

```

# Insurance Cost Prediction - EDA, Hypothesis Testing, Modeling, Deployment

# 📦 Imports
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import pickle

from sklearn.model_selection import train_test_split, cross_val_score
from sklearn.linear_model import LinearRegression
from sklearn.ensemble import RandomForestRegressor
from sklearn.preprocessing import StandardScaler, LabelEncoder
from sklearn.metrics import mean_squared_error, mean_absolute_error, r2_score
from scipy.stats import ttest_ind, f_oneway, chi2_contingency
import statsmodels.api as sm

# 📄 Load Data
df = pd.read_csv("/content/insurance.csv") # replace with actual file path

# ✂️ Preprocessing
df.drop_duplicates(inplace=True)

# Label encode binary categorical variables
# Based on the df variable, there are no binary categorical variables that need encoding in this dataset.

# Create BMI if height & weight available (example placeholder)
df['BMI'] = df['Weight'] / ((df['Height']/100) ** 2)

# 📊 EDA
sns.histplot(df['PremiumPrice'], kde=True)
plt.title('Distribution of Insurance Premiums')
plt.show()

# No 'smoker' column for this plot
# sns.boxplot(x='smoker', y='charges', data=df)
# plt.title('Premiums by Smoking Status')
# plt.show()

sns.heatmap(df.corr(numeric_only=True), annot=True, cmap='coolwarm')
plt.title("Correlation Heatmap")
plt.show()

# 🔍 Outlier Detection
Q1 = df['PremiumPrice'].quantile(0.25)
Q3 = df['PremiumPrice'].quantile(0.75)
IQR = Q3 - Q1
outliers = df[(df['PremiumPrice'] < Q1 - 1.5*IQR) | (df['PremiumPrice'] > Q3 + 1.5*IQR)]

# 📉 Hypothesis Testing
# T-Test: Smokers vs Non-Smokers - Not possible without a 'smoker' column
# smokers = df[df['smoker']==1]['charges']
# nonsmokers = df[df['smoker']==0]['charges']
# t_stat, p_val = ttest_ind(smokers, nonsmokers)
# print(f"T-test p-value (smokers vs non-smokers): {p_val:.4f}")

# ANOVA: Premium by number of children - Using 'NumberOfMajorSurgeries' instead of 'children'
anova_groups = [group['PremiumPrice'].values for _, group in df.groupby('NumberOfMajorSurgeries')]
