

Release notes X

...

```
#1. Demonstrate three different methods for creating identical 2D arrays.
```

```
#Method 1: Using np.array() with a list of lists
```

```
import numpy as np
data = [[1,2,3],[4,5,6]]
array1 = np.array(data)
print("Array using np.array with list of lists:\n", array1)
```

→ Array using np.array with list of lists:
[[1 2 3]
 [4 5 6]]

```
#Method 2 Using np.full()
```

```
rows, cols = 2,3
array2 = np.full((rows,cols),7)
print("Array using np.full():\n", array2)
```

→ Array using np.full():
[[7 7 7]
 [7 7 7]]

```
#Method 3: Using np.ones()
```

```
rows, cols = 2,3
array3 = np.ones((rows, cols), dtype = int)
print("Array using np.ones():\n", array3)
```

→ Array using np.ones():
[[1 1 1]
 [1 1 1]]

```
#2. Using the NumPy function generate an array of 100 evenly spaced numbers from 1 to 10.
```

```
arr_1D = np.linspace(1,10,100)
arr_2D = arr_1D.reshape(10,10)
print("Original 1D array:\n", arr_1D)
print("Reshaped 2D array:\n", arr_2D)
```

→ Original 1D array:

1.	1.09090909	1.18181818	1.27272727	1.36363636
1.54545455	1.63636364	1.72727273	1.81818182	1.90909091
2.09090909	2.18181818	2.27272727	2.36363636	2.45454545
2.63636364	2.72727273	2.81818182	2.90909091	3.
3.18181818	3.27272727	3.36363636	3.45454545	3.54545455
3.72727273	3.81818182	3.90909091	4.	4.09090909
4.27272727	4.36363636	4.45454545	4.54545455	4.63636364
4.81818182	4.90909091	5.	5.09090909	5.18181818
5.36363636	5.45454545	5.54545455	5.63636364	5.72727273
5.90909091	6.	6.09090909	6.18181818	6.27272727
6.45454545	6.54545455	6.63636364	6.72727273	6.81818182
7.	7.09090909	7.18181818	7.27272727	7.36363636
7.54545455	7.63636364	7.72727273	7.81818182	7.90909091
8.09090909	8.18181818	8.27272727	8.36363636	8.45454545
8.63636364	8.72727273	8.81818182	8.90909091	9.
9.18181818	9.27272727	9.36363636	9.45454545	9.54545455
9.72727273	9.81818182	9.90909091	10.	

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](#).

2024-11-11

- Users can now import Gemini API keys from AI Studio into their user secrets, all in Colab ([tweet](#)).
- Increased limit to 1000 characters for requests to Gemini in Chat and Generate windows.
- Improved saving notebook to GitHub flow.
- Updated Gemini spark icon to be colorful.
- [uv](#) is pre-installed on the PATH for faster package installs.
- Fixed bugs
 - Dropdown text for GitHub repository not visible [#4901](#).
 - Pre-installed California housing dataset README not correct [#4862](#).
 - Backend execution error for scheduled notebook [#4850](#).
 - Drive File Stream issues [#3441](#).
 - Linking to the signup page does not preserve the authuser parameter.
 - Error messages in Gemini chat are not polished.
 - Clicking in Gemini chat feedback causes jitters the UI.
 - Hovering over a table of contents entry would show the menu icons for all entries.
 - Surveys display over open dialogs.
 - Playground mode banner not shown on mobile.

Python package upgrades

- accelerate 0.34.2 → 1.1.1
- arviz 0.19.0 → 0.20.0
- bigframes 1.18.0 → 1.25.0
- bigquery-magics 0.2.0 → 0.4.0
- bokeh 3.4.3 → 3.6.1
- blosc 2.0.0 → 2.7.1
- cloudpickle 2.2.1 → 3.1.0
- cudf-cu12 24.4.1 → 24.10.1
- dask 2024.8.0 → 24.10.0
- debugpy 1.6.6 → 1.8.0
- earthengine-api 1.0.0 → 1.2.0
- folium 0.17.0 → 0.18.0
- gscfs 2024.6.1 → 2024.10.0
- geemap 0.34.3 → 0.35.1
- holidays 0.57 → 0.60
- huggingface-hub 0.24.7 → 0.26.2
- kagglehub 0.3.0 → 0.3.3
- lightgbm 4.4.0 → 4.5.0
- lxml 4.9.4 → 5.3.0

```
Reshaped 2D array:
[[ 1.          1.09090909  1.18181818  1.27272727  1.36363633
   1.54545455  1.63636364  1.72727273  1.81818182]
 [ 1.90909091  2.          2.09090909  2.18181818  2.27272727
   2.45454545  2.54545455  2.63636364  2.72727273]
 [ 2.81818182  2.90909091  3.          3.09090909  3.18181818
   3.36363636  3.45454545  3.54545455  3.63636364]
 [ 3.72727273  3.81818182  3.90909091  4.          4.09090909
   4.27272727  4.36363636  4.45454545  4.54545455]
 [ 4.63636364  4.72727273  4.81818182  4.90909091  5.
   5.18181818  5.27272727  5.36363636  5.45454545]
 [ 5.54545455  5.63636364  5.72727273  5.81818182  5.90909091
   6.09090909  6.18181818  6.27272727  6.36363636]
 [ 6.45454545  6.54545455  6.63636364  6.72727273  6.81818182
   7.          7.09090909  7.18181818  7.27272727]
 [ 7.36363636  7.45454545  7.54545455  7.63636364  7.72727273
   7.90909091  8.          8.09090909  8.18181818]
 [ 8.27272727  8.36363636  8.45454545  8.54545455  8.63636364
   8.81818182  8.90909091  9.          9.09090909]
 [ 9.18181818  9.27272727  9.36363636  9.45454545  9.54545455
   9.72727273  9.81818182  9.90909091  10.        ]]
```

#3. Explain the following terms:

#1. the difference in np.array, np.asarray and np.asanyarray

#2. the difference between Deep copy and Shallow copy

`#np.array(data, dtype=None, order=None):`

#This is the most flexible function. It always creates a new NumPy array.
#You can optionally specify the dtype (data type) of the elements.
#Use np.array when you want a guaranteed new array or need to control memory.

