Group 10 HW3 for Digital Economy & Decision Analytics

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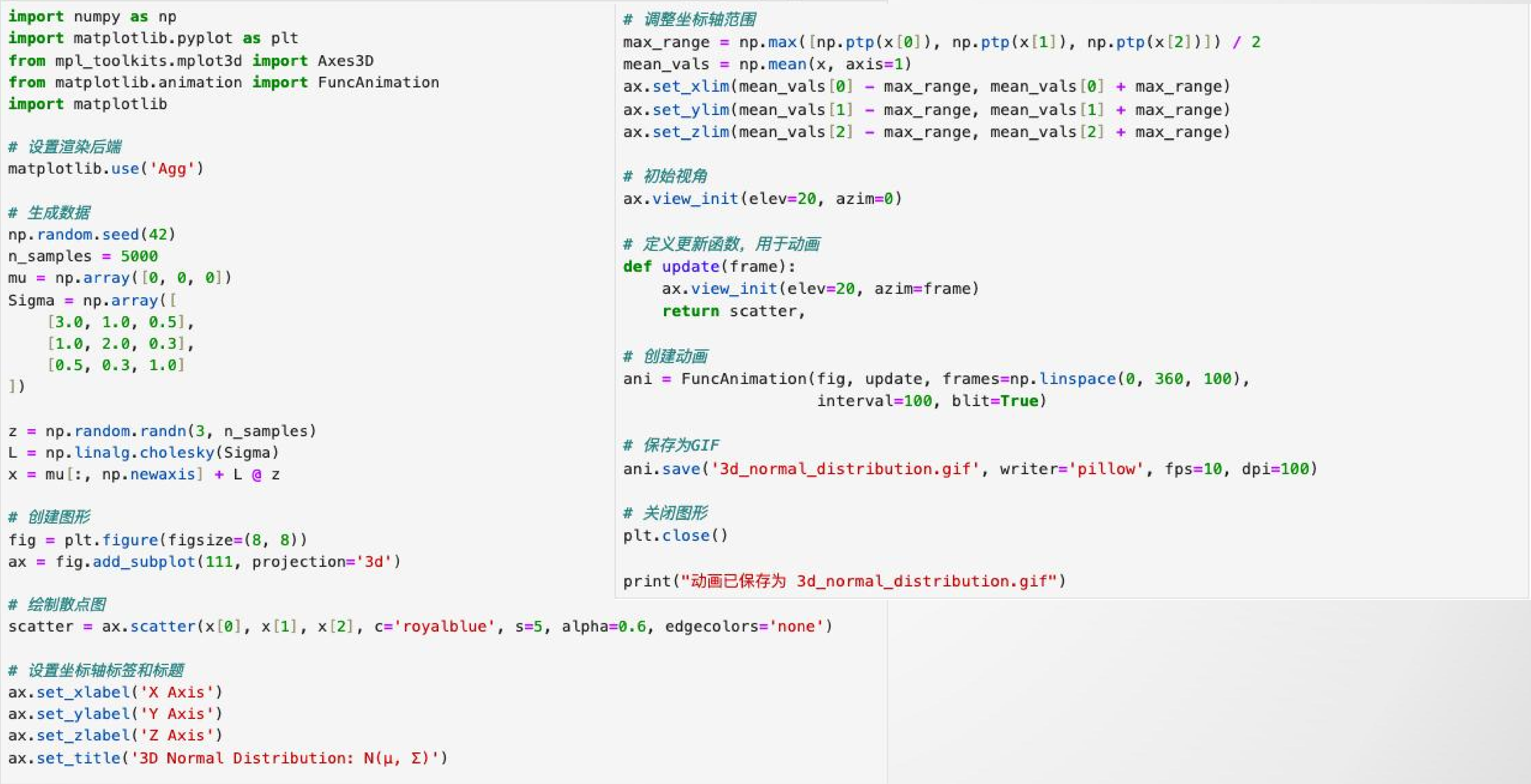
Outline of July 10 HW

1. create a N (mu, SIGMA), try in a rotating plot in 3D
2. Redo the LDA example IRTG1792

1. Code for creating a N(μ, Σ) and its rotating plot

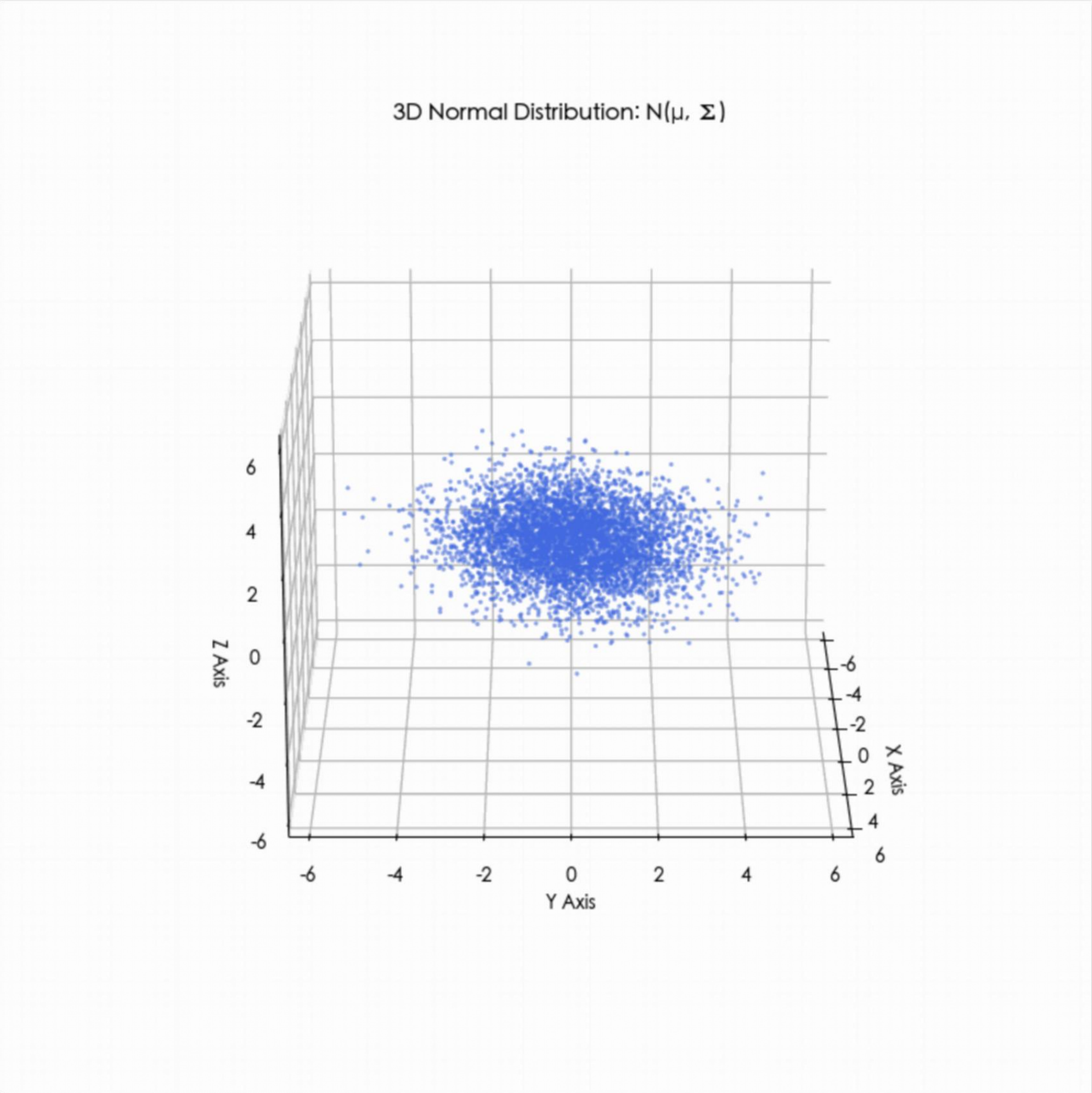
method 1: generate a rotating animation GIF



```python
import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
from matplotlib.animation import FuncAnimation
import matplotlib

# 设置渲染后端
matplotlib.use('Agg')

# 生成数据
np.random.seed(42)
n_samples = 5000
mu = np.array([0, 0, 0])
Sigma = np.array([
    [3.0, 1.0, 0.5],
    [1.0, 2.0, 0.3],
    [0.5, 0.3, 1.0]
])

z = np.random.randn(3, n_samples)
L = np.linalg.cholesky(Sigma)
x = mu[:, np.newaxis] + L @ z

# 创建图形
fig = plt.figure(figsize=(8, 8))
ax = fig.add_subplot(111, projection='3d')

# 绘制散点图
scatter = ax.scatter(x[0], x[1], x[2], c='royalblue', s=5, alpha=0.6, edgecolors='none')

# 设置坐标轴标签和标题
ax.set_xlabel('X Axis')
ax.set_ylabel('Y Axis')
ax.set_zlabel('Z Axis')
ax.set_title('3D Normal Distribution: N(μ, Σ)')
```

