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Roll No: 4059

Experiment No:3

Experiment Title:

Implement Named Entity Recognition (NER)

Aim:

To implement Named Entity Recognition (NER) using Python.

Objective:

- Understand the concept of Named Entity Recognition in NLP
- Implement NER using Python's NLP libraries – NLTK and spaCy.
- Extract different types of named entities from a given text.

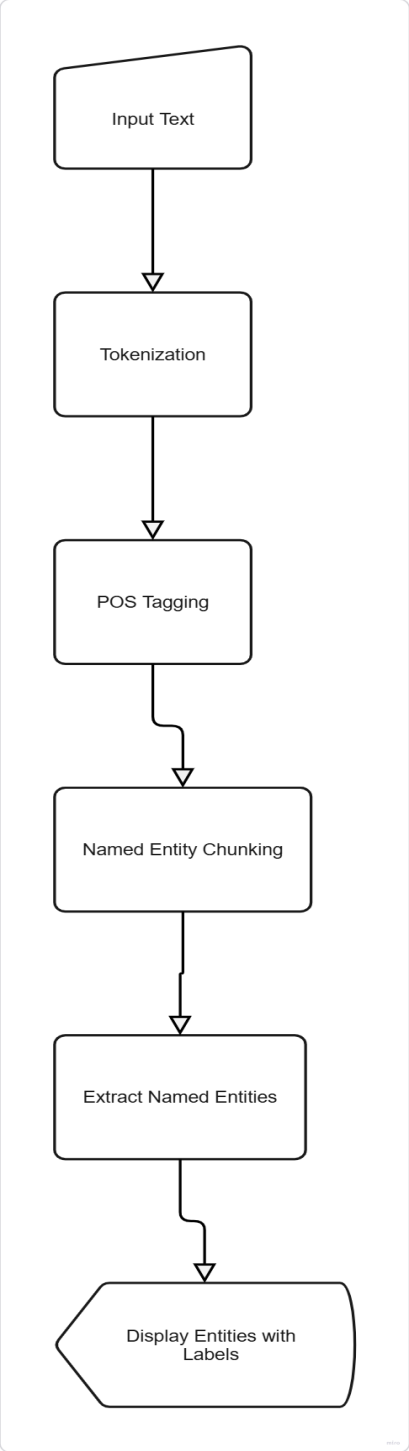
Procedure & Flowchart:

- ## Procedure:

Procedure (Using spaCy):

1. Install spaCy: pip install spacy
2. Download English model: python -m spacy download en_core_web_sm
3. Load model and process the text
4. Extract named entities using doc.ents
5. Display entities with labels

- **Flowchart:**


Input Text
Tokenization
POS Tagging
Named Entity Chunking
Extract Named Entities
Display Entities with Labels

Code / Implementation:

