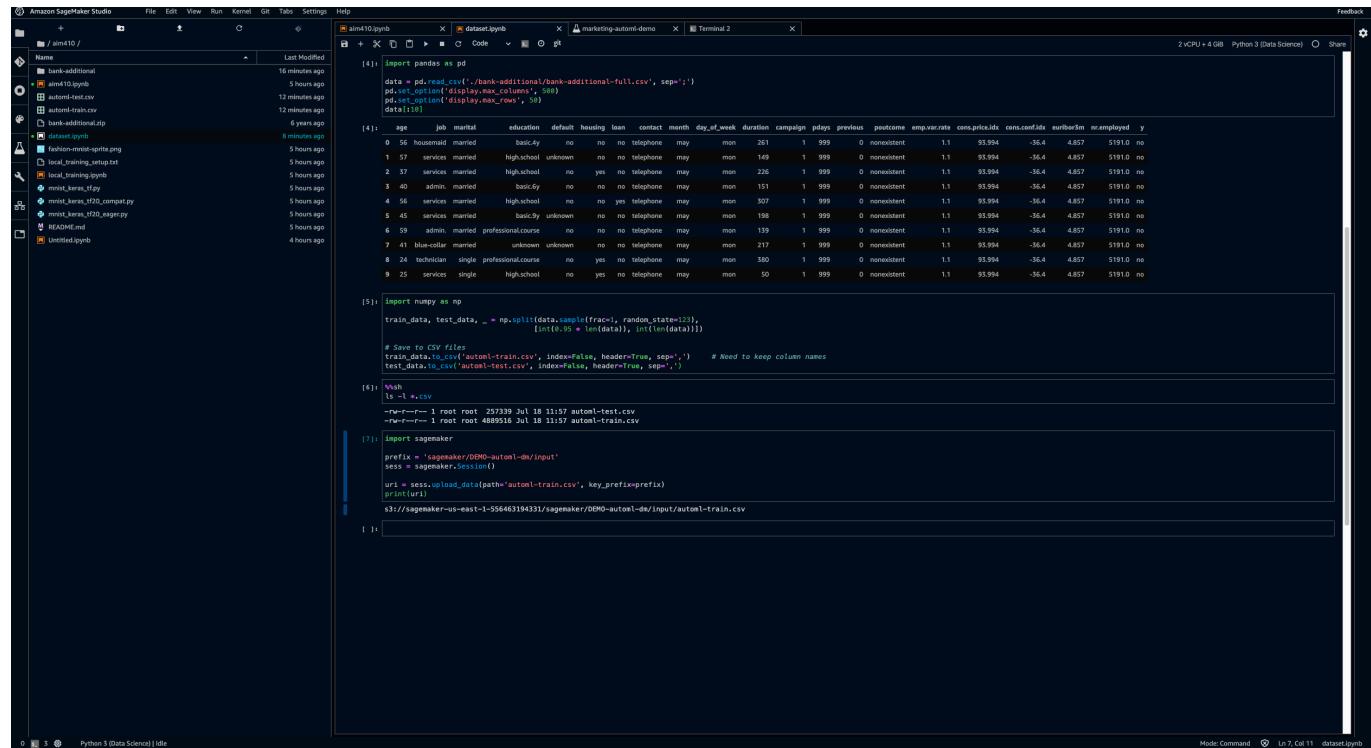


SageMaker AutoPilot

1. 샘플데이터 가져오기

아래 Julien Simon의 GitLab에 있는 Sample 데이터를 사용 SageMaker Studio에 clone하면 됨.

