

```
# Install required libraries
!pip install nltk spacy
!python -m spacy download en_core_web_sm
```

```
Requirement already satisfied: nltk in /usr/local/lib/python3.12/dist-packages (3.9.1)
Requirement already satisfied: spacy in /usr/local/lib/python3.12/dist-packages (3.8.11)
Requirement already satisfied: click in /usr/local/lib/python3.12/dist-packages (from nltk) (8.3.1)
Requirement already satisfied: joblib in /usr/local/lib/python3.12/dist-packages (from nltk) (1.5.3)
Requirement already satisfied: regex<=2021.8.3 in /usr/local/lib/python3.12/dist-packages (from nltk) (2025.11.3)
Requirement already satisfied: tqdm in /usr/local/lib/python3.12/dist-packages (from nltk) (4.67.1)
Requirement already satisfied: spacy-legacy<3.1.0,>=3.0.11 in /usr/local/lib/python3.12/dist-packages (from spacy) (3.0.12)
Requirement already satisfied: spacy-loggers<2.0.0,>=1.0.0 in /usr/local/lib/python3.12/dist-packages (from spacy) (1.0.5)
Requirement already satisfied: murmurhash<1.1.0,>=0.28.0 in /usr/local/lib/python3.12/dist-packages (from spacy) (1.0.15)
Requirement already satisfied: cymem<2.1.0,>=2.0.2 in /usr/local/lib/python3.12/dist-packages (from spacy) (2.0.13)
Requirement already satisfied: preshed<3.1.0,>=3.0.2 in /usr/local/lib/python3.12/dist-packages (from spacy) (3.0.12)
Requirement already satisfied: thinc<8.4.0,>=8.3.4 in /usr/local/lib/python3.12/dist-packages (from spacy) (8.3.10)
Requirement already satisfied: wasabi<1.2.0,>=0.9.1 in /usr/local/lib/python3.12/dist-packages (from spacy) (1.1.3)
Requirement already satisfied: srsly<3.0.0,>=2.4.3 in /usr/local/lib/python3.12/dist-packages (from spacy) (2.5.2)
Requirement already satisfied: catalogue<2.1.0,>=2.0.6 in /usr/local/lib/python3.12/dist-packages (from spacy) (2.0.10)
Requirement already satisfied: weasel<0.5.0,>=0.4.2 in /usr/local/lib/python3.12/dist-packages (from spacy) (0.4.3)
Requirement already satisfied: typer-slim<1.0.0,>=0.3.0 in /usr/local/lib/python3.12/dist-packages (from spacy) (0.21.1)
Requirement already satisfied: numpy>=1.19.0 in /usr/local/lib/python3.12/dist-packages (from spacy) (2.0.2)
Requirement already satisfied: requests<3.0.0,>=2.13.0 in /usr/local/lib/python3.12/dist-packages (from spacy) (2.32.4)
Requirement already satisfied: pydantic!=1.8,!1.8.1,<3.0.0,>=1.7.4 in /usr/local/lib/python3.12/dist-packages (from spacy) (2.10.6)
Requirement already satisfied: Jinja2 in /usr/local/lib/python3.12/dist-packages (from spacy) (3.1.6)
Requirement already satisfied: setuptools in /usr/local/lib/python3.12/dist-packages (from spacy) (75.2.0)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.12/dist-packages (from spacy) (25.0)
Requirement already satisfied: annotated-types>=0.6.0 in /usr/local/lib/python3.12/dist-packages (from pydantic!=1.8,!1.8.1)
Requirement already satisfied: pydantic-core==2.41.4 in /usr/local/lib/python3.12/dist-packages (from pydantic!=1.8,!1.8.1)
Requirement already satisfied: typing-extensions>=4.14.1 in /usr/local/lib/python3.12/dist-packages (from pydantic!=1.8,!1.8.1)
Requirement already satisfied: typing-inspection>=0.4.2 in /usr/local/lib/python3.12/dist-packages (from pydantic!=1.8,!1.8.1)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.12/dist-packages (from requests<3.0.0,>=2.13.0)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.12/dist-packages (from requests<3.0.0,>=2.13.0->spacy)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.12/dist-packages (from requests<3.0.0,>=2.13.0->spacy)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.12/dist-packages (from requests<3.0.0,>=2.13.0->spacy)
Requirement already satisfied: blis<1.4.0,>=1.3.0 in /usr/local/lib/python3.12/dist-packages (from thinc<8.4.0,>=8.3.4->spacy)
Requirement already satisfied: confection<1.0.0,>=0.0.1 in /usr/local/lib/python3.12/dist-packages (from thinc<8.4.0,>=8.3.4)
Requirement already satisfied: cloudpathlib<1.0.0,>=0.7.0 in /usr/local/lib/python3.12/dist-packages (from weasel<0.5.0,>=0.4.2)
Requirement already satisfied: smart-open<8.0.0,>=5.2.1 in /usr/local/lib/python3.12/dist-packages (from weasel<0.5.0,>=0.4.2)
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.12/dist-packages (from Jinja2->spacy) (3.0.3)
Requirement already satisfied: wrapt in /usr/local/lib/python3.12/dist-packages (from smart-open<8.0.0,>=5.2.1->weasel<0.5.0)
Collecting en-core-web-sm==3.8.0
```

