForestMSE_BAG_L1': 0.16, 'KNeighbor:
-33.9739 = Validation score (-root_mean_squared_error)
0.03s = Training runtime
0.0s = Validation runtime
Fitting 106 L2 models ...
Fitting model: LightGBMXT_BAG_L2 ... Training model for up to 109.02s of the 108.98s of remaining time.
Fitting 8 child models (S1F1 - S1F8) | Fitting with ParallelLocalFoldFittingStrategy (2 workers, per: cpus=1, gpu:
-32.0217 = Validation score (-root_mean_squared_error)
44.76s = Training runtime
1.53s = Validation runtime
Fitting model: LightGBM_BAG_L2 ... Training model for up to 59.98s of the 59.94s of remaining time.
Fitting 8 child models (S1F1 - S1F8) | Fitting with ParallelLocalFoldFittingStrategy (2 workers, per: cpus=1, gpu:
-31.3195 = Validation score (-root_mean_squared_error)
37.41s = Training runtime
0.44s = Validation runtime
Fitting model: RandomForestMSE_BAG_L2 ... Training model for up to 18.3s of the 18.26s of remaining time.
-33.0035 = Validation score (-root_mean_squared_error)
49.6s = Training runtime
1.21s = Validation runtime
Fitting model: WeightedEnsemble_L3 ... Training model for up to 360.0s of the -34.45s of remaining time.
Ensemble Weights: {'LightGBM_BAG_L2': 0.696, 'LightGBMXT_BAG_L2': 0.304}
-31.1517 = Validation score (-root_mean_squared_error)
0.07s = Training runtime
0.0s = Validation runtime
AutoGluon training complete, total runtime = 443.39s ... Best model: WeightedEnsemble_L3 | Estimated inference throughput
TabularPredictor saved. To load. use: predictor = TabularPredictor.load("AutoGluonModels/ag-20240919 143202")

```

```

performance_new_features = predictor_new_features.evaluate(train)
print(performance_new_features)

```

```

predictor_new_features.fit_summary()
predictor_new_features.leaderboard(silent=True).plot(kind="bar", x="model", y="score_val")

```

```

{ 'root_mean_squared_error': -16.353416247159764, 'mean_squared_error': -267.434222952869, 'mean_absolute_error': -10.5820'
*** Summary of fit() ***
Estimated performance of each model:

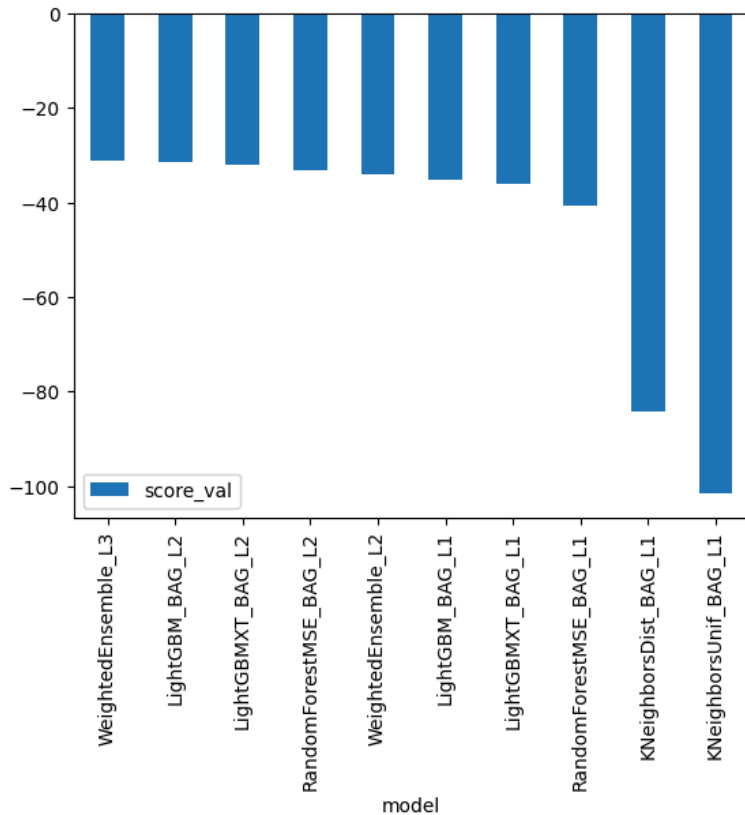
```

	model	score_val	eval_metric	pred_time_val	fit_time	pred_time_val_marginal	fit_time
0	WeightedEnsemble_L3	-31.151678	root_mean_squared_error	71.528347	355.340129	0.001137	
1	LightGBM_BAG_L2	-31.319541	root_mean_squared_error	70.000471	310.513413	0.441201	
2	LightGBMXT_BAG_L2	-32.021717	root_mean_squared_error	71.086009	317.864136	1.526740	
3	RandomForestMSE_BAG_L2	-33.003540	root_mean_squared_error	70.765061	322.706648	1.205791	
4	WeightedEnsemble_L2	-33.973933	root_mean_squared_error	69.481162	273.082732	0.001079	
5	LightGBM_BAG_L1	-35.300237	root_mean_squared_error	9.729428	81.285480	9.729428	
6	LightGBMXT_BAG_L1	-36.142399	root_mean_squared_error	58.549010	167.831077	58.549010	
7	RandomForestMSE_BAG_L1	-40.770714	root_mean_squared_error	1.096457	23.844838	1.096457	
8	KNeighborsDist_BAG_L1	-84.125061	root_mean_squared_error	0.105188	0.094381	0.105188	
9	KNeighborsUnif_BAG_L1	-101.546199	root_mean_squared_error	0.079187	0.051084	0.079187	