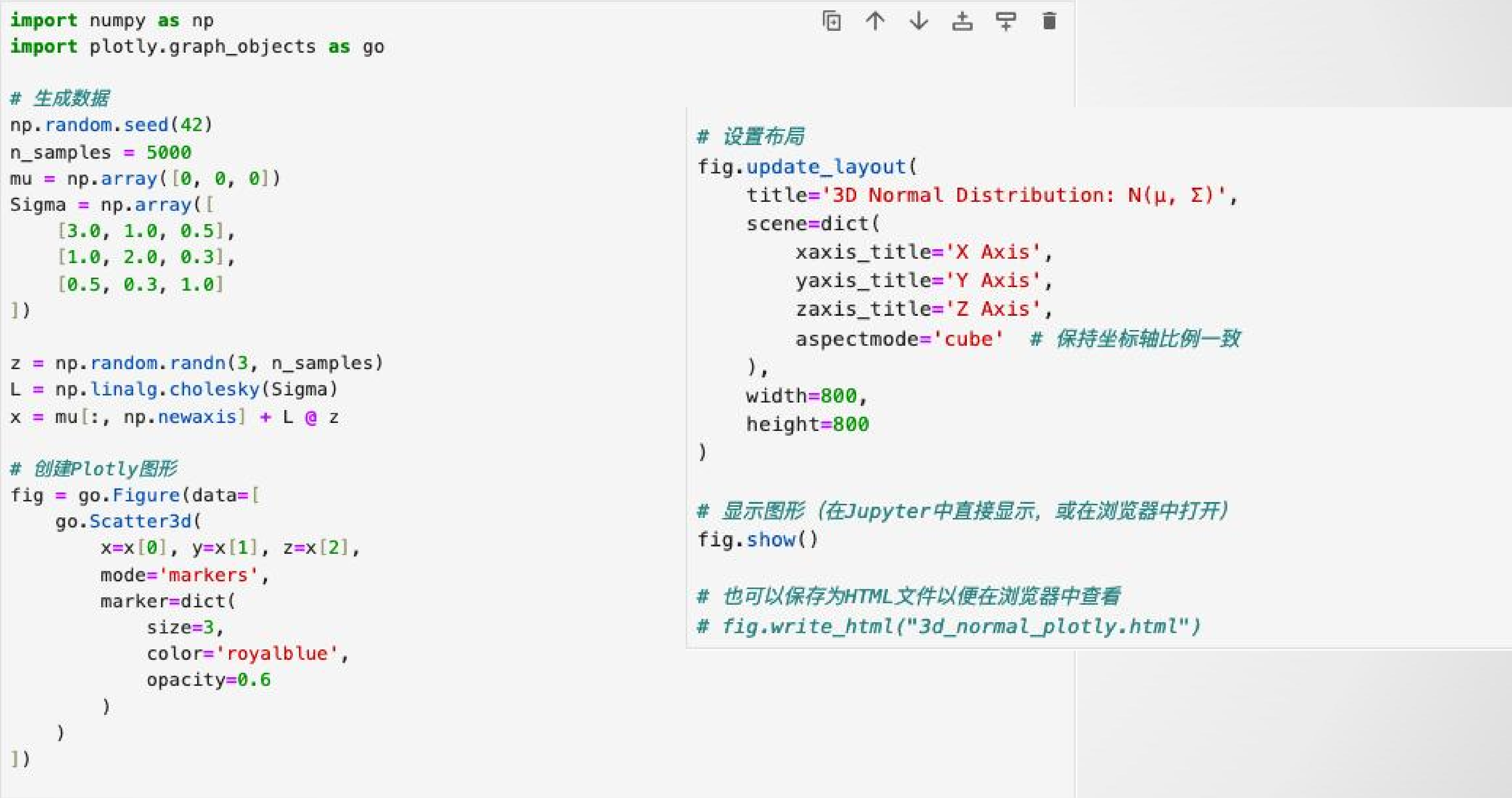
```python
# 调整坐标轴范围
max_range = np.max([np.ptp(x[0]), np.ptp(x[1]), np.ptp(x[2])]) / 2
mean_vals = np.mean(x, axis=1)
ax.set_xlim(mean_vals[0] - max_range, mean_vals[0] + max_range)
ax.set_ylim(mean_vals[1] - max_range, mean_vals[1] + max_range)
ax.set_zlim(mean_vals[2] - max_range, mean_vals[2] + max_range)

# 初始视角
ax.view_init(elev=20, azim=0)

# 定义更新函数，用于动画
def update(frame):
    ax.view_init(elev=20, azim=frame)
    return scatter,

# 创建动画
ani = FuncAnimation(fig, update, frames=np.linspace(0, 360, 100),
                    interval=100, blit=True)

# 保存为GIF
ani.save('3d_normal_distribution.gif', writer='pillow', fps=10, dpi=100)

# 关闭图形
plt.close()

print("动画已保存为 3d_normal_distribution.gif")
```

A rotating plot for N(μ, Σ)



1. Code for creating a N(μ, Σ) and its rotating plot

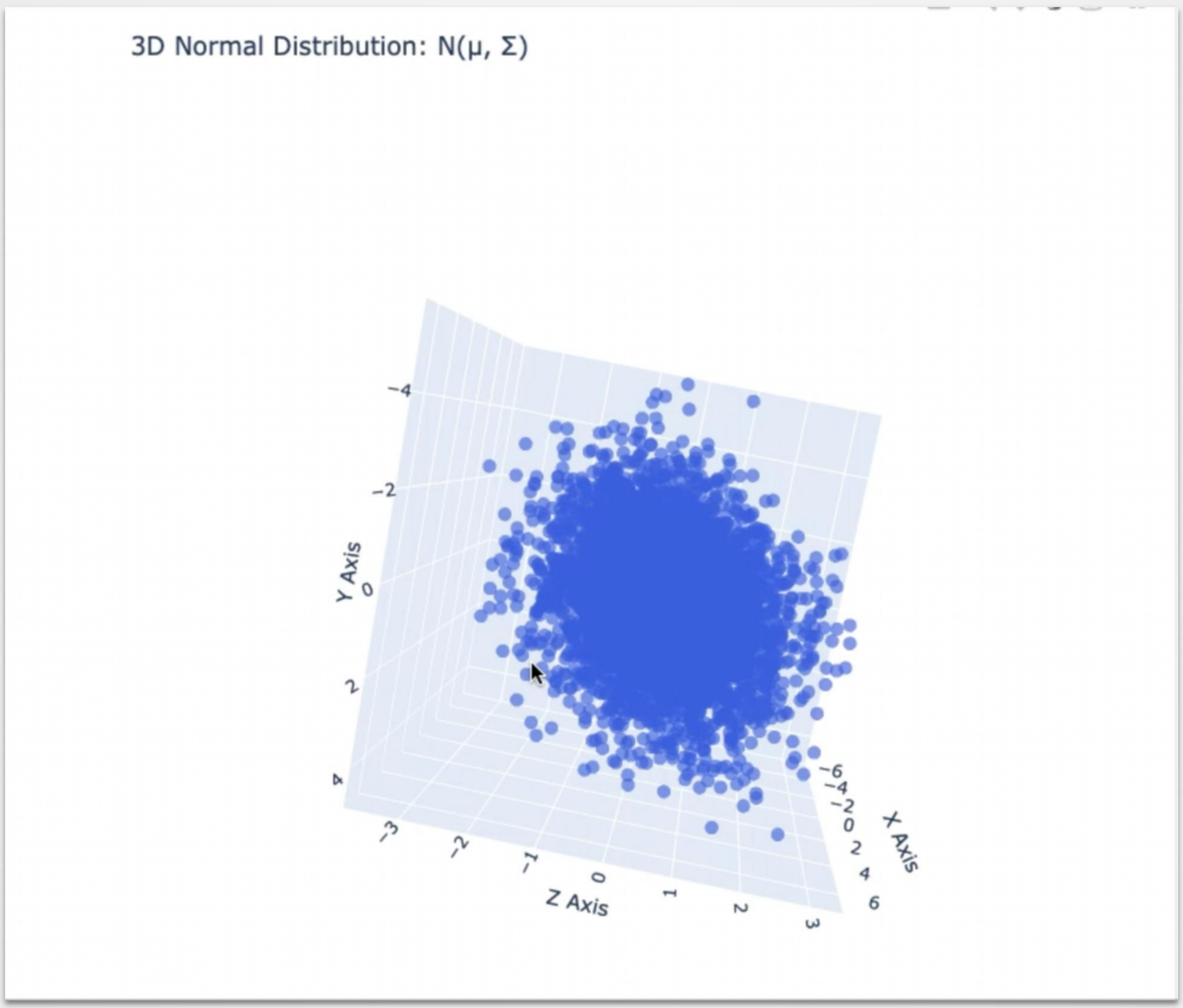
method 2: implementing interactive 3D graphs using Plotly



```python
import numpy as np
import plotly.graph_objects as go

# 生成数据
np.random.seed(42)
n_samples = 5000
mu = np.array([0, 0, 0])
Sigma = np.array([
    [3.0, 1.0, 0.5],
    [1.0, 2.0, 0.3],
    [0.5, 0.3, 1.0]
])

z = np.random.randn(3, n_samples)
L = np.linalg.cholesky(Sigma)
x = mu[:, np.newaxis] + L @ z

# 创建Plotly图形
fig = go.Figure(data=[
    go.Scatter3d(
        x=x[0], y=x[1], z=x[2],
        mode='markers',
        marker=dict(
            size=3,
            color='royalblue',
            opacity=0.6
        )
    )
])
```

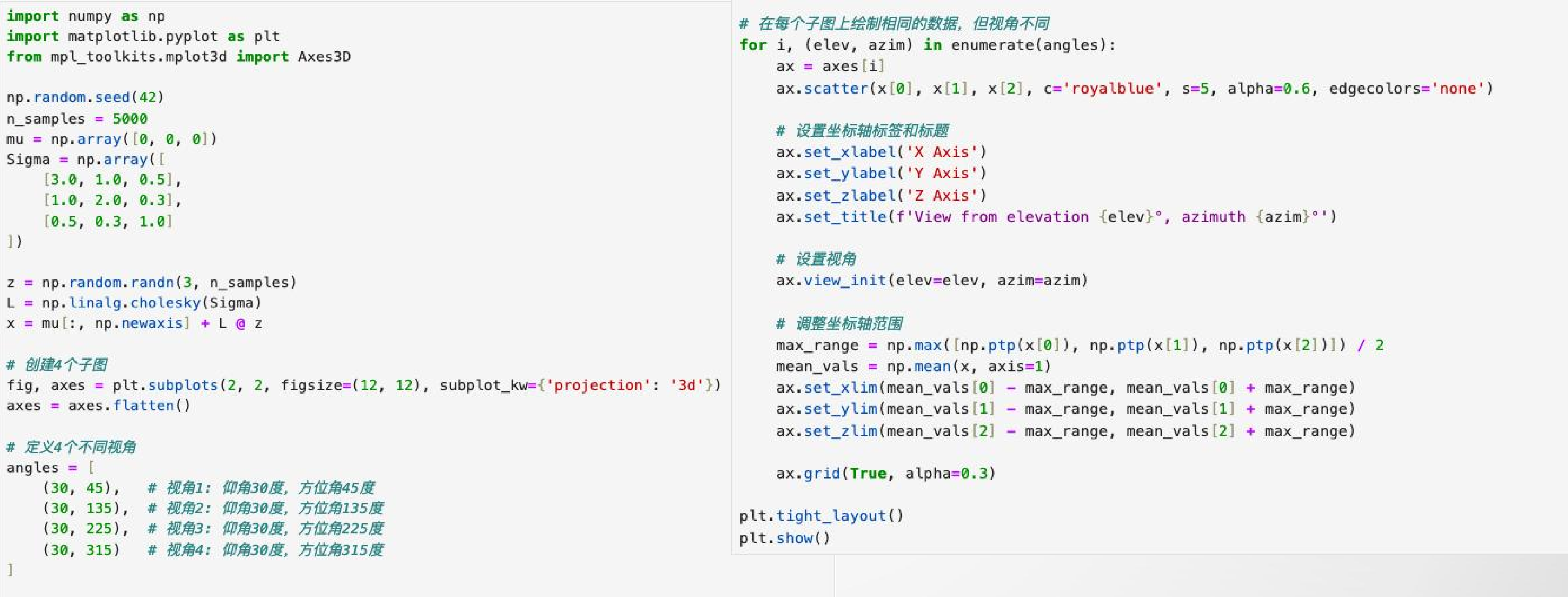
```python
# 设置布局
fig.update_layout(
    title='3D Normal Distribution: N(μ, Σ)',
    scene=dict(
        xaxis_title='X Axis',
        yaxis_title='Y Axis',
        zaxis_title='Z Axis',
        aspectmode='cube'  # 保持坐标轴比例一致
    ),
    width=800,
    height=800
)

# 显示图形（在Jupyter中直接显示，或在浏览器中打开）
fig.show()

# 也可以保存为HTML文件以便在浏览器中查看
# fig.write_html("3d_normal_plotly.html")
```

