

In this assignment you will build models to predict quality of wines. Please review the data dictionary and data provenance here:

<https://archive.ics.uci.edu/ml/datasets/wine+quality>

The target variable has been recoded as 1 (quality > 6) and 0 (quality < 7)

1. Load the data
2. Explore the distribution of the target variable
3. Assess if there are any missing values
4. Explore the information value and distribution of features using the pairplot


2 pts.

LOAD THE DATA


```
import pandas as pd
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn import tree

from google.colab import files
uploaded = files.upload()

import io
wine_data = pd.read_csv(io.BytesIO(uploaded['whitewine-cl
```

 No file chosen Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.
Saving whitewine-classification.csv to whitewi


```
wine_data.head()
```



	fixed_acidity	volatile_acidity	citric_acid	res:
0	7.0	0.27	0.36	
1	6.3	0.30	0.34	
2	8.1	0.28	0.40	
3	7.2	0.23	0.32	
4	7.2	0.23	0.32	

2. EXPLORE THE DISTRIBUTION OF TARGET VARIABLE

```
wine_data.goodwine.mean()
```

 0.21641486320947326

Please follow our [blog](#) to see more information about new features, tips and tricks, and featured notebooks such as [Analyzing a Bank Failure with Colab](#).

2024-05-13

- Code actions are now supported to automatically improve and refactor code. Code actions can be triggered by the keyboard shortcut "Ctrl/⌘ + ."
- Python package upgrades
 - bigframes 1.0.0 -> 1.5.0
 - google-cloud-aiplatform 1.47.0 -> 1.51.0
 - jax[tpu] 0.4.23 -> 0.4.26
- Python package inclusions
 - cudf 24.4.1

2024-04-15

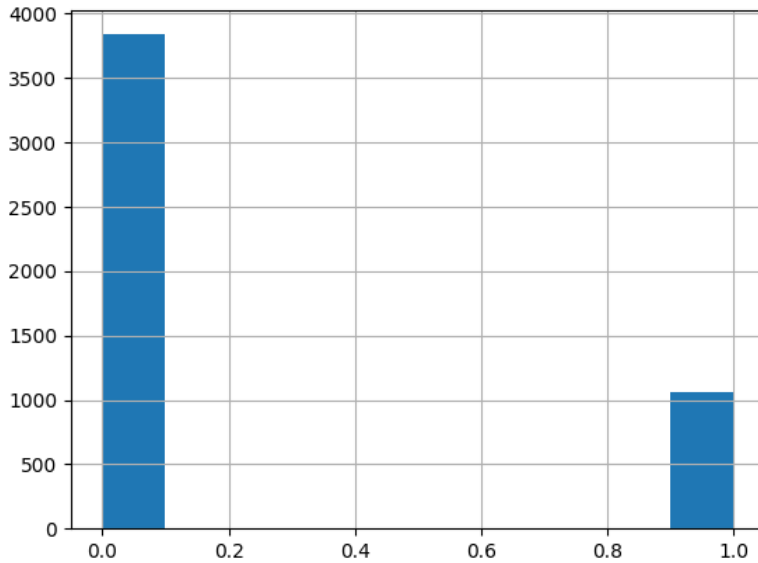
- TPU v2 runtime is now available
- L4 runtime is now available for paid users
- New distributed fine-tuning Gemma tutorial on TPUs ([GitHub](#))
- Symbol rename is now supported with keyboard shortcut F2
- Fixed bug causing inability to re-upload deleted files
- Fixed breaking bug in colabtools %upload_files_async
- Added syntax highlighting to %%writefile cells
- Cuda dependencies that come with Torch are cached for faster downloads for packages that require Torch and its dependencies ([GitHub issue](#))
- Python package upgrades
 - bigframes 0.24.0 -> 1.0.0
 - duckdb 0.9.2 -> 0.10.1
 - google-cloud-aiplatform 1.43.0 -> 1.47.0
 - jax 0.4.23 -> 0.4.26

2024-03-13

- Fixed bug that sometimes caused UserSecrets to move / disappear
- Improved messaging for mounting drive in an unsupported environment ([GitHub issue](#))
- Python package upgrades
 - torch 2.1.0 -> 2.2.1
 - torchaudio 2.1.0 -> 2.2.1
 - torchvision 0.16.0 -> 0.17.1
 - torchtext 0.16.0 -> 0.17.1
 - PyMC 5.7.2 -> 5.10.4
 - BigFrames 0.21.0 -> 0.24.0

```
wine_data.goodwine.hist()
```

<Axes: >



3. ASSESS IF THERE ARE ANY MISSING VALUES

```
sns.heatmap(wine_data.isnull(), cbar = False)
```

- google-cloud-aiplatform 1.42.1 -> 1.43.0
- tornado 6.3.2 -> 6.3.3

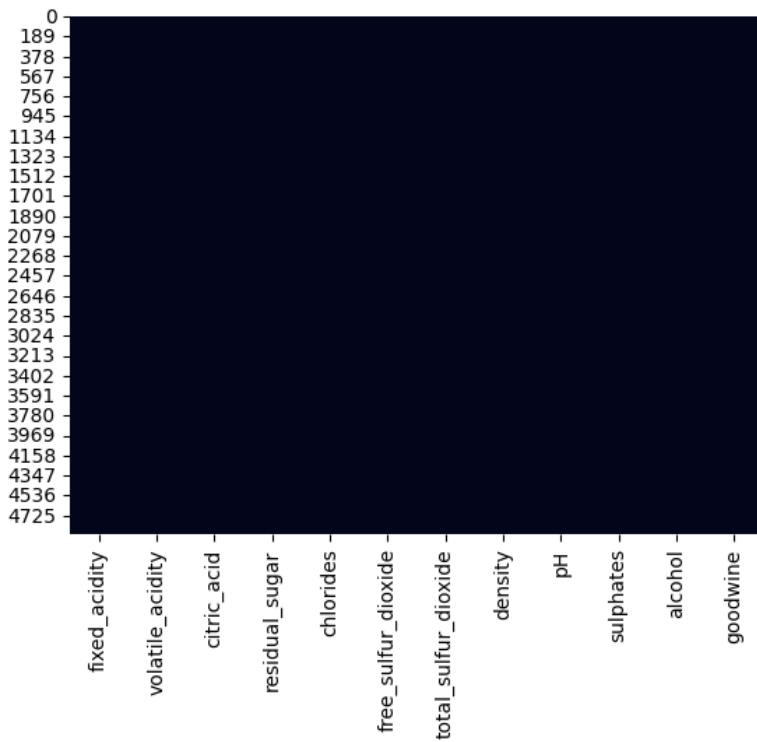
2024-02-21

- Try out Gemma on [Colab!](#)
- Allow unicode in form text inputs
- Display documentation and link to source when displaying functions
- Display image-like ndarrays as images
- Improved UX around quick charts and execution error suggestions
- Released Marketplace image for the month of February ([GitHub issue](#))
- Python package upgrades
 - bigframes 0.19.2 -> 0.21.0
 - regex 2023.6.3 -> 2023.12.25
 - spacy 3.6.1 -> 3.7.4
 - beautifulsoup4 4.11.2 -> 4.12.3
 - tensorflow-probability 0.22.0 -> 0.23.0
 - google-cloud-language 2.9.1 -> 2.13.1
 - google-cloud-aiplatform 1.39.0 -> 1.42.1
 - transformers 4.35.2 -> 4.37.2
 - pyarrow 10.0.1 -> 14.0.2