```

Number of models trained: 10
Types of models trained:
{'WeightedEnsembleModel_L3', 'StackerEnsembleModel_LGB', 'StackerEnsembleModel_KNN', 'StackerEnsembleModel_RF'}
Bagging used: True (with 8 folds)
Multi-layer stack-ensembling used: True (with 3 levels)
Feature Metadata (Processed):
(raw dtype, special dtypes):
('category', []) : 2 | ['season', 'weather']
('float', []) : 3 | ['temp', 'atemp', 'windspeed']
('int', []) : 3 | ['humidity', 'hour', 'day_of_week']
('int', ['bool']) : 2 | ['holiday', 'workingday']
('int', ['datetime_as_int']) : 4 | ['datetime', 'datetime.year', 'datetime.month', 'datetime.day']
*** End of fit() summary ***
/usr/local/lib/python3.10/dist-packages/autogluon/core/autogluon/plots.py:169: UserWarning: AutoGluon summary plots cannot be
warnings.warn('AutoGluon summary plots cannot be created because bokeh is not installed. To see plots, please do: "pip
<Axes: xlabel='model'>

```



```

# Remember to set all negative values to zero
predictions_new = predictor_new_features.predict(test)
predictions_new.head()
predictions_description_new = predictions_new.describe()
print(predictions_description_new)

num_negative_values_new = (predictions_new < 0).sum()
print(f'Number of negative values: {num_negative_values_new}')

```

```

count    6493.000000
mean      151.111679
std       132.681198

```

```

min          2.754606
25%          48.052208
50%          119.027191
75%          211.865540
max          807.542786
Name: count, dtype: float64
Number of negative values: 0

```

```
predictions_new[predictions_new < 0] = 0
```

```

# Same submitting predictions
submission["count"] = predictions_new
print(submission["count"].head())
submission.to_csv("submission_new_features.csv", index=False)

```

```

0    16.548439
1    12.219292
2    11.227691
3     9.673582
4     8.569694
Name: count, dtype: float32

```

```
!kaggle competitions submit -c bike-sharing-demand -f submission_new_features.csv -m "new features submission1"
```

```

100% 188k/188k [00:00<00:00, 304kB/s]
Successfully submitted to Bike Sharing Demand

```

```
!kaggle competitions submissions -c bike-sharing-demand | tail -n +1 | head -n 6
```

fileName	date	description	status	publicScore	privateScore
submission_new_features.csv	2024-09-19 14:57:42	new features submission1	complete	0.68507	0.68507
submission.csv	2024-09-19 14:29:24	original data submission1	complete	1.84061	1.84061
submission_new_hpo.csv	2024-09-18 23:05:44	new features with hyperparameters-2	complete	0.48480	0.48480
submission_new_hpo.csv	2024-09-18 22:46:12	new features with hyperparameters	complete	0.59355	0.59355

New Score of ?

## Step 6: Hyper parameter optimization

- There are many options for hyper parameter optimization.
- Options are to change the AutoGluon higher level parameters or the individual model hyperparameters.
- The hyperparameters of the models themselves that are in AutoGluon. Those need the `hyperparameter` and `hyperparameter_tune_kwargs` arguments.

```

# hyperparameter_tune_kwargs = {
#     'num_trials': 20, # Try 20 different configurations
#     'scheduler': 'local', # Run on local machine
#     'searcher': 'random', # Random search for hyperparameters
#     'max_t': 600 # Max time for each trial is 600 seconds
# }

```

```

# Exclude poor-performing models and define hyperparameters for tuning
hyperparameters = {
    'GBM': [
        {
            'learning_rate': 0.05, # Smaller learning rate for better generalization
            'num_leaves': 31, # Maximum number of leaves per tree
            'feature_fraction': 0.8, # Random subset of features for each iteration
            'bagging_fraction': 0.8, # Random subset of data for each iteration
            'bagging_freq': 5, # Bagging performed every 5 iterations
            'max_depth': 10, # Depth of the trees (you can set to -1 for no limit)
            'num_boost_round': 1000, # Number of boosting rounds
            'early_stopping_rounds': 50 # Early stopping if performance doesn't improve
        }
    ],
    'RF': [
        {

```