A rotating plot for N(μ, Σ)



1. Code for creating a N(μ, Σ) and its rotating plot

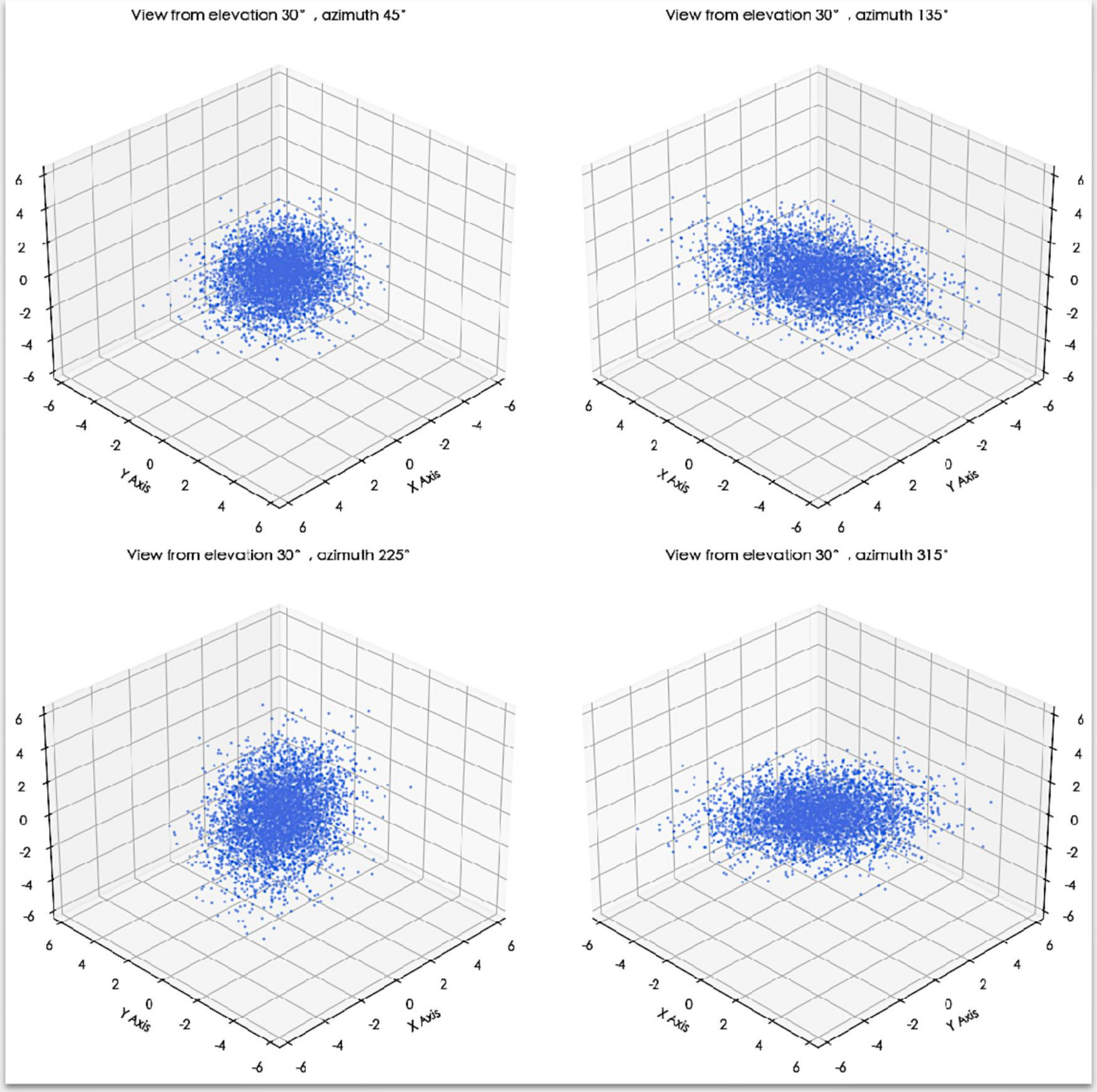
method 3: generate static multi-angle views



```python
import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D

np.random.seed(42)
n_samples = 5000
mu = np.array([0, 0, 0])
Sigma = np.array([
    [3.0, 1.0, 0.5],
    [1.0, 2.0, 0.3],
    [0.5, 0.3, 1.0]
])

z = np.random.randn(3, n_samples)
L = np.linalg.cholesky(Sigma)
x = mu[:, np.newaxis] + L @ z

# 创建4个子图
fig, axes = plt.subplots(2, 2, figsize=(12, 12), subplot_kw={'projection': '3d'})
axes = axes.flatten()

# 定义4个不同视角
angles = [
    (30, 45),   # 视角1: 仰角30度, 方位角45度
    (30, 135),  # 视角2: 仰角30度, 方位角135度
    (30, 225),  # 视角3: 仰角30度, 方位角225度
    (30, 315)   # 视角4: 仰角30度, 方位角315度
]
```

```python
# 在每个子图上绘制相同的数据, 但视角不同
for i, (elev, azim) in enumerate(angles):
    ax = axes[i]
    ax.scatter(x[0], x[1], x[2], c='royalblue', s=5, alpha=0.6, edgecolors='none')

    # 设置坐标轴标签和标题
    ax.set_xlabel('X Axis')
    ax.set_ylabel('Y Axis')
    ax.set_zlabel('Z Axis')
    ax.set_title(f'View from elevation {elev}°, azimuth {azim}°')

    # 设置视角
    ax.view_init(elev=elev, azim=azim)

    # 调整坐标轴范围
    max_range = np.max([np.ptp(x[0]), np.ptp(x[1]), np.ptp(x[2])]) / 2
    mean_vals = np.mean(x, axis=1)
    ax.set_xlim(mean_vals[0] - max_range, mean_vals[0] + max_range)
    ax.set_ylim(mean_vals[1] - max_range, mean_vals[1] + max_range)
    ax.set_zlim(mean_vals[2] - max_range, mean_vals[2] + max_range)

    ax.grid(True, alpha=0.3)

plt.tight_layout()
plt.show()
```

A rotating plot for N(μ, Σ)