Implement Named Entity Recognition.

```
# Step 1: Install spaCy (if not already installed)
!pip install -U spacy

# Step 2: Download the English model
!python -m spacy download en_core_web_sm

# Step 3: Import spaCy
import spacy

# Step 4: Load English model
nlp = spacy.load("en_core_web_sm")
```

```
Requirement already satisfied: spacy in /usr/local/lib/python3.11/dist-packages (3.8.7)
Requirement already satisfied: spacy-legacy<3.1.0,>=3.0.11 in /usr/local/lib/python3.11/dist-packages (from spacy) (3.0.12)
Requirement already satisfied: spacy-loggers<2.0.0,>=1.0.0 in /usr/local/lib/python3.11/dist-packages (from spacy) (1.0.5)
Requirement already satisfied: murmurhash<1.1.0,>=0.28.0 in /usr/local/lib/python3.11/dist-packages (from spacy) (1.0.13)
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Requirement already satisfied: jinja2 in /usr/local/lib/python3.11/dist-packages (from spacy) (3.1.6)
Requirement already satisfied: setuptools in /usr/local/lib/python3.11/dist-packages (from spacy) (75.2.0)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.11/dist-packages (from spacy) (25.0)
Requirement already satisfied: langcodes<4.0.0,>=3.2.0 in /usr/local/lib/python3.11/dist-packages (from spacy) (3.5.0)
Requirement already satisfied: language-data>=1.2 in /usr/local/lib/python3.11/dist-packages (from langcodes<4.0.0,>=3.2.0->spacy) (1.3.0)
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Requirement already satisfied: pydantic-core==2.33.2 in /usr/local/lib/python3.11/dist-packages (from pydantic!=1.8,!=1.8.1,<3.0.0,>=1.7.4->spacy) (2.33.2)
Requirement already satisfied: typing-extensions>=4.12.2 in /usr/local/lib/python3.11/dist-packages (from pydantic!=1.8,!=1.8.1,<3.0.0,>=1.7.4->spacy) (4.14.1)
Requirement already satisfied: typing-inspection>=0.4.0 in /usr/local/lib/python3.11/dist-packages (from pydantic!=1.8,!=1.8.1,<3.0.0,>=1.7.4->spacy) (0.4.1)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.11/dist-packages (from requests<3.0.0,>=2.13.0->spacy) (3.4.2)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.11/dist-packages (from requests<3.0.0,>=2.13.0->spacy) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.11/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/python3.11/dist-packages (from requests<3.0.0,>=2.13.0->spacy) (2025.7.14)
Requirement already satisfied: blis<1.4.0,>=1.3.0 in /usr/local/lib/python3.11/dist-packages (from thinc<8.4.0,>=8.3.4->spacy) (1.3.0)
Requirement already satisfied: confection<1.0.0,>=0.0.1 in /usr/local/lib/python3.11/dist-packages (from thinc<8.4.0,>=8.3.4->spacy) (0.1.5)
Requirement already satisfied: click>=8.0.0 in /usr/local/lib/python3.11/dist-packages (from typer<1.0.0,>=0.3.0->spacy) (8.2.1)
Requirement already satisfied: shellingham>=1.3.0 in /usr/local/lib/python3.11/dist-packages (from typer<1.0.0,>=0.3.0->spacy) (1.5.4)
Requirement already satisfied: rich>=10.11.0 in /usr/local/lib/python3.11/dist-packages (from typer<1.0.0,>=0.3.0->spacy) (13.9.4)
Requirement already satisfied: cloudpathlib<1.0.0,>=0.7.0 in /usr/local/lib/python3.11/dist-packages (from weasel<0.5.0,>=0.1.0->spacy) (0.21.1)
Requirement already satisfied: smart-open<8.0.0,>=5.2.1 in /usr/local/lib/python3.11/dist-packages (from weasel<0.5.0,>=0.1.0->spacy) (7.3.0.post1)
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.11/dist-packages (from jinja2->spacy) (3.0.2)
Requirement already satisfied: marisa-trie>=1.1.0 in /usr/local/lib/python3.11/dist-packages (from language-data>=1.2->langcodes<4.0.0,>=3.2.0->spacy) (1.2.1)
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Requirement already satisfied: wrapt in /usr/local/lib/python3.11/dist-packages (from smart-open<8.0.0,>=5.2.1->weasel<0.5.0,>=0.1.0->spacy) (1.17.2)
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Collecting en-core-web-sm==3.8.0
  Downloading https://github.com/explosion/spacy-models/releases/download/en_core_web_sm-3.8.0/en_core_web_sm-3.8.0-py3-none-any.whl (12.8 MB)
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✓ 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.
Named Entities:

Annasaheb Dange College of Engineering and Technology (ORG)
Sangli (GPE)
Maharashtra (NORP)
Artificial Intelligence and Data Science Engineering (ORG)
```

```
# Step 5: Custom text
text = """
Prathamesh Jadhav is studying at Annasaheb Dange College of Engineering and Technology in Sangli.
He lives in Maharashtra and is pursuing a degree in Artificial Intelligence and Data Science Engineering.
"""

# Step 6: Process the text
doc = nlp(text)

# Step 7: Display named entities
print("Named Entities:\n")
for ent in doc.ents:
    print(f"{ent.text} ({ent.label_})")
```

```
Named Entities:

Annasaheb Dange College of Engineering and Technology (ORG)
Sangli (GPE)
Maharashtra (NORP)
Artificial Intelligence and Data Science Engineering (ORG)
```

Student Activity - Code & Output

Student Task:

- Perform NER on a paragraph from a newspaper or academic article.
- Count how many entities were identified for each type (e.g., PERSON, ORGANIZATION).