```

        'n_estimators': 100,          # Number of trees in the forest
        'max_depth': 10,             # Maximum depth of each tree
        'min_samples_split': 5,      # Minimum number of samples required to split an internal node
        'min_samples_leaf': 2,       # Minimum number of samples required to be at a leaf node
        'max_features': 'sqrt',      # Number of features to consider when looking for the best split
        'bootstrap': True             # Whether bootstrap samples are used when building trees
    }
],
'CAT': [
    {
        'learning_rate': 0.05,        # Smaller learning rate for more gradual training
        'depth': 6,                   # Depth of the trees
        'l2_leaf_reg': 3.0,           # Regularization to avoid overfitting
        'iterations': 1000,           # Number of boosting iterations
        'one_hot_max_size': 10,       # Maximum size of categorical features for one-hot encoding
        'eval_metric': 'RMSE',        # Root Mean Squared Error (for regression tasks)
        'od_type': 'Iter',            # Early stopping based on the number of iterations
        'od_wait': 100                # Wait for improvement in 100 iterations before stopping
    }
],
}

```

```

excluded_model_types = ['KNN']
time_limit = 600

```

```

# 1. only exclude models          hpo1
# 2. exclude models + hyperparams hpo2
# 3. increase time to 1000 sec    hpo3

```

```

predictor_new_hpo1 = TabularPredictor(
    label='count',
    eval_metric='root_mean_squared_error'
).fit(
    train_data=train,
    time_limit=time_limit,
    presets='best_quality',
    excluded_model_types=excluded_model_types, # Exclude KNN
)

```



```

Fitting model: LightGBM_XT_BAG_L2 ... Training model for up to 111.90s of the 111.91s of remaining time.
Fitting 8 child models (S1F1 - S1F8) | Fitting with ParallelLocalFoldFittingStrategy (2 workers, per: cpus=1, gpus
-35.4105 = Validation score (-root_mean_squared_error)
33.85s = Training runtime
0.44s = Validation runtime
Fitting model: LightGBM_BAG_L2 ... Training model for up to 73.86s of the 73.8s of remaining time.
Fitting 8 child models (S1F1 - S1F8) | Fitting with ParallelLocalFoldFittingStrategy (2 workers, per: cpus=1, gpus
-34.709 = Validation score (-root_mean_squared_error)
35.41s = Training runtime
0.16s = Validation runtime
Fitting model: RandomForestMSE_BAG_L2 ... Training model for up to 30.65s of the 30.59s of remaining time.
-35.4162 = Validation score (-root_mean_squared_error)
36.14s = Training runtime
0.77s = Validation runtime
Fitting model: WeightedEnsemble_L3 ... Training model for up to 360.0s of the -7.82s of remaining time.
Ensemble Weights: {'LightGBM_BAG_L1': 0.348, 'LightGBM_XT_BAG_L1': 0.261, 'LightGBM_BAG_L2': 0.261, 'RandomForestMS
-34.1822 = Validation score (-root_mean_squared_error)
0.07s = Training runtime
0.0s = Validation runtime
AutoGluon training complete, total runtime = 397.69s ... Best model: WeightedEnsemble_L3 | Estimated inference throughput:
TabularPredictor saved. To load, use: predictor = TabularPredictor.load("AutogluonModels/ag-20240919_150116")

```

```

performance_new_hpo1 = predictor_new_hpo1.evaluate(train)
print(performance_new_hpo1)
predictor_new_hpo1.fit_summary()
predictor_new_hpo1.leaderboard(silent=True).plot(kind="bar", x="model", y="score_val")

```

```

{ 'root_mean_squared_error': -14.477321139849748, 'mean_squared_error': -209.59282738634042, 'mean_absolute_error': -9.2981
*** Summary of fit() ***
Estimated performance of each model:

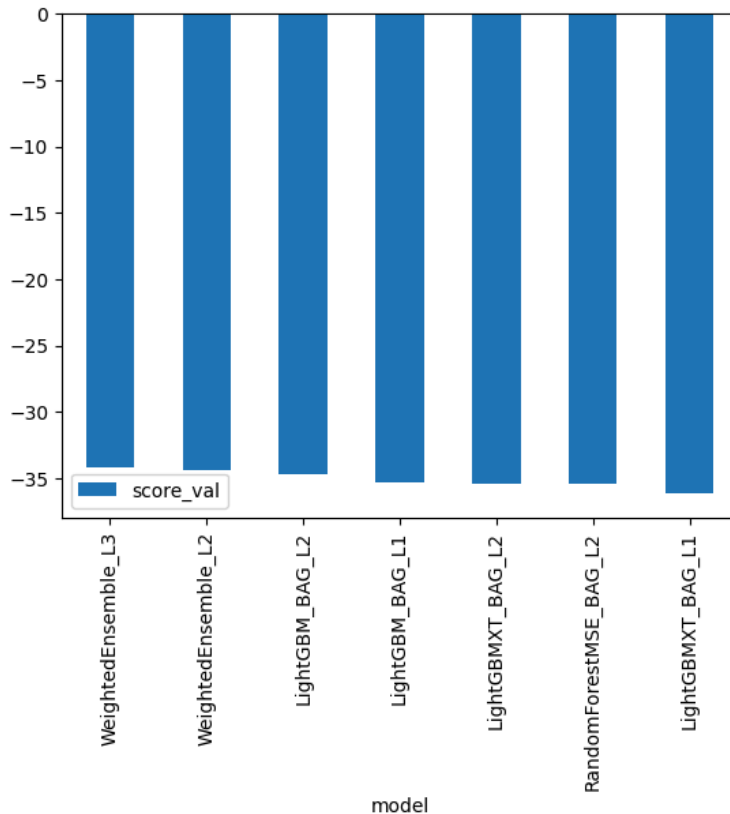
```

	model	score_val	eval_metric	pred_time_val	fit_time	pred_time_val_marginal	fit_time
0	WeightedEnsemble_L3	-34.182172	root_mean_squared_error	77.180456	330.845855	0.001240	
1	WeightedEnsemble_L2	-34.355720	root_mean_squared_error	76.247625	259.242725	0.000870	
2	LightGBM_BAG_L2	-34.708988	root_mean_squared_error	76.407416	294.626449	0.160661	
3	LightGBM_BAG_L1	-35.300237	root_mean_squared_error	11.354382	81.920167	11.354382	
4	LightGBMXT_BAG_L2	-35.410542	root_mean_squared_error	76.691324	293.069369	0.444569	
5	RandomForestMSE_BAG_L2	-35.416246	root_mean_squared_error	77.018555	295.365890	0.771800	
6	LightGBMXT_BAG_L1	-36.142399	root_mean_squared_error	64.892374	177.300834	64.892374	