`#np.asarray(data, dtype=None, order=None):`

#This function tries to be more memory-efficient. It attempts to reuse the input data.
#However, if the input data requires a different dtype, memory order or alignment,
#Use np.asarray when you want to avoid unnecessary copies but still want to control memory.

`#np.asanyarray(data, dtype=None, order=None):`

#This function is similar to np.asarray but is less strict. It will attempt to reuse the input data.
#It's more likely to create a new copy compared to np.asarray. Use it when you want to be explicit.

#Deep Copy:Creates a completely new and independent copy of the data structure.
#Changes made to the copy do not affect the original data structure.
#In Python, the copy.deepcopy function is used for deep copying.

#Shallow Copy:Creates a new data structure that references the same data.
#Changes made to the copy will affect the original data structure.
#In Python, copy.copy creates a shallow copy by default. However,

#4. Generate a 3x3 array with random floating-point numbers 5 and 5.5.

```
arr1_1D = np.random.rand(3*3)*(20-5)+5
arr1_2D = arr1_1D.reshape(3,3)
rounded_arr = np.around(arr1_2D, decimals = 2)
print("Original 1D array:\n", arr1_1D)
print("Reshaped and rounded 2D array:\n", rounded_arr)
```

- matplotlib 3.7.1 → 3.8.0
- mizani 0.11.4 → 0.13.0
- networkx 3.3 → 3.4.2
- nltk 3.8.1 → 3.9.1
- pandas 2.1.4 → 2.2.2
- pillow 10.4.0 → 11.0.0
- plotnine 0.13.6 → 0.14.1
- polars 1.6.0 → 1.9.0
- protobuf 3.20.3 → 4.25.5
- pyarrow 14.0.2 → 17.0.0
- pydrive2 1.20.0 → 1.21.1
- pymc 5.16.2 → 5.18.0
- torch 2.4.1 → 2.5.0
- torchaudio 2.4.1 → 2.5.0
- torchvision 0.19.1 → 0.20.0
- transformers 4.44.2 → 4.46.2
- xarray 2024.9.0 → 2024.10.0

Python package inclusions

- diffusers 0.31.0
- gitpython 3.1.43
- langchain 0.3.7
- openai 1.54.3
- pygit2 1.16.0
- pyspark 3.5.3
- sentence-transformers 3.2.1
- timm 1.0.11
- wandb 0.18.6

Library and driver upgrades

- drivesfs upgraded from 89.0.2 to 98.0.0

2024-09-23

- Improved code snippet search
- Updated Marketplace image and public local runtime container
- Improved the look-and-feel of interactive form dropdowns and checkboxes
- Fixed bugs
 - activating the skip link caused the notebook to scroll out of view
 - toggling a checkbox too much caused the page to crash
 - lightning fast drags could cause orphaned tabs
 - custom widgets snippet would show for local runtimes

Python package upgrades

- accelerate 0.32.1 → 0.34.2
- arviz 0.18.0 → 0.19
- autograd 1.6.2 → 1.7.0
- bigframes 1.14.0 → 1.18.0
- dask 2024.7.1 → 2024.8.0
- distributed 2024.7.1 → 2024.8.0
- duckdb 0.10.3 → 1.1.0
- earthengine-api 0.1.416 → 1.0.0
- flax 0.8.4 → 0.8.5
- gdown 5.1.0 → 5.2.0
- geemap 0.33.1 → 0.34.3
- geopandas 0.14.4 → 1.0.1
- google-cloud-aiplatform 1.59.0 → 1.67.1
- google-cloud-bigquery-storage 2.25.0 → 2.26.0
- holidays 0.54 → 0.57

➡ Original 1D array:

```
[19.39045504 14.80001608 9.99499643 10.95965403 12.29656009
 5.76538135 16.84412496 5.46749377]
```

Reshaped and rounded 2D array:

```
[[19.39 14.8  9.99]
 [10.96 12.3  5.01]
 [ 5.77 16.84 5.47]]
```

- huggingface-hub 0.23.5 -> 0.24.7
- ibis-framework 8.0.0 -> 9.2.0
- jax 0.4.26 -> 0.4.33
- jaxlib 0.4.26 -> 0.4.33
- kagglehub 0.2.9 -> 0.3.0
- lightgbm 4.4.0 -> 4.5.0
- matplotlib-venn 0.11.10 -> 1.1.1
- mizani 0.9.3 -> 0.11.4
- Pillow 9.4.0 -> 10.4.0
- plotly 5.15.0 -> 5.24.1
- plotnine 0.12.4 -> 0.13.6
- polars 0.20.2 -> 1.6.0
- progressbar2 4.2.0 -> 4.5.0
- PyDrive2 1.6.3 -> 1.20.0
- pymc 5.10.4 -> 5.16.2
- pytensor 2.18.6 -> 2.25.4
- scikit-image 0.23.2 -> 0.24.0
- scikit-learn 1.3.2 -> 1.5.2
- torch 2.3.1 -> 2.4.1
- torchaudio 2.3.1 -> 2.4.1
- torchvision 0.18.1 -> 0.19.1
- transformers 4.42.4 -> 4.44.2
- urllib3 2.0.7 -> 2.2.3
- xarray 2024.6.0 -> 2024.9.0