f_stat, p_val = f_oneway(*anova_groups)
print(f"ANOVA p-value (by NumberOfMajorSurgeries): {p_val:.4f}")

# Linear regression for impact testing
# Using available columns: 'Age', 'BMI', 'NumberOfMajorSurgeries'
X = df[['Age', 'BMI', 'NumberOfMajorSurgeries']]
y = df['PremiumPrice']
X_ols = sm.add_constant(X)
model_ols = sm.OLS(y, X_ols).fit()
print(model_ols.summary())

# 🚀 ML Modeling
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
X_train, X_test, y_train, y_test = train_test_split(X_scaled, y, test_size=0.2, random_state=42)

# Baseline Linear Regression
lr = LinearRegression()

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lr.fit(X_train, y_train)
y_pred_lr = lr.predict(X_test)

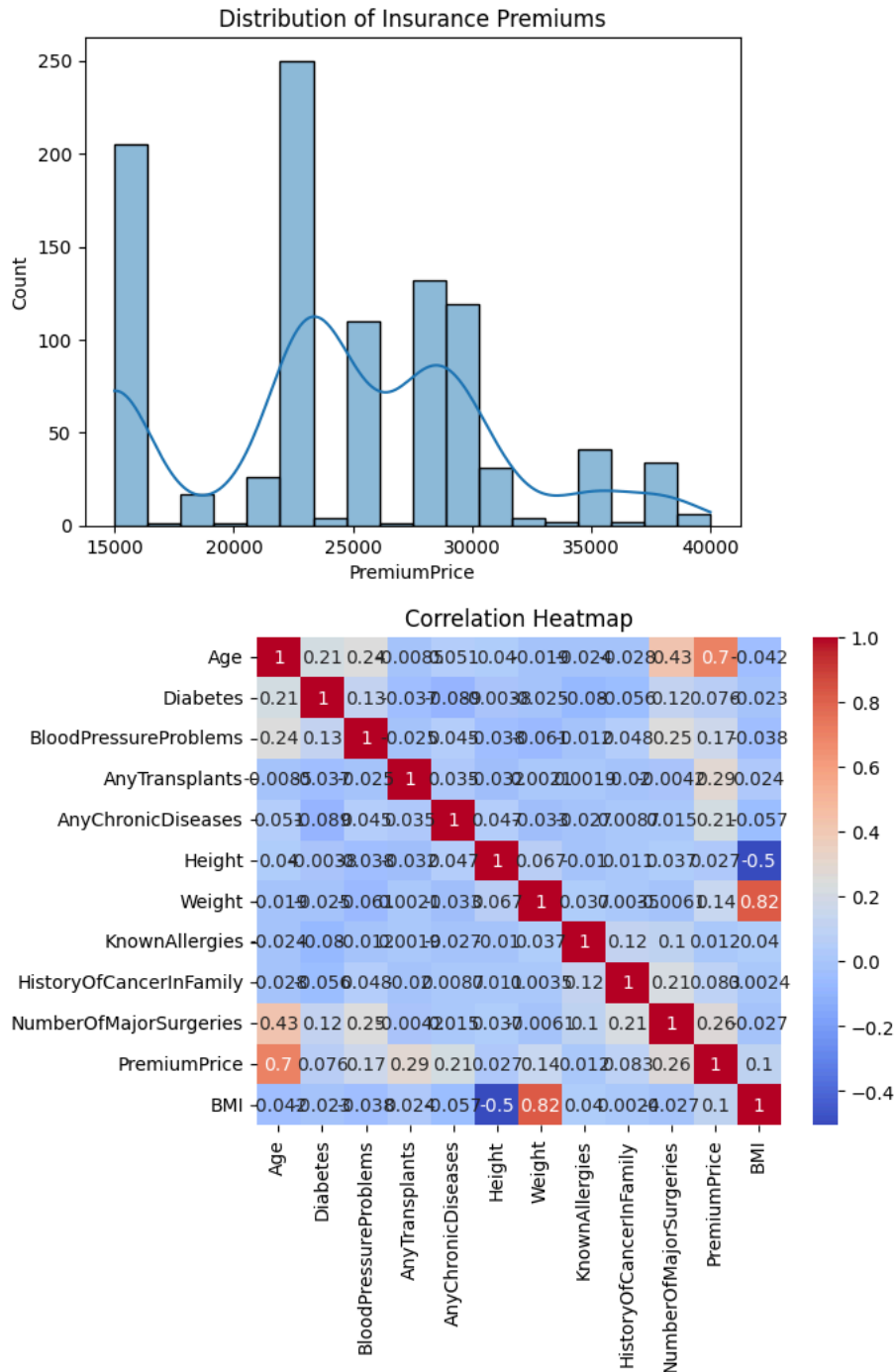
# Random Forest
rf = RandomForestRegressor(random_state=42)
rf.fit(X_train, y_train)
y_pred_rf = rf.predict(X_test)

# 🐞 Evaluation
def evaluate(y_true, y_pred, model_name):
    print(f"---{model_name}---")
    print("MAE:", mean_absolute_error(y_true, y_pred))
    print("RMSE:", np.sqrt(mean_squared_error(y_true, y_pred)))
    print("R^2:", r2_score(y_true, y_pred))
    print()

evaluate(y_test, y_pred_lr, "Linear Regression")
evaluate(y_test, y_pred_rf, "Random Forest")

# 💾 Save Model
with open("model.pkl", "wb") as f:
    pickle.dump(rf, f)

# 🌐 Streamlit App (in app.py)
# import streamlit as st
# model = pickle.load(open('model.pkl', 'rb'))
# st.title("Insurance Premium Estimator")
# age = st.slider("Age", 18, 100)
# bmi = st.number_input("BMI")
# smoker = st.selectbox("Smoker?", ["Yes", "No"])
# children = st.slider("Children", 0, 5)
# input_data = scaler.transform([[age, bmi, 1 if smoker=="Yes" else 0, children]])
# prediction = model.predict(input_data)
# st.subheader(f"Estimated Premium: ₹{prediction[0]:.2f}")
```