<https://gitlab.com/juliensimon/aim410>



```

[4]: import pandas as pd
data = pd.read_csv('../bank-additional/bank-additional-full.csv', sep=',')
data.set_option('display.max_columns', 30)
data.set_option('display.max_rows', 50)
data[:10]

[4]:   age job marital education default housing loan contact month day_of_week duration campaign pdays previous outcome emp.var.rate cons.price.idx cons.conf.idx cur bor3m nr.employed y
0 56 housemaid married basic-9y no no no telephone may mon 261 1 999 0 nonexistent 1.1 91.994 -36.4 4.857 5191.0 no
1 57 services married high-school unknown no no no telephone may mon 149 1 999 0 nonexistent 1.1 91.994 -36.4 4.857 5191.0 no
2 57 services married high-school no yes no no telephone may mon 226 1 999 0 nonexistent 1.1 91.994 -36.4 4.857 5191.0 no
3 40 admin. married basic-9y no no no telephone may mon 151 1 999 0 nonexistent 1.1 91.994 -36.4 4.857 5191.0 no
4 56 services married high-school no no yes telephone may mon 307 1 999 0 nonexistent 1.1 91.994 -36.4 4.857 5191.0 no
5 45 services married basic-9y unknown no no no telephone may mon 198 1 999 0 nonexistent 1.1 91.994 -36.4 4.857 5191.0 no
6 59 admin. married professional.course no no no telephone may mon 159 1 999 0 nonexistent 1.1 91.994 -36.4 4.857 5191.0 no
7 41 blue-collar married unknown unknown no no no telephone may mon 217 1 999 0 nonexistent 1.1 91.994 -36.4 4.857 5191.0 no
8 24 technician single professional.course no yes no no telephone may mon 380 1 999 0 nonexistent 1.1 91.994 -36.4 4.857 5191.0 no
9 25 services single high-school no yes no no telephone may mon 50 1 999 0 nonexistent 1.1 91.994 -36.4 4.857 5191.0 no

[5]: import numpy as np
train_data, test_data, _ = np.split(data.sample(frac=1, random_state=123),
[ int(0.85 * len(data)), int(len(data)) ])

# Save to CSV files
train_data.to_csv('automl-train.csv', index=False, header=True, sep=',') # Need to keep column names
test_data.to_csv('automl-test.csv', index=False, header=True, sep=',')

[6]: !ls -1 *.csv
root@root:~/root/257339-Jul-18-1115# automl-test.csv
root@root:~/root/4889916-Jul-18-1115# automl-train.csv

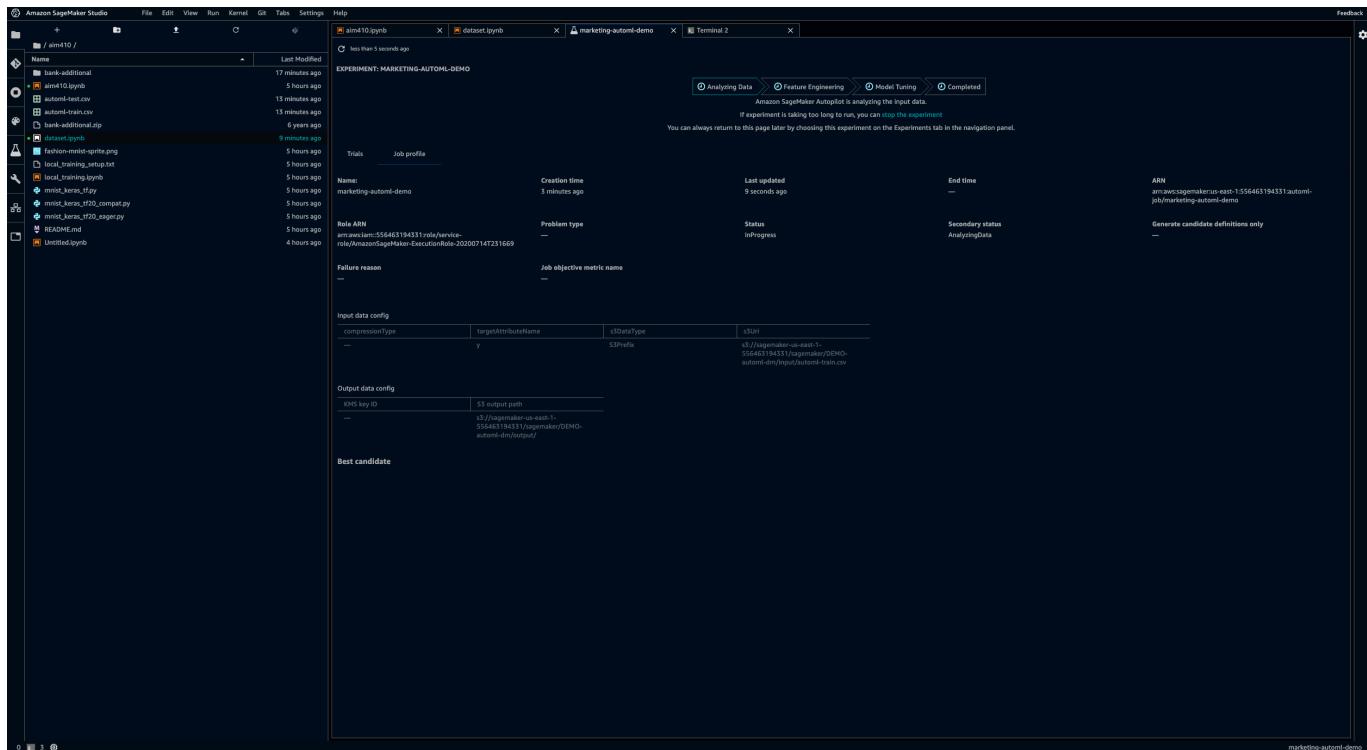
[7]: import sagemaker
prefix = 'sagemaker/DEMO-automl-dm/input'
sess = sagemaker.Session()
url = sess.upload_data(path='automl-train.csv', key_prefix=prefix)
print(url)
s3://sagemaker-us-east-1-556463194331/sagemaker/DEMO-automl-dm/input/automl-train.csv
[ ]

```

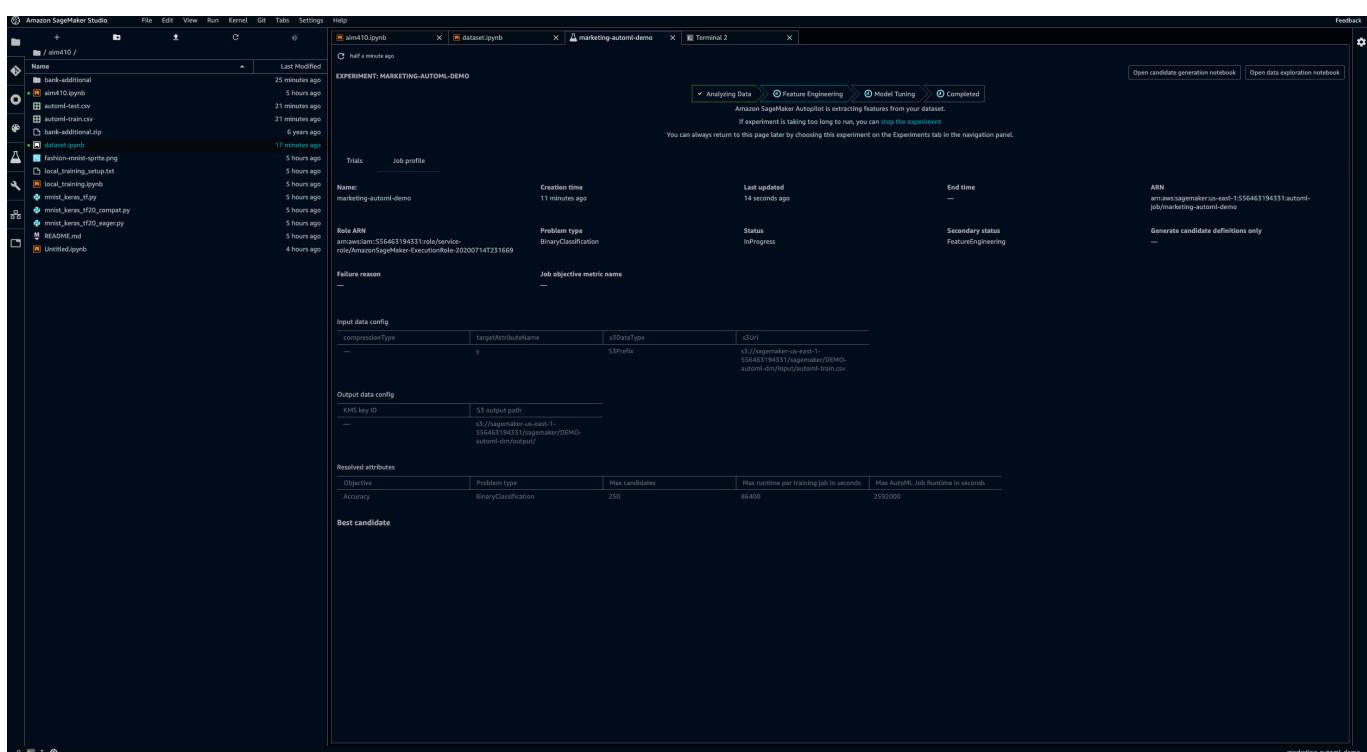
clone 후 unzip하고 data를 split 하기.