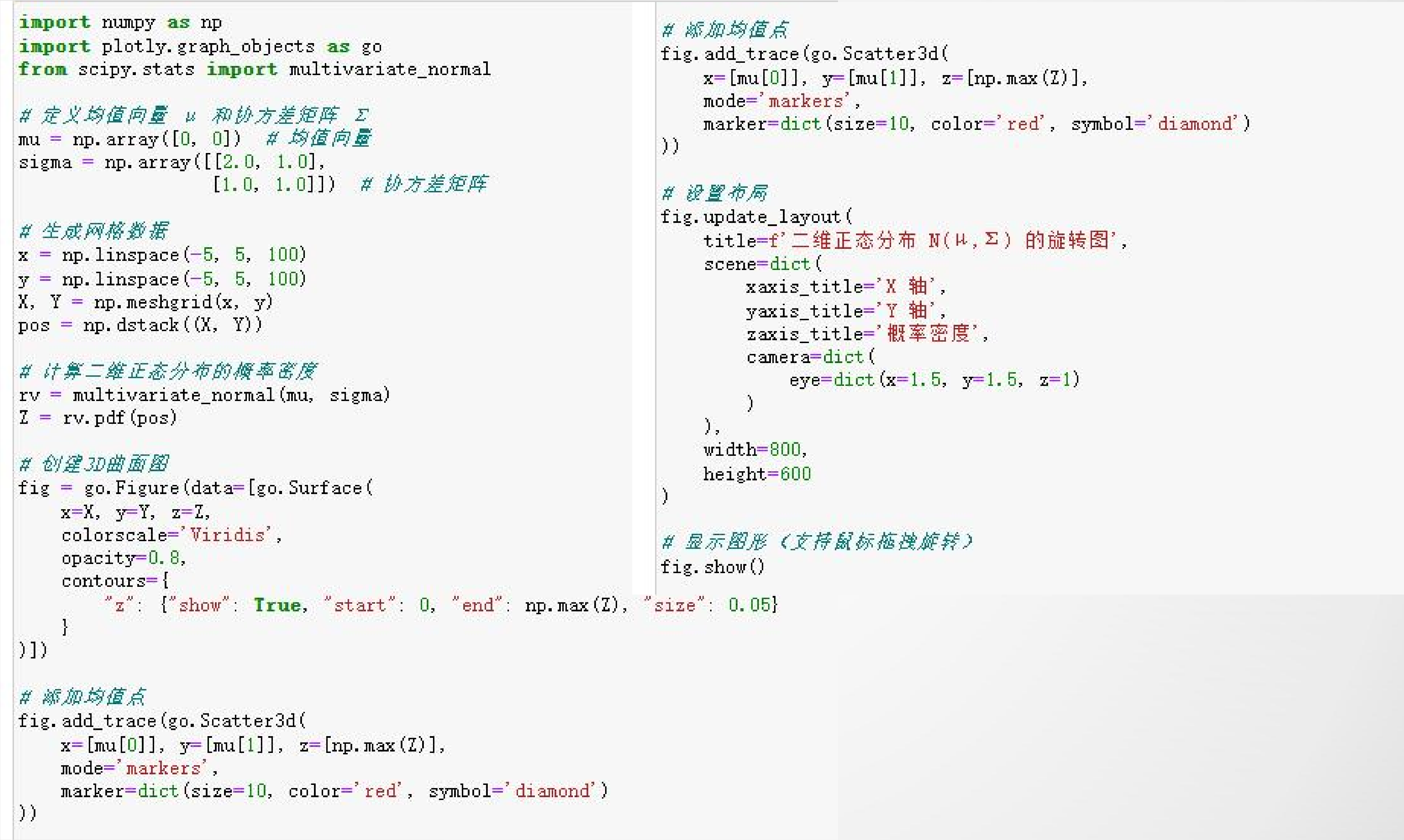
View from elevation 30° , azimuth 45°

View from elevation 30° , azimuth 135°

View from elevation 30° , azimuth 225°

View from elevation 30° , azimuth 315°

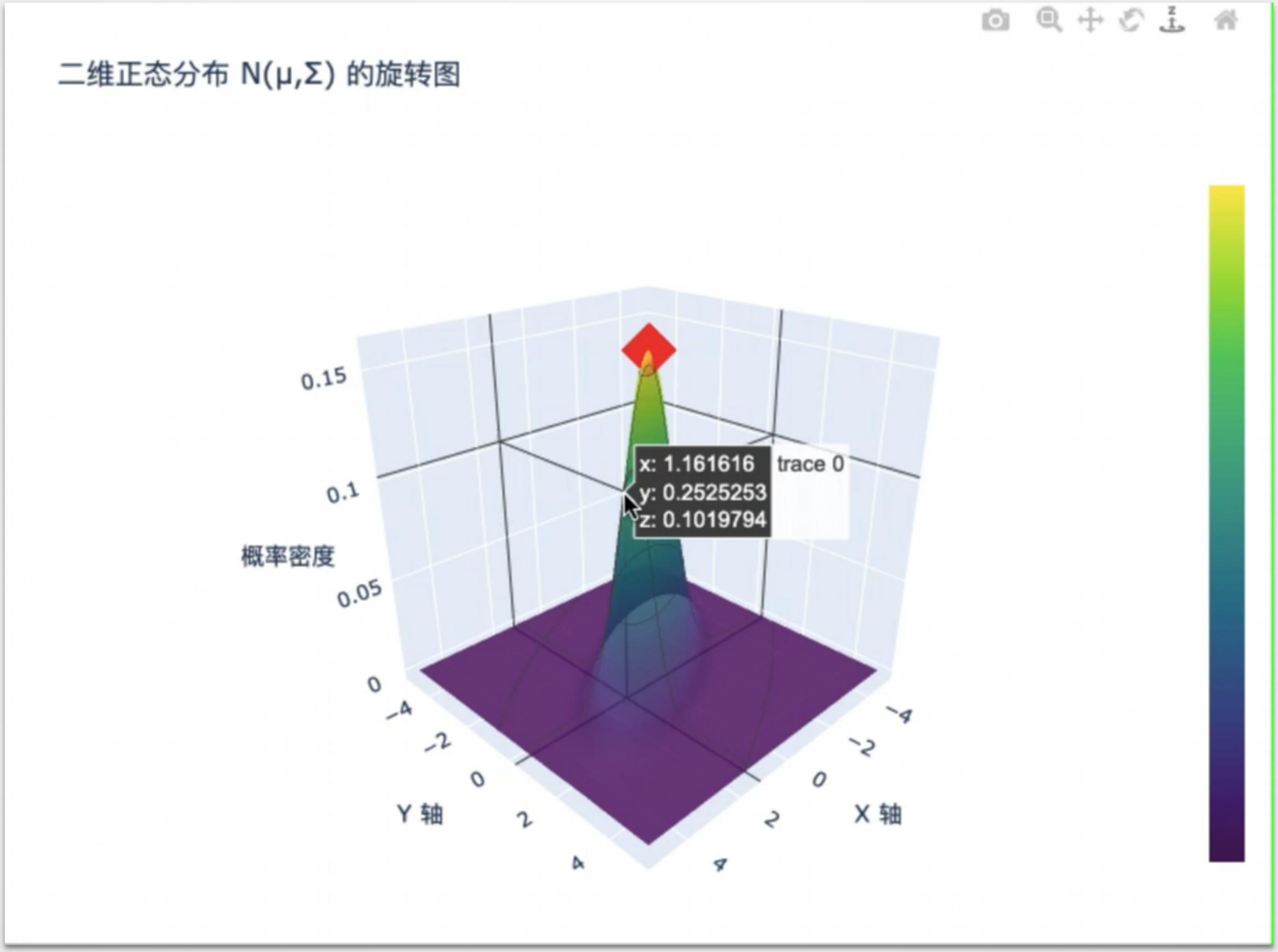
Code for creating a N(μ, Σ) and its PDF rotating plot



```python
import numpy as np
import plotly.graph_objects as go
from scipy.stats import multivariate_normal

# 定义均值向量 μ 和协方差矩阵 Σ
mu = np.array([0, 0])  # 均值向量
sigma = np.array([[2.0, 1.0],
                  [1.0, 1.0]])  # 协方差矩阵

# 生成网格数据
x = np.linspace(-5, 5, 100)
y = np.linspace(-5, 5, 100)
X, Y = np.meshgrid(x, y)
pos = np.dstack((X, Y))

# 计算二维正态分布的概率密度
rv = multivariate_normal(mu, sigma)
Z = rv.pdf(pos)

# 创建3D曲面图
fig = go.Figure(data=[go.Surface(
    x=X, y=Y, z=Z,
    colorscale='Viridis',
    opacity=0.8,
    contours={
        "z": {"show": True, "start": 0, "end": np.max(Z), "size": 0.05}
    }
)])

# 添加均值点
fig.add_trace(go.Scatter3d(
    x=[mu[0]], y=[mu[1]], z=[np.max(Z)],
    mode='markers',
    marker=dict(size=10, color='red', symbol='diamond')
))
```

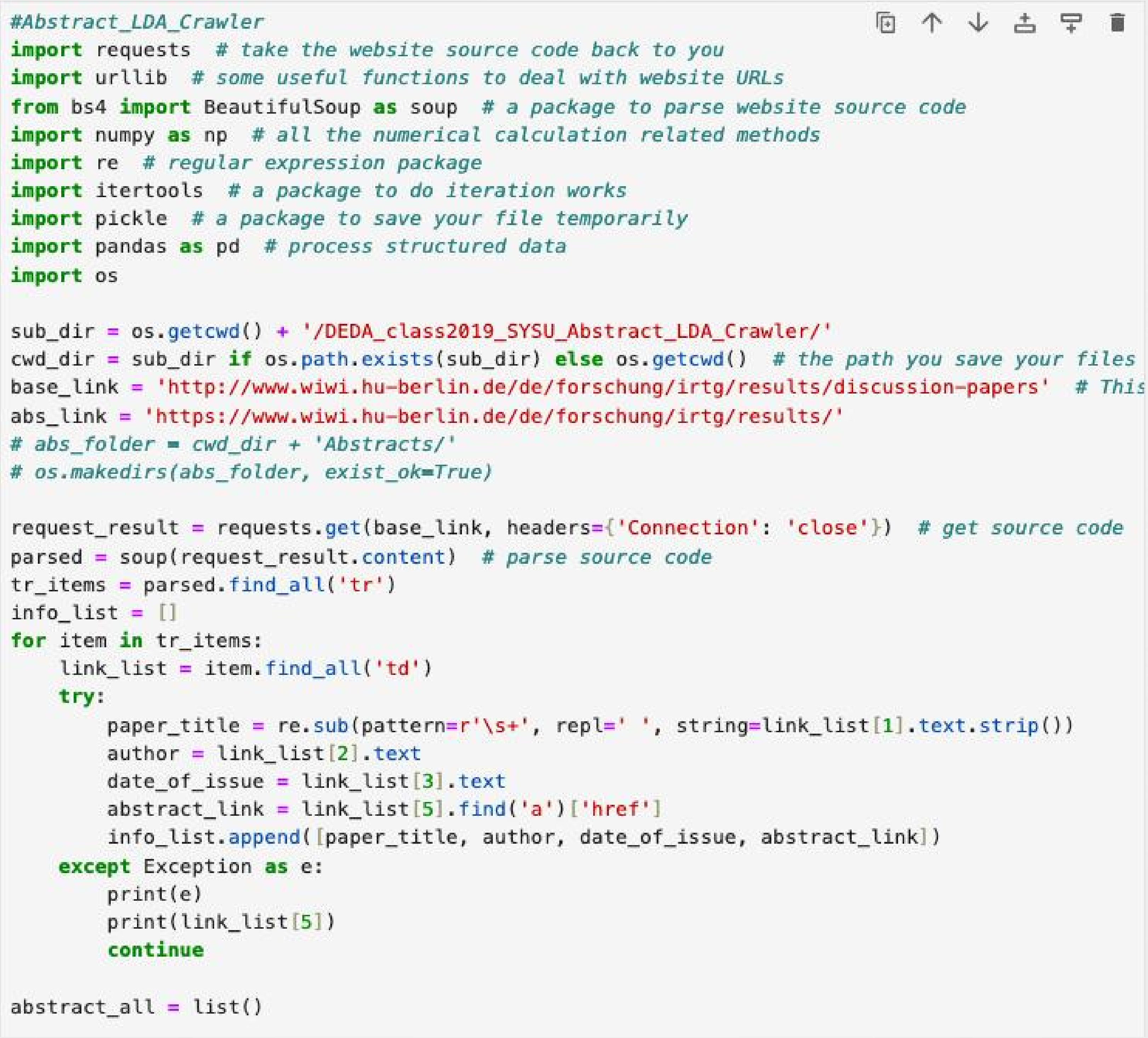
```python
# 添加均值点
fig.add_trace(go.Scatter3d(
    x=[mu[0]], y=[mu[1]], z=[np.max(Z)],
    mode='markers',
    marker=dict(size=10, color='red', symbol='diamond')
))

# 设置布局
fig.update_layout(
    title=f'二维正态分布 N(μ,Σ) 的旋转图',
    scene=dict(
        xaxis_title='X 轴',
        yaxis_title='Y 轴',
        zaxis_title='概率密度',
        camera=dict(
            eye=dict(x=1.5, y=1.5, z=1)
        )
    ),
    width=800,
    height=600
)

# 显示图形（支持鼠标拖拽旋转）
fig.show()
```

