```
# STEP 2: Import Libraries

# Install gensim if not already installed
!pip install gensim

# gensim -> to load pre-trained Word2Vec/GloVe models
import gensim.downloader as api

# numpy -> for numerical operations
import numpy as np

# pandas -> for displaying similarity results in table format
import pandas as pd

# matplotlib -> for visualization
import matplotlib.pyplot as plt

# sklearn -> for dimensionality reduction (PCA)
from sklearn.decomposition import PCA
```

```
Collecting gensim
  Downloading gensim-4.4.0-cp312-cp312-manylinux_2_24_x86_64.manylinux_2_28_x86_64.whl.metadata (8
Requirement already satisfied: numpy>=1.18.5 in /usr/local/lib/python3.12/dist-packages (from gens
Requirement already satisfied: scipy>=1.7.0 in /usr/local/lib/python3.12/dist-packages (from gensi
Requirement already satisfied: smart_open>=1.8.1 in /usr/local/lib/python3.12/dist-packages (from
Requirement already satisfied: wrapt in /usr/local/lib/python3.12/dist-packages (from smart_open>=
Downloading gensim-4.4.0-cp312-cp312-manylinux_2_24_x86_64.manylinux_2_28_x86_64.whl (27.9 MB)
   ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 27.9/27.9 MB 58.4 MB/s eta 0:00:00
Installing collected packages: gensim
Successfully installed gensim-4.4.0
```

```
# Load pre-trained GloVe model (100 dimensions)
model = api.load("glove-wiki-gigaword-100")

print("Model loaded successfully!")
```

```
[==================================================] 100.0% 128.1/128.1MB downloaded
Model loaded successfully!
```

```
print("Vocabulary Size:", len(model.key_to_index))
```

```
Vocabulary Size: 400000
```

```
word = "king"
vector = model[word]

print("Word:", word)
print("Vector Length:", len(vector))
print("First 10 values of vector:\n", vector[:10])
```

```
Word: king
Vector Length: 100
First 10 values of vector:
 [-0.32307 -0.87616  0.21977  0.25268  0.22976  0.7388  -0.37954 -0.35307
 -0.84369 -1.1113 ]
```

```
word_pairs = [
    ("doctor", "nurse"),
    ("cat", "dog"),
    ("car", "bus"),
```

```
    ("king", "queen"),
    ("boy", "girl"),
    ("teacher", "student"),
    ("sun", "moon"),
    ("paris", "france"),
    ("india", "china"),
    ("computer", "keyboard")
]

results = []

for w1, w2 in word_pairs:
    similarity = model.similarity(w1, w2)
    results.append((w1, w2, similarity))

df = pd.DataFrame(results, columns=["Word1", "Word2", "Cosine Similarity"])
df
```

	Word1	Word2	Cosine Similarity
0	doctor	nurse	0.752151
1	cat	dog	0.879807
2	car	bus	0.737271
3	king	queen	0.750769
4	boy	girl	0.917573
5	teacher	student	0.808340
6	sun	moon	0.613835
7	paris	france	0.748159
8	india	china	0.599711
9	computer	keyboard	0.541819

Next steps: Generate code with df | New interactive sheet

```
chosen_words = ["king", "university", "doctor", "india", "music"]

for word in chosen_words:
    print(f"\nTop 5 words similar to '{word}':")
    similar_words = model.most_similar(word, topn=5)
    for w, score in similar_words:
        print(w, "->", round(score, 3))
```

```
Top 5 words similar to 'king':
prince -> 0.768
queen -> 0.751
son -> 0.702
brother -> 0.699
monarch -> 0.698

Top 5 words similar to 'university':
college -> 0.829
harvard -> 0.816
yale -> 0.811
professor -> 0.81
graduate -> 0.799

Top 5 words similar to 'doctor':
physician -> 0.767
nurse -> 0.752
```

```
dr. -> 0.718
doctors -> 0.708
patient -> 0.707

Top 5 words similar to 'india':
pakistan -> 0.837
indian -> 0.78
delhi -> 0.771
bangladesh -> 0.766
lanka -> 0.764

Top 5 words similar to 'music':
musical -> 0.813
songs -> 0.798
dance -> 0.79
pop -> 0.786
recording -> 0.765
```

```
# king - man + woman
print("king - man + woman =")
print(model.most_similar(positive=["king", "woman"], negative=["man"], topn=1))

# paris - france + india
print("\nparis - france + india =")
print(model.most_similar(positive=["paris", "india"], negative=["france"], topn=1))

# teacher - school + hospital
print("\nteacher - school + hospital =")
print(model.most_similar(positive=["teacher", "hospital"], negative=["school"], topn=1))
```

```
king - man + woman =
[('queen', 0.7698540687561035)]

paris - france + india =
[('delhi', 0.8654932975769043)]

teacher - school + hospital =
[('nurse', 0.7798740267753601)]
```

