Bidirectional English-Nepali Machine Translation System for Legal Domain

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INTRODUCTION

- Deep Learning based Machine Translation models are performing better and have successful advancement in the translation domain.
- Movement from Statistical Based Machine Translation model to Neural Machine translation has not been smooth for the Nepali Language.
- Neural Machine Translation in the legal domain has not been explored previously.
- Translation in Nepali Legal Domain requires proper digital dataset and footprint, and most of the previous works are focused in the general domain of the language.
- Previous works are based on SMT and NMT model, and domain specific models with specific datasets are yet to be explored.

OBJECTIVES

- To explore Transformer based NMT models.
- To develop domain specific dataset in Legal Domain.
- To develop an efficient model better suited for Nepali legal domain.
- To identify various issues and challenges that arise while creating the dataset and models.
- To evaluate the previous general domain datasets performance and accuracy against legal terminologies.

RESEARCH METHODOLOGY

- Through previous literature and review, we identified the state of NMT, and areas that can be further improved through our contribution.
- We created a domain specific dataset of size 125,000 Nepali - English parallel sentences.
- We trained a transformer-based model from scratch for this specific domain-based translation purpose in Nepali English language pair.
- We analyzed the output and findings of the fine tuned model and also identified the areas for improvements.

Dataset Collection

- Documents provided by Legal firms upon NDA.
- Supreme Court Site for public legal proceedings.
- Scraping news site for English and Nepali pair news, consisting of legal terminologies.

Dataset

- Created Dataset from scratch for Legal Domain.

CORPUS Source	CORPUS Size (Parallel Sentences)
Manually Translated Documents	60k
Legal Websites	25k
News Sites	40k

Table 1 : *Data Source and CORPUS Size*

EVALUATION

- Evaluated our model using BLEU score for performance of the model in both general and legal domain.
- For final evaluation, legal professionals were also given access to the model, to try and rate the translation.

Model		Nepali - > English		English - > Nepali	
Model	Domain	Legal	General	Legal	General
NMT Model		7.98	13.67	6.63	9.47
RNN Model		6.19	-	5.89	-

Table 2 : *BLEU score of RNN and NMT model*

DATA PREPROCESSING

NORMALIZATION AND TOKENIZATION

- Used IndicNLP to Normalize and Tokenize Nepali sentences.
- Used Sacremoses library for English sentences.

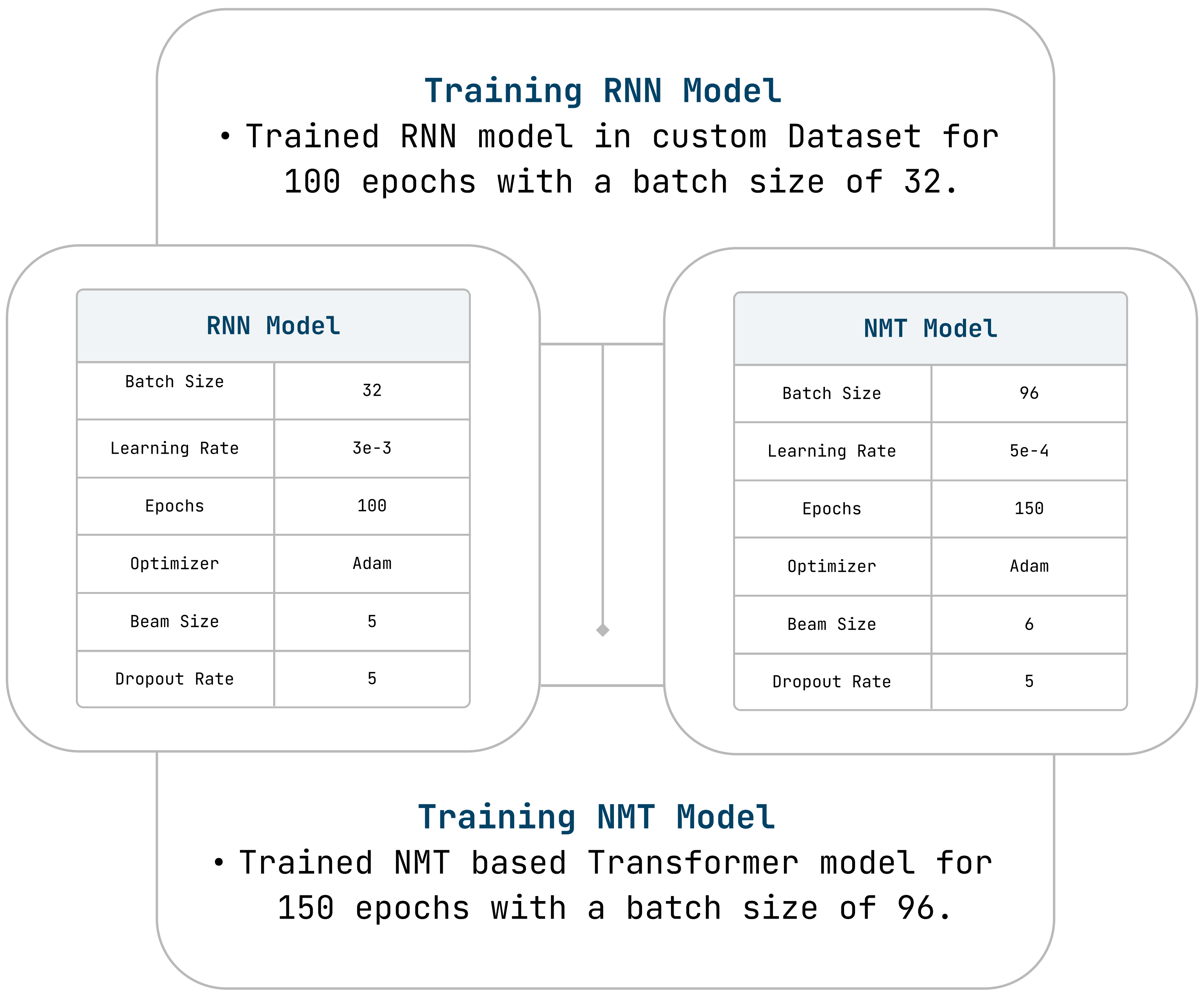
VOCABULARY BUILDING

- Used BPE to learn legal vocabulary of size about 10K.
- Used Sentencepiece library to learn BPE for source language (Nepali).

Used Alignment tools to align the sentence pair.

TRAINING

- Used RNN model initially to train the dataset.
- Used NMT based 6 encoder-decoder layer transformer model to train the dataset.



Training RNN Model
- Trained RNN model in custom Dataset for 100 epochs with a batch size of 32.

RNN Model	
Batch Size	32
Learning Rate	3e-3
Epochs	100
Optimizer	Adam
Beam Size	5
Dropout Rate	5

NMT Model	
Batch Size	96
Learning Rate	5e-4
Epochs	150
Optimizer	Adam
Beam Size	6
Dropout Rate	5

Training NMT Model
- Trained NMT based Transformer model for 150 epochs with a batch size of 96.

Figure 1 : *Training Parameters for models*

CONCLUSION & FUTURE WORKS

- Being first work in domain specific work in Nepali language, the results set a baseline for future works.
- Creating a proper domain specific dataset for translation model, can help further improve the performance and quality of the model.
- Need to work on date conversion from English Gregorian and Nepali Bikram-Sambat calendars.
- Can further improve the fluency of translation, given proper resources.
- Handle O-O-V words to improve the quality of translated documents.

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