```

Number of models trained: 7
Types of models trained:
{'WeightedEnsembleModel', 'StackerEnsembleModel_LGB', 'StackerEnsembleModel_RF'}
Bagging used: True (with 8 folds)
Multi-layer stack-ensembling used: True (with 3 levels)
Feature Metadata (Processed):
(raw dtype, special dtypes):
('category', []) : 2 | ['season', 'weather']
('float', []) : 3 | ['temp', 'atemp', 'windspeed']
('int', []) : 3 | ['humidity', 'hour', 'day_of_week']
('int', ['bool']) : 2 | ['holiday', 'workingday']
('int', ['datetime_as_int']) : 4 | ['datetime', 'datetime.year', 'datetime.month', 'datetime.day']
*** End of fit() summary ***
/usr/local/lib/python3.10/dist-packages/autogluon/core/utils/plots.py:169: UserWarning: AutoGluon summary plots cannot be
warnings.warn('AutoGluon summary plots cannot be created because bokeh is not installed. To see plots, please do: "pip
<Axes: xlabel='model'>

```



```

# Remember to set all negative values to zero
predictions_new_hpo1 = predictor_new_hpo1.predict(test)
predictions_new_hpo1.head()
predictions_description_new_hpo1 = predictions_new_hpo1.describe()
print(predictions_description_new_hpo1)
num_negative_values = (predictions_new_hpo1 < 0).sum()
print(f"Number of negative values: {num_negative_values}")
predictions_new_hpo1[predictions_new_hpo1 < 0] = 0

```

```

count    6493.000000
mean      190.406830
std       173.555099
min       -25.502981
25%        47.715908
50%       148.126572

```

```
75%      282.608582
max      886.808838
Name: count, dtype: float64
Number of negative values: 103
```

```
# Same submitting predictions
submission["count"] = predictions_new_hpo1
print(submission["count"].head())
submission.to_csv("submission_new_hpo1.csv", index=False)
```

```
0    17.823381
1     5.715229
2     4.324823
3     4.441064
4     4.176526
Name: count, dtype: float32
```

```
!kaggle competitions submit -c bike-sharing-demand -f submission_new_hpo1.csv -m "new features with hpo1"
```

```
100% 188k/188k [00:00<00:00, 306kB/s]
Successfully submitted to Bike Sharing Demand
```

```
!kaggle competitions submissions -c bike-sharing-demand | tail -n +1 | head -n 10
```

fileName	date	description	status	publicScore	privateScore
submission_new_hpo1.csv	2024-09-19 15:21:01	new features with hpo1	complete	0.58200	0.58200
submission_new_features.csv	2024-09-19 14:57:42	new features submission1	complete	0.68507	0.68507
submission.csv	2024-09-19 14:29:24	original data submission1	complete	1.84061	1.84061
submission_new_hpo.csv	2024-09-18 23:05:44	new features with hyperparameters-2	complete	0.48480	0.48480
submission_new_hpo.csv	2024-09-18 22:46:12	new features with hyperparameters	complete	0.59355	0.59355
submission_new_hpo.csv	2024-09-18 22:06:45	new features with hyperparameters	complete	0.49050	0.49050
submission_new_hpo.csv	2024-09-18 21:36:14	new features with hyperparameters	complete	0.49050	0.49050
submission_new_features.csv	2024-09-18 15:41:15	new features	complete	0.67692	0.67692

```
# 2. exclude + hyperparams hpo2
predictor_new_hpo2 = TabularPredictor(
    label='count',
    eval_metric='root_mean_squared_error'
).fit(
    train_data=train,
    time_limit=time_limit, # Adjust time limit as needed
    presets='best_quality',
    hyperparameters=hyperparameters,
    excluded_model_types=excluded_model_types,
)
```