A Possibility Density Function plot for N(μ, Σ)



2. the LDA analysis example IRTG1792

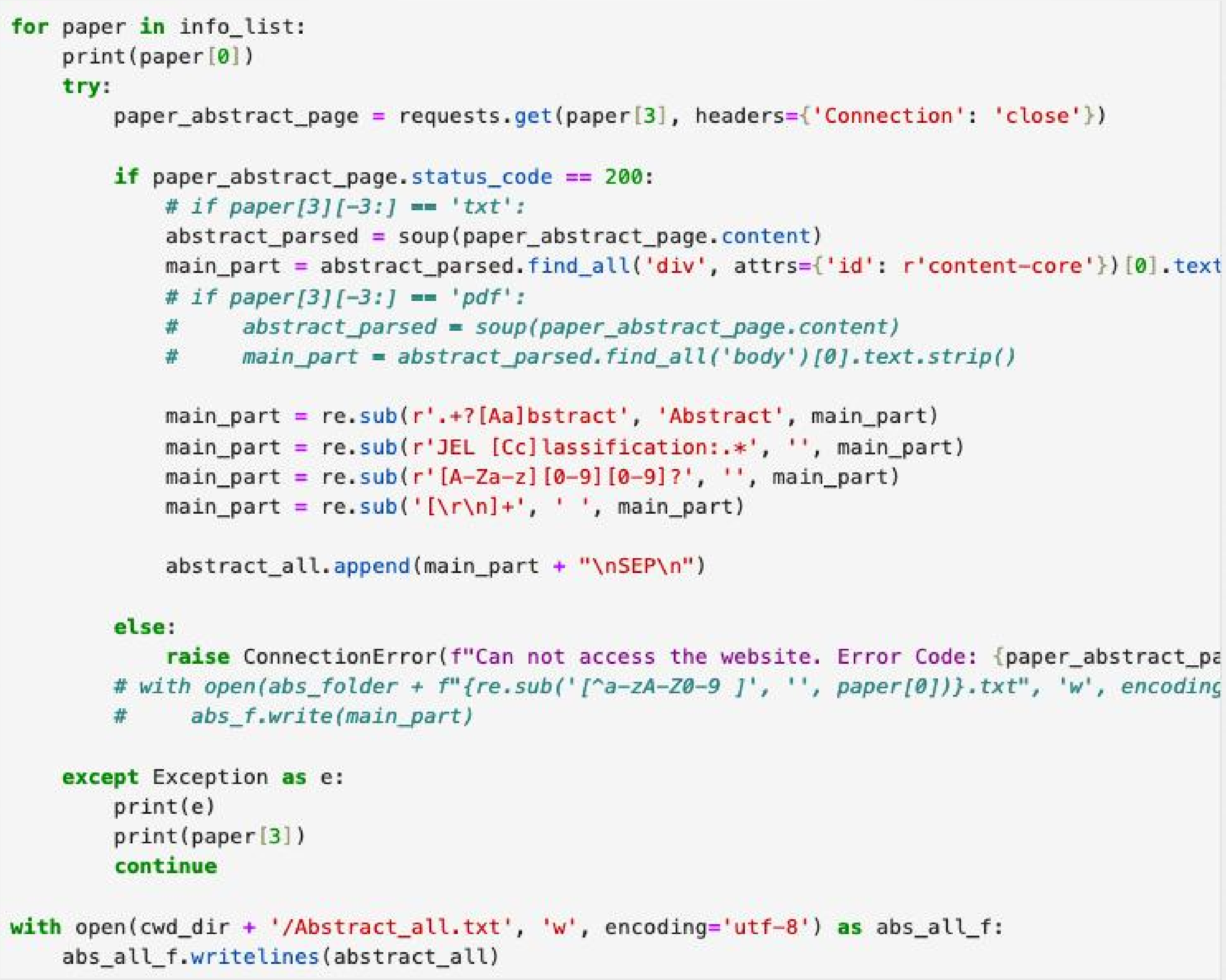
Step1: web scraping



```python
#Abstract_LDA_Crawler
import requests  # take the website source code back to you
import urllib  # some useful functions to deal with website URLs
from bs4 import BeautifulSoup as soup  # a package to parse website source code
import numpy as np  # all the numerical calculation related methods
import re  # regular expression package
import itertools  # a package to do iteration works
import pickle  # a package to save your file temporarily
import pandas as pd  # process structured data
import os

sub_dir = os.getcwd() + '/DEDA_class2019_SYSU_Abstract_LDA_Crawler/'
cwd_dir = sub_dir if os.path.exists(sub_dir) else os.getcwd()  # the path you save your files
base_link = 'http://www.wiwi.hu-berlin.de/de/forschung/irtg/results/discussion-papers'  # This
abs_link = 'https://www.wiwi.hu-berlin.de/de/forschung/irtg/results/'
# abs_folder = cwd_dir + 'Abstracts/'
# os.makedirs(abs_folder, exist_ok=True)

request_result = requests.get(base_link, headers={'Connection': 'close'})  # get source code
parsed = soup(request_result.content)  # parse source code
tr_items = parsed.find_all('tr')
info_list = []
for item in tr_items:
    link_list = item.find_all('td')
    try:
        paper_title = re.sub(pattern=r'\s+', repl=' ', string=link_list[1].text.strip())
        author = link_list[2].text
        date_of_issue = link_list[3].text
        abstract_link = link_list[5].find('a')['href']
        info_list.append([paper_title, author, date_of_issue, abstract_link])
    except Exception as e:
        print(e)
        print(link_list[5])
        continue

abstract_all = list()
```

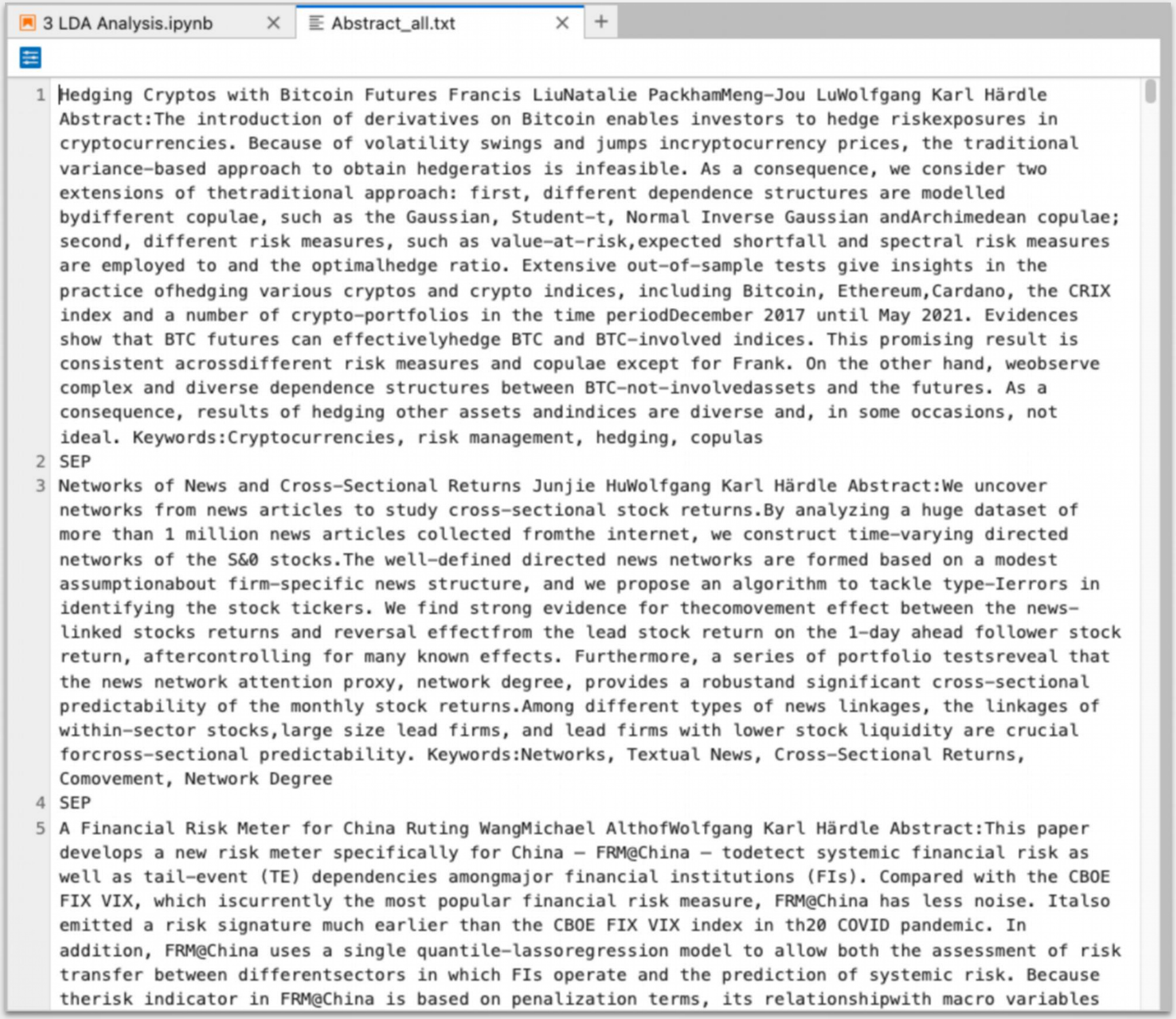
2. the LDA analysis example IRTG1792

Step1: web scraping



```
for paper in info_list:
    print(paper[0])
    try:
        paper_abstract_page = requests.get(paper[3], headers={'Connection': 'close'})

        if paper_abstract_page.status_code == 200:
            # if paper[3][-3:] == 'txt':
            abstract_parsed = soup(paper_abstract_page.content)
            main_part = abstract_parsed.find_all('div', attrs={'id': r'content-core'})[0].text
            # if paper[3][-3:] == 'pdf':
            #     abstract_parsed = soup(paper_abstract_page.content)
            #     main_part = abstract_parsed.find_all('body')[0].text.strip()

            main_part = re.sub(r'.+?[Aa]bstract', 'Abstract', main_part)
            main_part = re.sub(r'JEL [Cc]lassification:.*', '', main_part)
            main_part = re.sub(r'[A-Za-z][0-9][0-9]?', '', main_part)
            main_part = re.sub('[\r\n]+', ' ', main_part)

            abstract_all.append(main_part + "\nSEP\n")

        else:
            raise ConnectionError(f"Can not access the website. Error Code: {paper_abstract_pa
        # with open(abs_folder + f"{re.sub('[^a-zA-Z0-9 ]', '', paper[0])}.txt", 'w', encoding
        #     abs_f.write(main_part)

    except Exception as e:
        print(e)
        print(paper[3])
        continue

with open(cwd_dir + '/Abstract_all.txt', 'w', encoding='utf-8') as abs_all_f:
    abs_all_f.writelines(abstract_all)
```

