

# NLP with Deep Learning

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## 1. Introduction to NLP & Deep Learning

- What is Natural Language Processing (NLP)
  - Difference between classical and deep learning NLP
  - Real-world applications and use cases (chatbots, translators)
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## 2. Text Preprocessing & Linguistic Fundamentals

- Tokenization (words/subwords), stemming, lemmatization
  - Part-of-speech tagging & basic syntax
  - Cleaning and preparing text data for models
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## 3. Text Representation & Word Embeddings

- Bag-of-Words (BoW), TF-IDF
  - Word2Vec, GloVe, FastText embeddings
  - Contextual embeddings (ELMo, BERT)
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- The logo for Paarsh e-Learning features the word "PAIRSH" in a large, stylized blue font where the letters are interconnected. Below it, the word "e-LEARNING" is written in a smaller blue font. A tagline "Boost your creativity" is written in a smaller, italicized blue font to the right of "e-LEARNING". To the left of "PAIRSH", there is a circular graphic element containing the letters "P" and "e".
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## 4. Neural Networks Foundations for NLP

- Feedforward networks basics
  - Backpropagation and gradient descent fundamentals
  - Activation functions and loss for NLP
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## 5. Sequence Modeling: RNN, LSTM & GRU

- Recurrent neural networks (RNNs)
  - Long Short-Term Memory (LSTM) and GRU units
  - Sequence-based tasks (text generation, tagging)
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## **6. Attention Mechanisms & Seq2Seq Models**

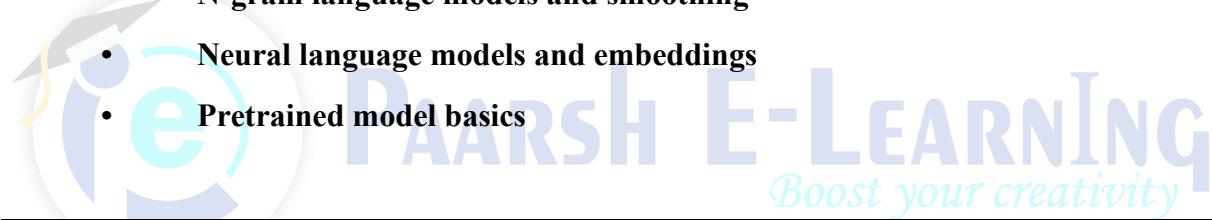
- Encoder-decoder architectures
  - Global and local attention
  - Beam search decoding for sequence generation
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## **7. Transformer Architectures & Self-Attention**

- Self-attention concept and positional encoding
  - Transformer encoder and decoder blocks
  - Benefits over RNN-based models
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## **8. Language Models: Statistical to Neural**

- N-gram language models and smoothing
  - Neural language models and embeddings
  - Pretrained model basics
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## **9. Modern Large Language Models (LLMs)**

- BERT, GPT, RoBERTa, T5 and other transformer models
  - Transfer learning and fine-tuning modern LLMs
  - Use cases for text generation, summarization, QA
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## **10. Chatbot Design & Conversational AI**

- Architecture for rule-based vs neural chatbots
  - Dialog management and intent classification
  - Evaluation of conversational responses
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## **11. NLP Tasks: Classification, NER & QA**

- Sentiment analysis
  - Named Entity Recognition (NER)
  - Question answering and extraction tasks
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## 12. Evaluation, Metrics & Model Optimization

- Accuracy, precision, recall, F1-score, BLEU, ROUGE
  - Hyperparameter tuning
  - Overfitting and regularization strategies
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## 13. Tools & Libraries (TensorFlow, PyTorch, Hugging Face)

- NLP tooling: NLTK, spaCy
  - Deep learning libs: TensorFlow, PyTorch
  - Transformers: Hugging Face ecosystem
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## 14. Projects, Deployment & Ethics in NLP

- End-to-end NLP applications (chatbot, summarizer)
  - Deploy models via APIs/web apps
  - Ethical considerations: bias, privacy, responsible AI
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