2024-01-29

- New [Kaggle Notebooks <-> Colab updates!](#) Now you can:
 - Import directly from Colab without having to download/re-upload
 - Upload via link, by pasting Google Drive or Colab URLs
 - Export & run Kaggle Notebooks on Colab with 1 click
- Try these notebooks that talk to Gemini:
 - [Gemini and Stable Diffusion](#)
 - [Learning with Gemini and ChatGPT](#)
 - [Talk to Gemini with Google's Speech to Text API](#)
 - [Sell lemonade with Gemini and Sheets](#)
 - [Generate images with Gemini and Vertex](#)
- Python package upgrades
 - google-cloud-aiplatform 1.38.1 -> 1.39.0
 - bigframes 0.18.0 -> 0.19.2
 - polars 0.17.3 -> 0.20.2
 - gdown 4.6.6 -> 4.7.3 ([GitHub issue](#))
 - tensorflow-hub 0.15.0 -> 0.16.0
 - flax 0.7.5 -> 0.8.0
- Python package inclusions

<Axes : >



4. EXPLORE THE INFORMATION VALUE AND DISTRIBUTION OF FEATURES USING THE PAIRPLOT

```
sns.pairplot(wine_data, hue = 'goodwine')
```

- sentencepiece 0.1.99

2024-01-08


- Avoid nested scrollbars for large outputs by using `google.colab.output.no_vertical_scrollbar` [Example notebook](#)
- Fix [bug](#) where downloading models from Hugging Face could freeze
- Python package upgrades
 - huggingface-hub 0.19.4 -> 0.20.2
 - bigframes 0.17.0 -> 0.18.0

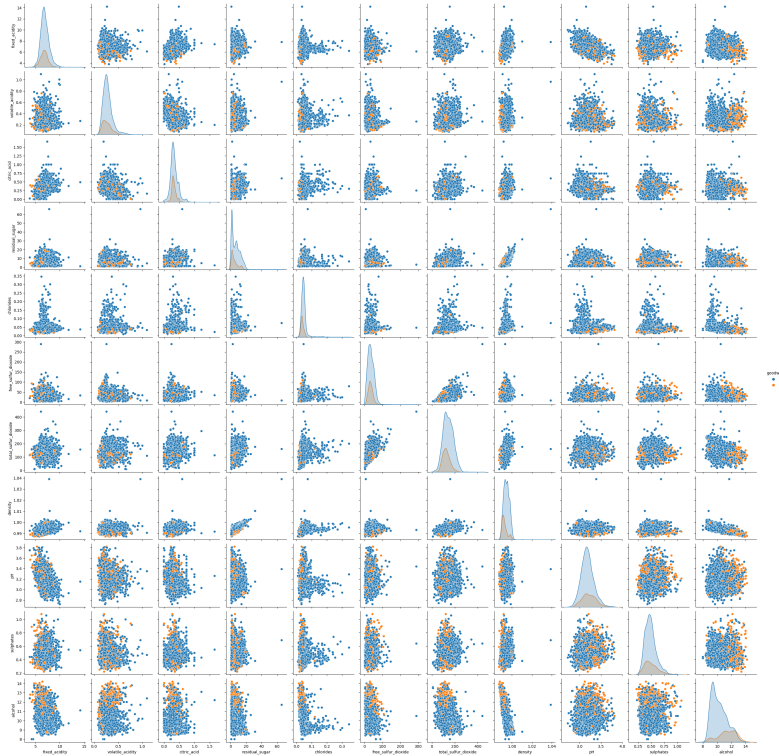
2023-12-18

- Expanded access to AI coding has arrived in Colab across 175 locales for all tiers of Colab users
- Improvements to display of ML-based inline completions (for eligible Pro/Pro+ users)
- Started a series of [notebooks](#) highlighting Gemini API capabilities
- Enable `⌘/Ctrl+L` to select the full line in an editor
- Fixed [bug](#) where we weren't correctly formatting output from multiple execution results
- Python package upgrades
 - CUDA 11.8 to CUDA 12.2
 - tensorflow 2.14.0 -> 2.15.0
 - tensorboard 2.14.0 -> 2.15.0
 - keras 2.14.0 -> 2.15.0
 - Nvidia drivers 525.105.17 -> 535.104.05
 - tensorflow-gcs-config 2.14.0 -> 2.15.0
 - bigframes 0.13.0 -> 0.17.0
 - geemap 0.28.2 -> 0.29.6
 - pyarrow 9.0.0 -> 10.0.1
 - google-generativeai 0.2.2 -> 0.3.1
 - jax 0.4.20 -> 0.4.23
 - jaxlib 0.4.20 -> 0.4.23
- Python package inclusions
 - kagglehub 0.1.4
 - google-cloud-aiplatform 1.38.1

2023-11-27

- Removed warning when calling `await` to make it render as code
- Added "Run selection" to the cell context menu
- Added highlighting for the `%python` cell magic
- Launched AI coding features for Pro/Pro+ users in more locales
- Python package upgrades
 - bigframes 0.12.0 -> 0.13.0

 <seaborn.axisgrid.PairGrid at 0x7be3bb823af0>



- Python package inclusions
 - transformers 4.35.2
 - google-generativeai 0.2.2

2023-11-08

- Launched Secrets, for safe storage of private keys on Colab ([tweet](#))
- Fixed issue where TensorBoard would not load ([#3990](#))
- Python package upgrades
 - lightgbm 4.0.0 -> 4.1.0
 - bigframes 0.10.0 -> 0.12.0
 - bokeh 3.2.2 -> 3.3.0
 - duckdb 0.8.1 -> 0.9.1
 - numba 0.56.4 -> 0.58.1
 - tweepy 4.13.0 -> 4.14.0
 - jax 0.4.16 -> 0.4.20
 - jaxlib 0.4.16 -> 0.4.20


2023-10-23

- Updated the **Open notebook** dialog for better usability and support for smaller screen sizes
- Added smart paste support for data from Google Sheets for R notebooks
- Enabled showing release notes in a tab
- Launched AI coding features for Pro/Pro+ users in Australia 🇺🇸 Canada 🇨🇦 India 🇮🇳 and Japan 🇯🇵 ([tweet](#))
- Python package upgrades
 - earthengine-api 0.1.357 -> 0.1.375
 - flax 0.7.2 -> 0.7.4
 - geemap 0.27.4 -> 0.28.2
 - jax 0.4.14 -> 0.4.16
 - jaxlib 0.4.14 -> 0.4.16
 - keras 2.13.1 -> 2.14.0
 - tensorboard 2.13.0 -> 2.14.1
 - tensorflow 2.13.0 -> 2.14.0
 - tensorflow-gcs-config 2.13.0 -> 2.14.0
 - tensorflow-hub 0.14.0 -> 0.15.0
 - tensorflow-probability 0.20.1 -> 0.22.0
 - torch 2.0.1 -> 2.1.0
 - torchaudio 2.0.2 -> 2.1.0
 - torchtex 0.15.2 -> 0.16.0
 - torchvision 0.15.2 -> 0.16.0
 - xgboost 1.7.6 -> 2.0.0
- Python package inclusions
 - bigframes 0.10.0
 - malloy 2023.1056

2023-09-22

- Added the ability to scope an AI generated suggestion to a specific Pandas dataframe ([tweet](#))

wine_data.info()

 <class 'pandas.core.frame.DataFrame'>
 RangeIndex: 4898 entries, 0 to 4897
 Data columns (total 12 columns):

#	Column	Non-Null Count	Dtype
0	fixed_acidity	4898	float64
1	volatile_acidity	4898	float64
2	total_acidity	4898	float64
3	chlorophenols	4898	float64
4	free_sulfur_dioxide	4898	float64
5	total_sulfur_dioxide	4898	float64
6	density	4898	float64
7	alcohol	4898	float64
8	quality	4898	float64
9	volatile_acidity	4898	float64
10	total_acidity	4898	float64
11	quality	4898	float64

```

0  fixed_acidity      4898 non-null  float64
1  volatile_acidity  4898 non-null  float64
2  citric_acid       4898 non-null  float64
3  residual_sugar    4898 non-null  float64
4  chlorides         4898 non-null  float64
5  free_sulfur_dioxide 4898 non-null  float64
6  total_sulfur_dioxide 4898 non-null  float64
7  density           4898 non-null  float64
8  pH                4898 non-null  float64
9  sulphates         4898 non-null  float64
10 alcohol           4898 non-null  float64
11 goodwine         4898 non-null  int64
dtypes: float64(11), int64(1)
memory usage: 459.3 KB

```

5. DEVELOP LOGISTIC REGRESSION, KNN (OPTIMIZE K), RANDOM FOREST AND BOOSTED TREE MODELS TO PREDICT WINE QUALITY. MAKE SURE TO PREPROCESS THE DATA AS NEEDED BY RESPECTIVE MODELS.