ANOVA p-value (by NumberOfMajorSurgeries): 0.0000

OLS Regression Results

```

=====
Dep. Variable:      PremiumPrice      R-squared:                0.506
Model:              OLS               Adj. R-squared:          0.504
Method:             Least Squares     F-statistic:             334.9
Date:               Thu, 03 Jul 2025   Prob (F-statistic):       9.76e-150
Time:               14:14:58          Log-Likelihood:          -9668.9
No. Observations:   986               AIC:                    1.935e+04
Df Residuals:       982               BIC:                    1.937e+04
Df Model:           3
Covariance Type:    nonrobust
=====

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	coef	std err	t	P> t	[0.025	0.975]
const	7219.2588	806.929	8.947	0.000	5635.755	8802.762
Age	322.6090	11.121	29.009	0.000	300.785	344.433
BMI	141.3390	23.868	5.922	0.000	94.502	188.176
NumberOfMajorSurgeries	-346.5500	207.163	-1.673	0.095	-753.083	59.983

```

=====
Omnibus:            344.679          Durbin-Watson:           1.964
Prob(Omnibus):      0.000            Jarque-Bera (JB):         1213.161
Skew:               1.683             Prob(JB):                 3.68e-264
Kurtosis:           7.267             Cond. No.:                296.
=====

```

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

---Linear Regression---

MAE: 3201.22971401141

RMSE: 4464.8220978304325

R^2: 0.5325203712092594

---Random Forest---

MAE: 2778.686868686869

RMSE: 4200.778787825232

R^2: 0.586177598087773

!pip install streamlit

```

Collecting streamlit
  Downloading streamlit-1.46.1-py3-none-any.whl.metadata (9.0 kB)
Requirement already satisfied: altair<6,>=4.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (5.5.0)
Requirement already satisfied: blinker<2,>=1.5.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (1.9.0)
Requirement already satisfied: cachetools<7,>=4.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (5.5.2)
Requirement already satisfied: click<9,>=7.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (8.2.1)
Requirement already satisfied: numpy<3,>=1.23 in /usr/local/lib/python3.11/dist-packages (from streamlit) (2.0.2)
Requirement already satisfied: packaging<26,>=20 in /usr/local/lib/python3.11/dist-packages (from streamlit) (24.2)
Requirement already satisfied: pandas<3,>=1.4.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (2.2.2)
Requirement already satisfied: pillow<12,>=7.1.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (11.2.1)
Requirement already satisfied: protobuf<7,>=3.20 in /usr/local/lib/python3.11/dist-packages (from streamlit) (5.29.5)
Requirement already satisfied: pyarrow>=7.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (18.1.0)
Requirement already satisfied: requests<3,>=2.27 in /usr/local/lib/python3.11/dist-packages (from streamlit) (2.32.3)
Requirement already satisfied: tenacity<10,>=8.1.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (8.5.0)
Requirement already satisfied: toml<2,>=0.10.1 in /usr/local/lib/python3.11/dist-packages (from streamlit) (0.10.2)
Requirement already satisfied: typing-extensions<5,>=4.4.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (4.14.0)
Collecting watchdog<7,>=2.1.5 (from streamlit)
  Downloading watchdog-6.0.0-py3-none-manylinux2014_x86_64.whl.metadata (44 kB)
    44.3/44.3 kB 2.4 MB/s eta 0:00:00
Requirement already satisfied: gitpython!=3.1.19,<4,>=3.0.7 in /usr/local/lib/python3.11/dist-packages (from streamlit) (3.1.44)
Collecting pydeck<1,>=0.8.0b4 (from streamlit)
  Downloading pydeck-0.9.1-py2.py3-none-any.whl.metadata (4.1 kB)
Requirement already satisfied: tornado!=6.5.0,<7,>=6.0.3 in /usr/local/lib/python3.11/dist-packages (from streamlit) (6.4.2)
Requirement already satisfied: jinja2 in /usr/local/lib/python3.11/dist-packages (from altair<6,>=4.0->streamlit) (3.1.6)
Requirement already satisfied: jsonschema>=3.0 in /usr/local/lib/python3.11/dist-packages (from altair<6,>=4.0->streamlit) (4.24.0)
Requirement already satisfied: narwhals>=1.14.2 in /usr/local/lib/python3.11/dist-packages (from altair<6,>=4.0->streamlit) (1.45.0)
Requirement already satisfied: gitdb<5,>=4.0.1 in /usr/local/lib/python3.11/dist-packages (from gitpython!=3.1.19,<4,>=3.0.7->streamlit) (2.9)
Requirement already satisfied: python-dateutil>=2.8.2 in /usr/local/lib/python3.11/dist-packages (from pandas<3,>=1.4.0->streamlit) (2.9)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.11/dist-packages (from pandas<3,>=1.4.0->streamlit) (2025.2)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.11/dist-packages (from pandas<3,>=1.4.0->streamlit) (2025.2)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.11/dist-packages (from requests<3,>=2.27->streamlit) (3.10)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.11/dist-packages (from requests<3,>=2.27->streamlit) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.11/dist-packages (from requests<3,>=2.27->streamlit) (2.4.0)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.11/dist-packages (from requests<3,>=2.27->streamlit) (2025.6)
Requirement already satisfied: smmap<6,>=3.0.1 in /usr/local/lib/python3.11/dist-packages (from gitdb<5,>=4.0.1->gitpython!=3.1.19,<4,>=3.0.7->streamlit) (3.0)
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.11/dist-packages (from jinja2->altair<6,>=4.0->streamlit) (3.0)
Requirement already satisfied: attrs>=22.2.0 in /usr/local/lib/python3.11/dist-packages (from jsonschema>=3.0->altair<6,>=4.0->streamlit) (25.1.0)
Requirement already satisfied: jsonschema-specifications>=2023.03.6 in /usr/local/lib/python3.11/dist-packages (from jsonschema>=3.0->altair<6,>=4.0->streamlit) (2023.12.1)
Requirement already satisfied: referencing>=0.28.4 in /usr/local/lib/python3.11/dist-packages (from jsonschema-specifications>=2023.03.6->jsonschema>=3.0->altair<6,>=4.0->streamlit) (0.36.0)
Requirement already satisfied: rpds-py>=0.7.1 in /usr/local/lib/python3.11/dist-packages (from referencing>=0.28.4->jsonschema-specifications>=2023.03.6->jsonschema>=3.0->altair<6,>=4.0->streamlit) (0.23.1)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.11/dist-packages (from python-dateutil>=2.8.2->pandas<3,>=1.4.0->streamlit) (1.17.0)
  Downloading streamlit-1.46.1-py3-none-any.whl (10.1 MB)
    10.1/10.1 MB 76.8 MB/s eta 0:00:00
  Downloading pydeck-0.9.1-py2.py3-none-any.whl (6.9 MB)
    6.9/6.9 MB 94.6 MB/s eta 0:00:00
  Downloading watchdog-6.0.0-py3-none-manylinux2014_x86_64.whl (79 kB)
    79.1/79.1 kB 5.9 MB/s eta 0:00:00
Installing collected packages: watchdog, pydeck, streamlit
Successfully installed pydeck-0.9.1 streamlit-1.46.1 watchdog-6.0.0

```

