```
vector = vectorizer.fit_transform([sentence])
vector.toarray()
```

Out[113…
```
array([[0.28867513, 0.28867513, 0.28867513, 0.28867513, 0.57735027,
        0.28867513, 0.28867513, 0.28867513, 0.28867513]])
```

25th July 2025

Chunking in NLP:

- In natural language processing (NLP), chunking refers to the process of dividing text into meaningful segments, typically called "chunks". These chunks often correspond to syntactic structures in a sentence, such as noun phrases, verb phrases, or other grammatical categories. Here's a detailed overview of chunking in NLP.

Key Concepts of Chunking in NLP

- Syntactic Analysis: Chunking helps in understanding the grammatical structure of sentences by identifying phrases.
- Information Extraction: By isolating key phrases, chunking facilitates the extraction of relevant information from text.

Types of Chunks:

```
- Noun Phrases (NP): Groups of words that function as a noun (e.g., "the big red ball")
- Verb Phrases (VP): Consist of the main verb and any accompanying words (e.g, "is running quickly").
- Prepositional Phrases (PP): Phrases that start with a preposition (e.g., "under the table").
```

Techniques:

- Rule-Based Approaches: Using predefined rules based on grammar to identify chunks.
- Statistical Methods: Leveraging machine learning techniques trained on annotated datasets to identify chunks.
- Neural Approaches: Utilizing deep learning models, such as transformers, to automatically learn chunking patterns from data.

Applications:

- Text Parsing: Understanding sentence structure for further processing.
- Sentiment Analysis: Identifying sentiment-bearing phrases.
- Question Answering: Extracting relevant information to respond to queries.

Example of Chunking

For the sentence "The quick brown for jumps over the lazy dog." chunking might identify:

Noun Phrase (NP): "The quick brown fox" Verb Phrase (VP): "jumps" Prepositional Phrase (PP): "over the lazy dog" Tools and Libraries Several libraries can help with chunking in python, including:

NLTK: Provides tools for tokenization, POS tagging, and chunking.spaCy:Offers efficient and easy-to-use NlP pipelines with built-in chunking capabilities. Standord NLP: Includes models that can handle chunking as part of their parsing capabilities.

In [1]:
```
import nltk
from nltk import pos_tag, word_tokenize, RegexpParser

# Download necessary NLTK data files (only need to do this once)
nltk.download('punkt')
nltk.download('averaged_perceptron_tagger')

# Sample text
text = "full stack datascience, generative ai, agentic ai, llm model keep increase by different company"

# Tokenize the text
tokens = word_tokenize(text)

# Perform part-of-speech tagging
tagged_tokens = pos_tag(tokens)

# Define a chunk grammar
chunk_grammar = r"""
    NP: {<DT>?<JJ>*<NN>} # Noun Phrase
    VP: {<VB.*><NP|PP>*} # Verb Phrase
    PP: {<IN><NP>} # Prepositional Phrase
"""

# Create a chunk parser
```

```
chunk_parser = RegexpParser(chunk_grammar)

# Parse the tagged tokens
chunked = chunk_parser.parse(tagged_tokens)

# Print the chunked output
print(chunked)

# Optionally, you can visualize the chunks
chunked.draw()
```

```
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\samua\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package averaged_perceptron_tagger to
[nltk_data]     C:\Users\samua\AppData\Roaming\nltk_data...
[nltk_data]   Package averaged_perceptron_tagger is already up-to-
[nltk_data]       date!
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  (NP full/JJ stack/NN)
  (NP datascience/NN)
  ,/,
  (NP generative/JJ ai/NN)
  ,/,
  (NP agentic/JJ ai/NN)
  ,/,
  (NP llm/JJ model/NN)
  (VP keep/VB (NP increase/NN))
  (PP by/IN (NP different/JJ company/NN)))
```

WHAT IS MEAN BY CHUNKING IN LLM -->

- In the context of large language models (LLMs), "chunking" refers to a method of processing input text in smaller, manageable segments or "chunks". This approach can help improve efficiency, manage memory usage, and enhance the model's ability to generate or analyze text. Here's a breakdown of what chunking means in this context:

Key Aspects of Chunking in LLMs

- Segmentation: Text is divided into smaller parts (e.g., sentences or paragraphs) rather than processing a large block of text all at once. This is particularly useful for very long texts that exceed the model's maximum token limit.
- Context Management: By processing smaller chunks, models can maintain context better for shorter segments. This can enhance coherence in tasks like text generation, summarization, or dialogue systems.
- Parallel Processing: Chunking allows for parallel processing of text segments. Differentw chunks can be processed simultaneously, improving computational efficiency.
- Handling Long Documents: For tasks like summarization or question-answering over large documents, chunking helps in breaking down the information into digestible pieces, allowing the model to focus on one part at a time.
- Attention Mechanism: In transformer-based models (like GPT), the attention mechanism operates over fixed-length sequences. Chunking allows the model to effectively attend to relevant parts of the input without being overwhelmed by long sequences.

Applications

- Text Generations: Generating text in parts, which can help maintain thematic or narrative consistency.
- Information Retrieval: Retrieving specific information from large datasets by processing sections individually.

In [3]:
```
!pip install transformers
```

```
Requirement already satisfied: transformers in c:\users\samua\anaconda3\lib\site-packages (4.55.0)
Requirement already satisfied: filelock in c:\users\samua\anaconda3\lib\site-packages (from transformers) (3.17.0)
Requirement already satisfied: huggingface-hub<1.0,>=0.34.0 in c:\users\samua\anaconda3\lib\site-packages (from transformers)
(0.34.1)
Requirement already satisfied: numpy>=1.17 in c:\users\samua\anaconda3\lib\site-packages (from transformers) (2.3.2)
Requirement already satisfied: packaging>=20.0 in c:\users\samua\anaconda3\lib\site-packages (from transformers) (24.2)
Requirement already satisfied: pyyaml>=5.1 in c:\users\samua\anaconda3\lib\site-packages (from transformers) (6.0.2)
Requirement already satisfied: regex!=2019.12.17 in c:\users\samua\anaconda3\lib\site-packages (from transformers) (2024.11.6)
Requirement already satisfied: requests in c:\users\samua\anaconda3\lib\site-packages (from transformers) (2.32.3)
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4)
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Requirement already satisfied: tqdm>=4.27 in c:\users\samua\anaconda3\lib\site-packages (from transformers) (4.67.1)
Requirement already satisfied: fsspec>=2023.5.0 in c:\users\samua\anaconda3\lib\site-packages (from huggingface-hub<1.0,>=0.34.
0->transformers) (2025.3.2)
Requirement already satisfied: typing-extensions>=3.7.4.3 in c:\users\samua\anaconda3\lib\site-packages (from huggingface-hub<
1.0,>=0.34.0->transformers) (4.12.2)
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Requirement already satisfied: idna<4,>=2.5 in c:\users\samua\anaconda3\lib\site-packages (from requests->transformers) (3.7)
Requirement already satisfied: urllib3<3,>=1.21.1 in c:\users\samua\anaconda3\lib\site-packages (from requests->transformers)
(2.3.0)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\samua\anaconda3\lib\site-packages (from requests->transformers)
(2025.7.14)
```