Logistic Regression:

```

from sklearn.preprocessing import MinMaxScaler

X_logit_scaled = wine_data.drop('goodwine', axis = 1)
scaler = MinMaxScaler()
X_logit = scaler.fit_transform(X_logit_scaled)
X_rescaled = pd.DataFrame(X_logit, columns=X_logit_scaled.columns)
X_rescaled.describe()
y=wine_data['goodwine']

```

```
X_rescaled.head()
```

```

↔

```

	fixed_acidity	volatile_acidity	citric_acid	res:
0	0.307692	0.186275	0.216867	
1	0.240385	0.215686	0.204819	
2	0.413462	0.196078	0.240964	
3	0.326923	0.147059	0.192771	
4	0.326923	0.147059	0.192771	

```
X_train, X_test, y_train, y_test = train_test_split(X_logit_scaled, y, test_size=0.2, random_state=42)
```

```

from sklearn.linear_model import LogisticRegression
logmodel = LogisticRegression(solver='liblinear')
logmodel.fit(X_train, y_train)

```

```

↔

```

▼ LogisticRegression

LogisticRegression(solver='liblinear')

```
y_pred = logmodel.predict(X_test)
```

- Added Colab link previews to Docs ([tweet](#))
- Added smart paste support for data from Google Sheets
- Increased font size of dropdowns in interactive forms
- Improved rendering of the notebook when printing
- Python package upgrades
 - tensorflow 2.12.0 -> 2.13.0
 - tensorboard 2.12.3 -> 2.13.0
 - keras 2.12.0 -> 2.13.1
 - tensorflow-gcs-config 2.12.0 -> 2.13.
 - scipy 1.10.1 -> 1.11.2
 - cython 0.29.6 -> 3.0.2
- Python package inclusions
 - geemap 0.26.0

2023-08-18

- Added "Change runtime type" to the menu in the connection button
- Improved auto-reconnection to an already running notebook ([#3764](#))
- Increased the specs of our highmem machines for Pro users
- Fixed add-apt-repository command on Ubuntu 22.04 runtime ([#3867](#))
- Python package upgrades
 - bokeh 2.4.3 -> 3.2.2
 - cmake 3.25.2 -> 3.27.2
 - cryptography 3.4.8 -> 41.0.3
 - dask 2022.12.1 -> 2023.8.0
 - distributed 2022.12.1 -> 2023.8.0
 - earthengine-api 0.1.358 -> 0.1.364
 - flax 0.7.0 -> 0.7.2
 - ipython-sql 0.4.0 -> 0.5.0
 - jax 0.4.13 -> 0.4.14
 - jaxlib 0.4.13 -> 0.4.14
 - lightgbm 3.3.5 -> 4.0.0
 - mkl 2019.0 -> 2023.2.0
 - notebook 6.4.8 -> 6.5.5
 - numpy 1.22.4 -> 1.23.5
 - opencv-python 4.7.0.72 -> 4.8.0.76
 - pillow 8.4.0 -> 9.4.0
 - plotly 5.13.1 -> 5.15.0
 - prettytable 0.7.2 -> 3.8.0
 - pytensor 2.10.1 -> 2.14.2
 - spacy 3.5.4 -> 3.6.1
 - statsmodels 0.13.5 -> 0.14.0
 - xarray 2022.12.0 -> 2023.7.0
- Python package inclusions
 - PyDrive2 1.6.3

2023-07-21

- Launched auto-plotting for dataframes, available using the chart button that shows up alongside datatables ([post](#))

```
from sklearn.metrics import confusion_matrix, classification_report
confusion_matrix(y_test, y_pred)
```

```
array([[1090, 46],
       [ 256, 78]])
```

```
print(classification_report(y_test, y_pred))
```

```
precision    recall  f1-score   support

0           0.81     0.96     0.88         113
1           0.63     0.23     0.34          33

 accuracy   0.79         147
 macro avg  0.72     0.60     0.61         147
 weighted avg 0.77     0.79     0.76         147
```

```
logmodel.coef_
```

```
array([[ -0.11888346, -2.76671297, -0.84722474,
         2.28523282, -2.80339987,
         1.89174978, -0.90629727, -1.11325831,
         0.78144494,  0.80877835,
         4.56931696]])
```

```
import statsmodels.api as sm
logit_model = sm.Logit(y_train, X_train)
logmodel_2 = logit_model.fit()
print(logmodel_2.summary2())
```

```
Optimization terminated successfully.
Current function value: 0.418831
Iterations 7
```

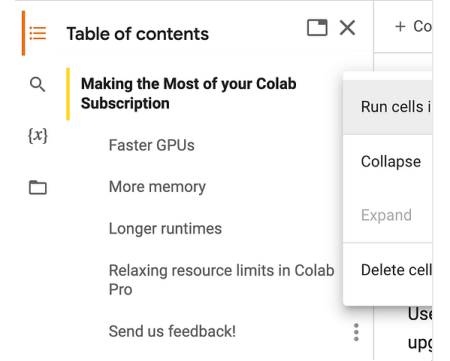
Results: Logit

```
=====
Model:                Logit                Method:
Dependent Variable:   goodwine                Pseudo R-square
Date:                2023-09-25 01:48                AIC:
No. Observations:    3428                BIC:
Df Model:            10                Log-Likelihood:
Df Residuals:        3417                LL-Null:
Converged:           1.0000                LLR p-value:
No. Iterations:      7.0000                Scale:
=====
```

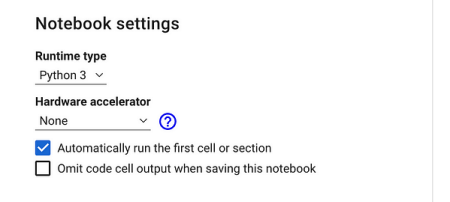
	Coef.	Std.Err.	z	P> z	[0
x1	7.1191	1.1415	6.2366	0.0000	4
x2	-3.8884	0.5930	-6.5575	0.0000	-5
x3	-1.5044	0.8025	-1.8747	0.0608	-3
x4	25.4429	2.5169	10.1088	0.0000	20
x5	-5.8632	1.6306	-3.5958	0.0003	-9
x6	2.0159	1.0301	1.9571	0.0503	-0
x7	0.0661	0.7762	0.0852	0.9321	-1
x8	-48.1629	5.0864	-9.4690	0.0000	-58
x9	4.0761	0.5680	7.1761	0.0000	2
x10	2.0507	0.3613	5.6762	0.0000	1
x11	-1.4666	0.6270	-2.3391	0.0193	-2

```
=====
```

- Added a menu to the table of contents to support running a section or collapsing/expanding sections ([post](#))



- Added an option to automatically run the first cell or section, available under Edit -> Notebook settings ([post](#))



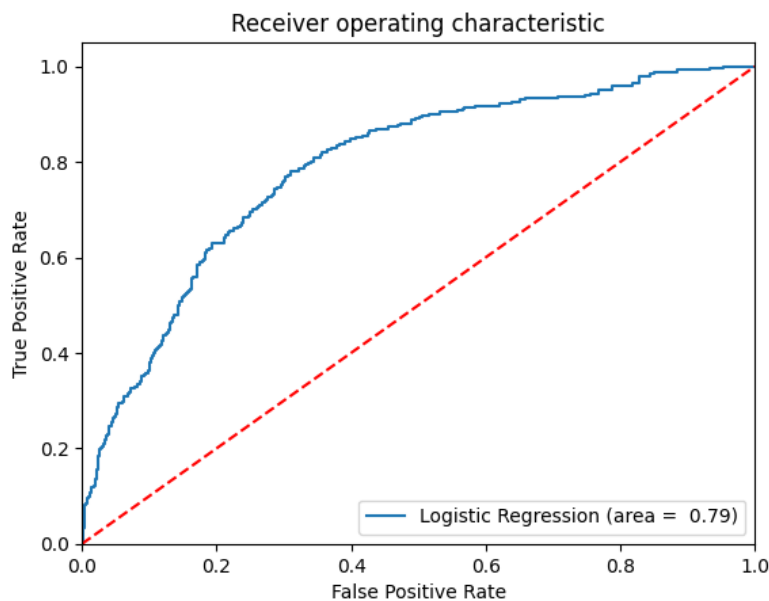
- Launched Pro/Pro+ to Algeria, Argentina, Chile, Ecuador, Egypt, Ghana, Kenya, Malaysia, Nepal, Nigeria, Peru, Rwanda, Saudi Arabia, South Africa, Sri Lanka, Tunisia, and Ukraine ([tweet](#))
- Added a command, "Toggle tab moves focus" for toggling tab trapping in the editor (Tools -> Command palette, "Toggle tab moves focus")
- Fixed issue where `files.upload()` was sometimes returning an incorrect filename ([#1550](#))
- Fixed f-string syntax highlighting bug ([#3802](#))
- Disabled ambiguous characters highlighting for commonly used LaTeX characters ([#3648](#))
- Upgraded Ubuntu from 20.04 LTS to [22.04 LTS](#)
- Updated the Colab Marketplace VM image
- Python package upgrades:
 - autograd 1.6.1 -> 1.6.2
 - drivesfs 76.0 -> 77.0
 - flax 0.6.11 -> 0.7.0
 - earthengine-api 0.1.357 -> 0.1.358
 - GDAL 3.3.2->3.4.3


```

from sklearn.metrics import roc_auc_score
from sklearn.metrics import roc_curve
import matplotlib.pyplot as plt

logit_roc_auc = roc_auc_score(y_test, logmodel.predict_x
fpr, tpr, thresholds = roc_curve(y_test, logmodel.predic
plt.figure()
plt.plot(fpr,tpr, label = 'Logistic Regression (area = %
plt.plot([0,1], [0,1], 'r--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver operating characteristic')
plt.legend(loc="lower right")
plt.savefig('Log_ROC')
plt.show()

```



- Develop logistic regression, kNN (optimize k), random forest and boosted tree models to predict wine quality. Make sure to preprocess the data as needed by the respective models.
- Assess the performance of each model using the following metrics: Recall, Precision, F1, ROC AUC. Which is the best model based on ROC AUC?

18 pts.

kNN Model

- google-cloud-bigquery-storage 2.20.0 -> 2.22.2
- gsread-dataframe 3.0.8 -> 3.3.1
- holidays 0.27.1 -> 0.29
- jax 0.4.10 -> jax 0.4.13
- jaxlib 0.4.10 -> jax 0.4.13
- jupyterlab-widgets 3.0.7 -> 3.0.8
- nbformat 5.9.0 -> 5.9.1
- opencv-python-headless 4.7.0.72 -> 4.8.0.74
- pygame 2.4.0 -> 2.5.0
- spacy 3.5.3 -> 3.5.4
- SQLAlchemy 2.0.16 -> 2.0.19
- tabulate 0.8.10 -> 0.9.0
- tensorflow-hub 0.13.0 -> 0.14.0

2023-06-23

- Launched AI coding features to subscribed users starting with Pro+ users in the US ([tweet](#), [post](#))
- Added the Kernel Selector in the Notebook Settings ([tweet](#))
- Fixed double space trimming issue in markdown [#3766](#)
- Fixed run button indicator not always centered [#3609](#)
- Fixed inconsistencies for automatic indentation on multi-line [#3697](#)
- Upgraded Python from 3.10.11 to 3.10.12
- Python package updates:
 - duckdb 0.7.1 -> 0.8.1
 - earthengine-api 0.1.350 -> 0.1.357
 - flax 0.6.9 -> 0.6.11
 - google-cloud-bigquery 3.9.0 -> 3.10.0
 - google-cloud-bigquery-storage 2.19.1 -> 2.20.0
 - grpcio 1.54.0 -> 1.56.0
 - holidays 0.25 -> 0.27.1
 - nbformat 5.8.0 -> 5.9.0
 - prophet 1.1.3 -> 1.1.4
 - pydata-google-auth 1.7.0 -> 1.8.0
 - spacy 3.5.2 -> 3.5.3
 - tensorboard 2.12.2 -> 2.12.3
 - xgboost 1.7.5 -> 1.7.6
- Python package inclusions:
 - gcsfs 2023.6.0
 - geopandas 0.13.2
 - google-cloud-bigquery-connection 1.12.0
 - google-cloud-functions 1.13.0
 - grpc-google-iam-v1 0.12.6
 - multidict 6.0.4
 - tensorboard-data-server 0.7.1

2023-06-02

- Released the new site colab.google
- Published Colab's Docker runtime image to us-docker.pkg.dev/colab

```
X_kNN = wine_data.drop(['goodwine'], axis = 1)
scaler = MinMaxScaler()
X_ = scaler.fit_transform(X_kNN)
X_rescaled = pd.DataFrame(X_, columns=X_knn.columns)
y = wine_data.goodwine
```

```
X_rescaled.describe()
```



	fixed_acidity	volatile_acidity	citric_acid
count	4898.000000	4898.000000	4898.000000
mean	0.293730	0.194354	0.201320
std	0.081141	0.098818	0.072903
min	0.000000	0.000000	0.000000
25%	0.240385	0.127451	0.162651
50%	0.288462	0.176471	0.192771
75%	0.336538	0.235294	0.234940
max	1.000000	1.000000	1.000000

kNN Model Development with k value=5

```
X_train_kNN, X_test_kNN, y_train_kNN, y_test_kNN = train
kNN = KNeighborsClassifier(n_neighbors=5, metric='euclid
kNN.fit(X_train_kNN, y_train_kNN)
```

```
y_pred_kNN = kNN.predict(X_test_kNN)
```

```
print(confusion_matrix(y_test_kNN,y_pred_kNN))
print(classification_report(y_test_kNN,y_pred_kNN))
```



```
[[1025  111]
 [ 163  171]]
```

	precision	recall	f1-score	support
0	0.86	0.90	0.88	113
1	0.61	0.51	0.56	33
accuracy			0.81	147
macro avg	0.73	0.71	0.72	147
weighted avg	0.80	0.81	0.81	147

```
print('ROC AUC: %0.2f' %roc_auc_score(y_test_kNN,kNN.pre
```



```
ROC AUC: 0.83
```

```
from sklearn.model_selection import cross_val_score
max_K = 100
cv_scores = [ ]
```

```
for K in range(1,max_K):
    knn = KNeighborsClassifier(n_neighbors = K)
```

images/public/runtime ([tweet](#), [instructions](#))

- Launched support for Google childrer accounts ([tweet](#))
- Launched DagsHub integration ([tweet](#), [post](#))
- Upgraded to Monaco Editor Version 0.37.1
- Fixed various Vim keybinding bugs
- Fixed issue where the N and P letters sometimes couldn't be typed ([#3664](#))
- Fixed rendering support for compositional inputs ([#3660](#), [#3679](#))
- Fixed lag in notebooks with lots of cells ([#3676](#))
- Improved support for R by adding a Runtime type notebook setting (Edit -> Notebook settings)
- Improved documentation for connecting to a local runtime (Connect -> Connect to a local runtime)
- Python package updates:
 - holidays 0.23 -> 0.25
 - jax 0.4.8 -> 0.4.10
 - jaxlib 0.4.8 -> 0.4.10
 - pip 23.0.1 -> 23.1.2
 - tensorflow-probability 0.19.0 -> 0.20.1
 - torch 2.0.0 -> 2.0.1
 - torchaudio 2.0.1 -> 2.0.2
 - torchdata 0.6.0 -> 0.6.1
 - torchtext 0.15.1 -> 0.15.2
 - torchvision 0.15.1 -> 0.15.2
 - tornado 6.2 -> 6.3.1

