

```
# Install required libraries
!pip install nltk spacy
```

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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) (0.20.0)
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) (2.12.3)
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,<3.0.0,>=1.7.4->spacy) (0.7.0)
Requirement already satisfied: pydantic-core==2.41.4 in /usr/local/lib/python3.12/dist-packages (from pydantic!=1.8,!1.8.1,<3.0.0,>=1.7.4->spacy) (2.41.4)
Requirement already satisfied: typing-extensions>=4.14.1 in /usr/local/lib/python3.12/dist-packages (from pydantic!=1.8,!1.8.1,<3.0.0,>=1.7.4->spacy) (4.15.0)
Requirement already satisfied: typing-inspection>=0.4.2 in /usr/local/lib/python3.12/dist-packages (from pydantic!=1.8,!1.8.1,<3.0.0,>=1.7.4->spacy) (0.4.2)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.12/dist-packages (from requests<3.0.0,>=2.13.0->spacy) (3.4.4)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.12/dist-packages (from requests<3.0.0,>=2.13.0->spacy) (3.11)
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) (2.5.0)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.12/dist-packages (from requests<3.0.0,>=2.13.0->spacy) (2025.11.12)
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) (1.3.3)
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->spacy) (0.1.5)
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->spacy) (0.23.0)
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->spacy) (7.5.0)
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,>=0.4.2->spacy) (2.0.1)
```

```
# Import libraries
import nltk
import spacy

from nltk.tokenize import sent_tokenize, word_tokenize
from nltk.stem import PorterStemmer, WordNetLemmatizer

# Download required NLTK data
nltk.download('punkt')
nltk.download('wordnet')
nltk.download('omw-1.4')
```

```
[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data]   Unzipping tokenizers/punkt.zip.
[nltk_data] Downloading package wordnet to /root/nltk_data...
[nltk_data] Downloading package omw-1.4 to /root/nltk_data...
```

```
medical_text = """
Patients with diabetes require regular monitoring of blood glucose levels.
Early diagnosis and proper treatment can reduce complications.
Doctors prescribed medications and recommended lifestyle changes for better health outcomes.
"""
```

```
nltk.download('punkt_tab')
sentences = sent_tokenize(medical_text)

print("Sentence Tokens:")
for i, sent in enumerate(sentences, 1):
    print(f"{i}. {sent}")
```

```
Sentence Tokens:
1.
Patients with diabetes require regular monitoring of blood glucose levels.
2. Early diagnosis and proper treatment can reduce complications.
3. Doctors prescribed medications and recommended lifestyle changes for better health outcomes.
[nltk_data] Downloading package punkt_tab to /root/nltk_data...
[nltk_data]   Package punkt_tab is already up-to-date!
```

```
words_nltk = word_tokenize(medical_text)
print("NLTK Word Tokens:")
print(words_nltk)
```

```
NLTK Word Tokens:
['Patients', 'with', 'diabetes', 'require', 'regular', 'monitoring', 'of', 'blood', 'glucose', 'levels', '.', 'Early', 'diagnosis', 'and', 'proper', 'treatment', 'can',
```

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

words_spacy = [token.text for token in doc]
print("spaCy Word Tokens:")
print(words_spacy)
```

```
spaCy Word Tokens:
['\n', 'Patients', 'with', 'diabetes', 'require', 'regular', 'monitoring', 'of', 'blood', 'glucose', 'levels', '.', '\n', 'Early', 'diagnosis', 'and', 'proper', 'treatm
```

```
stemmer = PorterStemmer()

stemmed_words = [stemmer.stem(word) for word in words_nltk if word.isalpha()]

print("Stemmed Words:")
print(stemmed_words)
```

Stemmed Words:

```
['patient', 'with', 'diabet', 'requir', 'regular', 'monitor', 'of', 'blood', 'glucos', 'level', 'earli', 'diagnosi', 'and', 'proper', 'treatment', 'can', 'reduc', 'comp']
```

```
lemmatizer = WordNetLemmatizer()
```

```
lemmatized_words_nltk = [lemmatizer.lemmatize(word.lower())  
                        for word in words_nltk if word.isalpha()]
```

```
print("NLTK Lemmatized Words:")
```

```
print(lemmatized_words_nltk)
```

NLTK Lemmatized Words:

```
['patient', 'with', 'diabetes', 'require', 'regular', 'monitoring', 'of', 'blood', 'glucose', 'level', 'early', 'diagnosis', 'and', 'proper', 'treatment', 'can', 'reduc']
```

```
lemmatized_words_spacy = [token.lemma_ for token in doc if token.is_alpha]
```

```
print("spaCy Lemmatized Words:")
```

```
print(lemmatized_words_spacy)
```

spaCy Lemmatized Words:

```
['patient', 'with', 'diabete', 'require', 'regular', 'monitoring', 'of', 'blood', 'glucose', 'level', 'early', 'diagnosis', 'and', 'proper', 'treatment', 'can', 'reduce']
```

```
print(f"{'Original':15} {'Stemmed':15} {'Lemmatized':15}")
```

```
print("-" * 45)
```

```
for word in words_nltk:
```

```
    if word.isalpha():
```

```
        print(f"{word:15} {stemmer.stem(word):15} {lemmatizer.lemmatize(word.lower()):15}")
```

Original	Stemmed	Lemmatized
Patients	patient	patient
with	with	with
diabetes	diabet	diabetes
require	requir	require
regular	regular	regular
monitoring	monitor	monitoring
of	of	of
blood	blood	blood
glucose	glucos	glucose
levels	level	level
Early	earli	early
diagnosis	diagnosi	diagnosis
and	and	and
proper	proper	proper
treatment	treatment	treatment
can	can	can
reduce	reduc	reduce
complications	complic	complication
Doctors	doctor	doctor
prescribed	prescrib	prescribed
medications	medic	medication

and	and	and
recommended	recommend	recommended
lifestyle	lifestyl	lifestyle
changes	chang	change
for	for	for
better	better	better
health	health	health
outcomes	outcom	outcome