Using cached https://github.com/explosion/spacy-models/releases/download/en_core_web_sm-3.8.0/en_core_web_sm-3.8.0-py3-nor

✓ Download and installation successful

You can now load the package via `spacy.load('en_core_web_sm')`

⚠ Restart to reload dependencies

If you are in a Jupyter or Colab notebook, you may need to restart Python in order to load all the package's dependencies. You can do this by selecting the 'Restart kernel' or 'Restart runtime' option.

```
nltk.download('punkt_tab')
```

```
[nltk_data] Downloading package punkt_tab to /root/nltk_data...
[nltk_data] Package punkt_tab is already up-to-date!
True
```

```
# Import libraries
import nltk
import spacy
from nltk.tokenize import word_tokenize
from collections import Counter
```

```
# Download NLTK resources
nltk.download('punkt')
nltk.download('averaged_perceptron_tagger')
```

```
[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data] Unzipping tokenizers/punkt.zip.
[nltk_data] Downloading package averaged_perceptron_tagger to
[nltk_data] /root/nltk_data...
[nltk_data] Unzipping taggers/averaged_perceptron_tagger.zip.
True
```

```
essay_text = """
Academic writing plays a crucial role in higher education.
It enables students to present arguments logically and support ideas with evidence.
Researchers use formal language to communicate findings effectively.
```

```
"""
```

```
nltk.download('punkt_tab')
tokens = word_tokenize(essay_text)
print("\n".join(tokens))
```

```
Academic
writing
plays
a
crucial
role
in
higher
education
.
It
enables
students
to
present
arguments
logically
and
support
ideas
with
evidence
.
Researchers
use
formal
language
to
communicate
findings
effectively
.
[nltk_data] Downloading package punkt_tab to /root/nltk_data...
[nltk_data] Package punkt_tab is already up-to-date!
```

```
nltk.download('averaged_perceptron_tagger_eng')
nltk_pos_tags = nltk.pos_tag(tokens)
print("\n".join([str(item) for item in nltk_pos_tags]))
```

```
('Academic', 'NNP')
('writing', 'NN')
('plays', 'VBZ')
('a', 'DT')
('crucial', 'JJ')
('role', 'NN')
('in', 'IN')
('higher', 'JJR')
('education', 'NN')
('.', '.')
('It', 'PRP')
('enables', 'VBZ')
('students', 'NNS')
('to', 'TO')
('present', 'VB')
('arguments', 'NNS')
('logically', 'RB')
('and', 'CC')
('support', 'VB')
('ideas', 'NNS')
('with', 'IN')
('evidence', 'NN')
('.', '.')
('Researchers', 'NNS')
('use', 'VBP')
('formal', 'JJ')
('language', 'NN')
('to', 'TO')
('communicate', 'VB')