```

40.07s = Training runtime
0.13s = Validation runtime
Fitting model: WeightedEnsemble_L2 ... Training model for up to 360.0s of the 312.92s of remaining time.
Ensemble Weights: {'LightGBM_BAG_L1': 0.81, 'CatBoost_BAG_L1': 0.19}
-35.5792 = Validation score (-root_mean_squared_error)
0.03s = Training runtime
0.0s = Validation runtime
Excluded models: [] (Specified by `excluded_model_types`)
Fitting 3 L2 models ...
Fitting model: LightGBM_BAG_L2 ... Training model for up to 312.87s of the 312.85s of remaining time.
Fitting 8 child models (S1F1 - S1F8) | Fitting with ParallelLocalFoldFittingStrategy (2 workers, per: cpus=1, gpu:
-36.5961 = Validation score (-root_mean_squared_error)
26.69s = Training runtime
0.15s = Validation runtime
Fitting model: RandomForest_BAG_L2 ... Training model for up to 279.02s of the 279.01s of remaining time.
-36.2967 = Validation score (-root_mean_squared_error)
2.37s = Training runtime
0.28s = Validation runtime
Fitting model: CatBoost_BAG_L2 ... Training model for up to 276.23s of the 276.22s of remaining time.
Fitting 8 child models (S1F1 - S1F8) | Fitting with ParallelLocalFoldFittingStrategy (2 workers, per: cpus=1, gpu:
-35.9421 = Validation score (-root_mean_squared_error)
33.21s = Training runtime
0.12s = Validation runtime
Fitting model: WeightedEnsemble_L3 ... Training model for up to 360.0s of the 236.77s of remaining time.
Ensemble Weights: {'LightGBM_BAG_L1': 0.56, 'CatBoost_BAG_L2': 0.24, 'RandomForest_BAG_L2': 0.16, 'CatBoost_BAG_L
-35.482 = Validation score (-root_mean_squared_error)
0.03s = Training runtime
0.0s = Validation runtime
AutoGluon training complete, total runtime = 179.87s ... Best model: WeightedEnsemble_L3 | Estimated inference throughput
TabularPredictor saved. To load, use: predictor = TabularPredictor.load("AutoGluonModels/aq-20240919 152215")

performance_new_hpo2 = predictor_new_hpo2.evaluate(train)
print(performance_new_hpo2)
predictor_new_hpo2.fit_summary()
predictor_new_hpo2.leaderboard(silent=True).plot(kind="bar", x="model", y="score_val")

```

```

{ 'root_mean_squared_error': -22.379799921419355, 'mean_squared_error': -500.85544452276184, 'mean_absolute_error': -14.42'
*** Summary of fit() ***
Estimated performance of each model:

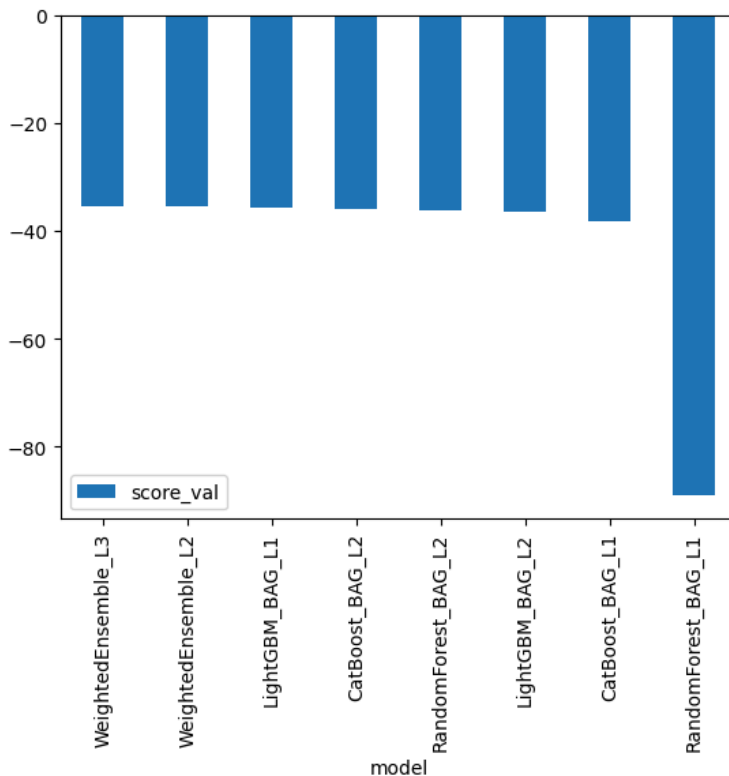
```

	model	score_val	eval_metric	pred_time_val	fit_time	pred_time_val_marginal	fit_time_m
0	WeightedEnsemble_L3	-35.481964	root_mean_squared_error	3.591426	128.185781	0.000952	0
1	WeightedEnsemble_L2	-35.579192	root_mean_squared_error	2.966970	91.557700	0.001032	0
2	LightGBM_BAG_L1	-35.731527	root_mean_squared_error	2.838163	42.858309	2.838163	42
3	CatBoost_BAG_L2	-35.942125	root_mean_squared_error	3.312475	125.781837	0.115207	33
4	RandomForest_BAG_L2	-36.296722	root_mean_squared_error	3.475267	94.938793	0.278000	2
5	LightGBM_BAG_L2	-36.596124	root_mean_squared_error	3.350437	119.260593	0.153169	26
6	CatBoost_BAG_L1	-38.140505	root_mean_squared_error	0.127776	48.668673	0.127776	48
7	RandomForest_BAG_L1	-88.924396	root_mean_squared_error	0.231329	1.039885	0.231329	1