2023-05-05

- Released GPU type selection for paid users, allowing them to choose a preferred NVidia GPU
- Upgraded R from 4.2.3 to 4.3.0
- Upgraded Python from 3.9.16 to 3.10.11
- Python package updates:
 - attrs 22.2.0 -> attrs 23.1.0
 - earthengine-api 0.1.349 -> earthengine-api 0.1.350
 - flax 0.6.8 -> 0.6.9
 - grpcio 1.53.0 -> 1.54.0
 - nbclient 0.7.3 -> 0.7.4
 - tensorflow-datasets 4.8.3 -> 4.9.2
 - termcolor 2.2.0 -> 2.3.0
 - zict 2.2.0 -> 3.0.0

2023-04-14

- Python package updates:
 - google-api-python-client 2.70.0 -> 2.84.0
 - google-auth-oauthlib 0.4.6 -> 1.0.0
 - google-cloud-bigquery 3.4.2 -> 3.9.0

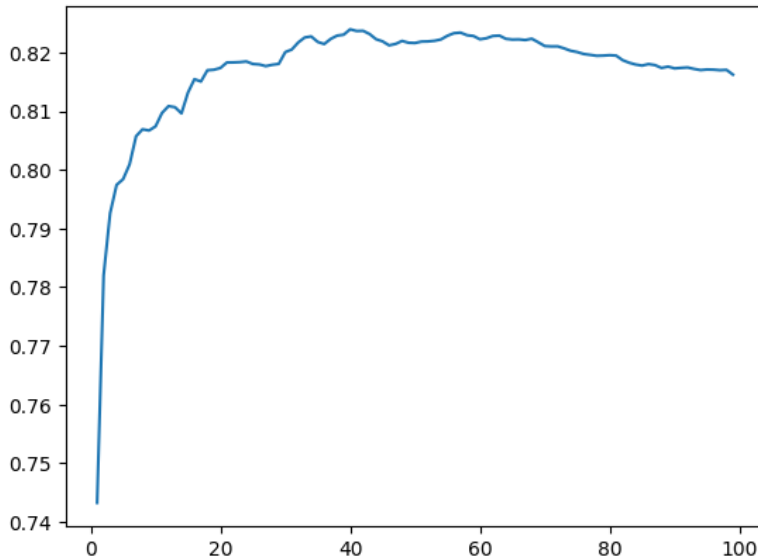

```
scores = cross_val_score(knn,X_train_kNN,y_train_kNN
cv_scores.append(scores.mean())
```

```
print('Max Accuracy: ', max(cv_scores))
print('Optimal k: ', cv_scores.index(max(cv_scores))+1)
```

```
↪ Max Accuracy: 0.823966075951381
Optimal k: 40
```

```
sns.lineplot(x=range(1,max_K), y=cv_scores)
```

```
↪ <Axes: >
```



Development of model with optimal value of K = 40

```
X_train_kNN, X_test_kNN, y_train_kNN, y_test_kNN = train
kNN = KNeighborsClassifier(n_neighbors=40, metric='eucli
kNN.fit(X_train_kNN, y_train_kNN)
```

```
y_pred_kNN = kNN.predict(X_test_kNN)
```

```
print(confusion_matrix(y_test_kNN,y_pred_kNN))
print(classification_report(y_test_kNN,y_pred_kNN))
```

```
↪ [[1072  64]
 [ 218 116]]
```

	precision	recall	f1-score	support
0	0.83	0.94	0.88	113
1	0.64	0.35	0.45	33
accuracy			0.81	147
macro avg	0.74	0.65	0.67	147
weighted avg	0.79	0.81	0.79	147

- google-cloud-datastore 2.11.1 -> 2.15.1
- google-cloud-firestore 2.7.3 -> 2.11.0
- google-cloud-language 2.6.1 -> 2.9.1
- google-cloud-storage 2.7.0 -> 2.8.0
- google-cloud-translate 3.8.4 -> 3.11.1
- networkx 3.0 -> 3.1
- notebook 6.3.0 -> 6.4.8
- jax 0.4.7 -> 0.4.8
- pandas 1.4.4 -> 1.5.3
- spacy 3.5.1 -> 3.5.2
- SQLAlchemy 1.4.47 -> 2.0.9
- xgboost 1.7.4 -> 1.7.5

2023-03-31

- Improve bash ! syntax highlighting ([GitHub issue](#))
- Fix bug where VIM keybindings weren't working in the file editor
- Upgraded R from 4.2.2 to 4.2.3
- Python package updates:
 - arviz 0.12.1 -> 0.15.1
 - astropy 4.3.1 -> 5.2.2
 - dopamine-rl 1.0.5 -> 4.0.6
 - gensim 3.6.0 -> 4.3.1
 - ipykernel 5.3.4 -> 5.5.6
 - ipython 7.9.0 -> 7.34.0
 - jax 0.4.4 -> 0.4.7
 - jaxlib 0.4.4 -> 0.4.7
 - jupyter_core 5.2.0 -> 5.3.0
 - keras 2.11.0 -> 2.12.0
 - lightgbm 2.2.3 -> 3.3.5
 - matplotlib 3.5.3 -> 3.7.1
 - nltk 3.7 -> 3.8.1
 - opencv-python 4.6.0.66 -> 4.7.0.72
 - plotly 5.5.0 -> 5.13.1
 - pymc 4.1.4 -> 5.1.2
 - seaborn 0.11.2 -> 0.12.2
 - spacy 3.4.4 -> 3.5.1
 - sympy 1.7.1 -> 1.11.1
 - tensorboard 2.11.2 -> 2.12.0
 - tensorflow 2.11.0 -> 2.12.0
 - tensorflow-estimator 2.11.0 -> 2.12.0
 - tensorflow-hub 0.12.0 -> 0.13.0
 - torch 1.13.1 -> 2.0.0
 - torchaudio 0.13.1 -> 2.0.1
 - torchtex 0.14.1 -> 0.15.1
 - torchvision 0.14.1 -> 0.15.1

2023-03-10

- Added the [Colab editor shortcuts](#) example notebook
- Fixed triggering of @-mention and email autocomplete for large comments ([GitHub issue](#))
- Added View Resources to the Runtime menu
- Made file viewer images fit the view by default, resizing to original size on

```
knn_roc_auc = roc_auc_score(y_test, kNN.predict_proba(X_test))
print('ROC AUC: %0.2f' %roc_auc_score(y_test_kNN, kNN.predict_proba(X_test)))
```

```
ROC AUC: 0.82
```

When K=40, ROC AUC = 0.82 When K=5, ROC AUC = 0.83 The higher the ROC, the better the performance of a model and a perfect model has an AUC of 1. Hence, the model fits well when the optimum value is k=5.