2. the LDA analysis example IRTG1792



Hedging Cryptos with Bitcoin Futures Francis LiuNatalie PackhamMeng-Jou LuWolfgang Karl Härdle Abstract:The introduction of derivatives on Bitcoin enables investors to hedge riskexposures in cryptocurrencies. Because of volatility swings and jumps incryptocurrency prices, the traditional variance-based approach to obtain hedgeratios is infeasible. As a consequence, we consider two extensions of thetraditional approach: first, different dependence structures are modelled bydifferent copulae, such as the Gaussian, Student-t, Normal Inverse Gaussian andArchimedean copulae; second, different risk measures, such as value-at-risk,expected shortfall and spectral risk measures are employed to and the optimalhedge ratio. Extensive out-of-sample tests give insights in the practice ofhedging various cryptos and crypto indices, including Bitcoin, Ethereum,Cardano, the CRIX index and a number of crypto-portfolios in the time periodDecember 2017 until May 2021. Evidences show that BTC futures can effectivelyhedge BTC and BTC-involved indices. This promising result is consistent acrossdifferent risk measures and copulae except for Frank. On the other hand, weobserve complex and diverse dependence structures between BTC-not-involvedassets and the futures. As a consequence, results of hedging other assets andindices are diverse and, in some occasions, not ideal. Keywords:Cryptocurrencies, risk management, hedging, copulas

SEP

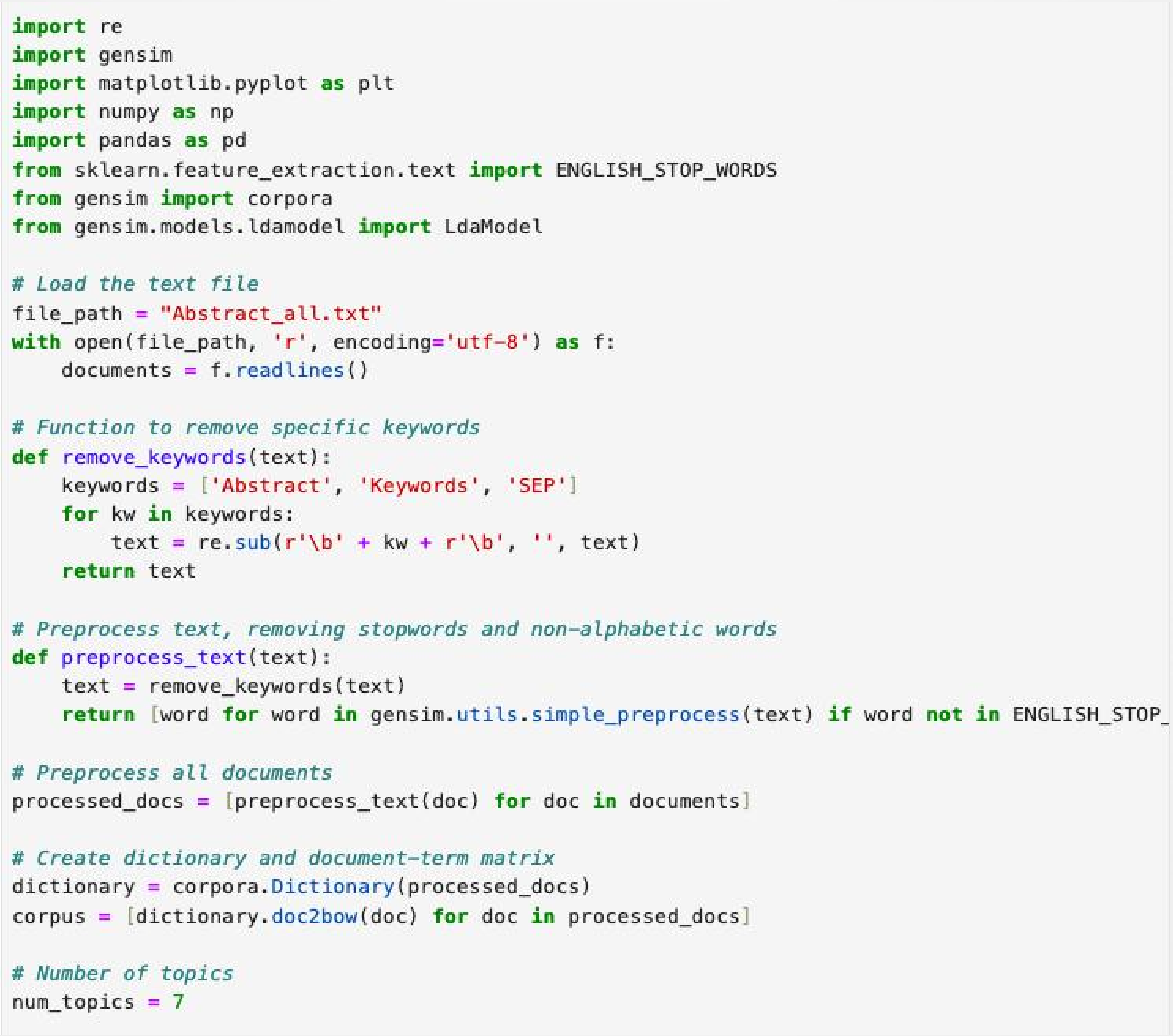
Networks of News and Cross-Sectional Returns Junjie HuWolfgang Karl Härdle Abstract:We uncover networks from news articles to study cross-sectional stock returns.By analyzing a huge dataset of more than 1 million news articles collected fromthe internet, we construct time-varying directed networks of the S&0 stocks.The well-defined directed news networks are formed based on a modest assumptionabout firm-specific news structure, and we propose an algorithm to tackle type-Ierrors in identifying the stock tickers. We find strong evidence for thecomovement effect between the news-linked stocks returns and reversal effectfrom the lead stock return on the 1-day ahead follower stock return, aftercontrolling for many known effects. Furthermore, a series of portfolio testsreveal that the news network attention proxy, network degree, provides a robustand significant cross-sectional predictability of the monthly stock returns.Among different types of news linkages, the linkages of within-sector stocks,large size lead firms, and lead firms with lower stock liquidity are crucial forcross-sectional predictability. Keywords:Networks, Textual News, Cross-Sectional Returns, Comovement, Network Degree

SEP

A Financial Risk Meter for China Ruting WangMichael AlthofWolfgang Karl Härdle Abstract:This paper develops a new risk meter specifically for China – FRM@China – todetect systemic financial risk as well as tail-event (TE) dependencies amongmajor financial institutions (FIs). Compared with the CBOE FIX VIX, which iscurrently the most popular financial risk measure, FRM@China has less noise. Italso emitted a risk signature much earlier than the CBOE FIX VIX index in th20 COVID pandemic. In addition, FRM@China uses a single quantile-lassoregression model to allow both the assessment of risk transfer between differentsectors in which FIs operate and the prediction of systemic risk. Because therisk indicator in FRM@China is based on penalization terms, its relationshipwith macro variables