#5. Create a NumPy array with random integers between 1 and 10 of

#a. Extract all even integers from array

#b. Extract all odd integers from array

```
arr = np.random.randint(1,11,size=(5,6))
even_int = arr[arr%2==0]
odd_int = arr[arr%2!=0]
print("Original array:\n", arr)
print("\nEven integers:\n", even_int)
print("\nOdd integers:\n", odd_int)
```

➡ Original array:

```
[[ 7  3  4  7  4  9]
 [ 5  8  2  5  3  8]
 [ 3  6  5  6 10  9]
 [ 3  1  8  6 10  4]
 [ 4  3  6  4  9  3]]
```

Even integers:

```
[ 4  4  8  2  8  6  6 10  8  6 10  4  4  6  4]
```

Odd integers:

```
[7 3 7 9 5 5 3 3 5 9 3 1 3 9 3]
```

#6. Create a 3D NumPy array of shape (3,3,3) containing random in-

#a. Find the indices of the maximum values along each depth level

#b. Perform element-wise multiplication of between both array

```
arr1 = np.random.randint(1, 11, size=(3, 3, 3))
arr2 = np.random.randint(1, 11, size=(3, 3, 3))
max_indices = np.unravel_index(np.argmax(arr1, axis=2), arr1.shape[1:])
element_wise_product = arr1 * arr2
print("Original array 1:\n", arr1)
print("\nOriginal array 2:\n", arr2)
print("\nIndices of maximum values along depth level:\n", max_indices)
print("\nElement-wise product:\n", element_wise_product)
```

➡ Original array 1:

```
[[[ 6  9  5]
 [ 1  6  4]
 [ 5  9  9]]]
```

```
[[ 1  4  7]
 [ 1  6  5]
 [ 9  2  8]]
```

```
[[ 6  2 10]]
```

Python package inclusions

- bigquery-magics 0.2.0

2024-08-20

- TPU memory usage and utilization can now be checked with !tpu-info
- Gemini Chat responses are now grounded in relevant sources
- Added a new "Create Gemini API key" link in the user secrets panel
- Added a new "Gemini: Creating a prompt snippet and touched up the existing "Gemini: Connecting to Gemini" snippet
- Added the ability to specify custom placeholder text for various interactive form params (see [examples](#))
- Keyboard navigation a11y improvements to comments UI
- Various minor rendering improvements to interactive forms UI
- A11y improvements for the run button and header
- Updated tooltip styling
- A11y improvements for the file browser's disk usage bar
- On mobile, tooltips now trigger on long press
- On mobile, release notes updates will no longer display automatically
- Python package upgrades
 - astropy 5.3.4 -> 6.1.2
 - bigframes 1.11.1 -> 1.14.0
 - bokeh 3.3.4 -> 3.4.3
 - dask 2023.8.1 -> 2024.7.1
 - earthengine-api 0.1.412 -> 0.1.416

```
[ 4  4  8]
[ 5  5  4]]]
```

```
Original array 2:
[[[ 5 10 10]
 [ 5  4  8]
 [ 3  4  4]]]
```

```
[[ 8  8  2]
 [ 4  8  5]
 [10  4  3]]]
```

```
[[ 1  2  4]
 [ 7  6  6]
 [ 6  4  9]]]
```

Indices of maximum values along depth level:

```
(array([[0, 0, 0],
       [0, 0, 0],
       [0, 0, 0]]), array([[1, 1, 1],
       [2, 1, 0],
       [2, 2, 0]]))
```

Element-wise product:

```
[[[30 90 50]
 [ 5 24 32]
 [15 36 36]]]
```

```
[[ 8 32 14]
 [ 4 48 25]
 [90  8 24]]]
```

```
[[ 6  4 40]
 [28 24 48]
 [30 20 36]]]
```

```
#10. Create a 7*5 Dataframe in Pandas using a series generated from the following code
import pandas as pd
import numpy as np
random_series = pd.Series(np.random.randint(1, 7, 35))
dataframe = random_series.values.reshape(7, 5)
df = pd.DataFrame(dataframe)
print(df)
```

	0	1	2	3	4
0	4	4	1	5	1
1	1	6	6	5	5
2	4	3	1	6	5
3	4	1	1	6	6
4	3	6	5	2	5
5	2	2	2	6	1
6	2	3	3	2	6

```
#11. Create two different series, each of length 50, with the following properties:
```

```
#a. The first series should contain random numbers ranging from 10 to 50.
```

```
#b. The second series should contain random numbers ranging from 1 to 10.
```

```
#c. Create a Dataframe by joining these series by column and change the column names to "A" and "B".
```

```
series1 = pd.Series(np.random.randint(10, 51, 50))
```

- geopandas 0.13.2 -> 0.14.4
- kagglehub 0.2.8 -> 0.2.9
- keras 2.15.0 -> 3.4.1
- lightgbm 4.1.0 -> 4.4.0
- malloy 2023.1067 -> 2024.1067
- numba 0.58.1 -> 0.60.0
- numpy 1.25.2 -> 1.26.4
- opencv-python 4.8.0.76 -> 4.10.0.84
- pandas 2.0.3 -> 2.1.4
- pandas-gbq 0.19.2 -> 0.23.1
- panel 1.3.8 -> 1.4.5
- requests 2.31.0 -> 2.32.3
- scikit-learn 1.2.2. -> 1.3.2
- scipy 1.11.4 -> 1.13.1
- tensorboard 2.15.2 -> 2.17.0
- tensorflow 2.15.0 -> 2.17.0
- tf-keras 2.15.1 -> 2.17.0
- xarray 2023.7.0 -> 2024.6.0
- xgboost 2.0.3 -> 2.1.1
- Python package inclusions
 - einops 0.8.0