Sample Code for Student Activity:

Named Entity Recognition (NER)

```
# Step 1: Install and load spaCy
!pip install -U spacy
!python -m spacy download en_core_web_sm

# Step 2: Import required libraries
import spacy
from collections import Counter

# Step 3: Load English NLP model
nlp = spacy.load("en_core_web_sm")

# Step 4: Input a paragraph from a newspaper or academic article
text = """
In a groundbreaking development, researchers at the Massachusetts Institute of Technology (MIT) have created a new AI model capable of detecting early-stage Alzl
The study, published in the journal Nature Medicine, involved over 5,000 participants from the United States, Canada, and Germany.
Dr. Emily Chen, a leading neuroscientist, said the model could change the landscape of preventive healthcare.
Funding for the project was provided by the National Institutes of Health (NIH) and Google Health.
"""

# Step 5: Process the text with spaCy
doc = nlp(text)

# Step 6: Extract and count named entities by type
entity_counts = Counter(ent.label_ for ent in doc.ents)

# Step 7: Display named entities and their types
print("Named Entities Found:\n")
for ent in doc.ents:
    print(f"{ent.text} ({ent.label_})")

# Step 8: Display counts by entity type
print("\n\nEntity Counts by Type:\n")
for label, count in entity_counts.items():
    print(f"{label} ({spacy.explain(label)}): {count}")
```

```
Requirement already satisfied: setuptools in /usr/local/lib/python3.11/dist-packages (from spacy) (75.2.0)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.11/dist-packages (from spacy) (25.0)
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Requirement already satisfied: shellingham>=1.3.0 in /usr/local/lib/python3.11/dist-packages (from typer<1.0.0,>=0.3.0->spacy) (1.5.4)
Requirement already satisfied: rich>=10.11.0 in /usr/local/lib/python3.11/dist-packages (from typer<1.0.0,>=0.3.0->spacy) (13.9.4)
Requirement already satisfied: cloudpathlib<1.0.0,>=0.7.0 in /usr/local/lib/python3.11/dist-packages (from weasel<0.5.0,>=0.1.0->spacy) (0.21.1)
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Requirement already satisfied: pygments<3.0.0,>=2.13.0 in /usr/local/lib/python3.11/dist-packages (from rich>=10.11.0->typer<1.0.0,>=0.3.0->spacy) (2.19.2)
Requirement already satisfied: wrapt in /usr/local/lib/python3.11/dist-packages (from smart-open<8.0.0,>=5.2.1->weasel<0.5.0,>=0.1.0->spacy) (1.17.2)
Requirement already satisfied: mdurl~=0.1 in /usr/local/lib/python3.11/dist-packages (from markdown-it-py>=2.2.0->rich>=10.11.0->typer<1.0.0,>=0.3.0->spacy) (0.1
Collecting en-core-web-sm==3.8.0
  Downloading https://github.com/explosion/spacy-models/releases/download/en_core_web_sm-3.8.0/en_core_web_sm-3.8.0-py3-none-any.whl (12.8 MB)
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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.
Named Entities Found:

the Massachusetts Institute of Technology (ORG)
MIT (ORG)
AI (GPE)
Nature Medicine (PRODUCT)
5,000 (CARDINAL)
the United States (GPE)
Canada (GPE)
Germany (GPE)
Emily Chen (PERSON)
the National Institutes of Health (ORG)
NIH (ORG)
Google Health (ORG)


Entity Counts by Type:

ORG (Companies, agencies, institutions, etc.): 5
GPE (Countries, cities, states): 4
PRODUCT (Objects, vehicles, foods, etc. (not services)): 1
CARDINAL (Numerals that do not fall under another type): 1
PERSON (People, including fictional): 1
```

Questions & Answers:

1. What is Named Entity Recognition in NLP? (CO1)
Answer:
Named Entity Recognition (NER) is the process of identifying and classifying named entities such as persons, organizations, locations, dates, etc., from a body of text using Natural Language Processing techniques.

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2. List some types of named entities identified in NER. (CO1)
Answer:
Common types of named entities include:
• PERSON (e.g., Elon Musk)
• ORGANIZATION (e.g., NASA)
• LOCATION (e.g., India)
• DATE (e.g., August 6, 2025)
• TIME, MONEY, PERCENTAGE, etc.

---

3. Explain the role of `ne_chunk()` in NER. (CO3)
Answer:
The `ne_chunk()` function in NLTK identifies named entities in a POS-tagged sentence by creating a chunk tree. It uses statistical models to group named entities such as people, organizations, and locations in the form of subtree structures.

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4. Why is NER important in text analytics and NLP applications? (CO5)
Answer:
NER plays a vital role in extracting structured information from unstructured text. It supports applications like:
• Information retrieval
• Question answering systems
• Text summarization
• Sentiment analysis
• Chatbots and digital assistants

Conclusion:

In this experiment, we successfully implemented Named Entity Recognition (NER) using NLTK and spaCy libraries in Python. NER helps in extracting meaningful information from text such as names of persons, locations, organizations, and dates. It plays a crucial role in applications like search engines, information retrieval systems, chatbots, and digital assistants.