2. Experiment create 하기.

3. Data가 Analyzing 되길 기다리기.



10분정도 기다려주면 아래와 같이 분석이 끝난다.



4. 분석된 자료 보기

Candidate definition notebook

The screenshot shows the Amazon SageMaker Studio interface. On the left, there's a file browser titled 'aim410 /' showing various files and folders related to the AutoML job. The main content area is titled 'Amazon SageMaker Autopilot Candidate Definition Notebook'. It contains a note about the dataset being split into training and validation sets for a binary classification problem. Below this is a 'Contents' section with a tree view of the notebook's structure. The terminal window at the bottom shows a command to sync artifacts to an S3 bucket.

```
[1]: [1]: mkdir -p marketing-automl-demo-artifacts
[1]: aws s3 sync $1://sagemaker-us-east-1-55645314333/sagemaker/DEMO-autonl-dr/output/marketing-automl-demo/sagemaker-autonl-candidates/pr-1-2c4484ac4546c5982977f/f4ecdf4ac80a1b1184edbaef2725d4/generated_modules/marketing-
[1]: aws s3 sync $1://sagemaker-us-east-1-55645314333/sagemaker/DEMO-autonl-dr/output/marketing-automl-demo/sagemaker-autonl-candidates/pr-1-2c4484ac4546c5982977f/f4ecdf4ac80a1b1184edbaef2725d4/notebooks/sagemaker-autonl
```

250가지의 tuning jobs가 가능하다고 합니다.

내려가다 보면 Deploying Best Pipeline도 나옵니다.

weed out bad models를 가능하게 해줍니다.

Full visibility over auto ml process and full control. cuz we can run and keep teaking.

스냅샷은 아래 경로에 있습니다.

<https://d-gjg6mytpl2a2.studio.us-east-1.sagemaker.aws/jupyter/default/lab?sagemaker-share-id=tXzeKtCu8A-pWCPDu0UiYqXsGR5Dy35WUzWzC-TrTl%3D>

Data exploration

Amazon SageMaker Studio

File Edit View Run Kernel Git Tabs Settings Help

Read-only mode

Amazon SageMaker Autopilot Data Exploration

This report provides insights about the dataset you provided as input to the AutoML job. It was automatically generated by the AutoML training job: marketing-automl-demo.

As part of the AutoML job, the input dataset was randomly split into two pieces, one for training and one for validation. The training dataset was randomly sampled, and metrics were computed for each of the columns. This notebook provides these metrics so that you can:

- Understand how the job analyzed features to select the candidate pipelines.
- Modify and improve the generated AutoML pipelines using knowledge that you have about the dataset.

We read 39128 rows from the training dataset. The dataset has 21 columns and the column named `y` is used as the target column. This is identified as a `BinaryClassification` problem. Here are 2 examples of labels: ['yes', 'no'] .

Suggested Action Items

- Look for sections like this for recommended actions that you can take.

Contents

- Dataset Sample
- Column Analysis

Dataset Sample

The following table is a random sample of 10 rows from the training dataset. For ease of presentation, we are only showing 20 of the 21 columns of the dataset.

Suggested Action Items

- Verify the input headers correctly align with the columns of the dataset sample. If they are incorrect, update the header names of your input dataset in Amazon Simple Storage Service (Amazon S3).

	age	job	marital	education	default	housing	loan	contact	month	day_of_week	...	campaign	pdays	previous	poutcome	emp.var.rate	cons.price.idx	cons.conf.idx	euribor3m	nr.employed	y
0	52	blue-collar	married	basic-4y	unknown	yes	no	cellular	jul	fri	...	1	999	0	nonexistent	1.4	93.89799999999999	-42.7	4.962	5228.1	yes
1	32	technician	single	professional.course	no	yes	no	cellular	may	wed	...	2	999	0	nonexistent	-1.8	92.89799999999999	-46.2	1.354	5099.1	no
2	47	services	married	high.school	unknown	yes	no	cellular	aug	fri	...	1	999	0	nonexistent	1.4	93.5444	-36.1	4.962	4969999999999995	228.1
3	51	technician	single	university.degree	no	yes	no	cellular	jun	fri	...	1	999	0	nonexistent	-2.9	92.965	-40.8	1.268	5076.2	yes
4	54	blue-collar	single	unknown	no	yes	no	cellular	jul	mon	...	3	999	0	nonexistent	1.4	93.91799999999999	-42.7	4.962	5228.1	no
5	43	housemaid	married	basic-9y	unknown	no	no	cellular	jul	wed	...	1	999	0	nonexistent	1.4	93.91799999999999	-42.7	4.957	5228.1	no
6	38	blue-collar	married	basic-6y	no	no	no	cellular	jul	wed	...	2	999	0	nonexistent	1.4	93.91799999999999	-42.7	4.963	5228.1	no
7	27	blue-collar	married	basic-6y	no	yes	no	cellular	may	wed	...	3	999	0	nonexistent	-1.8	92.89799999999999	-46.2	1.281	5099.1	no
8	29	blue-collar	single	university.degree	no	yes	no	cellular	aug	wed	...	2	999	0	nonexistent	1.4	93.5444	-36.1	4.965	5228.1	no
9	32	admin.	married	university.degree	no	yes	yes	cellular	aug	mon	...	1	999	0	nonexistent	1.4	93.444	-36.1	4.965	5228.1	no