2. the LDA analysis example IRTG1792

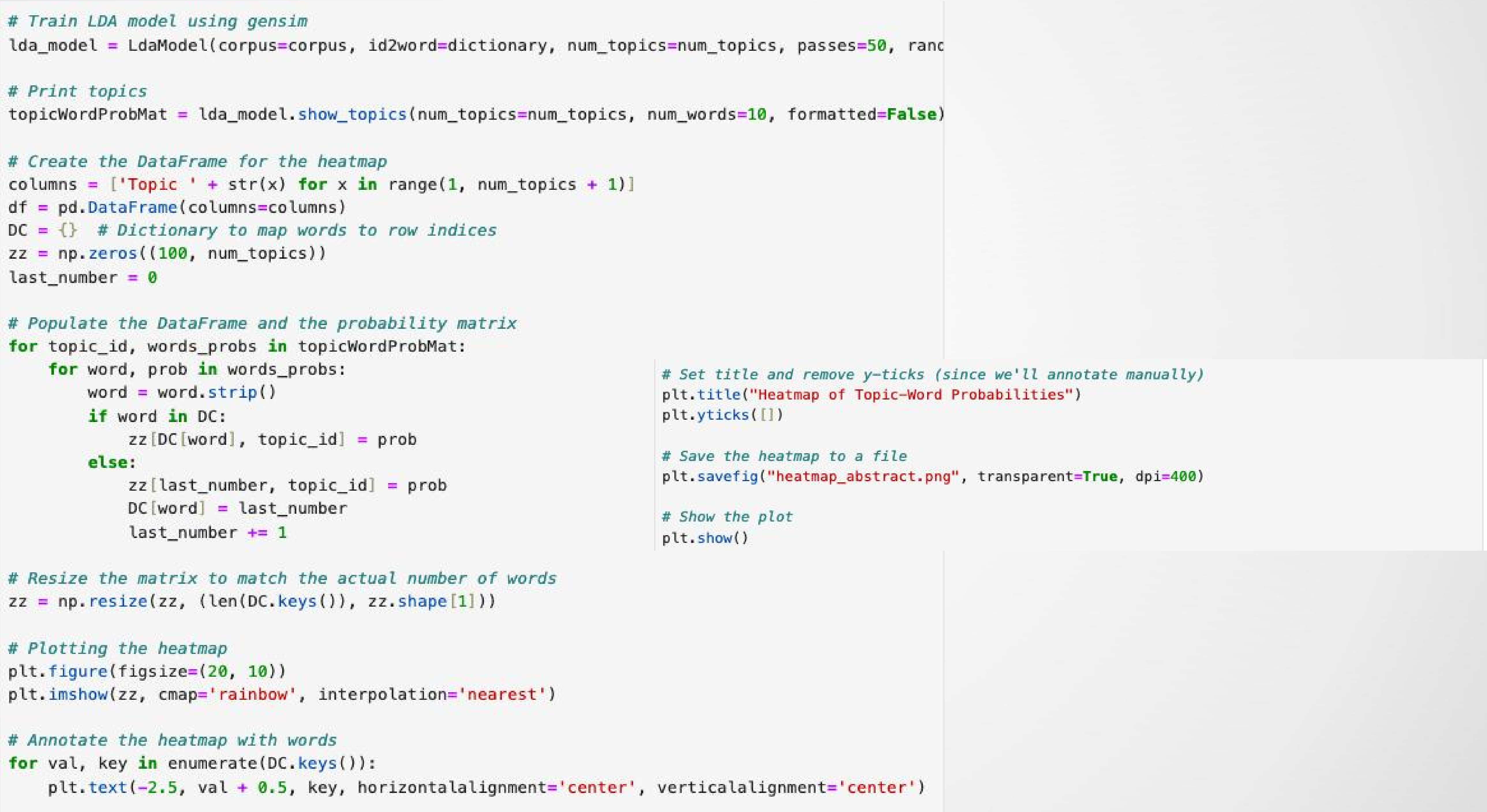
Step2: heat map to find correlations and topics



```
import re
import gensim
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
from sklearn.feature_extraction.text import ENGLISH_STOP_WORDS
from gensim import corpora
from gensim.models.ldamodel import LdaModel

# Load the text file
file_path = "Abstract_all.txt"
with open(file_path, 'r', encoding='utf-8') as f:
    documents = f.readlines()

# Function to remove specific keywords
def remove_keywords(text):
    keywords = ['Abstract', 'Keywords', 'SEP']
    for kw in keywords:
        text = re.sub(r'\b' + kw + r'\b', '', text)
    return text

# Preprocess text, removing stopwords and non-alphabetic words
def preprocess_text(text):
    text = remove_keywords(text)
    return [word for word in gensim.utils.simple_preprocess(text) if word not in ENGLISH_STOP_

# Preprocess all documents
processed_docs = [preprocess_text(doc) for doc in documents]

# Create dictionary and document-term matrix
dictionary = corpora.Dictionary(processed_docs)
corpus = [dictionary.doc2bow(doc) for doc in processed_docs]

# Number of topics
num_topics = 7
```

2. the LDA analysis example IRTG1792

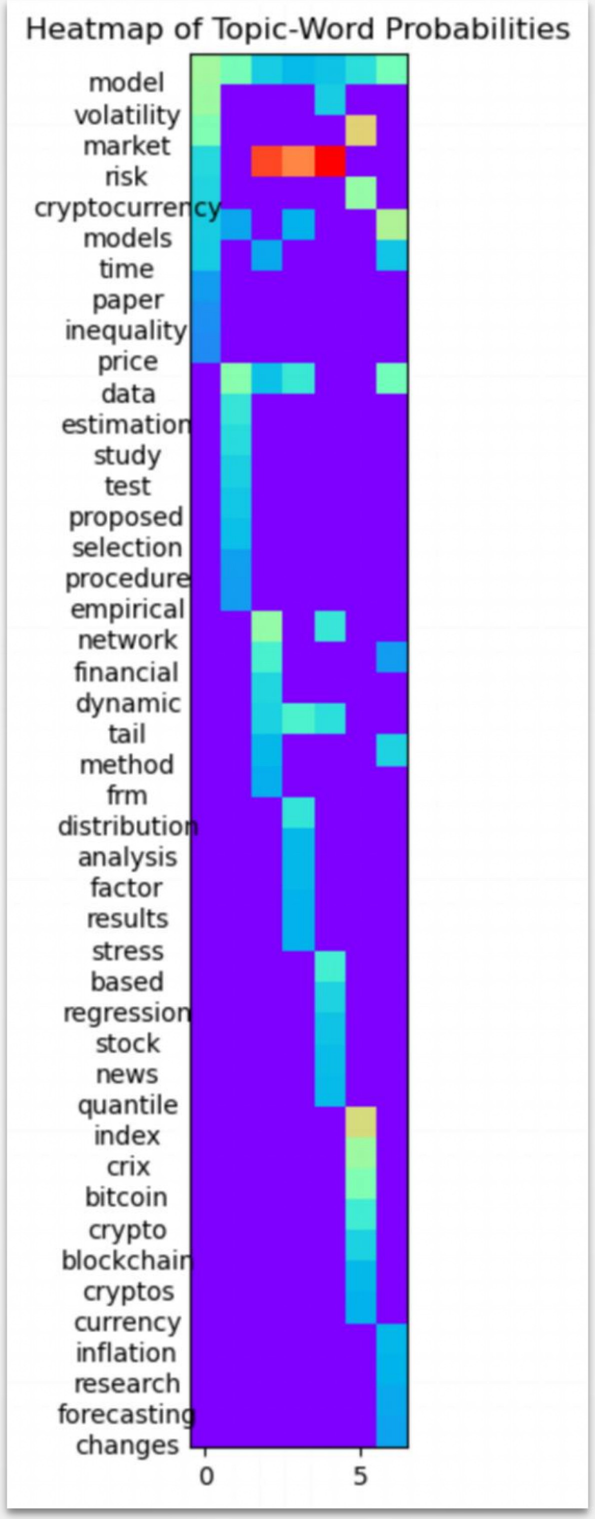
Step2: heat map to find correlations and topics



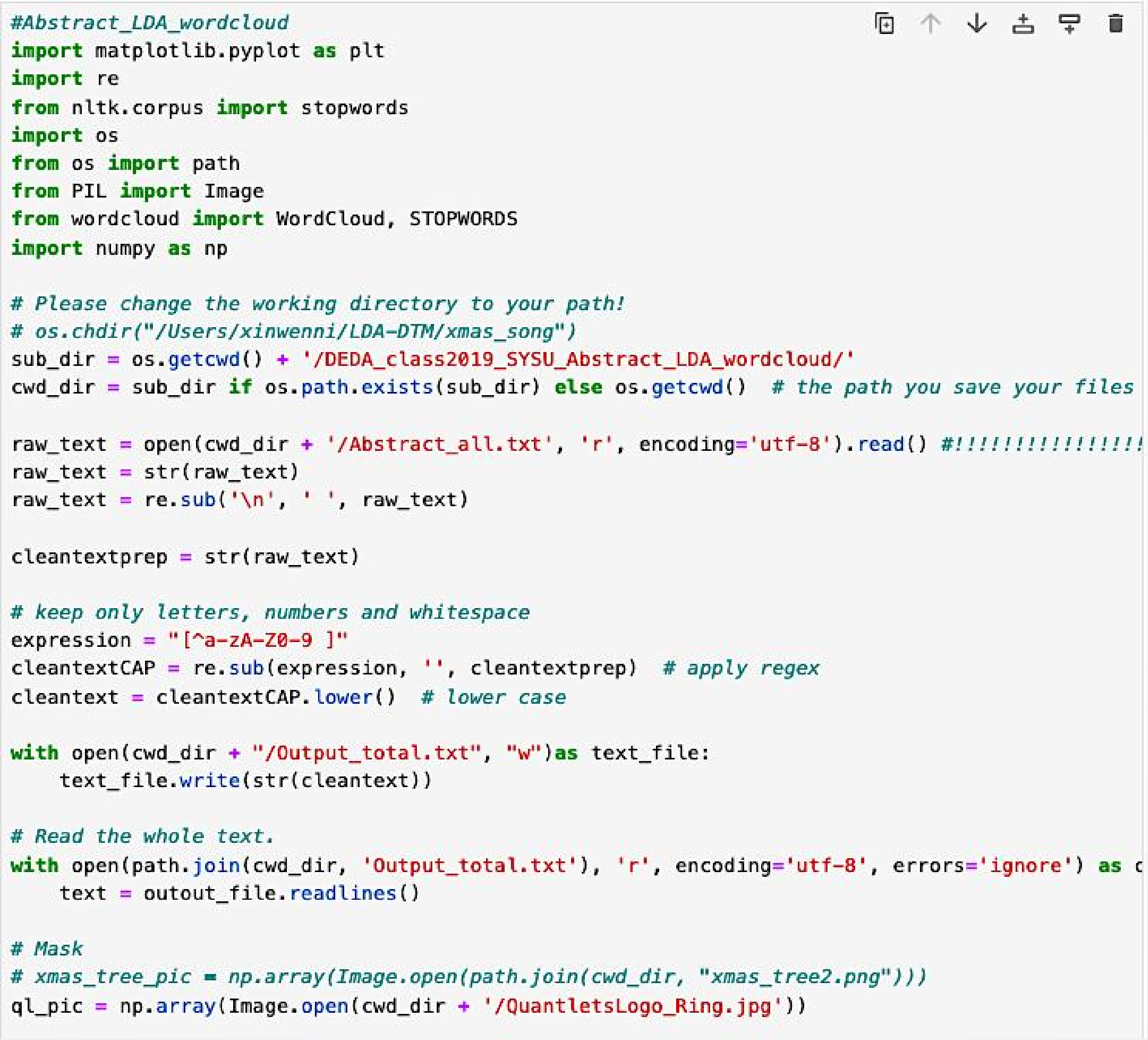
```python
# Train LDA model using gensim
lda_model = LdaModel(corpus=corpus, id2word=dictionary, num_topics=num_topics, passes=50, ranc

# Print topics
topicWordProbMat = lda_model.show_topics(num_topics=num_topics, num_words=10, formatted=False)

# Create the DataFrame for the heatmap
columns = ['Topic ' + str(x) for x in range(1, num_topics + 1)]
df = pd.DataFrame(columns=columns)
DC = {}  # Dictionary to map words to row indices
zz = np.zeros((100, num_topics))
last_number = 0

# Populate the DataFrame and the probability matrix
for topic_id, words_probs in topicWordProbMat:
    for word, prob in words_probs:
        word = word.strip()
        if word in DC:
            zz[DC[word], topic_id] = prob
        else:
            zz[last_number, topic_id] = prob
            DC[word] = last_number
            last_number += 1

# Resize the matrix to match the actual number of words
zz = np.resize(zz, (len(DC.keys()), zz.shape[1]))

# Plotting the heatmap
plt.figure(figsize=(20, 10))
plt.imshow(zz, cmap='rainbow', interpolation='nearest')

# Annotate the heatmap with words
for val, key in enumerate(DC.keys()):
    plt.text(-2.5, val + 0.5, key, horizontalalignment='center', verticalalignment='center')
```

```python
# Set title and remove y-ticks (since we'll annotate manually)
plt.title("Heatmap of Topic-Word Probabilities")
plt.yticks([])

# Save the heatmap to a file
plt.savefig("heatmap_abstract.png", transparent=True, dpi=400)

# Show the plot
plt.show()
```