2024-07-22

- You can now embed Google sheets directly into Colab to streamline interactions with data with InteractiveSheet.
- Example:


```
from google.colab import sheets
sh = sheets.InteractiveSheet()
df = sh.as_df()
```
- Fixed multiple rendering bugs in cell editors with wide text content (i.e. text is no longer hidden or clipped)
- Fixed multiple accessibility issues in Colab's comments feature (e.g. proper keyboard focus management, added accessibility landmarks, etc)
- Fixed bug where AI code generation would fail for extremely long broken code snippets
- Fixed multiple scrollbar bugs in the user secrets panel
- Added the ability for workspace admin to purchase Colab Pro and Pro+ Subscriptions for users
- Fixed bug where user secrets couldn't be moved to a tab
- Fixed several focus management accessibility issues in tabs, the table of contents, the left toolbar, and the run button
- Fixed bug where overflowing cells may be omitted when pasting from Google Sheets
- Fixed bug where the generate code button did not activate on touch
- Python package upgrades

```
series2 = pd.Series(np.random.randint(100, 1001, 50))
df = pd.DataFrame({'col1': series1, 'col2': series2})
print(df)
```

	col1	col2
0	10	509
1	20	341
2	34	971
3	45	195
4	25	334
5	44	400
6	32	437
7	36	580
8	19	830
9	48	522
10	40	557
11	22	652
12	49	977
13	33	854
14	43	850
15	49	486
16	29	501
17	40	459
18	39	944
19	36	729
20	20	226
21	16	525
22	15	337
23	33	531
24	34	658
25	44	601
26	38	525
27	24	436
28	35	655
29	11	208
30	42	297
31	19	162
32	12	958
33	43	832
34	48	405
35	21	789
36	28	233
37	43	864
38	38	341
39	34	290
40	23	895
41	39	991
42	20	379
43	36	972
44	43	369
45	24	428
46	27	533
47	37	686
48	28	625
49	10	275

```
#13. Create two NumPy arrays, x and y, each containing 100 random
#   numbers between 0 and 1. Plot them using plt.scatter.
#   a. Create a scatter plot using x and y, setting the color of the
#       points to a random color.
#   b. Add a horizontal line at y = 0.5 using a dashed line style and
#       a solid black color.
#   c. Add a vertical line at x = 0.5 using a dotted line style and :
```

- bigframes 1.9.0 → 1.11.1
- cvxpy 1.3.4 → 1.5.2
- earthengine-api 0.1.408 → 0.1.412
- google-api-core 2.11.1 → 2.19.1
- google-api-python-client 2.84.0 → 2.137.0
- google-cloud-aiplatform 1.56.0 → 1.59.0
- google-cloud-bigquery 3.21.0 → 3.25.0
- google-cloud-core 2.3.3 → 2.4.1
- google-cloud-datastore 2.15.2 → 2.19.0
- google-cloud-firebase 2.11.1 → 2.16.1
- google-cloud-functions 1.13.3 → 1.16.4
- google-generativeai 0.5.4 → 0.7.2
- kagglehub 0.2.5 → 0.2.8
- pip 23.1.2 → 24.1.2
- setuptools 67.7.2 → 71.0.4
- sympy 1.12.1 → 1.13.1
- torch 2.3.0 → 2.3.1
- transformers 4.41.2 → 4.42.4
- Python package inclusions
 - accelerate 0.32.1

2024-06-18

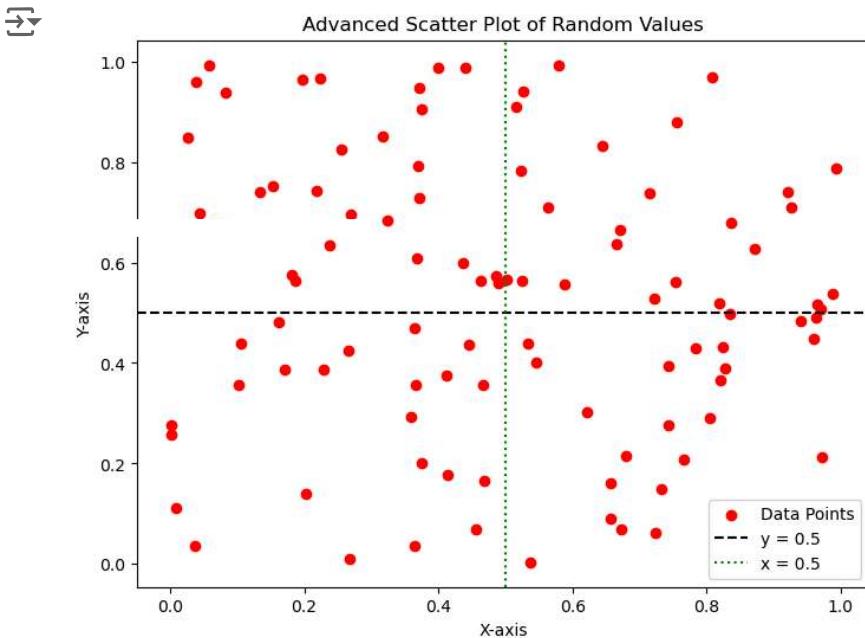
- Inline AI completions are now available to users on the free-of-charge tier
- Reduced latency for LSP and terminal connections
- Improved quality of inline completions
- Visual improvements to switch controls across Colab
- Various bug fixes, performance and a11y improvements to the user secrets panel
- Improved tooltip UX behavior
- Improved behavior when copying data from Google Sheets and pasting in Colab
- Scroll to cell fixes for single tabbed view and jump to cell command
- Improved tab header behavior
- A11y improvements for notebook-focused cells
- Python package upgrades
 - torch 2.2.1 → 2.3.0
 - torchaudio 2.2.1 → 2.3.0
 - torchvision 0.17.1 → 0.18.0
 - torchtext 0.17.1 → 0.18.0
 - google-cloud-aiplatform 1.51.0 → 1.56.0
 - bigframes 1.5.0 → 1.8.0
 - regex 2023.12.25 → 2024.5.15

