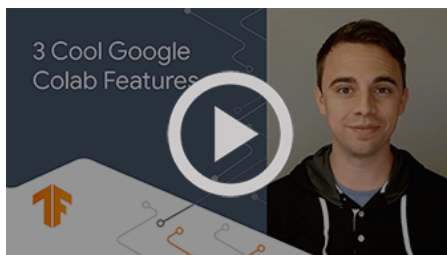# Welcome to Colab!

If you're already familiar with Colab, check out this video to learn about interactive tables, the executed code history view, and the command palette.

What is Colab?

Colab, or "Colaboratory", allows you to write and execute Python in your browser, with

- Zero configuration required
- Access to GPUs free of charge
- Easy sharing

Whether you're a **student**, a **data scientist** or an **AI researcher**, Colab can make your work easier. Watch [Introduction to Colab](#) to learn more, or just get started below!

▼ Getting started

The document you are reading is not a static web page, but an interactive environment called a **Colab notebook** that lets you write and execute code.

For example, here is a **code cell** with a short Python script that computes a value, stores it in a variable, and prints the result:

```
seconds_in_a_day = 24 * 60 * 60
seconds_in_a_day
```

```
86400
```

To execute the code in the above cell, select it with a click and then either press the play button to the left of the code, or use the keyboard shortcut "Command/Ctrl+Enter". To edit the code, just click the cell and start editing.

Variables that you define in one cell can later be used in other cells:

```
seconds_in_a_week = 7 * seconds_in_a_day
seconds_in_a_week
```

```
604800
```

Colab notebooks allow you to combine **executable code** and **rich text** in a single document, along with **images**, **HTML**, **LaTeX** and more. When you create your own Colab notebooks, they are stored in your Google Drive account. You can easily share your Colab notebooks with co-workers or friends, allowing them to comment on your notebooks or even edit them. To learn more, see [Overview of Colab](#). To create a new Colab notebook you can use the File menu above, or use the following link: [create a new Colab notebook](#).

Colab notebooks are Jupyter notebooks that are hosted by Colab. To learn more about the Jupyter project, see [jupyter.org](#).
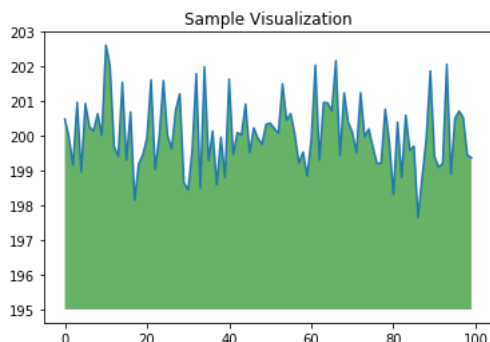
▼ Data science

With Colab you can harness the full power of popular Python libraries to analyze and visualize data. The code cell below uses **numpy** to generate some random data, and uses **matplotlib** to visualize it. To edit the code, just click the cell and start editing.

```
import numpy as np
from matplotlib import pyplot as plt

ys = 200 + np.random.randn(100)
x = [x for x in range(len(ys))]

plt.plot(x, ys, '-')
plt.fill_between(x, ys, 195, where=(ys > 195), facecolor='g', alpha=0.6)
```

```
plt.title("Sample Visualization")
plt.show()
```


You can import your own data into Colab notebooks from your Google Drive account, including from spreadsheets, as well as from Github and many other sources. To learn more about importing data, and how Colab can be used for data science, see the links below under Working with Data.

▾ Machine learning

With Colab you can import an image dataset, train an image classifier on it, and evaluate the model, all in just a few lines of code. Colab notebooks execute code on Google's cloud servers, meaning you can leverage the power of Google hardware, including GPUs and TPUs, regardless of the power of your machine. All you need is a browser.

Colab is used extensively in the machine learning community with applications including:

- Getting started with TensorFlow
- Developing and training neural networks
- Experimenting with TPUs
- Disseminating AI research
- Creating tutorials

To see sample Colab notebooks that demonstrate machine learning applications, see the machine learning examples below.

▾ More Resources

Working with Notebooks in Colab

- Overview of Colaboratory
- Guide to Markdown
- Importing libraries and installing dependencies
- Saving and loading notebooks in GitHub
- Interactive forms
- Interactive widgets

Working with Data

- Loading data: Drive, Sheets, and Google Cloud Storage
- Charts: visualizing data
- Getting started with BigQuery

Machine Learning Crash Course

These are a few of the notebooks from Google's online Machine Learning course. See the full course website for more.