2. the LDA analysis example IRTG1792

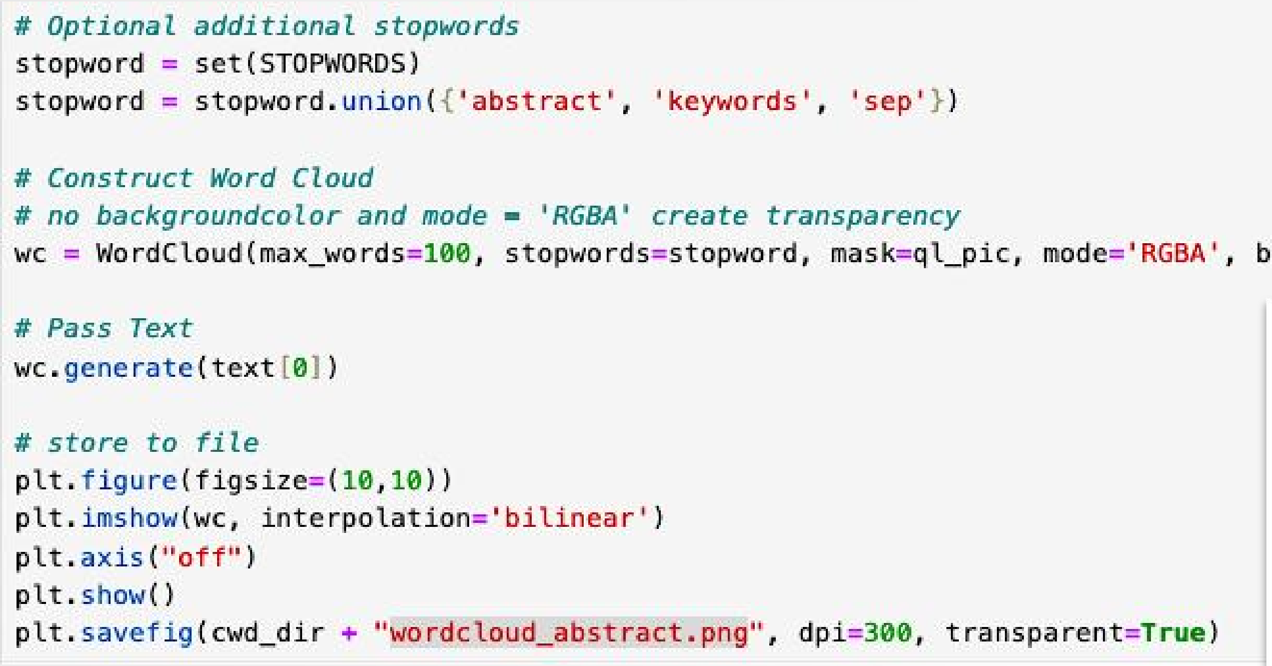


WordCloud of the LDA analysis example IRTG1792

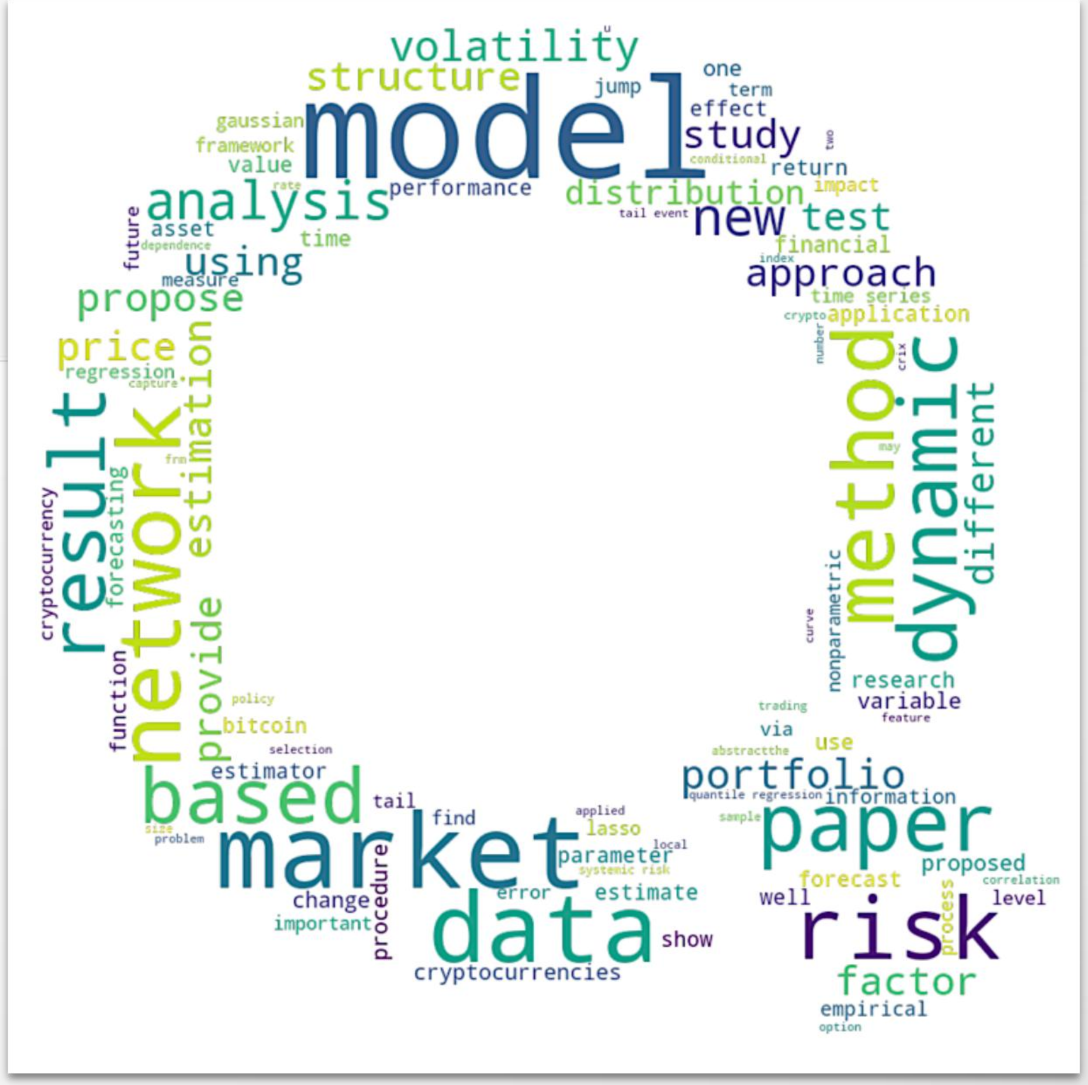


```
#Abstract_LDA_wordcloud
import matplotlib.pyplot as plt
import re
from nltk.corpus import stopwords
import os
from os import path
from PIL import Image
from wordcloud import WordCloud, STOPWORDS
import numpy as np

# Please change the working directory to your path!
# os.chdir("/Users/xinwenni/LDA-DTM/xmas_song")
sub_dir = os.getcwd() + '/DEDA_class2019_SYSU_Abstract_LDA_wordcloud/'
cwd_dir = sub_dir if os.path.exists(sub_dir) else os.getcwd()  # the path you save your files

raw_text = open(cwd_dir + '/Abstract_all.txt', 'r', encoding='utf-8').read() #!!!!!!!!!!!!!!!!
raw_text = str(raw_text)
raw_text = re.sub('\n', ' ', raw_text)

cleantextprep = str(raw_text)

# keep only letters, numbers and whitespace
expression = "[^a-zA-Z0-9 ]"
cleantextCAP = re.sub(expression, '', cleantextprep)  # apply regex
cleantext = cleantextCAP.lower()  # lower case

with open(cwd_dir + "/Output_total.txt", "w")as text_file:
    text_file.write(str(cleantext))

# Read the whole text.
with open(path.join(cwd_dir, 'Output_total.txt'), 'r', encoding='utf-8', errors='ignore') as c
    text = outout_file.readlines()

# Mask
# xmas_tree_pic = np.array(Image.open(path.join(cwd_dir, "xmas_tree2.png")))
ql_pic = np.array(Image.open(cwd_dir + '/QuantletsLogo_Ring.jpg'))
```

WordCloud of the LDA analysis example IRTG1792



```
# Optional additional stopwords
stopword = set(STOPWORDS)
stopword = stopword.union({'abstract', 'keywords', 'sep'})

# Construct Word Cloud
# no backgroundcolor and mode = 'RGBA' create transparency
wc = WordCloud(max_words=100, stopwords=stopword, mask=ql_pic, mode='RGBA', background_color=N

# Pass Text
wc.generate(text[0])

# store to file
plt.figure(figsize=(10,10))
plt.imshow(wc, interpolation='bilinear')
plt.axis("off")
plt.show()
plt.savefig(cwd_dir + "wordcloud_abstract.png", dpi=300, transparent=True)
```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