Column Analysis

The AutoML job analyzed the 21 input columns to infer each data type and select the feature processing pipelines for each training algorithm. For more details on the specific AutoML pipeline candidates, see [Amazon SageMaker Autopilot Candidate Definition Notebook.ipynb](#).

Percent of Missing Values

Within the data sample, the following columns contained missing values, such as: `nan`, `white spaces`, or `empty fields`. SageMaker Autopilot will attempt to fill in missing values using various techniques. For example, missing values can be replaced with a new `'unknown'` category for `Categorical` features and missing `Numerical` values can be replaced with the `mean` or `median` of the column.

스냅샷은 아래 경로에 있습니다.

<https://d-gjg6mytpl2a2.studio.us-east-1.sagemaker.aws/jupyter/default/lab?sagemaker-share-id=qf65Fz7RRR2fhF4UoJ3SI3GDVzhMsOw2l0i9d5a1C4%3D>

5. Feature Engineering.

더 기다리면 feature engineering이 마무리됩니다.

Amazon SageMaker Studio

File Edit View Run Kernel Git Tabs Settings Help

Last Modified

EXPERIMENT: MARKETING-AUTOML-DEMO

Analyzing Data Feature Engineering Model Tuning Completed

If experiment is taking too long to run, you can view the experiment. You can always return to this page later by choosing this experiment on the Experiments tab in the navigation panel.

Trials Job profile

Name: marketing-automl-demo Creation time: 31 minutes ago Last updated: 0 seconds ago End time: — ARN: arn:aws:sagemaker:us-east-1:556463194331:role/AmazonSageMaker-ExecutionRole-20200714T231659

Role ARN: arn:aws:sagemaker:us-east-1:556463194331:role/AmazonSageMaker-ExecutionRole-20200714T231659 Problem type: BinaryClassification Status: InProgress Secondary status: ModelTraining Generate candidate definitions only: —

Failure reason: — Job objective metric name: —

Input data config:

compressionType	targetAttributeName	s3DataType	s3Prefix
—	y	String	s3://sagemaker-us-east-1-556463194331/sagemaker/DEMO-automl-dm/train/

Output data config:

IAM key ID	S3 output path
—	s3://sagemaker-us-east-1-556463194331/sagemaker/DEMO-automl-dm/output/

Resolved attributes:

Objective	Problem type	Max candidates	Max runtime per training job in seconds	Max AutoML Job Runtime in seconds
Accuracy	BinaryClassification	250	86400	2592000

Best candidate:

Summary	Name	Status	Creation time	Last modified	End time	Objective value	Objective metric name	AutoML job name
—	012-9a00914	Completed	3 minutes ago	0 seconds ago	2 minutes ago	0.9131599731656047	validation:accuracy	marketing-automl-demo

Inference containers:

Image	Model Data URL	Environment - Transform mode	Environment - default invocations	Environment - SageMaker program	Environment - SageMaker submit directory
683115588728.dkr.ecr.us-east-1.amazonaws.com/sagemaker-alexa-automl-tf-cpu-py3	s3://sagemaker-us-east-1-556463194331/sagemaker/DEMO-automl-dm/inference-containers/models/marketing-automl-tf-cpu-py3-1.0.0.tar.gz	feature-transform	application/x-protobuf	sagemaker_inference	sagemaker_inference/model/sagemaker_inference
683115588728.dkr.ecr.us-east-1.amazonaws.com/sagemaker-alexa-automl-tf-cpu-ay3	s3://sagemaker-us-east-1-556463194331/sagemaker/DEMO-automl-dm/inference-containers/models/marketing-automl-tf-cpu-ay3-1.0.0.tar.gz	text/csv	—	—	—

candidates는 combination of a pre-processing and algorithm.

mostly we have XG boost

based on 10 candidates.

notebook run about 250 jobs in a row, parallelizing that stuff.

We are trying to tune 10 models, it's only 25 attempts for per model.