In [6]:

```python
from transformers import AutoTokenizer, AutoModelForCausalLM

# Load a pre-trained model and tokenizer
model_name = "gpt2" # You can replace with any other LLM
tokenizer = AutoTokenizer.from_pretrained(model_name)
model = AutoModelForCausalLM.from_pretrained(model_name)

def chunk_text(text, max_length=512):
    """Chunk text into smaller pieces."""
    tokens = tokenizer.encode(text, return_tensors='pt')[0]
    chunks = []

    for i in range(0, len(tokens), max_length):
        chunk = tokens[i:i + max_length]
        chunks.append(chunk)
```

```
    return chunks

def generate_responses(chunks):
    """Generate responses for each chunk using the LLM."""
    responses = []
    for chunk in chunks:
        input_ids = chunk.unsqueeze(0) # Add batch dimension
        output = model.generate(input_ids, max_length=100) # Generate response
        responses.append(tokenizer.decode(output[0], skip_special_tokens=True))

    return responses

# Example long text
long_text = "Your long text goes here. " * 50 # Repeat to simulate long text

# Chunk the text
chunks = chunk_text(long_text)

# Generate responses for each chunk
responses = generate_responses(chunks)

# Print the responses
for i, response in enumerate(responses):
    print(f"Response for chunk {i+1}:\n{response}\n")
```

```
---------------------------------------------------------------------------
ImportError                               Traceback (most recent call last)
Cell In[6], line 6
      4 model_name = "gpt2" # You can replace with any other LLM
      5 tokenizer = AutoTokenizer.from_pretrained(model_name)
----> 6 model = AutoModelForCausalLM.from_pretrained(model_name)
      8 def chunk_text(text, max_length=512):
      9     """Chunk text into smaller pieces."""

File ~\anaconda3\Lib\site-packages\transformers\utils\import_utils.py:2132, in DummyObject.__getattribute__(cls, key)
   2130 if (key.startswith("_") and key != "_from_config") or key == "is_dummy" or key == "mro" or key == "call":
   2131     return super().__getattribute__(key)
-> 2132 requires_backends(cls, cls._backends)

File ~\anaconda3\Lib\site-packages\transformers\utils\import_utils.py:2118, in requires_backends(obj, backends)
   2115         failed.append(msg.format(name))
   2117 if failed:
-> 2118     raise ImportError("".join(failed))

ImportError:
AutoModelForCausalLM requires the PyTorch library but it was not found in your environment. Check out the instructions on the
installation page: https://pytorch.org/get-started/locally/ and follow the ones that match your environment.
Please note that you may need to restart your runtime after installation.
```

In [5]:
```
pip install torch torchvision torchaudio --index-url https://download.pytorch.org/whl/cpu
```

```
Looking in indexes: https://download.pytorch.org/whl/cpuNote: you may need to restart the kernel to use updated packages.

Collecting torch
  Downloading https://download.pytorch.org/whl/cpu/torch-2.7.1%2Bcpu-cp313-cp313-win_amd64.whl.metadata (27 kB)
Collecting torchvision
  Downloading https://download.pytorch.org/whl/cpu/torchvision-0.22.1%2Bcpu-cp313-cp313-win_amd64.whl.metadata (6.3 kB)
Collecting torchaudio
  Downloading https://download.pytorch.org/whl/cpu/torchaudio-2.7.1%2Bcpu-cp313-cp313-win_amd64.whl.metadata (6.8 kB)
Requirement already satisfied: filelock in c:\users\samua\anaconda3\lib\site-packages (from torch) (3.17.0)
Requirement already satisfied: typing-extensions>=4.10.0 in c:\users\samua\anaconda3\lib\site-packages (from torch) (4.12.2)
Requirement already satisfied: sympy>=1.13.3 in c:\users\samua\anaconda3\lib\site-packages (from torch) (1.13.3)
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Requirement already satisfied: setuptools in c:\users\samua\anaconda3\lib\site-packages (from torch) (80.9.0)
Requirement already satisfied: numpy in c:\users\samua\anaconda3\lib\site-packages (from torchvision) (2.3.2)
Requirement already satisfied: pillow!=8.3.*,>=5.3.0 in c:\users\samua\anaconda3\lib\site-packages (from torchvision) (11.1.0)
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3.0)
Requirement already satisfied: MarkupSafe>=2.0 in c:\users\samua\anaconda3\lib\site-packages (from jinja2->torch) (3.0.2)
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Installing collected packages: torch, torchvision, torchaudio

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Successfully installed torch-2.7.1+cpu torchaudio-2.7.1+cpu torchvision-0.22.1+cpu
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In [ ]: