

## **Generative AI (Fall-2025)**

### **Assignment-4**

#### **Instructor**

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#### **Submission Guidelines:**

- Submit your assignment on Google Classroom in the format "22XX.ipynb". You have to submit one report document and one code file.
- The deadline is 29 October, 2025, at 11:59 PM. No extensions will be granted.

#### **Declarations:**

- Late submissions will incur penalties: 25% deduction on the first day, 50% on the second day, and zero marks thereafter.
- Plagiarism will result in zero marks for the assignment.
- This is an individual assignment; collaboration or group work is strictly prohibited. Please ensure that you submit your own original work.

#### **VIVA Policy:**

- A VIVA (oral examination) will be conducted to assess your understanding of the assignment.
- The VIVA will be scheduled separately, and you will be notified of the date and time.
- Failure to attend the VIVA will result in zero marks for the assignment.

#### **Academic Integrity:**

- Plagiarism, collusion, and academic dishonesty will not be tolerated. Any instances of academic misconduct will be reported to the authorities and may result in severe penalties.

# Deep Learning for Sentiment Analysis on Urdu Text

You are required to develop a **sentiment analysis system** for Urdu text using **deep learning architectures**. The goal is to classify Urdu text or reviews as *positive*, *negative*, or *neutral*.

## Tasks

### 1. Data Preparation

- Preprocess the Urdu dataset (tokenization, normalization, and stopwords removal).
- Use the following **word embedding techniques**:
  - Word2Vec
  - FastText
  - ELMo

### 2. Model Implementation

- Implement two deep learning models:
  - RNN (Recurrent Neural Network)
  - LSTM (Long Short-Term Memory Network)
- Test each model with all three embeddings (i.e., run RNN and LSTM separately with Word2Vec, FastText, and ELMo).
- Evaluate performance using Accuracy, Precision, Recall, and F1-score.

### 3. Visualization

- Use **Plotly** to visualize model results.
- Create comparative plots for model-embedding combinations (e.g., accuracy vs embedding type, confusion matrices, etc.).

### 4. Analysis

- Discuss the effect of each embedding on model performance.
- Explain challenges specific to Urdu language sentiment analysis and how embeddings help handle them.
- Finally, specify which embedding technique performed the best and which model achieved the highest overall accuracy.

## Deliverables

- Python code file (.ipynb)
- Report (2–3 pages) including:
  - Dataset description
  - Model and embedding details

- Comparative performance results
- Visualizations and analysis
- Final conclusion on the best-performing embedding and model

## Evaluation Tables

**Table 1: RNN Performance with Different Embeddings**

Metric	RNN with Word2Vec	RNN with FastText	RNN with ELMo
F1-score			
Accuracy			
Precision			
Recall			

**Table 2: LSTM Performance with Different Embeddings**

Metric	LSTM with Word2Vec	LSTM with FastText	LSTM with ELMo
F1-score			
Accuracy			
Precision			
Recall			

## Conclusion

At the end of your report, specify:

- Which **embedding technique** performed best for Urdu sentiment analysis.
- Which **model** (RNN or LSTM) achieved the highest overall accuracy and F1-score.