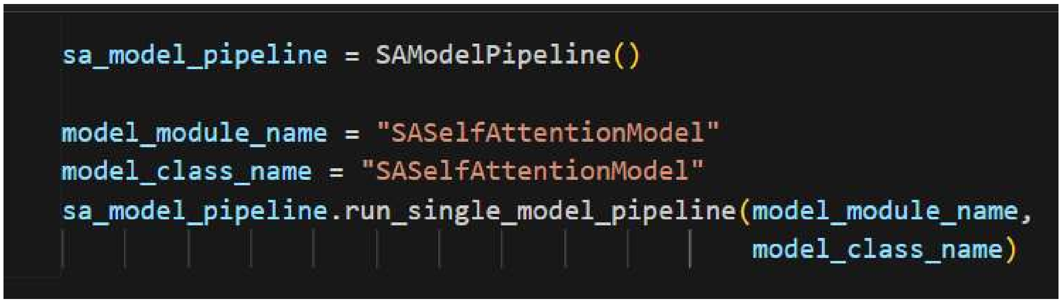
How to add a model step-by-step:

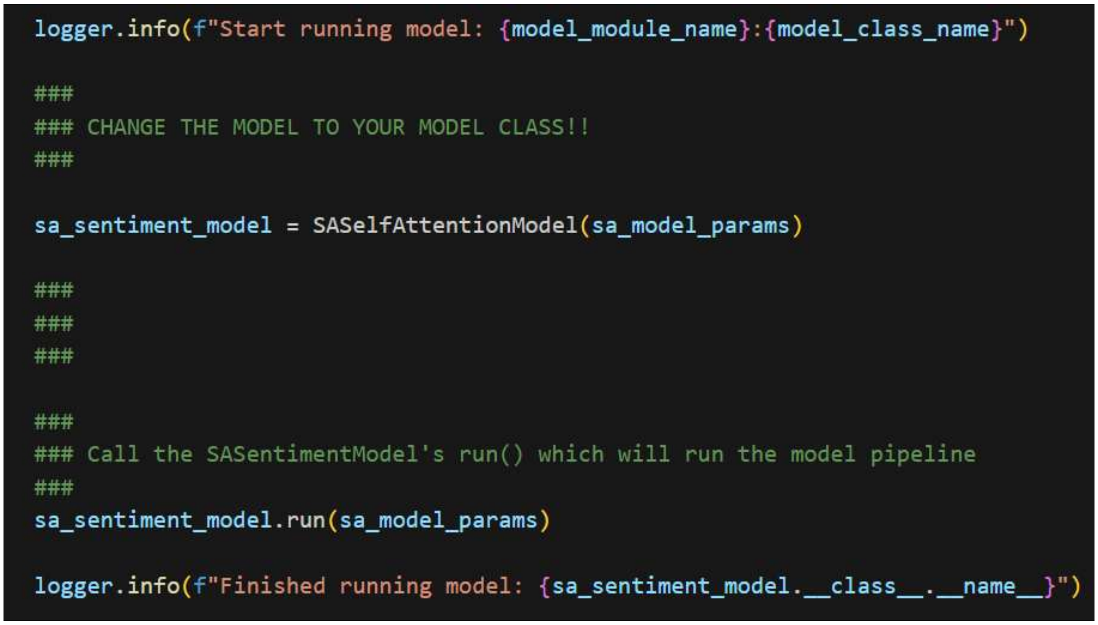
1. Adding a model consists of 3 steps
    a. Ensure the train, test and validation csv data files exist.
    b. Ensure your model can integrate into the model pipeline framework
    c. Ensure you run your model using the model pipeline framework
2. Ensuring the train, test and validation csv data files exist.
    a. Check the repo for your model's CSV file like train_1K.CSV or test_10K.csv, etc
    b. If your data file doesn't exist, add an entry to gen_data_info.csv, then run Jupyter notebook test_data_generator.ipynb. Baring any error, this should generate your data file you specified in gen_data_info.csv. Ensure you have an entry for train, test and validation or 3 entries.
3. Ensure your model can integrate into the model pipeline framework
    a. Your model needs to inherit from the SASentimentModel abstract base class
    b. And then implement all the abstract methods that your model will implement anyway.
    c. Of note is if you are using the model_config's model parameters. In your model's register() method, check that the keys you will be using to access the model paramaters are defined your model's entry in the model config file. Look at SASelfAttentionModel's register() method as an example. This ensures you don't encounter any run-time error when you run the rest of your model. Better to get a run-time error early in register().
4. Ensure you run your model using the model pipeline framework
    a. Your model is developed and you are ready to test, then add an entry to the model_config.csv
    b. The first column is the name of your model. You can name it Supercalifragilisticexpialidocious. It is only used for display purposes
    c. The 2nd column is the name of the module. This is the file name of your model. For example, you can name your file sa_self_attention.py. Then the 2nd column should be sa_self_attention
    d. The 3rd column is the class name. This is the name of your model class. For example, "class SASelfAttentionModel:" then the 3rd column should be SASelfAttentionModel
    e. The 4th column is any model params you like to use in your model. For example, vocab_size, max_sequence_length, epoch, etc. Then the 4th column should be a quoted string like "vocab_size=10000,max_sequence_length=100,epoch=10" Quoted string.
5. After you have configured the model_config.csv file, you test the model by
    a. Running one of three Jupyter notebooks
        i. test_model_pipeline.ipynb which runs ALL the models defined in the model_config.csv file or
        ii. test_single_model_pipeline.ipynb and modify the 2 parameters, model_module_name and model_class_name. This will run your model instance calling all the abstract methods you defined in your class.

iii. 

```
sa_model_pipeline = SAModelPipeline()

model_module_name = "SASelfAttentionModel"
model_class_name = "SASelfAttentionModel"
sa_model_pipeline.run_single_model_pipeline(model_module_name,
                                            model_class_name)
```

iv. Or run test_single_model.ipynb and similarly modify model_module_name and model_class_name to match your model. Then instantiate your model toward the end of the main() method. So change SASelfAttentionModel to your class while passing in the same parameter sa_model_params, see screen shot.



```
logger.info(f"Start running model: {model_module_name}:{model_class_name}")

###
### CHANGE THE MODEL TO YOUR MODEL CLASS!!
###

sa_sentiment_model = SASelfAttentionModel(sa_model_params)

###
###
###


###
### Call the SASentimentModel's run() which will run the model pipeline
###
sa_sentiment_model.run(sa_model_params)

logger.info(f"Finished running model: {sa_sentiment_model.__class__.__name__}")
```

<u>Use this method to run your model initially while developing your model</u>

b. Why 3 ways to run a model?

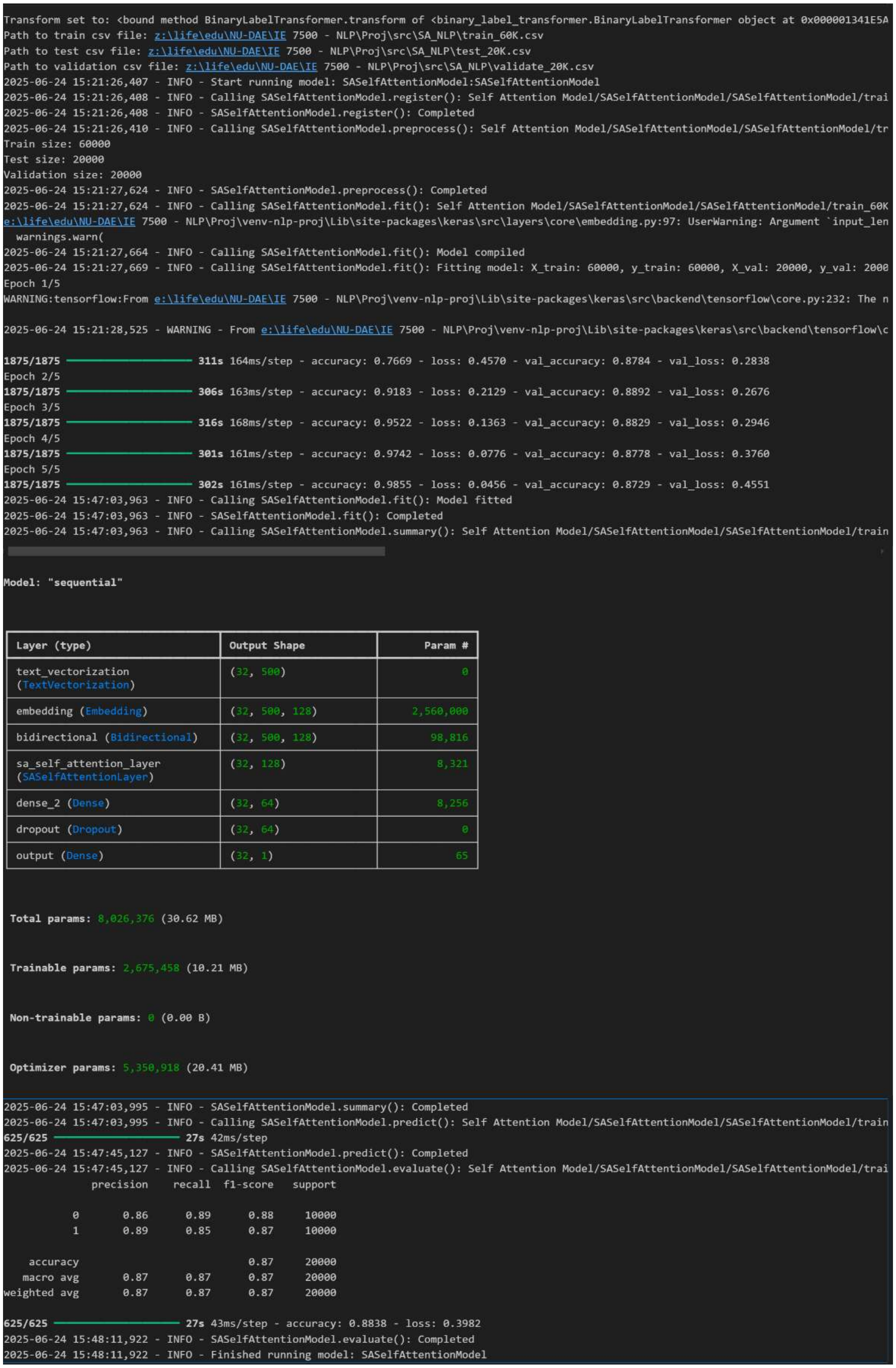
i. Test_model_pipeline.ipynb will run all the model pipelines defined in the model_config.csv file. Use this method if you have more than one model you want to run like a RNN model and a LSTM model. However, each entry of the model config file must be a different model. We will be using this to test all our models eventually. Let it run overnight, then look at the result in the morning.

ii. Test_single_model_pipeline.ipynb runs a single model's pipeline. Run this to ensure your model is integrated into the model pipeline framework.

iii. Finally, test_single_model.ipynb instantiates your model instead of using the python module/class loading facility that the model pipeline uses. This is the ***<u>PREFERRED</u>*** method while you are developing your model. The model pipeline, because it uses the python module/class loading facility, can give strange stack traces so you don't have a good way to know where your code is bombing out. However, when you instantiate a model directly, the stack trace is far better. Therefore, use this method while you are developing your code.

6. That's it.

Sample output of a run of the SASelfAttentionModel:



```
Transform set to: <bound method BinaryLabelTransformer.transform of <binary_label_transformer.BinaryLabelTransformer object at 0x000001341E5A
Path to train csv file: z:\life\edu\NU-DAE\IE 7500 - NLP\Proj\src\SA_NLP\train_60K.csv
Path to test csv file: z:\life\edu\NU-DAE\IE 7500 - NLP\Proj\src\SA_NLP\test_20K.csv
Path to validation csv file: z:\life\edu\NU-DAE\IE 7500 - NLP\Proj\src\SA_NLP\validate_20K.csv
2025-06-24 15:21:26,407 - INFO - Start running model: SASelfAttentionModel:SASelfAttentionModel
2025-06-24 15:21:26,408 - INFO - Calling SASelfAttentionModel.register(): Self Attention Model/SASelfAttentionModel/SASelfAttentionModel/trai
2025-06-24 15:21:26,408 - INFO - SASelfAttentionModel.register(): Completed
2025-06-24 15:21:26,410 - INFO - Calling SASelfAttentionModel.preprocess(): Self Attention Model/SASelfAttentionModel/SASelfAttentionModel/tr
Train size: 60000
Test size: 20000
Validation size: 20000
2025-06-24 15:21:27,624 - INFO - SASelfAttentionModel.preprocess(): Completed
2025-06-24 15:21:27,624 - INFO - Calling SASelfAttentionModel.fit(): Self Attention Model/SASelfAttentionModel/SASelfAttentionModel/train_60K
e:\life\edu\NU-DAE\IE 7500 - NLP\Proj\venv-nlp-proj\Lib\site-packages\keras\src\layers\core\embedding.py:97: UserWarning: Argument `input_len
  warnings.warn(
2025-06-24 15:21:27,664 - INFO - Calling SASelfAttentionModel.fit(): Model compiled
2025-06-24 15:21:27,669 - INFO - Calling SASelfAttentionModel.fit(): Fitting model: X_train: 60000, y_train: 60000, X_val: 20000, y_val: 2000
Epoch 1/5
WARNING:tensorflow:From e:\life\edu\NU-DAE\IE 7500 - NLP\Proj\venv-nlp-proj\Lib\site-packages\keras\src\backend\tensorflow\core.py:232: The n

2025-06-24 15:21:28,525 - WARNING - From e:\life\edu\NU-DAE\IE 7500 - NLP\Proj\venv-nlp-proj\Lib\site-packages\keras\src\backend\tensorflow\c

1875/1875 ━━━━━━━━━━━━━━━━━━━━ 311s 164ms/step - accuracy: 0.7669 - loss: 0.4570 - val_accuracy: 0.8784 - val_loss: 0.2838
Epoch 2/5
1875/1875 ━━━━━━━━━━━━━━━━━━━━ 306s 163ms/step - accuracy: 0.9183 - loss: 0.2129 - val_accuracy: 0.8892 - val_loss: 0.2676
Epoch 3/5
1875/1875 ━━━━━━━━━━━━━━━━━━━━ 316s 168ms/step - accuracy: 0.9522 - loss: 0.1363 - val_accuracy: 0.8829 - val_loss: 0.2946
Epoch 4/5
1875/1875 ━━━━━━━━━━━━━━━━━━━━ 301s 161ms/step - accuracy: 0.9742 - loss: 0.0776 - val_accuracy: 0.8778 - val_loss: 0.3760
Epoch 5/5
1875/1875 ━━━━━━━━━━━━━━━━━━━━ 302s 161ms/step - accuracy: 0.9855 - loss: 0.0456 - val_accuracy: 0.8729 - val_loss: 0.4551
2025-06-24 15:47:03,963 - INFO - Calling SASelfAttentionModel.fit(): Model fitted
2025-06-24 15:47:03,963 - INFO - SASelfAttentionModel.fit(): Completed
2025-06-24 15:47:03,963 - INFO - Calling SASelfAttentionModel.summary(): Self Attention Model/SASelfAttentionModel/SASelfAttentionModel/train

Model: "sequential"

┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━┓
┃ Layer (type)                    ┃ Output Shape           ┃       Param # ┃
┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━┩
│ text_vectorization              │ (32, 500)              │             0 │
│ (TextVectorization)             │                        │               │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ embedding (Embedding)           │ (32, 500, 128)         │     2,560,000 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ bidirectional (Bidirectional)   │ (32, 500, 128)         │        98,816 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ sa_self_attention_layer         │ (32, 128)              │         8,321 │
│ (SASelfAttentionLayer)          │                        │               │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dense_2 (Dense)                 │ (32, 64)               │         8,256 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dropout (Dropout)               │ (32, 64)               │             0 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ output (Dense)                  │ (32, 1)                │            65 │
└─────────────────────────────────┴────────────────────────┴───────────────┘


 Total params: 8,026,376 (30.62 MB)


 Trainable params: 2,675,458 (10.21 MB)


 Non-trainable params: 0 (0.00 B)


 Optimizer params: 5,350,918 (20.41 MB)

2025-06-24 15:47:03,995 - INFO - SASelfAttentionModel.summary(): Completed
2025-06-24 15:47:03,995 - INFO - Calling SASelfAttentionModel.predict(): Self Attention Model/SASelfAttentionModel/SASelfAttentionModel/train
625/625 ━━━━━━━━━━━━━━━━━━━━ 27s 42ms/step
2025-06-24 15:47:45,127 - INFO - SASelfAttentionModel.predict(): Completed
2025-06-24 15:47:45,127 - INFO - Calling SASelfAttentionModel.evaluate(): Self Attention Model/SASelfAttentionModel/SASelfAttentionModel/trai
              precision    recall  f1-score   support

           0       0.86      0.89      0.88     10000
           1       0.89      0.85      0.87     10000

    accuracy                           0.87     20000
   macro avg       0.87      0.87      0.87     20000
weighted avg       0.87      0.87      0.87     20000

625/625 ━━━━━━━━━━━━━━━━━━━━ 27s 43ms/step - accuracy: 0.8838 - loss: 0.3982
2025-06-24 15:48:11,922 - INFO - SASelfAttentionModel.evaluate(): Completed
2025-06-24 15:48:11,922 - INFO - Finished running model: SASelfAttentionModel
```