Trial name	Status	Start time	Objective
tuning-job-1-7b453157996d47489-097-av47a02	In Progress	1 minute ago	
tuning-job-1-7b453157996d47489-096-045e8b1	In Progress	1 minute ago	
tuning-job-1-7b453157996d47489-095-f178b46	In Progress	1 minute ago	
tuning-job-1-7b453157996d47489-094-f700a87c	In Progress	1 minute ago	
tuning-job-1-7b453157996d47489-093-045a9eb0	In Progress	1 minute ago	
tuning-job-1-7b453157996d47489-092-0366666	In Progress	1 minute ago	
tuning-job-1-7b453157996d47489-091-0366666	Completed	2 minutes ago	0.81194999321798705
tuning-job-1-7b453157996d47489-090-0195e30	Completed	2 minutes ago	0.516549906404174
tuning-job-1-7b453157996d47489-089-0262a22	Completed	2 minutes ago	0.5154600028207598
tuning-job-1-7b453157996d47489-088-7b9c021	Completed	5 minutes ago	0.5157800078352029
tuning-job-1-7b453157996d47489-087-0bd4a42	Completed	5 minutes ago	0.51591000556458
tuning-job-1-7b453157996d47489-086-679102e	Completed	5 minutes ago	0.5161700010259683
tuning-job-1-7b453157996d47489-085-5265c8b	Completed	5 minutes ago	0.5166799783706665
tuning-job-1-7b453157996d47489-084-01130d0	Completed	5 minutes ago	0.51335999566772
tuning-job-1-7b453157996d47489-083-5265c8c	Completed	5 minutes ago	0.515269970891859
tuning-job-1-7b453157996d47489-082-686905a	Completed	4 minutes ago	
tuning-job-1-7b453157996d47489-081-0747115a	Completed	4 minutes ago	
tuning-job-1-7b453157996d47489-080-42468f7	Completed	4 minutes ago	
tuning-job-1-7b453157996d47489-079-0d05392	Completed	4 minutes ago	0.500010005051406
tuning-job-1-7b453157996d47489-078-0974689	Completed	4 minutes ago	0.5170400017847454
tuning-job-1-7b453157996d47489-077-0227326	Completed	5 minutes ago	0.5142300162314654
tuning-job-1-7b453157996d47489-076-380108b	Completed	5 minutes ago	0.5026200075265339
tuning-job-1-7b453157996d47489-075-03249c6	Completed	5 minutes ago	0.5142500152174654
tuning-job-1-7b453157996d47489-074-037816	Completed	5 minutes ago	0.5006199973105384
tuning-job-1-7b453157996d47489-073-c1a762	Completed	5 minutes ago	0.502109980581909
tuning-job-1-7b453157996d47489-072-5055106	Completed	5 minutes ago	0.5060699919727783
tuning-job-1-7b453157996d47489-071-0a55967	Completed	5 minutes ago	0.5013400077819824
tuning-job-1-7b453157996d47489-070-d13a520	Completed	6 minutes ago	0.509940006321106
tuning-job-1-7b453157996d47489-069-0272326	Completed	6 minutes ago	0.514510016729756
tuning-job-1-7b453157996d47489-068-2116f01	Completed	6 minutes ago	0.51479999551616
tuning-job-1-7b453157996d47489-067-178efc8	Completed	7 minutes ago	0.510699623433191
tuning-job-1-7b453157996d47489-066-4-e6b0ff	Completed	7 minutes ago	0.51310004196167
tuning-job-1-7b453157996d47489-065-ec53f3f	Completed	7 minutes ago	0.500019990354509
tuning-job-1-7b453157996d47489-064-053315	Completed	7 minutes ago	0.504952050791143
tuning-job-1-7b453157996d47489-063-053315	Completed	7 minutes ago	0.503352050791143
■ Best: tuning-job-1-7b453157996d47489-062-499130d5	Completed	7 minutes ago	0.5173200130462646
tuning-job-1-7b453157996d47489-061-49cc826	Completed	7 minutes ago	0.5124600291252156

이런식으로 계속 experiment trial 중입니다.

Deploy model을 누르면 deploy 가능합니다.

하지만 model들이 completed 될 때까지 기다리는게 좋습니다.

250 jobs들이 completed 될 때 까지 기다립니다.

<https://d-gjg6mytpl2a2.studio.us-east-1.sagemaker.aws/jupyter/default/lab/worksheets/auto-E>

6. Model Tuning.

The screenshot shows the 'marketing-autml-demo' experiment in the Amazon SageMaker Studio. The 'Trials' tab is selected, displaying a list of completed tuning jobs. Each job entry includes the trial name, status (Completed), start time, and the value of the objective metric. The interface also features a search bar, filters for rows selected (0/20), and various navigation and configuration buttons.

30분? 정도 기다리면 위와같이 튜닝이 끝납니다.

위의 튜닝은 candidate에 있는 것들을 한 것입니다.

The screenshot shows the 'marketing-autml-c' experiment in the Amazon SageMaker Studio. The 'Trials' tab is selected, displaying a list of completed training jobs. Each job entry includes the trial name, status (Completed), start time, and the value of the objective metric. The interface also features a search bar, filters for rows selected (0/20), and various navigation and configuration buttons.

trial component에 들어가면 trial component list가 나오는데 그중 가장 objectiveMetric 값이 높은것을 택합니다. (Table Properties의 Type filter에서 Training job만 선택하여 볼 수 있음)

(Metrics의 objectiveMetric을 체크하여 보아도 됨)

가장 높은 것을 우클릭하여 open in trial details를 누릅니다.

그러면 위와 같은 창이 됩니다.

여러개를 골라 add chart할 수도 있습니다.

Amazon SageMaker Studio

File Edit View Run Kernel Git Tabs Settings Help

less than a minute ago

EXPERIMENTS

1 row selected 0/20 Filters Create Experiment

Search column name to sort

Name Created Last modified

Unsigned trial components

marketing-automl-demo... 3 hours ago 2 hours ago

customer-churn-prediction... 4 days ago 4 days ago

End of the list

TRIAL COMPONENTS 15 rows selected. Select rows to toggle chart visibility.