Random Forest

```
from sklearn.ensemble import RandomForestClassifier

rf_model = RandomForestClassifier(max_depth=5, random_state=42)
rf_model.fit(X_train, y_train)
y_pred_rf = rf_model.predict(X_test)
```

```
confusion_matrix(y_test, y_pred_rf)
```

```
array([[1106, 30],
       [ 242, 92]])
```

```
print(classification_report(y_test, y_pred_rf))
```

```

              precision    recall  f1-score   support

0               0.82         0.97         0.89         113
1               0.75         0.28         0.40          33

 accuracy                   0.81         147
 macro avg                 0.79         0.62         0.65         147
 weighted avg              0.81         0.81         0.78         147
```

```
rf_roc_auc = roc_auc_score(y_test, rf_model.predict_proba(X_test))
rf_fpr, rf_tpr, rf_thresholds = roc_curve(y_test, rf_model.predict_proba(X_test)[:,1])
```

```
print("ROC AUC %0.2f" %rf_roc_auc)
```

```
ROC AUC 0.85
```

Boosted Tree Model:

```
from sklearn.ensemble import AdaBoostClassifier

bt_model = AdaBoostClassifier(n_estimators=100)

bt_model.fit(X_train, y_train)

y_pred_bt = bt_model.predict(X_test)
```

click

- When in VIM mode, enable copy as well as allowing propagation to monaco-vim to escape visual mode ([GitHub issue](#))
- Upgraded CUDA 11.6.2 -> 11.8.0 and cuDNN 8.4.0.27 -> 8.7.0.84
- Upgraded Nvidia drivers 525.78.01 -> 530.30.02
- Upgraded Python 3.8.10 -> 3.9.16
- Python package updates:
 - beautifulsoup4 4.6.3 -> 4.9.3
 - bokeh 2.3.3 -> 2.4.3
 - debugpy 1.0.0 -> 1.6.6
 - Flask 1.1.4 -> 2.2.3
 - jax 0.3.25 -> 0.4.4
 - jaxlib 0.3.25 -> 0.4.4
 - Jinja2 2.11.3 -> 3.1.2
 - matplotlib 3.2.2 -> 3.5.3
 - nbconvert 5.6.1 -> 6.5.4
 - pandas 1.3.5 -> 1.4.4
 - pandas-datareader 0.9.0 -> 0.10.0
 - pandas-profiling 1.4.1 -> 3.2.0
 - Pillow 7.1.2 -> 8.4.0
 - plotnine 0.8.0 -> 0.10.1
 - scikit-image 0.18.3 -> 0.19.3
 - scikit-learn 1.0.2 -> 1.2.2
 - scipy 1.7.3 -> 1.10.1
 - setuptools 57.4.0 -> 63.4.3
 - sklearn-pandas 1.8.0 -> 2.2.0
 - statsmodels 0.12.2 -> 0.13.5
 - urllib3 1.24.3 -> 1.26.14
 - Werkzeug 1.0.1 -> 2.2.3
 - wrapt 1.14.1 -> 1.15.0
 - xgboost 0.90 -> 1.7.4
 - xlrd 1.2.0 -> 2.0.1

2023-02-17

- Show graphs of RAM and disk usage in notebook toolbar
- Copy cell links directly to the clipboard instead of showing a dialog when clicking on the link icon in the cell toolbar
- Updated the [Colab Marketplace VM image](#)
- Upgraded CUDA to 11.6.2 and cuDNN to 8.4.0.27
- Python package updates:
 - tensorflow 2.9.2 -> 2.11.0
 - tensorboard 2.9.1 -> 2.11.2
 - keras 2.9.0 -> 2.11.0
 - tensorflow-estimator 2.9.0 -> 2.11.0
 - tensorflow-probability 0.17.0 -> 0.19.0
 - tensorflow-gcs-config 2.9.0 -> 2.11.0
 - earthengine-api 0.1.339 -> 0.1.341
 - flatbuffers 1.12 -> 23.1.21
 - platformdirs 2.6.2 -> 3.0.0
 - pydata-google-auth 1.6.0 -> 1.7.0

```
confusion_matrix(y_test,y_pred_bt)
```

```
↔ array([[1049,  87],
        [ 175, 159]])
```

```
print(classification_report(y_test,y_pred_bt))
```

```
↔
```

	precision	recall	f1-score	suppor
0	0.86	0.92	0.89	113
1	0.65	0.48	0.55	33
accuracy			0.82	147
macro avg	0.75	0.70	0.72	147
weighted avg	0.81	0.82	0.81	147

```
bt_roc_auc = roc_auc_score(y_test, bt_model.predict_prob
bt_fpr, bt_tpr, bt_thresholds = roc_curve(y_test, bt_moc
```

```
print("ROC AUC %0.2f" %rf_roc_auc)
```

```
↔ ROC AUC 0.85
```

```
plt.figure()
plt.plot(rf_fpr, rf_tpr, label='Random Forest (area = %0.2f)' % rf_roc_auc)
plt.plot(bt_fpr, bt_tpr, label='Boosted tree (area = %0.2f)' % bt_roc_auc)
plt.plot([0, 1], [0, 1], 'r--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver operating characteristic')
plt.legend(loc="lower right")
plt.savefig('Log_ROC')
plt.show()
```

- python-utils 3.4.5 -> 3.5.2
- tenacity 8.1.0 -> 8.2.1
- tifffile 2023.1.23.1 -> 2023.2.3
- notebook 5.7.16 -> 6.3.0
- tornado 6.0.4 -> 6.2
- aiohttp 3.8.3 -> 3.8.4
- charset-normalizer 2.1.1 -> 3.0.1
- fastai 2.7.0 -> 2.7.1
- soundfile 0.11.0 -> 0.12.1
- typing-extensions 4.4.0 -> 4.5.0
- widgetsnbextension 3.6.1 -> 3.6.2
- pydantic 1.10.4 -> 1.10.5
- zipp 3.12.0 -> 3.13.0
- numpy 1.21.6 -> 1.22.4
- drivefs 66.0 -> 69.0
- gdal 3.0.4 -> 3.3.2 [GitHub issue](#)

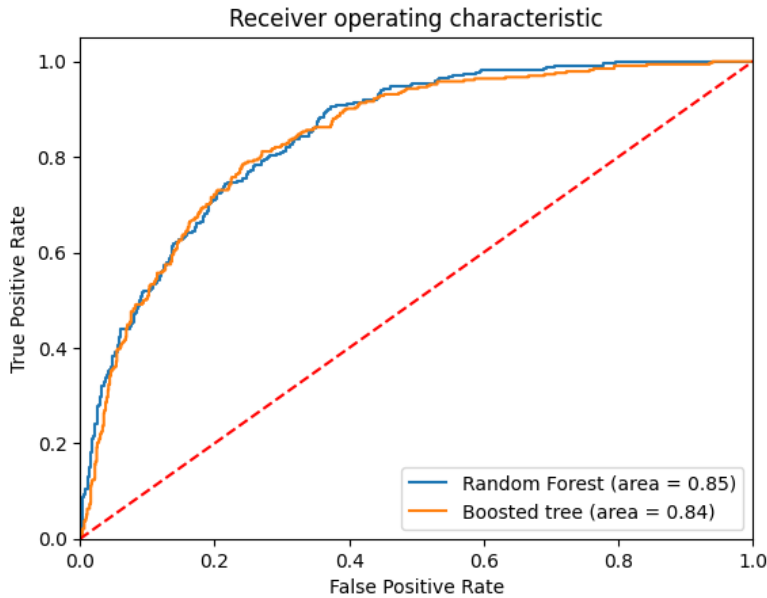
- Added libdunits2-dev for smoother F package installs [GitHub issue](#)

2023-02-03

- Improved tooltips for pandas series to show common statistics about the series object
- Made the forms dropdown behave like an autocomplete box when it allows input
- Updated the nvidia driver from 460.32.03 to 510.47.03
- Python package updates:
 - absl-py 1.3.0 -> 1.4.0
 - bleach 5.0.1 -> 6.0.0
 - cachetools 5.2.1 -> 5.3.0
 - cmdstanpy 1.0.8 -> 1.1.0
 - dnspython 2.2.1 -> 2.3.0
 - fsspec 2022.11.0 -> 2023.1.0
 - google-cloud-bigquery-storage 2.17.0 -> 2.18.1
 - holidays 0.18 -> 0.19
 - jupyter-core 5.1.3 -> 5.2.0
 - packaging 21.3 -> 23.0
 - prometheus-client 0.15.0 -> 0.16.0
 - pyct 0.4.8 -> 0.5.0
 - pydata-google-auth 1.5.0 -> 1.6.0
 - python-slugify 7.0.0 -> 8.0.0
 - sqlalchemy 1.4.46 -> 2.0.0
 - tensorflow-io-gcs-filesystem 0.29.0 -> 0.30.0
 - tifffile 2022.10.10 -> 2023.1.23.1
 - zipp 3.11.0 -> 3.12.0
 - Pinned sqlalchemy to version 1.4.46