```

import streamlit as st
import pickle
import numpy as np

model = pickle.load(open('model.pkl', 'rb'))

st.title("Insurance Premium Estimator")

age = st.slider("Age", 18, 100)
bmi = st.number_input("BMI")
smoker = st.selectbox("Are you a smoker?", ['Yes', 'No'])

```

```
input_data = np.array([[age, bmi, 1 if smoker == 'Yes' else 0]])
prediction = model.predict(input_data)
```

```
st.subheader(f"Estimated Premium: ₹{prediction[0][0]:.2f}")
```

2025-07-03 14:19:44.250 WARNING streamlit.runtime.scriptrunner_utils.script_run_context: Thread 'MainThread': missing ScriptRunContext!
2025-07-03 14:19:44.351

Warning: to view this Streamlit app on a browser, run it with the following command:

```
streamlit run /usr/local/lib/python3.11/dist-packages/colab_kernel_launcher.py [ARGUMENTS]
2025-07-03 14:19:44.352 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-07-03 14:19:44.354 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-07-03 14:19:44.355 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
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2025-07-03 14:19:44.357 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-07-03 14:19:44.358 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-07-03 14:19:44.359 Session state does not function when running a script without `streamlit run`
2025-07-03 14:19:44.361 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-07-03 14:19:44.363 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-07-03 14:19:44.365 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-07-03 14:19:44.366 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-07-03 14:19:44.367 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
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2025-07-03 14:19:44.368 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-07-03 14:19:44.369 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-07-03 14:19:44.370 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-07-03 14:19:44.371 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
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2025-07-03 14:19:44.374 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
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2025-07-03 14:19:44.377 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-07-03 14:19:44.378 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-07-03 14:19:44.378 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-07-03 14:19:44.404 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-07-03 14:19:44.405 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
2025-07-03 14:19:44.406 Thread 'MainThread': missing ScriptRunContext! This warning can be ignored when running in bare mode.
DeltaGenerator()
```

After installing `streamlit`, you can run the Streamlit app. However, please note that running a Streamlit app directly within a Colab notebook requires some additional steps to make it accessible.