2024-05-13

- Code actions are now supported to automatically improve and refactor code

```
#d. Label the x-axis as 'X-axis' and the y-axis as 'Y-axis'.
#e. Set the title of the plot as 'Advanced Scatter Plot of Random Values'
#d. Display a legend for the scatter plot, the horizontal line, and the vertical line

import matplotlib.pyplot as plt
import numpy as np
x = np.random.rand(100)
y = np.random.rand(100)
plt.figure(figsize=(8, 6))
plt.scatter(x, y, c='red', marker='o', label='Data Points')
plt.axhline(y=0.5, color='black', linestyle='--', label='y = 0.5')
plt.axvline(x=0.5, color='green', linestyle=':', label='x = 0.5')
plt.xlabel('X-axis')
plt.ylabel('Y-axis')
plt.title('Advanced Scatter Plot of Random Values')
plt.legend()
plt.show()
```



```
#14. Create a time-series dataset in a Pandas DataFrame with columns 'Date', 'Temperature', and 'Humidity'.
#a. Plot the 'Temperature' and 'Humidity' on the same plot with 'Date' on the x-axis
#b. Label the x-axis as 'Date'
#c. Set the title of the plot as 'Temperature and Humidity Over Time'
```

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

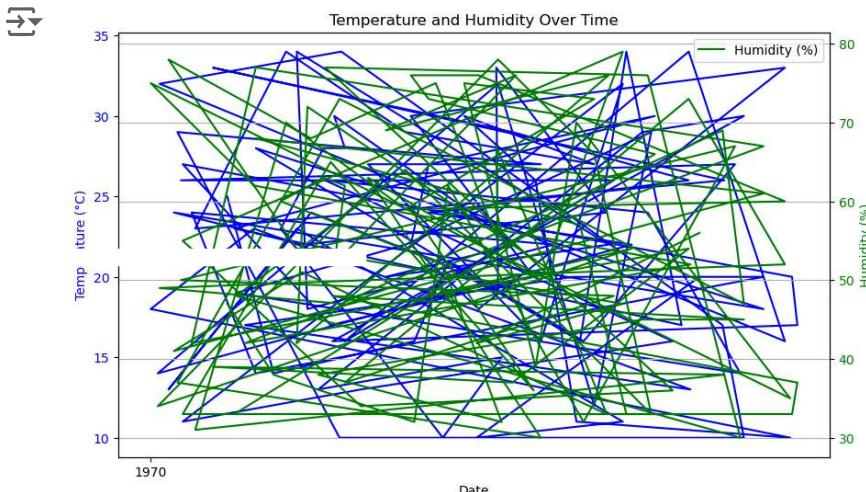
2024-02-21

- Try out Gemma on [Colab!](#)
- Allow unicode in form text inputs
- Display documentation and link to source when displaying functions

```

import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
dates = pd.to_datetime(np.random.rand(100) * 365)
temps = np.random.randint(10, 35, 100)
humidity = np.random.randint(30, 80, 100)
df = pd.DataFrame({'Date': dates, 'Temperature': temps, 'Humidity': humidity})
fig, ax1 = plt.subplots(figsize=(10, 6))
ax1.plot(df['Date'], df['Temperature'], 'b-', label='Temperature')
ax1.set_xlabel('Date')
ax1.set_ylabel('Temperature (°C)', color='b')
ax1.tick_params(axis='y', labelcolor='b')
ax2 = ax1.twinx()
ax2.plot(df['Date'], df['Humidity'], 'g-', label='Humidity (%)')
ax2.set_ylabel('Humidity (%)', color='g')
ax2.tick_params(axis='y', labelcolor='g')
plt.title('Temperature and Humidity Over Time')
plt.legend()
plt.grid(True)
plt.show()

```



```

#15. Create a NumPy array data containing 1000 samples from a normal distribution
#a. Plot a histogram of the data with 30 bins
#b. Overlay a line plot representing the normal distribution's probability density function
#c. Label the x-axis as 'Value' and the y-axis as 'Frequency/Probability'
#d. Set the title of the plot as 'Histogram with PDF Overlay'.

```

- 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
 - sentencepiece 0.1.99

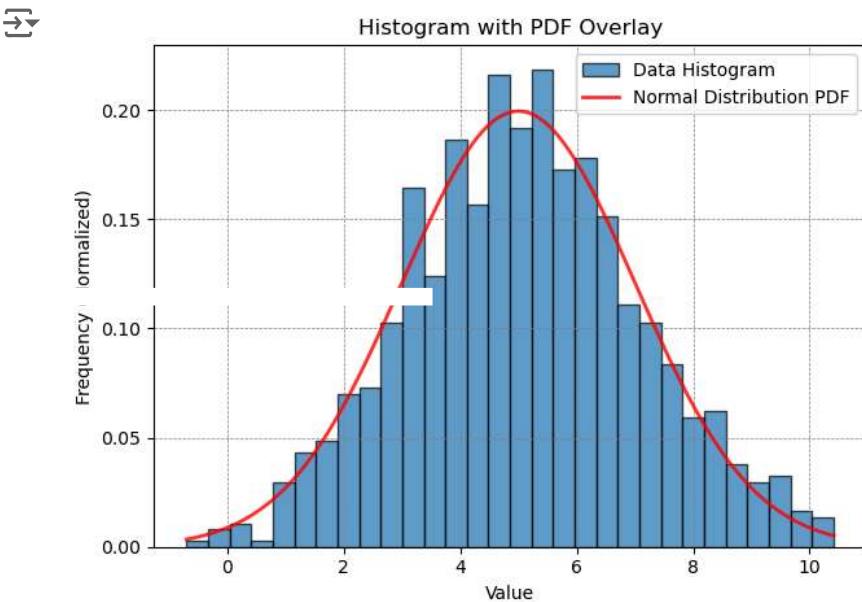
2024-01-08

- 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

```

import matplotlib.pyplot as plt
import numpy as np
from scipy.stats import norm
data = np.random.normal(loc=5, scale=2, size=1000)
plt.hist(data, bins=30, density=True, edgecolor='black', alpha=0.5)
x = np.linspace(min(data), max(data), 1000)
pdf = norm.pdf(x, loc=5, scale=2)
plt.plot(x, pdf, 'r-', linewidth=2, label='Normal Distribution PDF')
plt.xlabel('Value')
plt.ylabel('Frequency (Normalized)')
plt.title('Histogram with PDF Overlay')
plt.legend()
plt.grid(True, linestyle='--', linewidth=0.5, color='gray')
plt.tight_layout()
plt.show()

