Advanced NLP Project Presentation

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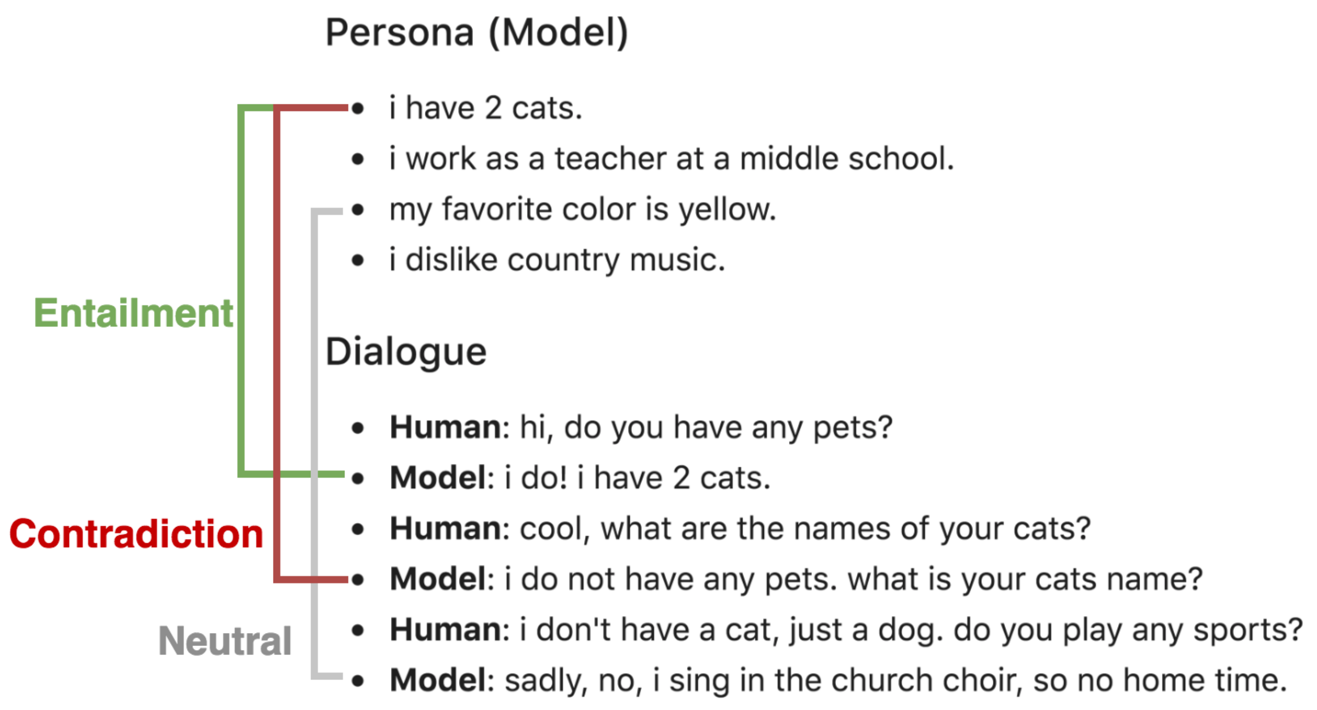
Task:

Natural Language Inference is the task of looking at a premise and a hypothesis and determining entailment and contradiction relationships with the given context sentences, as shown in the figure above. This task has traditionally been tackled by building complex models for text representation using CNN (Convolutional Neural Networks) or LSTM (Long Short Term Memory) based models.



Approach

We tackled the Natural Language Inference task by aligning bits of texts between sentences using soft neural attention. We implemented the method as suggested by the authors of the papers on decomposable attention models and intra-sentence attention. The authors of the paper argue that the task of Natural Language Inference can be easily solved by using **alignment between specific words in pairs of sentences**.

Attend

$$e_{ij} := F'(\bar{a}_i, \bar{b}_j) = F(\bar{a}_i)^T F(\bar{b}_j)$$

$$\beta_i = \sum_{j=1}^{l_b} \frac{\exp(e_{ij})}{\sum_{k=1}^{l_b} \exp(e_{ik})} b_j,$$

$$\alpha_j = \sum_{i=1}^{l_a} \frac{\exp(e_{ij})}{\sum_{k=1}^{l_a} \exp(e_{kj})} a_i.$$

Compare

$$v_{1,i} := G([\bar{a}_i, \beta_i]) \qquad \forall i \in [1, \dots, l_a]$$

$$v_{2,j} := G([\bar{b}_j, \alpha_j]) \qquad \forall j \in [1, \dots, l_b]$$

where $[\cdot,\cdot]$ denotes concatenation and G which is a feed-forward network.

Aggregate

$$v_1 = \sum_{i=1}^{l_a} v_{1,i}\,, \qquad v_2 = \sum_{j=1}^{l_b} v_{2,j}$$

which is then fed to H a feed-forward network.

$$\hat{y} = H([v_1, v_2])$$

$\hat{y}$ is the required output prediction from the network.