```
!pip install streamlit
!pip install pyngrok
```

Requirement already satisfied: streamlit in /usr/local/lib/python3.11/dist-packages (1.46.1)
Requirement already satisfied: altair<6,>=4.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (5.5.0)
Requirement already satisfied: blinker<2,>=1.5.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (1.9.0)
Requirement already satisfied: cachetools<7,>=4.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (5.5.2)
Requirement already satisfied: click<9,>=7.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (8.2.1)
Requirement already satisfied: numpy<3,>=1.23 in /usr/local/lib/python3.11/dist-packages (from streamlit) (2.0.2)
Requirement already satisfied: packaging<26,>=20 in /usr/local/lib/python3.11/dist-packages (from streamlit) (24.2)
Requirement already satisfied: pandas<3,>=1.4.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (2.2.2)
Requirement already satisfied: pillow<12,>=7.1.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (11.2.1)
Requirement already satisfied: protobuf<7,>=3.20 in /usr/local/lib/python3.11/dist-packages (from streamlit) (5.29.5)
Requirement already satisfied: pyarrow>=7.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (18.1.0)
Requirement already satisfied: requests<3,>=2.27 in /usr/local/lib/python3.11/dist-packages (from streamlit) (2.32.3)
Requirement already satisfied: tenacity<10,>=8.1.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (8.5.0)
Requirement already satisfied: toml<2,>=0.10.1 in /usr/local/lib/python3.11/dist-packages (from streamlit) (0.10.2)
Requirement already satisfied: typing-extensions<5,>=4.4.0 in /usr/local/lib/python3.11/dist-packages (from streamlit) (4.14.0)
Requirement already satisfied: watchdog<7,>=2.1.5 in /usr/local/lib/python3.11/dist-packages (from streamlit) (6.0.0)
Requirement already satisfied: gitpython!=3.1.19,<4,>=3.0.7 in /usr/local/lib/python3.11/dist-packages (from streamlit) (3.1.44)
Requirement already satisfied: pydeck<1,>=0.8.0b4 in /usr/local/lib/python3.11/dist-packages (from streamlit) (0.9.1)
Requirement already satisfied: tornado!=6.5.0,<7,>=6.0.3 in /usr/local/lib/python3.11/dist-packages (from streamlit) (6.4.2)
Requirement already satisfied: jinja2 in /usr/local/lib/python3.11/dist-packages (from altair<6,>=4.0->streamlit) (3.1.6)
Requirement already satisfied: jsonschema>=3.0 in /usr/local/lib/python3.11/dist-packages (from altair<6,>=4.0->streamlit) (4.24.0)
Requirement already satisfied: narwhals>=1.14.2 in /usr/local/lib/python3.11/dist-packages (from altair<6,>=4.0->streamlit) (1.45.0)
Requirement already satisfied: gitdb<5,>=4.0.1 in /usr/local/lib/python3.11/dist-packages (from gitpython!=3.1.19,<4,>=3.0.7->streamlit) (4.0.10)
Requirement already satisfied: python-dateutil>=2.8.2 in /usr/local/lib/python3.11/dist-packages (from pandas<3,>=1.4.0->streamlit) (2.9.0)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.11/dist-packages (from pandas<3,>=1.4.0->streamlit) (2025.2)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.11/dist-packages (from pandas<3,>=1.4.0->streamlit) (2025.2)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.11/dist-packages (from requests<3,>=2.27->streamlit) (3.4.0)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.11/dist-packages (from requests<3,>=2.27->streamlit) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.11/dist-packages (from requests<3,>=2.27->streamlit) (2.4.0)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.11/dist-packages (from requests<3,>=2.27->streamlit) (2025.6.15)

