# Lesson 1: Text Classification and Sentiment Analysis

## Introduction to NLP

Natural Language Processing (NLP) is a field of Artificial Intelligence that focuses on the interaction between computers and human language. It enables machines to read, interpret, and generate human language in a valuable way. In this lesson, we'll explore the evolution of NLP, real-world applications, and core tasks.

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## The Evolution of NLP

- **1950s - 1980s:** NLP began with rule-based systems and symbolic approaches. Machine translation between Russian and English during the Cold War led to early NLP systems.
- **1990s - Early 2000s:** Statistical methods became prominent. NLP shifted from hard-coded rules to data-driven approaches. The introduction of corpora and probabilistic models was a turning point.
- **2010s - Present:** Deep learning revolutionized NLP. Models like Word2Vec, BERT, and GPT changed how machines understand language. Transfer learning and pre-trained models became standard.

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## Real-World Applications of NLP

- **Machine Translation: Services like Google Translate use NLP models to convert text from one language to another.**
- **Search Engines: NLP enhances search relevance by understanding query intent and content.**
- **Chatbots and Virtual Assistants: Siri, Alexa, and others rely on NLP for speech recognition and response generation.**
- **Sentiment Analysis: Brands use NLP to analyze public opinion from social media and reviews.**
- **Spam Detection: Classifying messages as spam or not based on content patterns.**

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## Key Challenges in NLP

- **Ambiguity: Words can have multiple meanings depending on context. (e.g., "bank" as a financial institution vs. riverbank)**
- **Context Understanding: Capturing the true meaning of a sentence requires contextual knowledge.**
- **Sarcasm and Idioms: Machines struggle to understand non-literal expressions.**
- **Multilingual Processing: Supporting multiple languages with different grammar structures is complex.**

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## Core NLP Tasks

- **Tokenization: Splitting text into words or sentences.**
- **Part-of-Speech (POS) Tagging: Assigning grammatical tags (noun, verb, etc.) to words.**
- **Named Entity Recognition (NER): Identifying proper names (people, organizations, places).**
- **Dependency Parsing: Understanding grammatical structure and relationships between words.**
- **Text Classification: Categorizing text (e.g., spam detection).**
- **Language Modeling: Predicting the next word in a sentence or generating new text.**

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## Popular NLP libraries

- **NLTK: A comprehensive Python library for symbolic and statistical NLP.**
- **spaCy: Industrial-strength NLP with fast, easy-to-use APIs.**
- **Transformers (Hugging Face): Provides state-of-the-art pre-trained models like BERT and GPT.**

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## Summary

**In this lesson, you learned:**

- **The history and evolution of NLP**
- **Key real-world applications and challenges**
- **Essential NLP tasks**
- **Libraries that enable NLP workflows**