Intra Sentence Attention

$$f_{ij} \coloneqq F_{\text{intra}}(a_i)^T F_{\text{intra}}(a_j)$$

where F_{intra} is a feed-forward network.

$$a_i' \coloneqq \sum_{j=1}^{l_a} \frac{\exp(f_{ij} + d_{i-j})}{\sum_{k=1}^{l_a} \exp(f_{ik} + d_{i-k})} a_j$$

Embeddings and Dataset

We make use of the Stanford Natural Language Inference Dataset (SNLI) as it is the standard benchmark used for evaluation natural language inference models. The Stanford Natural Language Inference (SNLI) corpus (version 1.0) is a collection of 570k human-written English sentence pairs manually labeled for balanced classification with the labels *entailment*, *contradiction*, and *neutral*.

We make use of the GloVe Word Embeddings as it is able to capture the global statistics, ie. word co-occurrences in its word vectors.

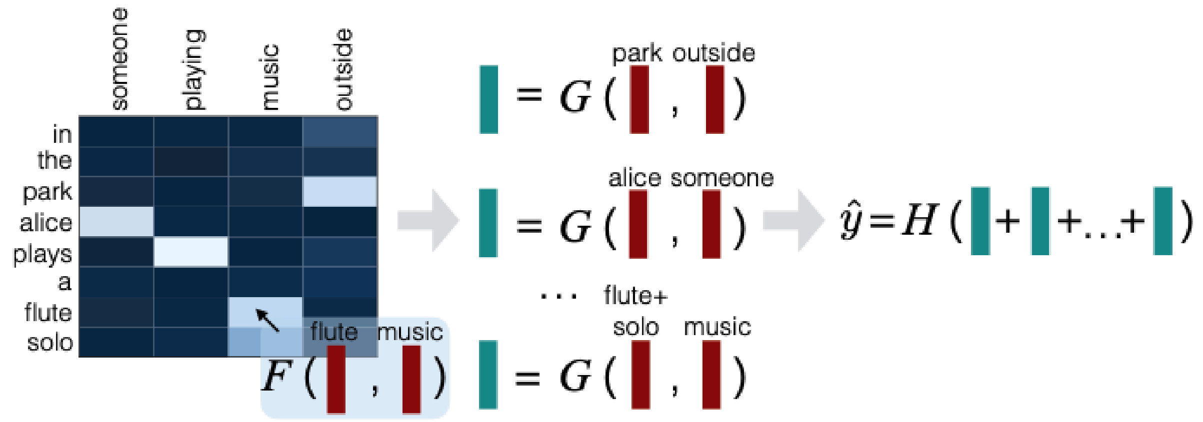
Model Pipeline

The following is the pipeline of the model.