```

Number of models trained: 8
Types of models trained:
{'WeightedEnsembleModel', 'StackerEnsembleModel_CatBoost', 'StackerEnsembleModel_LGB', 'StackerEnsembleModel_RF'}
Bagging used: True (with 8 folds)
Multi-layer stack-ensembling used: True (with 3 levels)
Feature Metadata (Processed):
(raw dtype, special dtypes):
('category', []) : 2 | ['season', 'weather']
('float', []) : 3 | ['temp', 'atemp', 'windspeed']
('int', []) : 3 | ['humidity', 'hour', 'day_of_week']
('int', ['bool']) : 2 | ['holiday', 'workingday']
('int', ['datetime_as_int']) : 4 | ['datetime', 'datetime.year', 'datetime.month', 'datetime.day']
*** End of fit() summary ***
/usr/local/lib/python3.10/dist-packages/autogluon/core/Utils/plots.py:169: UserWarning: AutoGluon summary plots cannot be
warnings.warn('AutoGluon summary plots cannot be created because bokeh is not installed. To see plots, please do: "pip :
<Axes: xlabel='model'>

```



```

predictions_new_hpo2 = predictor_new_hpo2.predict(test)
predictions_new_hpo2.head()
predictions_description_new_hpo2 = predictions_new_hpo2.describe()
print(predictions_description_new_hpo2)
num_negative_values = (predictions_new_hpo2 < 0).sum()
print(f'Number of negative values: {num_negative_values}')
predictions_new_hpo2[predictions_new_hpo2 < 0] = 0

```

```

count    6493.000000
mean      190.372559
std       173.766769
min       -23.048771
25%        47.012825
50%       147.574249
75%       285.164734

```



```
max      890.309570
Name: count, dtype: float64
Number of negative values: 96
```

```
submission["count"] = predictions_new_hpo2
print(submission["count"].head())
submission.to_csv("submission_new_hpo2.csv", index=False)
```

```
➡ 0    13.463066
   1     2.278706
   2     0.458701
   3     2.398850
   4     2.369717
   Name: count, dtype: float32
```

```
!kaggle competitions submit -c bike-sharing-demand -f submission_new_hpo2.csv -m "new features with hpo2"
```

```
➡ 100% 188k/188k [00:00<00:00, 296kB/s]
Successfully submitted to Bike Sharing Demand
```

```
!kaggle competitions submissions -c bike-sharing-demand | tail -n +1 | head -n 10
```

➡ fileName	date	description	status	publicScore	privateScore
submission_new_hpo2.csv	2024-09-19 15:54:03	new features with hpo2	complete	0.56763	0.56763
submission_new_hpo1.csv	2024-09-19 15:21:01	new features with hpo1	complete	0.58200	0.58200
submission_new_features.csv	2024-09-19 14:57:42	new features submission1	complete	0.68507	0.68507
submission.csv	2024-09-19 14:29:24	original data submission1	complete	1.84061	1.84061
submission_new_hpo.csv	2024-09-18 23:05:44	new features with hyperparameters-2	complete	0.48480	0.48480
submission_new_hpo.csv	2024-09-18 22:46:12	new features with hyperparameters	complete	0.59355	0.59355
submission_new_hpo.csv	2024-09-18 22:06:45	new features with hyperparameters	complete	0.49050	0.49050
submission_new_hpo.csv	2024-09-18 21:36:14	new features with hyperparameters	complete	0.49050	0.49050

```
time_limit = 1000
#####
# 3. only hyperparams hpo3
predictor_new_hpo3 = TabularPredictor(
    label='count',
    eval_metric='root_mean_squared_error'
).fit(
    train_data=train,
    time_limit=time_limit, # Adjust time limit as needed
    presets='best_quality',
    hyperparameters=hyperparameters,
    excluded_model_types=excluded_model_types,
)
```