```



#17. Create a Seaborn scatter plot of two random arrays, color points by quadrant.

```

import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np
x = np.random.randn(100)
y = np.random.randn(100)
def get_quadrant(x, y):
    if x > 0 and y > 0:
        return "Upper Right"
    elif x < 0 and y > 0:
        return "Upper Left"
    elif x < 0 and y < 0:
        return "Lower Left"
    else:
        return "Lower Right"

```

- 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

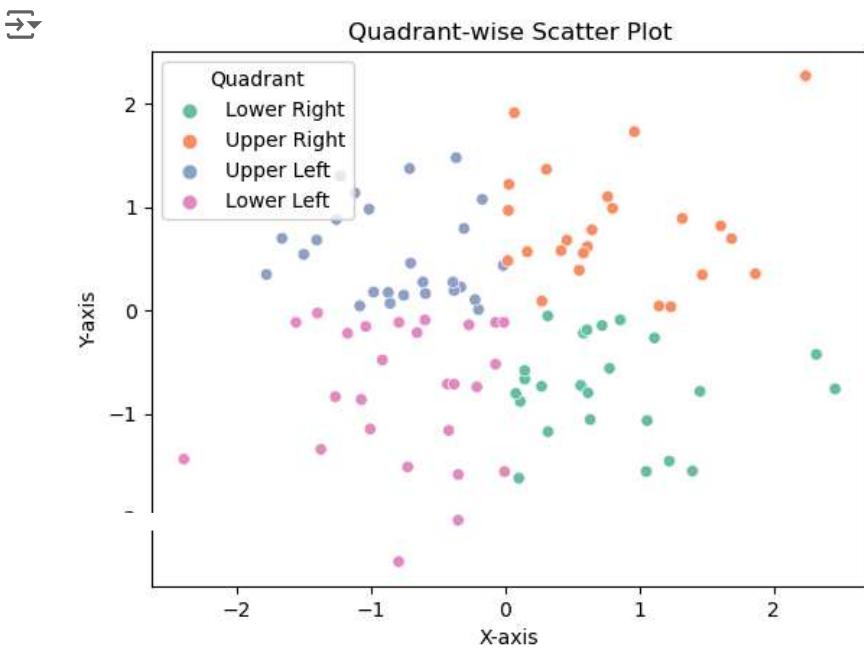
2023-11-27

- 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
- 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

```
quadrants = [get_quadrant(x_val, y_val) for x_val, y_val in zip(x, y)]
sns.scatterplot(x=x, y=y, hue=quadrants, palette="Set2")
plt.legend(title="Quadrant")
plt.xlabel("X-axis")
plt.ylabel("Y-axis")
plt.title("Quadrant-wise Scatter Plot")
plt.show()
```



```
#18. With Bokeh, plot a line chart of a sine wave function, add grid lines, and include a title.
```

```
from bokeh.plotting import figure, show
x = list(range(100))
y = [np.sin(i * 0.1) for i in x]
p = figure(title="Sine Wave Function", x_axis_label="X", y_axis_label="Y")
p.line(x, y, line_width=2, color="blue", alpha=0.8)
show(p)
```

```
#19. Using Bokeh, generate a bar chart of randomly generated categorical data.
```

```
from bokeh.plotting import figure, show
x = list(range(-10, 11))
y = [math.sin(i) for i in x]
p = figure(title="Sine Wave Function")
p.line(x, y, line_width=2)
p.xaxis.grid = True
p.yaxis.grid = True
p.xaxis.axis_label = "X"
p.yaxis.axis_label = "Y"
show(p)
```

- 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 AU Canada CA India IN and Japan JP ([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
 - tensorflow 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
 - torchtext 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](#))
- 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
 - tensorflowboard 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

```
NameError
recent call last)
Cell In[20], line 5
  3 from bokeh.plotting import figure, show
  4 x = list(range(-10, 11))
----> 5 y = [math.sin(i) for i in x]
      6 p = figure(title="Sine Wave Function")
      7 p.line(x, y, line_width=2)

Cell In[20], line 5, in <listcomp>(.0)
  3 from bokeh.plotting import figure, show
  4 x = list(range(-10, 11))
----> 5 y = [math.sin(i) for i in x]
      6 p = figure(title="Sine Wave Function")
      7 p.line(x, y, line_width=2)

NameError: name 'math' is not defined
```

#20. Using Plotly, create a basic line plot of a randomly generated dataset.

```
import plotly.graph_objects as go
import plotly.express as px
import numpy as np
x = list(range(10))
y = [np.random.randint(1, 100) for _ in x]
fig = px.line(x=x, y=y, title="Simple Line Plot")
fig.update_layout(xaxis_title="X-axis", yaxis_title="Y-axis")
fig.show()
```

```
ModuleNotFoundError
recent call last)
Cell In[21], line 3
  1 #20. Using Plotly, create a basic line plot of a
  randomly generated dataset, label the axes, and set the title
  as 'Simple Line Plot'
----> 3 import plotly.graph_objects as go
      4 import plotly.express as px
      5 import numpy as np
```