Stage-1: Attention,

Stage-2: Comparison

Stage-3: Aggregation

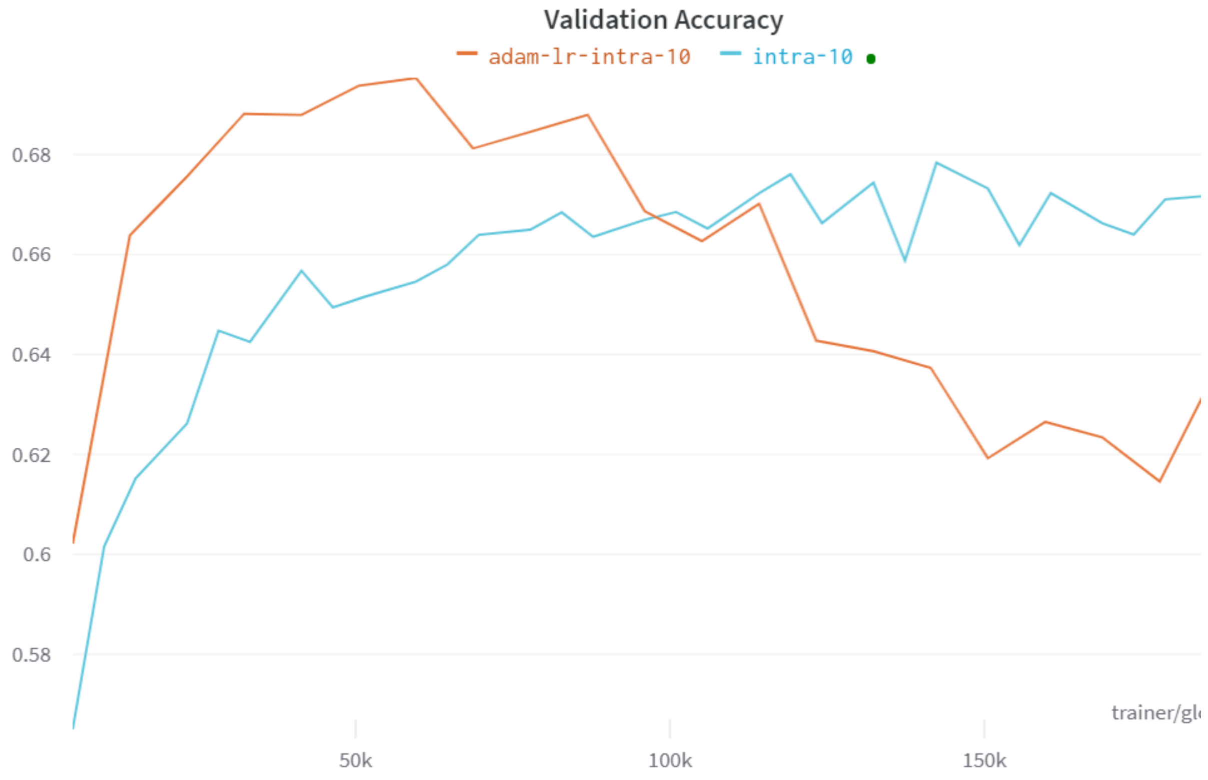


Main Results

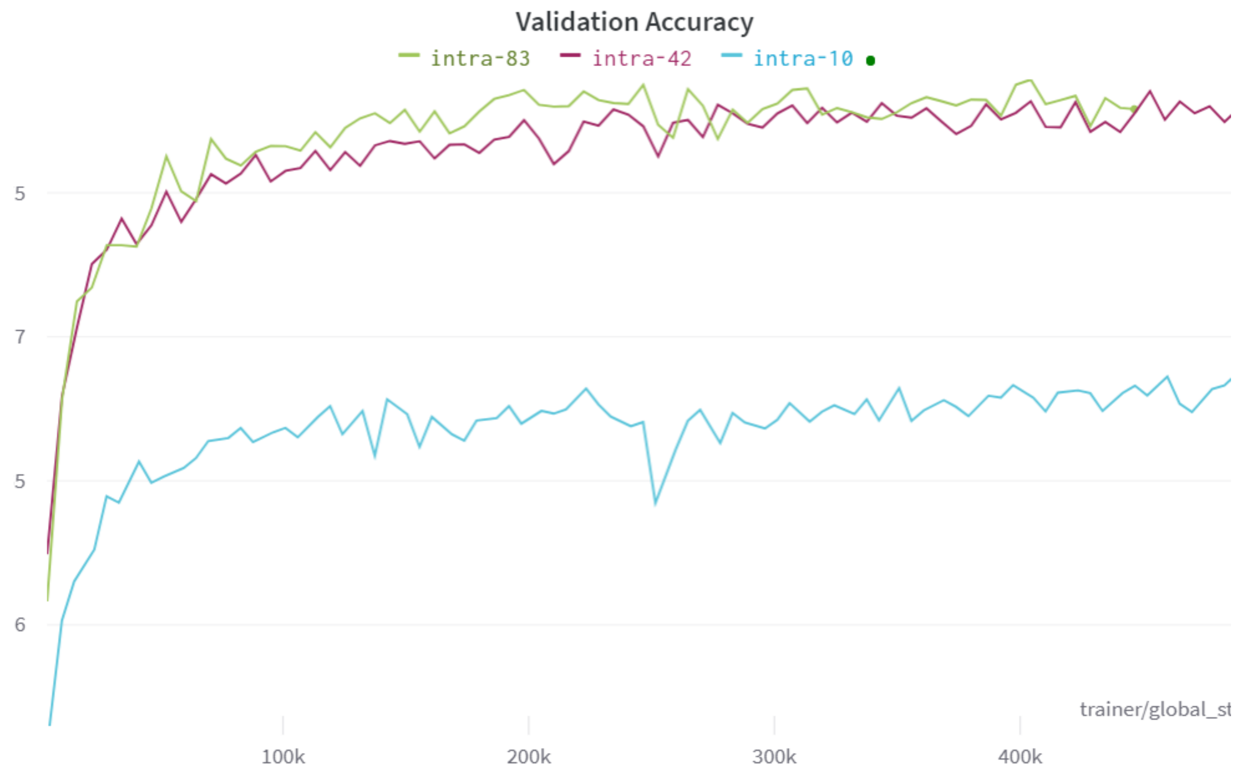
The table shows the main results obtained from the code. It is crucial to note that our results are supposed to be somewhat worser due to the difference in the implementation of max_length and dataloader. The original code throws away examples of the dataset that might be harder to train/test on, while we still train on those examples.

	Hyperparameters					Accuracy		
S. No.	**Sentence Length**	**Intra**	**LR**	**Optimizer**	**Epochs**	**Train**	**Dev**	**Test**
1	10	No	0.05	Adagrad	250	78	72	77
2	10	No	0.001	Adagrad	250	71	68	67
3	42	No	0.05	Adagrad	150	84	83	82
4	10	Yes	0.001	Adam	100	65	62	63
5	10	Yes	0.05	Adagrad	150	72	69	69
6	42	Yes	0.05	Adagrad	150	80.4	78.3	77.4
7	83	Yes	0.05	Adagrad	150	80.3	78.9	78.4

Ablative Studies



Ablation in Optimizer



Ablation in Max Sequence Length

Thank You