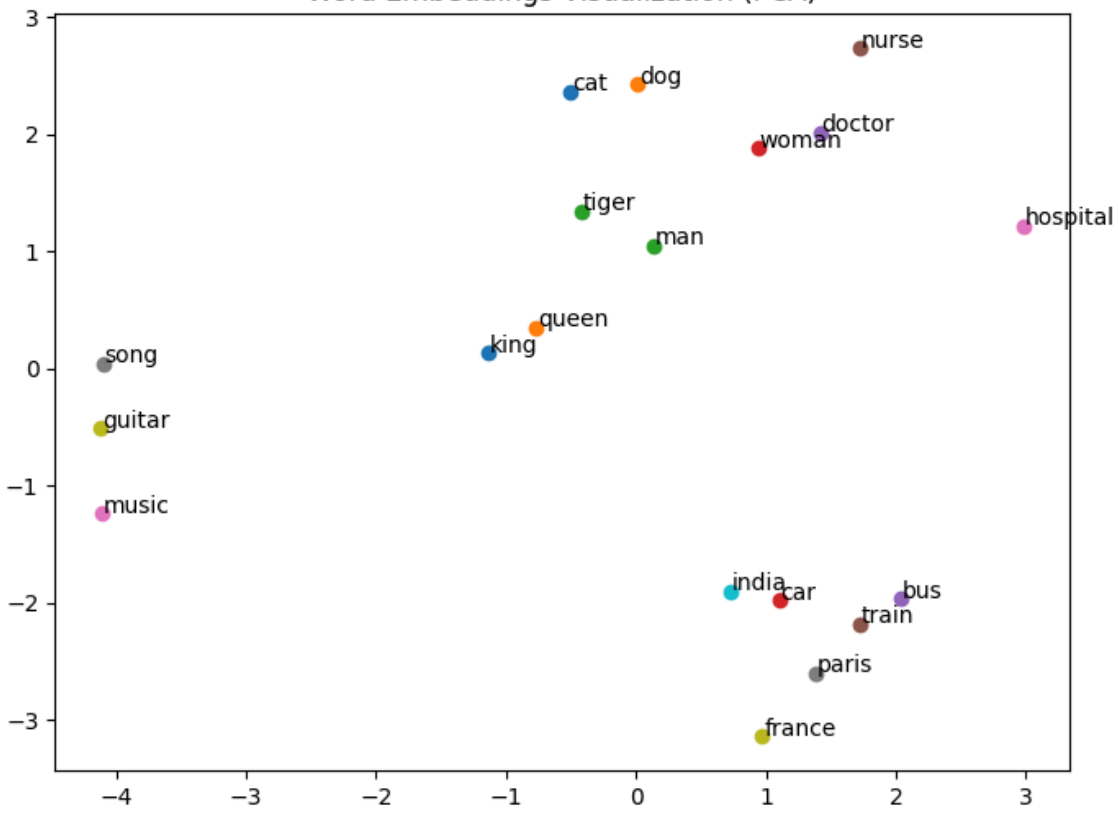
```
# Select words for visualization
words = ["king", "queen", "man", "woman",
         "doctor", "nurse", "hospital",
         "paris", "france", "india",
         "cat", "dog", "tiger",
         "car", "bus", "train",
         "music", "song", "guitar"]

word_vectors = [model[word] for word in words]

# Reduce to 2D
pca = PCA(n_components=2)
reduced = pca.fit_transform(word_vectors)

# Plot
plt.figure(figsize=(8,6))
for i, word in enumerate(words):
    x, y = reduced[i]
    plt.scatter(x, y)
    plt.text(x+0.01, y+0.01, word)

plt.title("Word Embeddings Visualization (PCA)")
plt.show()
```




```
Start coding or generate with AI.
```

This cell installs the `gensim` library if it's not already present. It then imports all the necessary libraries for the word embedding task, including `gensim` for loading pre-trained models, `numpy` for numerical operations, `pandas` for data manipulation and displaying results, `matplotlib` for visualization, and `sklearn.decomposition.PCA` for dimensionality reduction.

This cell loads a pre-trained GloVe model (specifically 'glove-wiki-gigaword-100'), which contains 100-dimensional word embeddings. It then prints a confirmation message once the model is successfully loaded.

This cell prints the total number of words in the loaded GloVe model's vocabulary. This gives an idea of the scale of the pre-trained model.

This cell demonstrates how to retrieve the vector representation for a specific word ("king") from the loaded model. It then prints the word, the length of its vector, and the first 10 values of the vector.

This cell calculates and displays the cosine similarity between several pairs of words. Cosine similarity measures the cosine of the angle between two vectors, indicating how similar two words are in the embedding space. The results are presented in a pandas DataFrame.

This cell finds and prints the top 5 most similar words for a given list of `chosen_words` (king, university, doctor, india, music). It iterates through each chosen word and uses the `model.most_similar` method to retrieve its closest semantic neighbors.

This cell demonstrates word analogy (vector arithmetic) by performing operations like `king - man + woman` to find words that have similar relationships. It uses the `model.most_similar` method with positive

and negative word lists to perform these calculations.

This cell visualizes a selection of word embeddings in a 2D space using Principal Component Analysis (PCA). It reduces the dimensionality of the word vectors to 2 components and then plots them on a scatter plot, labeling each point with its corresponding word. This helps to visually understand the semantic relationships between words.