#21. Using Plotly, create an interactive pie chart of randomly generated data.

```
import plotly.graph_objects as go
import numpy as np
data = ["Slice 1", "Slice 2", "Slice 3", "Slice 4"]
values = np.random.randint(1, 101, size=4)
percentages = [round((val / sum(values)) * 100, 1) for val in values]
fig = go.Figure(data=[go.Pie(labels=data, values=values, textinfo='label+percent')])
fig.show()
```

- 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

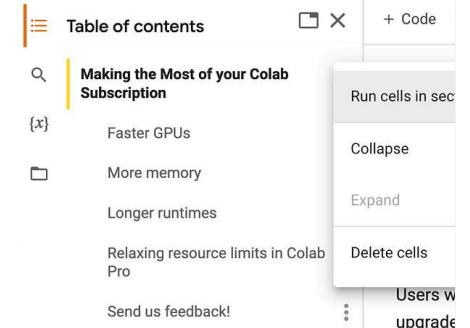
- Python package inclusions
 - PyDrive2 1.6.3

2023-07-21

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



- 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 ->

```
ModuleNotFoundError
recent call last)
Cell In[32], line 3
    1 #21. Using Plotly, create an interactive pie chart of
   randomly generated data, add labels and percentages, set the
   title as 'Interactive Pie Chart'.
----> 3 import plotly.graph_objects as go
    4 import numpy as np
    5 data = ["Slice 1", "Slice 2", "Slice 3", "Slice 4"]
```

#7. Clean and transform the 'Phone' column in the sample dataset

```
import pandas as pd
df = pd.read_csv('People_Data.csv')
df['Phone_Numeric'] = df['Phone'].str.replace(r'\D+', '', regex = True)
df['Phone_Numeric'] = pd.to_numeric(df['Phone_Numeric'], errors = 'coerce')
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 11 columns):
 #   Column      Non-Null Count  Dtype  
--- 
 0   Index       1000 non-null   int64  
 1   User Id     1000 non-null   object  
 2   First Name  1000 non-null   object  
 3   Last Name   1000 non-null   object  
 4   Gender      1000 non-null   object  
 5   Email       1000 non-null   object  
 6   Phone        979 non-null   object  
 7   Date of birth 1000 non-null object  
 8   Job Title   1000 non-null   object  
 9   Salary       1000 non-null   int64  
 10  Phone_Numeric 979 non-null   float64 
dtypes: float64(1), int64(2), object(8)
memory usage: 86.1+ KB
```

df

> Notebook settings ([post](#))

Notebook settings

Runtime type
Python 3
Hardware accelerator
None
 Automatically run the first cell or section
 Ommit code cell output when saving this notebook

- 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
 - drivefs 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
 - google-cloud-bigquery-storage 2.20.0 -> 2.22.2
 - gspread-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](#))



Index	User Id	First Name	Last Name	Gender
0	1	8717bbf45cCDBeE	Shelia	Mahoney
1	2	3d5AD30A4cD38ed	Jo	Rivers
2	3	810Ce0F276Badec	Sheryl	Lowery
3	4	BF2a889C00f0cE1	Whitney	Hooper
4	5	9affEafAe1CBBB9	Lindsey	Rice
...
995	996	fedF4c7Fd9e7cFa	Kurt	Bryant
996	997	ECddaFEDdEc4FAB	Donna	Barry
997	998	2adde51d8B8979E	Cathy	Mckinney
998	999	Fb2FE369D1E171A	Jermaine	Phelps
999	1000	8b756f6231DDC6e	Lee	Tran

1000 rows × 11 columns

Perform the following tasks using people dataset:

- #a) Read the 'data.csv' file using pandas, skipping the first 50 rows.
- #b) Only read the columns: 'Last Name', 'Gender', 'Email', 'Phone'.
- #c) Display the first 10 rows of the filtered dataset.
- #d) Extract the 'Salary' column as a Series and display its last 5 values.

- #a) Read the 'data.csv' file using pandas, skipping the first 50 rows.

- 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-images/public/runtime ([tweet](#), [instructions](#))
- Launched support for Google children 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

```
df = pd.read_csv('People_Data.csv', skiprows=50)
```

```
df
```



	50	affF3018e9cdd1dA	George	Mercer	Female	dougl
0	51	CccE5DAb6E288e5	Jo	Zavala	Male	
1	52	DfBDc3621D4bcec	Joshua	Carey	Female	c
2	53	f55b0A249f5E44D	Rickey	Hobbs	Female	
3	54	Ed71DcfaBFd0beE	Robyn	Reilly	Male	c
4	55	FDaFD0c3f5387EC	Christina	Conrad	Male	f
...
945	996	fedF4c7Fd9e7cFa	Kurt	Bryant	Female	
946	997	ECddaFEDdEc4FAB	Donna	Barry	Female	
947	998	2adde51d8B8979E	Cathy	Mckinney	Female	
948	999	Fb2FE369D1E171A	Jermaine	Phelps	Male	
949	1000	8b756f6231DDC6e	Lee	Tran	Female	

950 rows × 10 columns

#b) Only read the columns: 'Last Name', 'Gender', 'Email', 'Phone' :

```
import pandas as pd
df = pd.read_csv('People_Data.csv')
selected_columns = ["Last Name", "Gender", "Email", "Phone", "Salary"]
df = df[selected_columns]
```

```
df
```

- 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
 - google-cloud-datastore 2.11.1 → 2.15.1
 - google-cloud-firebase 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

	Last Name	Gender	Email	Phone
0	Mahoney	Male	pwarner@example.org	857.139.8239
1	Rivers	Female	fergusonkatherine@example.net	NaN
2	Lowery	Female	fhoward@example.org	(599)782-0605
3	Hooper	Male	zjohnston@example.com	17-11
4	Rice	Female	elin@example.net	(390)417-1635x3010
...	15-04
995	Bryant	Female	lyonsdaisy@example.net	06-08
996	Barry	Female	dariusbryan@example.com	02-12
997	Mckinney	Female	georgechan@example.org	02-12
998	Phelps	Male	wanda04@example.net	01-12