2023-01-12

- Added support for @-mention and email autocomplete in comments
- Improved errors when GitHub notebooks can't be loaded
- Increased color contrast for colors used for syntax highlighting in the code editor



****6. Assess the performance of each model using the following metrics: Recall, Precision, F1, ROC AUC. Which is the best model based on ROC AUC?**

```
print("Logistic Regression model\n")
print(classification_report(y_test,y_pred))
print('ROC AUC: %0.2f' % logit_roc_auc)
print("\n")
```



Logistic Regression model

	precision	recall	f1-score	support
0	0.86	0.90	0.88	113
1	0.61	0.51	0.56	33
accuracy			0.81	147
macro avg	0.73	0.71	0.72	147
weighted avg	0.80	0.81	0.81	147
ROC AUC: 0.79				

```
print("knn model\n")
print(classification_report(y_test_kNN,y_pred_kNN))
print('ROC AUC: %0.2f' %roc_auc_score(y_test_kNN,kNN.pre
print("\n")
```



knn model

	precision	recall	f1-score	support
0	0.83	0.94	0.88	113

- Added terminal access for custom GCE VM runtimes
- Upgraded Ubuntu from 18.04 LTS to 20.04 LTS ([GitHub issue](#))
- Python package updates:
 - GDAL 2.2.2 -> 2.2.3.
 - NumPy from 1.21.5 to 1.21.6.
 - attrs 22.1.0 -> 22.2.0
 - chardet 3.0.4 -> 4.0.0
 - cloudpickle 1.6.0 -> 2.2.0
 - filelock 3.8.2 -> 3.9.0
 - google-api-core 2.8.2 -> 2.11.0
 - google-api-python-client 1.12.11 -> 2.70.0
 - google-auth-httpplib2 0.0.3 -> 0.1.0
 - google-cloud-bigquery 3.3.5 -> 3.4.1
 - google-cloud-datastore 2.9.0 -> 2.11.0
 - google-cloud-firestore 2.7.2 -> 2.7.3
 - google-cloud-storage 2.5.0 -> 2.7.0
 - holidays 0.17.2 -> holidays 0.18
 - importlib-metadata 5.2.0 -> 6.0.0
 - networkx 2.8.8 -> 3.0
 - opencv-python-headless 4.6.0.66 -> 4.7.0.68
 - pip 21.1.3 -> 22.04
 - pip-tools 6.2.0 -> 6.6.2
 - prettytable 3.5.0 -> 3.6.0
 - requests 2.23.0 -> 2.25.1
 - termcolor 2.1.1 -> 2.2.0
 - torch 1.13.0 -> 1.13.1
 - torchaudio 0.13.0 -> 0.13.1
 - torchtext 0.14.0 -> 0.14.1
 - torchvision 0.14.0 -> 0.14.1

2022-12-06

- Made fallback runtime version available until mid-December ([GitHub issue](#))
- Upgraded to Python 3.8 ([GitHub issue](#))
- Python package updates:
 - jax from 0.3.23 to 0.3.25, jaxlib from 0.3.22 to 0.3.25
 - pyarrow from 6.0.1 to 9.0.0
 - torch from 1.12.1 to 1.13.0
 - torchaudio from 0.12.1 to 0.13.0
 - torchvision from 0.13.1 to 0.14.0
 - torchtext from 0.13.1 to 0.14.0
 - xldr from 1.1.0 to 1.2.0
 - DriveFS from 62.0.1 to 66.0.3
- Made styling of markdown tables in outputs match markdown tables in text cells
- Improved formatting for empty interactive table rows

	1	0.64	0.35	0.45	33
accuracy				0.81	147
macro avg	0.74	0.65	0.67		147
weighted avg	0.79	0.81	0.79		147

ROC AUC: 0.82

```
print(" Boosted Tree model\n")
print(classification_report(y_test,y_pred_bt))
print('ROC AUC: %0.2f' %bt_roc_auc)
print("\n")
```



Boosted Tree model

	precision	recall	f1-score	support
0	0.86	0.92	0.89	113
1	0.65	0.48	0.55	33
accuracy			0.82	147
macro avg	0.75	0.70	0.72	147
weighted avg	0.81	0.82	0.81	147

ROC AUC: 0.84

```
print("Random Forest model\n")
print(classification_report(y_test,y_pred_bt))
print("ROC AUC %0.2f" %rf_roc_auc)
```



Random Forest model

	precision	recall	f1-score	support
0	0.86	0.92	0.89	113
1	0.65	0.48	0.55	33
accuracy			0.82	147
macro avg	0.75	0.70	0.72	147
weighted avg	0.81	0.82	0.81	147

ROC AUC 0.85

Best Model based on ROC AUC:

ROC AUC of Different Models:

Logistic Regression - 0.79

kNN with k=5 - 0.83

kNN with k=40 - 0.82

Random Forest - 0.85

Boosted Tree - 0.84

- Fixed syntax highlighting for variables with names that contain Python keywords ([GitHub issue](#))

2022-11-11

- Added more dark editor themes for Monaco (when in dark mode, "Editor colorization" appears as an option in the Editor tab of the Tools → Settings dialog)
- Fixed bug where collapsed forms were deleted on mobile [GitHub issue](#)
- Python package updates:
 - rpy2 from 3.4.0 to 3.5.5 ([GitHub issue](#))
 - notebook from 5.5.0 to 5.7.16
 - tornador from 5.1.1 to 6.0.4
 - tensorflow_probability from 0.16.0 to 0.17.0
 - pandas-gbq from 0.13.3 to 0.17.9
 - protobuf from 3.17.3 to 3.19.6
 - google-api-core[grpc] from 1.31.5 to 2.8.2
 - google-cloud-bigquery from 1.21.0 to 3.3.5
 - google-cloud-core from 1.0.1 to 2.3.2
 - google-cloud-datastore from 1.8.0 to 2.9.0
 - google-cloud-firestore from 1.7.0 to 2.7.2
 - google-cloud-language from 1.2.0 to 2.6.1
 - google-cloud-storage from 1.18.0 to 2.5.0
 - google-cloud-translate from 1.5.0 to 3.8.4

2022-10-21

- Launched a single-click way to get from BigQuery to Colab to further explore query results ([announcement](#))
- Launched [Pro, Pro+, and Pay As You Go](#) to 19 additional countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, Greece, Hungary, Latvia, Lithuania, Norway, Portugal, Romania, Slovakia, Slovenia, and Sweden ([tweet](#))
- Updated jax from 0.3.17 to 0.3.23, jaxlib from 0.3.15 to 0.3.22, TensorFlow from 2.8.2 to 2.9.2, CUDA from 11.1 to 11.2, and cuDNN from 8.0 to 8.1 ([backend-info](#))
- Added a readonly option to [drive.mount](#)
- Fixed bug where Xarray was not working ([GitHub issue](#))
- Modified Markdown parsing to ignore block quote symbol within MathJax ([GitHub issue](#))

2022-09-30

Based on both Accuracy Value as well as ROC AUC Curve, Random Forest Model and Boosted Tree Models proves out to be the best models amongst various models.

The higher the ROC, the better the performance of the model. Hence, it's always the model whose ROC Curve is to the upper left corner of the graph that is chosen.