```
➡
```

```

-35.1403 = Validation score (-root_mean_squared_error)
57.31s = Training runtime
0.17s = Validation runtime
Fitting model: WeightedEnsemble_L2 ... Training model for up to 360.0s of the 652.43s of remaining time.
Ensemble Weights: {'LightGBM_BAG_L1': 0.81, 'CatBoost_BAG_L1': 0.19}
-35.5792 = Validation score (-root_mean_squared_error)
0.03s = Training runtime
0.0s = Validation runtime
Excluded models: [] (Specified by `excluded_model_types`)
Fitting 3 L2 models ...
Fitting model: LightGBM_BAG_L2 ... Training model for up to 652.36s of the 652.34s of remaining time.
Fitting 8 child models (S1F1 - S1F8) | Fitting with ParallelLocalFoldFittingStrategy (2 workers, per: cpus=1, gpu:
-36.5961 = Validation score (-root_mean_squared_error)
35.84s = Training runtime
0.19s = Validation runtime
Fitting model: RandomForest_BAG_L2 ... Training model for up to 607.71s of the 607.69s of remaining time.
-36.2967 = Validation score (-root_mean_squared_error)
1.89s = Training runtime
0.29s = Validation runtime
Fitting model: CatBoost_BAG_L2 ... Training model for up to 605.38s of the 605.36s of remaining time.
Fitting 8 child models (S1F1 - S1F8) | Fitting with ParallelLocalFoldFittingStrategy (2 workers, per: cpus=1, gpu:
-35.9421 = Validation score (-root_mean_squared_error)
41.62s = Training runtime
0.11s = Validation runtime
Fitting model: WeightedEnsemble_L3 ... Training model for up to 360.0s of the 555.42s of remaining time.
Ensemble Weights: {'LightGBM_BAG_L1': 0.56, 'CatBoost_BAG_L2': 0.24, 'RandomForest_BAG_L2': 0.16, 'CatBoost_BAG_L
-35.482 = Validation score (-root_mean_squared_error)
0.04s = Training runtime
0.0s = Validation runtime
AutoGluon training complete, total runtime = 221.92s ... Best model: WeightedEnsemble_L3 | Estimated inference throughput
TabularPredictor saved. To load, use: predictor = TabularPredictor.load("AutogluonModels/ag-20240919_155654")

```

```

performance_new_hpo3 = predictor_new_hpo3.evaluate(train)
print(performance_new_hpo3)
predictor_new_hpo3.fit_summary()
predictor_new_hpo3.leaderboard(silent=True).plot(kind="bar", x="model", y="score_val")

```

```

predictions_new_hpo3 = predictor_new_hpo3.predict(test)
predictions_new_hpo3.head()
predictions_description_new_hpo3 = predictions_new_hpo3.describe()
print(predictions_description_new_hpo3)
num_negative_values = (predictions_new_hpo3 < 0).sum()
print(f"Number of negative values: {num_negative_values}")
predictions_new_hpo3[predictions_new_hpo3 < 0] = 0

```

```

submission["count"] = predictions_new_hpo3
print(submission["count"].head())
submission.to_csv("submission_new_hpo3.csv", index=False)

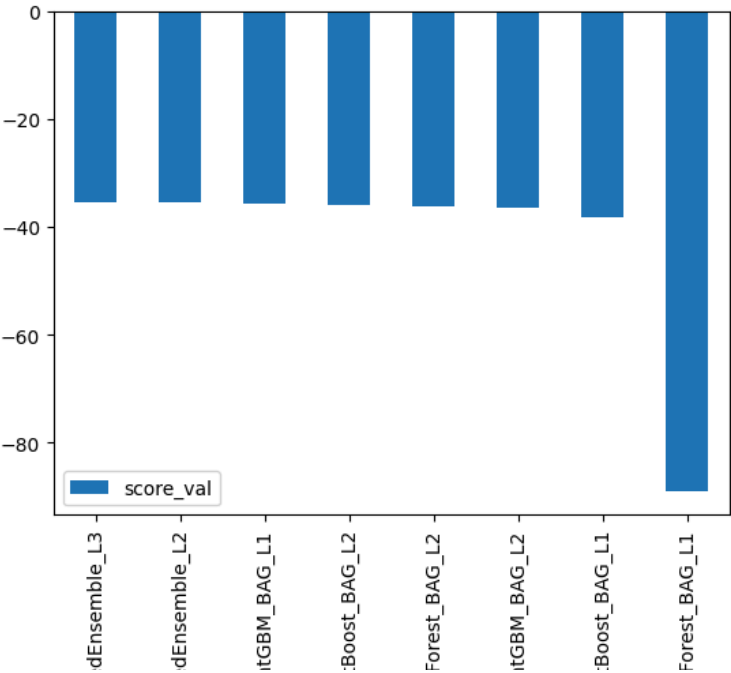
```

```

!kaggle competitions submit -c bike-sharing-demand -f submission_new_hpo3.csv -m "new features with hpo3"
!kaggle competitions submissions -c bike-sharing-demand | tail -n +1 | head -n 10

```