Experiment	Trial	Trial Component	Type	Training time	Actions
marketing-automl-demo...	tuning-job-1-76453157996d47489-128-217f09b-aws-training-job	Tuning job	Training job	1 minute	Remove
marketing-automl-demo...	tuning-job-1-76453157996d47489-218-64c652a-aws-training-job	Tuning job	Training job	1 minute	Remove
marketing-automl-demo...	tuning-job-1-76453157996d47489-266-0c4d4f-a-aws-training-job	Tuning job	Training job	1 minute	Remove
marketing-automl-demo...	tuning-job-1-76453157996d47489-144-4637fcfb-a-aws-training-job	Tuning job	Training job	1 minute	Remove
marketing-automl-demo...	tuning-job-1-76453157996d47489-185-76-cdd6f-a-aws-training-job	Tuning job	Training job	49 seconds	Remove
marketing-automl-demo...	tuning-job-1-76453157996d47489-186-1e5f6fa-aws-training-job	Tuning job	Training job	1 minute	Remove
marketing-automl-demo...	tuning-job-1-76453157996d47489-160-7f8292-a-aws-training-job	Tuning job	Training job	44 seconds	Remove
marketing-automl-demo...	tuning-job-1-76453157996d47489-156-9023635-a-aws-training-job	Tuning job	Training job	56 seconds	Remove
marketing-automl-demo...	tuning-job-1-76453157996d47489-179-49023635-a-aws-training-job	Tuning job	Training job	1 minute	Remove
marketing-automl-demo...	tuning-job-1-76453157996d47489-147-919deca-a-aws-training-job	Tuning job	Training job	58 seconds	Remove
marketing-automl-demo...	tuning-job-1-76453157996d47489-178-0bc86fe-a-aws-training-job	Tuning job	Training job	1 minute	Remove
marketing-automl-demo...	tuning-job-1-76453157996d47489-158-e5d204cd-a-aws-training-job	Tuning job	Training job	54 seconds	Remove
marketing-automl-demo...	tuning-job-1-76453157996d47489-191-6d518ef-a-aws-training-job	Tuning job	Training job	49 seconds	Remove
marketing-automl-demo...	tuning-job-1-76453157996d47489-141-daf182a-a-aws-training-job	Tuning job	Training job	49 seconds	Remove
marketing-automl-demo...	tuning-job-1-76453157996d47489-158-3bbef92a-a-aws-training-job	Tuning job	Training job	1 minute	Remove

CHART PROPERTIES

Data type: Time series Summary statistics

Chart type: Histogram

X-axis: validationaccuracy_max

Y-axis: trainaccuracy_max

Color: trialComponentName

1 CHART

trainaccuracy_max vs validationaccuracy_max

trialComponentName

Trial Component Name

그러면 위와 같은 차트를 그릴 수 있습니다.

각 trial들의 cross validation을 알 수 있습니다.

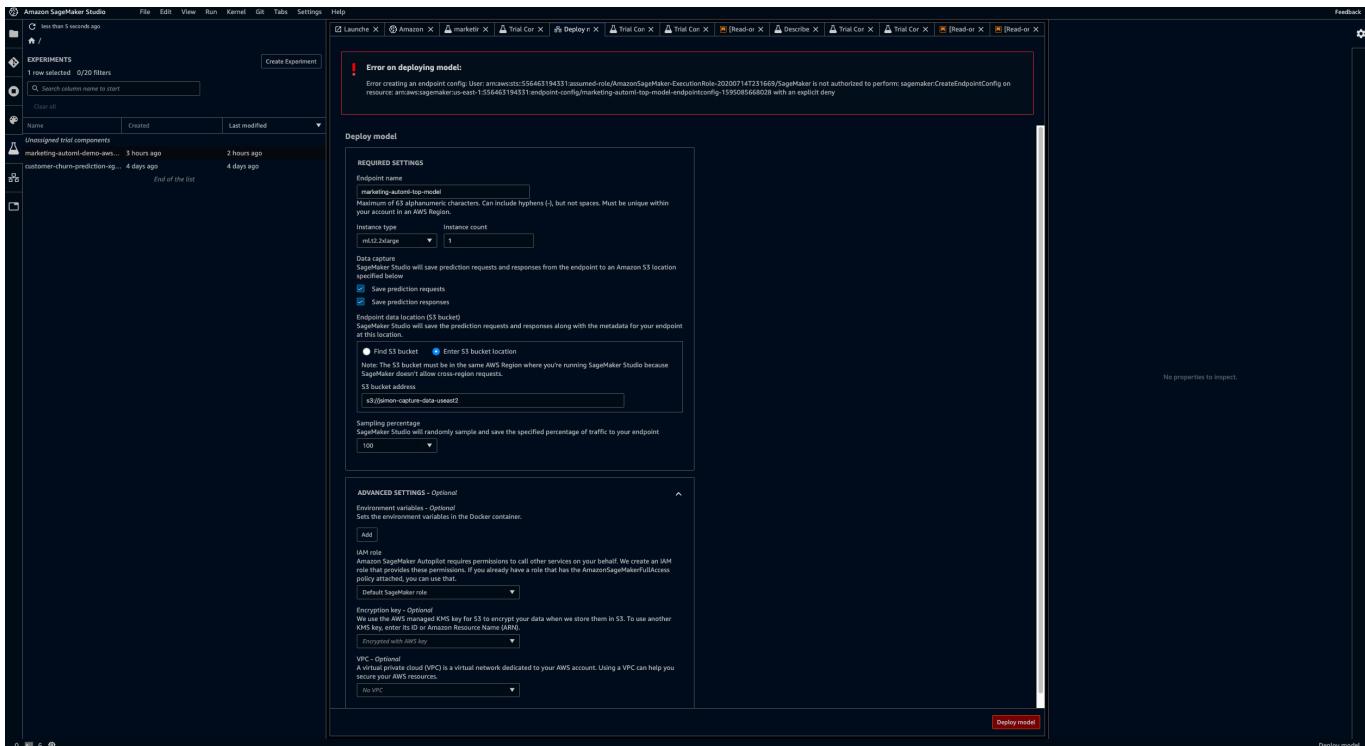
7. Deploy 하기

The screenshot shows the Amazon SageMaker Studio interface with the 'EXPERIMENTS' tab selected. In the center, there's a search bar and a table titled 'TRIAL COMPONENTS'. The table has the following columns: Name, Created, Last modified, Trial component name, Trial component type, Created, Last modified, Created by, Tags, Debugger status, and ObjectiveMetric. There are 20 rows of data, each representing a training job. On the right side, there's a sidebar titled 'TABLE PROPERTIES' which lists various metrics and parameters. At the bottom right, there's a 'Trial Component List' button.

하나 골라서 deploy model을 눌러줍니다.

The screenshot shows the 'Deploy model' configuration dialog in Amazon SageMaker Studio. It has two main sections: 'REQUIRED SETTINGS' and 'ADVANCED SETTINGS - Options'. In 'REQUIRED SETTINGS', you can set the endpoint name, instance type (mt2.2xlarge), instance count (1), and the S3 bucket address (\$3:linear-capture-data-user2). In 'ADVANCED SETTINGS', you can configure IAM roles, encryption keys, and VPC settings. At the bottom right, there's a 'Deploy model' button.