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

- Launched [Pay As You Go](#), allowing premium GPU access without requiring a subscription
- Added vim and tcclib to our runtime image
- Fixed bug where open files were closed on kernel disconnect ([GitHub issue](#))
- Fixed bug where the play button/execution indicator was not clickable when scrolled into the cell output ([GitHub issue](#))
- Updated the styling for form titles so that they avoid obscuring the code editor
- Created a GitHub repo, [backend-info](#), with the latest apt-list.txt and pip-freeze.txt files for the Colab runtime ([GitHub issue](#))
- Added [files.upload_file\(filename\)](#) to upload a file from the browser to the runtime with a specified filename

2022-09-16

- Upgraded pymc from 3.11.0 to 4.1.4, jax from 0.3.14 to 0.3.17, jaxlib from 0.3.14 to 0.3.15, fsspec from 2022.8.1 to 2022.8.2
- Modified our save flow to avoid persisting Drive filenames as titles in notebook JSON
- Updated our [Terms of Service](#)
- Modified the Jump to Cell command to locate the cursor at the end of the command palette input (Jump to cell in Tools → Command palette in a notebook with section headings)
- Updated the styling of the Drive notebook comment UI
- Added support for terminating your runtime from code: python from google.colab import runtime runtime.unassign()
- Added regex filter support to the Recent notebooks dialog
- Inline google.colab.files.upload JS to fix files.upload() not working ([GitHub issue](#))

2022-08-26

- Upgraded PyYAML from 3.13 to 6.0 ([GitHub issue](#)), drivefs from 61.0.3 to 62.0.1
- Upgraded TensorFlow from 2.8.2 to 2.9.1 and ipywidgets from 7.7.1 to 8.0.1 but rolled both back due to a number of user reports ([GitHub issue](#) [GitHub issue](#))
- Stop persisting inferred titles in notebook JSON ([GitHub issue](#))
- Fix bug in background execution which affected some Pro+ users ([GitHub issue](#))

- Fix bug where Download as .py incorrectly handled text cells ending in a double quote
- Fix bug for Pro and Pro+ users where we weren't honoring the preference (Tools → Settings) to use a temporary scratch notebook as the default landing page
- Provide undo/redo for scratch cells
- When writing ipynb files, serialize empty multiline strings as [] for better consistency with JupyterLab

2022-08-11

- Upgraded ipython from 5.5.0 to 7.9.0, fbprophet 0.7 to prophet 1.1, tensorflow-datasets from 4.0.1 to 4.6.0, drivefs from 60.0.2 to 61.0.3, pytorch from 1.12.0 to 1.12.1, numba from 0.51 to 0.56, and lxml from 4.2.0 to 4.9.1
- Loosened our requests version requirement ([GitHub issue](#))
- Removed support for TensorFlow 1
- Added Help → Report Drive abuse for Drive notebooks
- Fixed indentation for Python lines ending in [
- Modified styling of tables in Markdown to left-align them rather than centering them
- Fixed special character replacement when copying interactive tables as Markdown
- Fixed ansi 8-bit color parsing ([GitHub issue](#))
- Configured logging to preempt transitive imports and other loading from implicitly configuring the root logger
- Modified forms to use a value of None instead of causing a parse error when clearing raw and numeric-typed form fields

2022-07-22

- Update scipy from 1.4.1 to 1.7.3, drivefs from 59.0.3 to 60.0.2, pytorch from 1.11 to 1.12, jax & jaxlib from 0.3.8 to 0.3.14, opencv-python from 4.1.2.30 to 4.6.0.66, spaCy from 3.3.1 to 3.4.0, and dlib from 19.18.0 to 19.24.0
- Fix Open in tab doc link which was rendering incorrectly ([GitHub issue](#))
- Add a preference for the default tab orientation to the Site section of the settings menu under Tools → Settings
- Show a warning for USE_AUTH_EPHEM usage when running authenticate_user on a TPU runtime ([code](#))

2022-07-01

- Add a preference for code font to the settings menu under Tools → Settings
- Update drivefs from 58.0.3 to 59.0.3 and spacy from 2.2.4 to 3.3.1
- Allow [display_data](#) and [execute_result](#) text outputs to wrap, matching behavior of JupyterLab (does not affect stream outputs/print statements).
- Improve LSP handling of some magics, esp. %%writefile ([GitHub issue](#)).
- Add a [FAQ entry](#) about the mount Drive button behavior and include link buttons for each FAQ entry.
- Fix bug where the notebook was sometimes hidden behind other tabs on load when in single pane view.
- Fix issue with inconsistent scrolling when an editor is in multi-select mode.
- Fix bug where clicking on a link in a form would navigate away from the notebook
- Show a confirmation dialog before performing Replace all from the Find and replace pane.

2022-06-10

- Update drivefs from 57.0.5 to 58.0.3 and tensorflow from 2.8.0 to 2.8.2
- Support more than 100 repos in the GitHub repo selector shown in the open dialog and the clone to GitHub dialog
- Show full notebook names on hover in the open dialog
- Improve the color contrast for links, buttons, and the `ipywidgets.Accordion` widget in dark mode

2022-05-20

- Support URL params for linking to some common pref settings: [force_theme=dark](#), [force_corgi_mode=1](#), [force_font_size=14](#). Params forced by URL are not persisted unless saved using Tools → Settings.
- Add a class `markdown-google-sans` to allow Markdown to render in Google Sans
- Update monaco-vim from 0.1.19 to 0.3.4
- Update drivefs from 55.0.3 to 57.0.5, jax from 0.3.4 to 0.3.8, and jaxlib from 0.3.2 to 0.3.7

2022-04-29

- Added 🐛 mode (under Miscellaneous in Tools → Settings)
- Added "Disconnect and delete runtime" option to the menu next to

- the Connect button
- Improved rendering of filter options in an interactive table
- Added git-lfs to the base image
- Updated torch from 1.10.0 to 1.11.0, jupyter-core from 4.9.2 to 4.10.0, and cmake from 3.12.0 to 3.22.3
- Added more details to our [FAQ](#) about unsupported uses (using proxies, downloading torrents, etc.)
- Fixed [issue](#) with apt-get dependencies

2022-04-15

- Add an option in the file browser to show hidden files.
- Upgrade gdown from 4.2.0 to 4.4.0, google-api-core[grpc] from 1.26.0 to 1.31.5, and pytz from 2018.4 to 2022.1

2022-03-25

- Launched [Pro/Pro+](#) to 12 additional countries: Australia, Bangladesh, Colombia, Hong Kong, Indonesia, Mexico, New Zealand, Pakistan, Philippines, Singapore, Taiwan, and Vietnam
- Added [google.colab.auth.authentications](#) to support using [Service Account keys](#)
- Update jax from 0.3.1 to 0.3.4 & jaxlib from 0.3.0 to 0.3.2
- Fixed an issue with Twitter previews of notebooks shared as GitHub Gists

2022-03-10

- Launched [Pro/Pro+](#) to 10 new countries: Ireland, Israel, Italy, Morocco, the Netherlands, Poland, Spain, Switzerland, Turkey, and the United Arab Emirates
- Launched support for [scheduling notebooks for Pro+ users](#)
- Fixed bug in interactive datatables where filtering by number did not work
- Finished removing the python2 kernelspec

2022-02-25

- Made various accessibility improvements to the header
- Fix bug with [forms run:auto](#) where a form field change would trigger multiple runs
- Minor updates to the [bigquery example notebook](#) and snippet
- Include background execution setting in the sessions dialog for Pro+ users
- Update tensorflow-probability from 0.15 to 0.16

- Update jax from 0.2.25 to 0.3.1 & jaxlib from 0.1.71 to 0.3.0

2022-02-11

- Improve keyboard navigation for the open dialog
- Fix issue where nvidia-smi stopped reporting resource utilization for some users who were modifying the version of nvidia used
- Update tensorflow from 2.7 to 2.8, keras from 2.7 to 2.8, numpy from 1.19.5 to 1.21.5, tables from 3.4.4 to 3.7.0

2022-02-04

- Improve UX for opening content alongside your notebook, such as files opened from the file browser. This includes a multi-pane view and drag-drop support
- Better Twitter previews when sharing example Colab notebooks and notebooks opened from GitHub Gists
- Update pandas from 1.1.5 to 1.3.5
- Update openpyxl from 2.5.9 to 3.0.0 and pyarrow from 3.0.0 to 6.0.0
- Link to the release notes from the Help menu

2022-01-28

- Add a copy button to [data tables](#)
- Python LSP support for better completions and code diagnostics. This can be configured in the Editor Settings (Tools → Settings)
- Update [gsread examples](#) in our documentation
- Update gdown from 3.6 to 4.2