```
{'root_mean_squared_error': -22.379799938813722, 'mean_squared_error': -500.8554453013267, 'mean_absolute_error': -14.421}
*** Summary of fit() ***
Estimated performance of each model:
      model  score_val  eval_metric  pred_time_val  fit_time  pred_time_val_marginal  fit_time_m
0  WeightedEnsemble_L3 -35.481964  root_mean_squared_error    5.948557  152.741427    0.001060    0
1  WeightedEnsemble_L2 -35.579192  root_mean_squared_error    5.243127  108.105030    0.001039    0
2    LightGBM_BAG_L1 -35.731527  root_mean_squared_error    5.068578   50.760226    5.068578   50
3    CatBoost_BAG_L2 -35.942125  root_mean_squared_error    5.652593  150.817706    0.105721   41
4  RandomForest_BAG_L2 -36.296722  root_mean_squared_error    5.841776  111.087182    0.294904    1
5    LightGBM_BAG_L2 -36.596124  root_mean_squared_error    5.733250  145.045569    0.186377   35
6    CatBoost_BAG_L1 -38.140505  root_mean_squared_error    0.173509   57.314312    0.173509   57
7  RandomForest_BAG_L1 -88.924396  root_mean_squared_error    0.304785   1.127600    0.304785    1
Number of models trained: 8
Types of models trained:
{'WeightedEnsembleModel', 'StackerEnsembleModel_CatBoost', 'StackerEnsembleModel_LGB', 'StackerEnsembleModel_RF'}
Bagging used: True (with 8 folds)
Multi-layer stack-ensembling used: True (with 3 levels)
Feature Metadata (Processed):
(raw dtype, special dtypes):
('category', [])          : 2 | ['season', 'weather']
('float', [])             : 3 | ['temp', 'atemp', 'windspeed']
('int', [])               : 3 | ['humidity', 'hour', 'day_of_week']
('int', ['bool'])         : 2 | ['holiday', 'workingday']
('int', ['datetime_as_int']): 4 | ['datetime', 'datetime.year', 'datetime.month', 'datetime.day']
*** End of fit() summary ***
/usr/local/lib/python3.10/dist-packages/autogluon/core/utils/plots.py:169: UserWarning: AutoGluon summary plots cannot be
warnings.warn('AutoGluon summary plots cannot be created because bokeh is not installed. To see plots, please do: "pip
count      6493.000000
mean       190.372559
std        173.766769
min        -23.048771
25%        47.012825
50%       147.574249
75%       285.164703
max        890.309570
Name: count, dtype: float64
Number of negative values: 96
0      13.463066
1      2.278706
2      0.458701
3      2.398850
4      2.369717
Name: count, dtype: float32
100% 188k/188k [00:00<00:00, 289kB/s]
Successfully submitted to Bike Sharing DemandfileName          date          description
-----
submission_new_hpo3.csv  2024-09-19 16:06:03  new features with hpo3  complete  0.56763  0.56763
submission_new_hpo2.csv  2024-09-19 15:54:03  new features with hpo2  complete  0.56763  0.56763
submission_new_hpo1.csv  2024-09-19 15:21:01  new features with hpo1  complete  0.58200  0.58200
submission_new_features.csv  2024-09-19 14:57:42  new features submission1  complete  0.68507  0.68507
submission.csv           2024-09-19 14:29:24  original data submission1  complete  1.84061  1.84061
submission_new_hpo.csv   2024-09-18 23:05:44  new features with hyperparameters-2  complete  0.48480  0.48480
submission_new_hpo.csv   2024-09-18 22:46:12  new features with hyperparameters  complete  0.59355  0.59355
submission_new_hpo.csv   2024-09-18 22:06:45  new features with hyperparameters  complete  0.49050  0.49050
```



Weighte	Weighte	Ligh	Cal	Random	Ligh	Cal	Random
				model			

✓ New Score of ?

```
time_limit = 600
hyperparameters = {
    'GBM': [
        {
            'learning_rate': 0.01, # Lower learning rate for more gradual updates
            'num_boost_round': 1500, # More boosting rounds
            'num_leaves': 40, # Increase leaves for more complex trees
            'feature_fraction': 0.8, # Try lowering feature fraction for better generalization
            'bagging_fraction': 0.7, # Decrease to reduce overfitting
            'bagging_freq': 5, # Bagging every 5 iterations
            'max_depth': 15, # Allow deeper trees
            'early_stopping_rounds': 100 # Early stop if no improvement
        }
    ],
    'CAT': [
        {
            'iterations': 1200, # Increase iterations
            'depth': 8, # Adjust depth
            'learning_rate': 0.03, # Slightly lower learning rate
            'l2_leaf_reg': 4.0, # Increase regularization to avoid overfitting
            'one_hot_max_size': 10, # Categorical features with more categories use one-hot encoding
            'eval_metric': 'RMSE', # Ensure you're optimizing for RMSE
            'od_type': 'Iter', # Use iterative early stopping
            'od_wait': 50 # Early stopping after 50 iterations without improvement
        }
    ],
}

hyperparameter_tune_kwargs = {
    'num_trials': 20, # Try 20 different configurations
    'scheduler': 'local', # Run on local machine
    'searcher': 'random', # Random search for hyperparameters
    'max_t': 600 # Max time for each trial is 600 seconds
}

excluded_models = ['RandomForest', 'KNN']

#####
# 4. hyperparams, hyperparameter_tune_kwargs, modelexclude hpo4
predictor_new_hpo4 = TabularPredictor(
    label='count',
    eval_metric='root_mean_squared_error'
).fit(
    train_data=train,
    time_limit=time_limit, # Adjust time limit as needed
    presets='best_quality',
    hyperparameters=hyperparameters,
    excluded_model_types=excluded_model_types,
    hyperparameter_tune_kwargs=hyperparameter_tune_kwargs
)
```