

# Lab 10: Sequence Labeling and Text Classification Part – I: Enhanced Intent Classification and Slot Filling RNN Model by adding bidirectionality and dropout layers.

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## 1. Introduction:

This lab was focused on two important tasks in Natural Language Understanding: sequence labeling (specifically, Slot Filling) and text classification (Intent Classification). The purpose of this lab report is to provide an overview of the sequence neural network model for intent classification and slot filling (IAS). The Model IAS is a baseline architecture that has been modified to improve its performance.

## 2. Analyze the IAS Model:

- The Model IAS is a sequential neural network composed of an utterance encoder, slot output layer, and intent output layer.
- It utilizes word embeddings to represent input utterances and employs an LSTM layer for processing.
- The slot output layer produces predictions for individual slots, while the intent output layer generates the intent prediction for the entire utterance.

## 3. Enhancements:

- **Bidirectionality:** The original unidirectional LSTM layer in Model IAS has been replaced with a bidirectional LSTM layer.
- **Dropout Layer:** A dropout layer with a dropout rate of 0.1 has been added after the embedding layer.

## 4. ModelIAS Class:

- The ModelIAS class defines the structure of the enhanced Model IAS.
- It takes parameters such as hidden size, output sizes for slot filling and intent classification, word embedding size, and vocabulary length.
- The forward method performs the forward pass of the model, processing the utterance and generating slot and intent predictions.

## 5. Training Setup:

- The training setup includes hyperparameters such as hidden size, embedding size, learning rate, and gradient clipping value.
- The model is initialized and an Adam/ AdamW optimizer is used for optimization.
- Cross-entropy loss functions are employed for slot filling and intent classification.

## 5. Results:

- I did different experiments to evaluate the enhanced Model IAS, here I mention 2 experiments with best results.
- **Experiment 1** utilized the AdamW optimizer and achieved an average Slot F1 score of 0.9369 and an average Intent Accuracy of 0.9471.
- **Experiment 2** used the Adam optimizer and resulted in an average Slot F1 score of 0.9401 and an average Intent Accuracy of 0.9449.

## 6. Key Takeaway:

The enhancements of bidirectionality and the addition of a dropout layer have shown improvements in the performance of the Model IAS for intent classification and slot filling tasks. These modifications have the potential to enhance the model's ability to capture contextual dependencies and improve generalization and robustness.