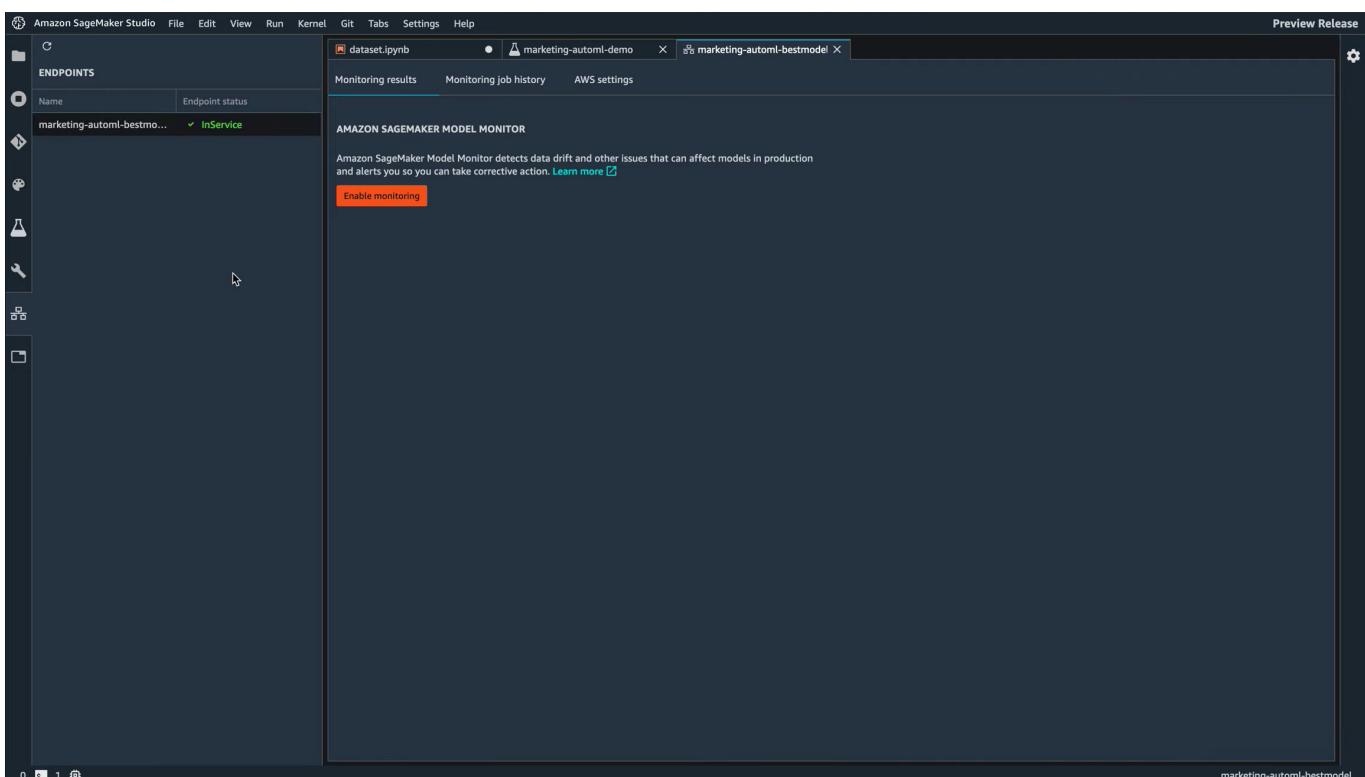
deploy 해주면



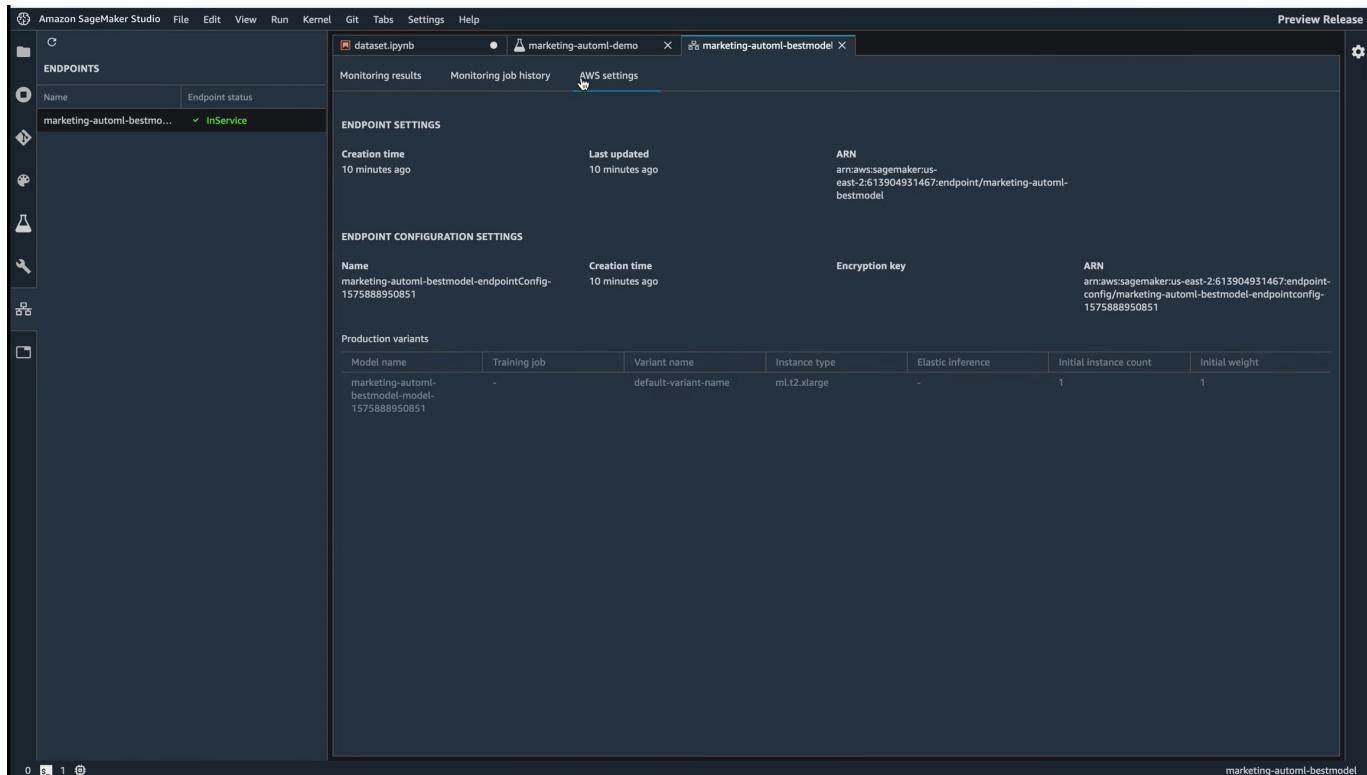
위와 같은 에러가 뜹니다.