- 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
- torchtext 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 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

```
8     Designer, multimedia   50000
9 Insurance account manager 50000
```

#d) Extract the 'Salary' column as a Series and display its last

```
import pandas as pd
df = pd.read_csv('People_Data.csv')
salary_series = df["Salary"]
print(salary_series.tail(5))
```

```
→ 995    90000
  996    50000
  997    60000
  998    100000
  999    90000
Name: Salary, dtype: int64
```

#9. Filter and select rows from the People_Dataset, where the "Last Name" is Duke and the "Gender" is Female.

```
import pandas as pd
df = pd.read_csv('People_Data.csv')
filtered_df = df[(df['Last Name'] == 'Duke') & (df['Gender'] == 'Female')]
print(filtered_df)
```

```
→      Index      User Id First Name Last Name Gender \
45      46  99A502C175C4EBd    Olivia    Duke Female \
210     211 DF17975CC0a0373    Katrina    Duke Female
457     458 dcE1B7DE83c1076    Traci    Duke Female
729     730 c9b482D7aa3e682    Lonnie    Duke Female

                           Email                  Phone Date of
45      diana26@example.net  001-366-475-8607x04350  13-1
210     robin78@example.com  740.434.0212        21-0
457     perryhoffman@example.org +1-903-596-0995x489  11-0
729     kevinkramer@example.net  982.692.6257        12-0

          Job Title  Salary
45        Dentist   60000
210 Producer, radio 50000
457       Herbalist  50000
729       Nurse, adult 70000
```

#12. Perform the following operations using people data set:

#a) Delete the 'Email', 'Phone', and 'Date of birth' columns from
#b) Delete the rows containing any missing values.
#d) Print the final output also

```
import pandas as pd
df = pd.read_csv('People_Data.csv')
```

#a) Delete the 'Email', 'Phone', and 'Date of birth' columns from
columns_to_drop = ["Email", "Phone", "Date of birth"]

- 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
 - 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 libudunits2-dev for smoother R 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

```
df = df.drop(columns_to_drop, axis=1)
df
```

Index	User Id	First Name	Last Name	Gender	
-	-	-	-	Male	
1	2 3d5AD30A4cD38ed	Jo	Rivers	Female	
2	3 810Ce0F276Badec	Sheryl	Lowery	Female	
3	4 BF2a889C00f0cE1	Whitney	Hooper	Male	
4	5 9afFEafAe1CBBB9	Lindsey	Rice	Female	Bi
...
995	996 fedF4c7Fd9e7cFa	Kurt	Bryant	Female	
996	997 ECddaFEDdEc4FAB	Donna	Barry	Female	
997	998 2adde51d8B8979E	Cathy	Mckinney	Female	Com

#b) Delete the rows containing any missing values.

```
df = df.dropna()
df
```

Index	User Id	First Name	Last Name	Gender	
0	1 8717bbf45cCDBEe	Shelia	Mahoney	Male	
1	2 3d5AD30A4cD38ed	Jo	Rivers	Female	
2	3 810Ce0F276Badec	Sheryl	Lowery	Female	
3	4 BF2a889C00f0cE1	Whitney	Hooper	Male	
4	5 9afFEafAe1CBBB9	Lindsey	Rice	Female	Bi
...
995	996 fedF4c7Fd9e7cFa	Kurt	Bryant	Female	
996	997 ECddaFEDdEc4FAB	Donna	Barry	Female	
997	998 2adde51d8B8979E	Cathy	Mckinney	Female	Com

#d) Print the final output also

```
print(df)
```

- 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
- 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-httplib2 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-firebase 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

	Index	User Id	First Name	Last Name	Gender	\
0	1	8717bbf45cCDBEe	Shelia	Mahoney	Male	
1	2	3d5AD30A4cD38ed	Jo	Rivers	Female	
2	3	810Ce0F276Badec	Sheryl	Lowery	Female	
3	4	BF2a889C00f0cE1	Whitney	Hooper	Male	
4	5	9afFEafAe1CBBB9	Lindsey	Rice	Female	
..	
995	996	fedF4c7Fd9e7cFa	Kurt	Bryant	Female	
996	997	ECddaFEDdEc4FAB	Donna	Barry	Female	
997	998	2adde51d8B8979E	Cathy	Mckinney	Female	
998	999	Fb2FE369D1E171A	Jermaine	Phelps	Male	
999	1000	8b756f6231DDC6e	Lee	Tran	Female	

	Job Title	Salary
0	Probation officer	90000
1	Dancer	80000
2	Copy	50000
3	Counselling psychologist	65000
4	Biomedical engineer	100000
..
995	Personnel officer	90000
996	Education administrator	50000
997	Commercial/residential surveyor	60000
998	Ambulance person	100000
999	Nurse, learning disability	90000

[1000 rows x 7 columns]

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

- 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
 - xlrd 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
- 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
 - tornado 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-firebase 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

- Launched [Pay As You Go](#), allowing premium GPU access without requiring a subscription
- Added vim and tcllib 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/Prot](#) to 12 additional countries: Australia, Bangladesh, Colombia, Hong Kong, Indonesia, Mexico, New Zealand, Pakistan, Philippines, Singapore, Taiwan, and Vietnam
- Added [google.colab.auth.authenticate_se](#) 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/Prot](#) 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 [gspread examples](#) in our documentation
- Update gdown from 3.6 to 4.2

2022-01-21

- New documentation for the [google.colab package](#)
- Show GPU RAM in the resource usage tab
- Improved security for mounting Google