('findings', 'NNS')
('effectively', 'RB')
('.', '.')
[nltk_data] Downloading package averaged_perceptron_tagger_eng to
[nltk_data] /root/nltk_data...
[nltk_data] Package averaged_perceptron_tagger_eng is already up-to-
[nltk_data] date!
```

```
nlp = spacy.load("en_core_web_sm")
doc = nlp(essay_text)
```

```
spacy_pos_tags = [(token.text, token.pos_) for token in doc]
```

```
print("\n".join([str(item) for item in spacy_pos_tags]))
```

```
('\n', 'SPACE')
('Academic', 'ADJ')
('writing', 'NOUN')
('plays', 'VERB')
('a', 'DET')
('crucial', 'ADJ')
('role', 'NOUN')
('in', 'ADP')
('higher', 'ADJ')
('education', 'NOUN')
('.', 'PUNCT')
('\n', 'SPACE')
('It', 'PRON')
('enables', 'VERB')
('students', 'NOUN')
('to', 'ADP')
('present', 'ADJ')
('arguments', 'NOUN')
('logically', 'ADV')
('and', 'CCONJ')
('support', 'VERB')
('ideas', 'NOUN')
('with', 'ADP')
('evidence', 'NOUN')
('.', 'PUNCT')
('\n', 'SPACE')
('Researchers', 'NOUN')
('use', 'VERB')
('formal', 'ADJ')
('language', 'NOUN')
('to', 'PART')
('communicate', 'VERB')
('findings', 'NOUN')
('effectively', 'ADV')
('.', 'PUNCT')
('\n', 'SPACE')
```

```
nltk_nouns = [word for word, tag in nltk_pos_tags if tag.startswith('NN')]
nltk_verbs = [word for word, tag in nltk_pos_tags if tag.startswith('VB')]
```

```
spacy_nouns = [token.text for token in doc if token.pos_ == "NOUN"]
spacy_verbs = [token.text for token in doc if token.pos_ == "VERB"]
```

```
print("Noun Frequency (spaCy):")
print(Counter(spacy_nouns))

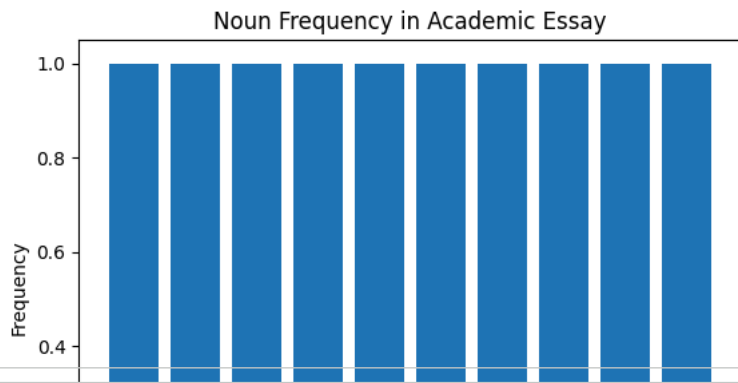
print("\nVerb Frequency (spaCy):")
print(Counter(spacy_verbs))
```

```
Noun Frequency (spaCy):
Counter({'writing': 1, 'role': 1, 'education': 1, 'students': 1, 'arguments': 1, 'ideas': 1, 'evidence': 1, 'Researchers': 1})

Verb Frequency (spaCy):
Counter({'plays': 1, 'enables': 1, 'support': 1, 'use': 1, 'communicate': 1})
```

```
import matplotlib.pyplot as plt

noun_freq = Counter(spacy_nouns) # Define noun_freq
plt.figure()
plt.bar(noun_freq.keys(), noun_freq.values())
plt.xlabel("Nouns")
plt.ylabel("Frequency")
plt.title("Noun Frequency in Academic Essay")
plt.xticks(rotation=45)
plt.show()
```



```
import matplotlib.pyplot as plt
from collections import Counter

verb_freq = Counter(spacy_verbs) # Define verb_freq
plt.figure()
plt.bar(verb_freq.keys(), verb_freq.values())
plt.xlabel("Verbs")
plt.ylabel("Frequency")
plt.title("Verb Frequency in Academic Essay")
plt.xticks(rotation=45)
plt.show()
```