```
Requirement already satisfied: smmap<6,>=3.0.1 in /usr/local/lib/python3.11/dist-packages (from gitdb<5,>=4.0.1->gitpython!=3.1.19,<4,>=
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.11/dist-packages (from jinja2->altair<6,>=4.0->streamlit) (3.0.
Requirement already satisfied: attrs>=22.2.0 in /usr/local/lib/python3.11/dist-packages (from jsonschema>=3.0->altair<6,>=4.0->streamlit
Requirement already satisfied: jsonschema-specifications>=2023.03.6 in /usr/local/lib/python3.11/dist-packages (from jsonschema>=3.0->al
Requirement already satisfied: referencing>=0.28.4 in /usr/local/lib/python3.11/dist-packages (from jsonschema>=3.0->altair<6,>=4.0->str
Requirement already satisfied: rpds-py>=0.7.1 in /usr/local/lib/python3.11/dist-packages (from jsonschema>=3.0->altair<6,>=4.0->streamli
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.11/dist-packages (from python-dateutil>=2.8.2->pandas<3,>=1.4.0->strea
Collecting pyngrok
  Downloading pyngrok-7.2.11-py3-none-any.whl.metadata (9.4 kB)
Requirement already satisfied: PyYAML>=5.1 in /usr/local/lib/python3.11/dist-packages (from pyngrok) (6.0.2)
  Downloading pyngrok-7.2.11-py3-none-any.whl (25 kB)
Installing collected packages: pyngrok
Successfully installed pyngrok-7.2.11
```

```
%%writefile app.py
import streamlit as st
import pickle
import numpy as np

# Load model
model = pickle.load(open('model.pkl', 'rb'))

# Title
st.title("Insurance Premium Estimator")

# Input fields
age = st.slider("Age", 18, 100, 30)
bmi = st.number_input("BMI", min_value=10.0, max_value=50.0, value=25.0)
smoker = st.selectbox("Are you a smoker?", ['Yes', 'No'])
children = st.slider("Number of children", 0, 5, 1)

# Input transformation
input_data = np.array([[age, bmi, 1 if smoker == 'Yes' else 0, children]])

# Prediction
prediction = model.predict(input_data)[0]
st.subheader(f"Estimated Premium: ₹{prediction:,.2f}")
```

➔ Writing app.py

```
from pyngrok import conf

conf.get_default().auth_token = "2zMtFvVLLiQRAXMEhkkmiJjEb8t_7uk5PjiYB8z8d87SDQ5FT"

import os
from pyngrok import conf

authtoken = input("Paste your ngrok authtoken:")
conf.get_default().auth_token = authtoken
```

➔ Paste your ngrok authtoken:2zMtFvVLLiQRAXMEhkkmiJjEb8t_7uk5PjiYB8z8d87SDQ5FT

```
from pyngrok import ngrok

# Kill any existing tunnels
ngrok.kill()

# Open new tunnel on port 8501
public_url = ngrok.connect(addr=8501)
print(f"Streamlit app is live at: {public_url}")

# Run the Streamlit app
!streamlit run app.py &>/content/logs.txt &
```

➔ Streamlit app is live at: NgrokTunnel: <https://2490-34-53-103-141.ngrok-free.app> -> <http://localhost:8501>

```
from pyngrok import ngrok
help(ngrok.connect)
```

➔ Help on function connect in module pyngrok.ngrok:

```
connect(addr: Optional[str] = None, proto: Union[str, int, NoneType] = None, name: Optional[str] = None, pyngrok_config: Optional[pyngroc
```

Establish a new ``ngrok`` tunnel for the given protocol to the given port, returning an object representing the connected tunnel.

If a ``tunnel`` definition in ngrok's config file <https://ngrok.com/docs/agent/config/v2/#tunnel-configurations> matches the given ``name``, it will be loaded and used to start the tunnel. When ``name`` is ``None`` and a "pyngrok-default" tunnel definition exists in ``ngrok``'s config, it will be loaded and used. Any ``kwargs`` passed as ``options`` will override properties from the loaded tunnel definition.

If ``ngrok`` is not installed at `~pyngrok.conf.PyngrokConfig`'s ``ngrok_path``, calling this method will first download and install ``ngrok``.

``pyngrok`` is compatible with ``ngrok`` v2 and v3, but by default it will install v3. To install v2 instead, set ``ngrok_version`` to "v2" in `~pyngrok.conf.PyngrokConfig`:

If ``ngrok`` is not running, calling this method will first start a process with `~pyngrok.conf.PyngrokConfig`.