- Intro to Pandas DataFrame
- Linear regression with tf.keras using synthetic data

Using Accelerated Hardware

- TensorFlow with GPUs
- TensorFlow with TPUs

▾ Featured examples

- [NeMo Voice Swap](): Use Nvidia's NeMo conversational AI Toolkit to swap a voice in an audio fragment with a computer generated one.

- [Retraining an Image Classifier](): Build a Keras model on top of a pre-trained image classifier to distinguish flowers.

- [Text Classification](): Classify IMDB movie reviews as either *positive* or *negative*.

- [Style Transfer](): Use deep learning to transfer style between images.

- [Multilingual Universal Sentence Encoder Q&A](): Use a machine learning model to answer questions from the SQuAD dataset.

- [Video Interpolation](): Predict what happened in a video between the first and the last frame.

```python
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.metrics import r2_score
from sklearn import metrics
from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import RandomizedSearchCV, GridSearchCV
a=pd.read_csv("/content/heart_disease_data.csv")
x=a.drop(columns=["target"],axis=1)
y=a["target"]
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.8, random_state=101)
model=RandomForestClassifier()
model.fit(x_train,y_train)
```

```
▾ RandomForestClassifier
RandomForestClassifier()
```

```python
print(f'x_train : {x_train.shape}')
print(f'y_train : {y_train.shape}')
print(f'x_test : {x_test.shape}')
print(f'y_test : {y_test.shape}')
```

```
x_train : (121, 13)
y_train : (121,)
x_test : (485, 13)
y_test : (485,)
```

```python
# Number of trees in random forest
n_estimators = [int(x) for x in np.linspace(start = 50, stop = 150, num = 5)]
# Number of features to consider at every split
max_features = ['auto', 'sqrt']
# Maximum number of levels in tree
max_depth = [10, 20]
# Minimum number of samples required to split a node
min_samples_split = [2, 5,10]
# Minimum number of samples required at each leaf node
min_samples_leaf = [1, 2,10]
# Method of selecting samples for training each tree
bootstrap = [True, False]


# Create the param grid
param_grid = {'n_estimators': n_estimators,
              'max_features': max_features,
              'max_depth': max_depth,
              'min_samples_split': min_samples_split,
              'min_samples_leaf': min_samples_leaf,
              'bootstrap': bootstrap}
print(param_grid)
```

```
{'n_estimators': [50, 75, 100, 125, 150], 'max_features': ['auto', 'sqrt'], 'max_depth': [10, 20], 'min_samples_split': [2, 5, 10],
```

```python
from sklearn.model_selection import GridSearchCV
rf_Grid = GridSearchCV(estimator = model, param_grid = param_grid, cv = 5, verbose=2, n_jobs = 4)


rf_Grid.fit(x_train, y_train)
```

```
    Fitting 5 folds for each of 360 candidates, totalling 1800 fits
    /usr/local/lib/python3.10/dist-packages/sklearn/ensemble/_forest.py:424: FutureWarnin
```

```python
print (f'Train Accuracy - : {rf_Grid.score(x_train,y_train):.3f}')
print (f'Test Accuracy - : {rf_Grid.score(x_test,y_test):.3f}')
```

```
    Train Accuracy - : 1.000
    Test Accuracy - : 0.889
```

```python
from sklearn.model_selection import cross_val_score
v=cross_val_score(model,x,y,cv=10)
for i in range(10):
  print("accuracy of decesion tree is: {0:.2%}".format(v[i,]))
print(" ")
print("mean accuracy",v.mean())
```

```
    accuracy of decesion tree is: 100.00%
    accuracy of decesion tree is: 100.00%
    accuracy of decesion tree is: 100.00%
    accuracy of decesion tree is: 100.00%
    accuracy of decesion tree is: 96.72%
    accuracy of decesion tree is: 96.72%
    accuracy of decesion tree is: 100.00%
    accuracy of decesion tree is: 100.00%
    accuracy of decesion tree is: 100.00%
    accuracy of decesion tree is: 100.00%

    mean accuracy 0.9934426229508198
```

```python
y_predict=model.predict(x_test)
from sklearn.metrics import accuracy_score,classification_report
print(accuracy_score(y_test,y_predict))
print(classification_report(y_test,y_predict))
pd.crosstab(y_test,y_predict)
```

```
    0.8680412371134021
                  precision    recall  f1-score   support

               0       0.88      0.83      0.85       222
               1       0.86      0.90      0.88       263

        accuracy                           0.87       485
       macro avg       0.87      0.86      0.87       485
    weighted avg       0.87      0.87      0.87       485
```

col_0	0	1
target		
0	184	38
1	26	237