저는 S3가 구축되지 않았기 때문이죠.

제대로 구축하고 기다려 주면



이렇게 inService가 됩니다.



이렇게 setting들도 볼 수 있습니다.

notebook으로 돌아가서

```

prefix = 'sagemaker/DEMO-automl-sm/input'
sess = sagemaker.Session()
uri = sess.upload_data(path='automl-train.csv', key_prefix=prefix)
print(uri)

Predict the test data set
[9]: ep_name = 'marketing-automl-bestmodel'
[10]: import boto3,sys
sm_rt = boto3.Session().client('runtime.sagemaker')
[11]: tp = tn = fp = fn = count = 0
with open('automl-test.csv') as f:
    lines = f.readlines()
    for l in lines[1:]:
        l = l.split(',')
        label = l[-1] # Store 'yes/no' label
        l = l[:-1]
        l = ', '.join(l) # Rebuild CSV line without label
        response = sm_rt.invoke_endpoint(EndpointName=ep_name, ContentType='text/csv', Accept='text/csv', Body=l)
        response = response['Body'].read().decode('utf-8')
        #print ('label %s' % (label,response))
        if 'yes' in label:
            # Sample is positive
            if 'yes' in response:
                # True positive
                tp+=1
            else:
                # False negative
                fn+=1
        else:
            # Sample is negative
            if 'no' in response:
                # True negative
                tn+=1
            else:
                # False positive
                fp+=1
        count += 1
        if (count % 100 == 0):
    
```

```

# AWS Lambda function to calculate metrics from CSV file
def lambda_handler(event, context):
    # Read CSV file
    with open('automl-test.csv') as f:
        lines = f.readlines()
        for l in lines[1:]:
            l = l.split(',')
            label = l[-1] # Store 'yes/no' label
            l = l[:-1] # Remove label
            l = ''.join(l) # Rebuild CSV line without label

    response = sm_rt.invoke_endpoint(EndpointName=ep_name, ContentType='text/csv', Accept='text/csv', Body=l)

    response = response['Body'].read().decode('utf-8')
    print("label %s" % (label, response))

    if 'yes' in label:
        # Sample is positive
        if 'yes' in response:
            # True positive
            tp += 1
        else:
            # False negative
            fn += 1
    else:
        # Sample is negative
        if 'no' in response:
            # True negative
            tn += 1
        else:
            # False positive
            fp += 1

    count += 1
    if (count % 100 == 0):
        sys.stdout.write(str(count) + ' ')
    print("Done")

    print("tn %d fp %d" % (tn, fp))
    print("fn %d tp %d" % (fn, tp))

    accuracy = (tp+tn)/(tp+tn+fp+fn)
    precision = tp/(tp+fp)
    recall = tn/(tn+fn)
    f1 = ((2*precision*recall))/(precision+recall)

    print("%s %s %s %s" % (accuracy, precision, recall, f1))

```

```

100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 Done
1770 52
112 126
0.9204 0.7079 0.9405 0.8078

```

8. 참고자료

AWS re:Invent 2019 - AI/ML recap - Part2: Amazon SageMaker (튜토리얼)

<https://medium.com/@julsimon/aws-re-invent-2019-ai-ml-recap-part-2-amazon-sagemaker-f83f05a1bc>

Documentation

<https://docs.aws.amazon.com/sagemaker/latest/dg/sagemaker-dg.pdf#whatis>

Amazon SageMaker Autopilot – Automatically Create High-Quality Machine Learning Models With Full Control And Visibility

<https://aws.amazon.com/ko/blogs/aws/amazon-sagemaker-autopilot-fully-managed-automatic-machine-learning/>

Amazon SageMaker Studio: The First Fully Integrated Development Environment For Machine Learning

<https://aws.amazon.com/ko/blogs/aws/amazon-sagemaker-studio-the-first-fully-integrated-development-environment-for-machine-learning/>

Dataset.ipynb (예시 코드)

<https://gitlab.com/juliensimon/amazon-studio-demos/blob/master/dataset.ipynb>

Julien Gitlab (예시)

<https://gitlab.com/juliensimon/amazon-studio-demos/blob/master/dataset.ipynb>

내가 한 분석 링크 (로그인 안하면 접근 불가?)

<https://d-gjg6mytpl2a2.studio.us-east-1.sagemaker.aws/jupyter/default/lab/workspaces/auto-E>

SageMaker 개발자 리소스

<https://aws.amazon.com/ko/sagemaker/developer-resources/>

한글 참조 자료

<https://docs.aws.amazon.com/sagemaker/index.html>

영어 Documentation

<https://docs.aws.amazon.com/sagemaker/latest/dg/whatis.html>