Learning Spoken Language Representations with Neural Lattice Language Modeling

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Code available at https://github.com/MiuLab/Lattice-ELMo
The idea of LM pretraining is adopted on lattices

We introduce a lattice language modeling objective

A 2-stage framework is proposed for learning contextualized representations of lattices efficiently
Task: Spoken Language Understanding

- Intuitive way for SLU: pipelined approach

- ASR errors affects downstream tasks

We can preserve uncertainty using ASR lattices
Preserve uncertainty using ASR lattices

• Lattices:
  directed acyclic graphs which encode several ASR hypotheses
Preserve uncertainty using ASR lattices

Using lattices helps

LM pre-training helps

LatticeRNN

ELMo

Can we combine them together?
Lattice language modeling

• Use LatticeLSTM to encode nodes of a lattice

• Ask the model to predict the outgoing transitions (words) given a node’s representation

• When the lattice has only one hypothesis, this reduces to normal language modeling
Lattice language modeling

- So now we can pre-train a LatticeELMo!

- However, LatticeLSTM runs prohibitively slow

- Observation: sequential text is actually a lattice with only one hypothesis

  => normal LM pretraining is also lattice LM pretraining

We can do pre-training in two stages!
Two-stage pre-training

Stage 1: Pre-Training on Sequential Texts

Stage 2: Pre-Training on Lattices

Training Target Task Classifier

classification

Max pooling

LatticeLSTM
Results

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<th>ATIS</th>
<th>SNIPS</th>
<th>SWDA</th>
<th>MRDA</th>
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Conclusion

• We extend the sequential LM objective to a lattice language modeling objective

• We propose a 2-stage framework for learning contextualized representations of lattices efficiently

• Experiments on various SLU tasks show that our proposed framework provides consistent improvements
Thanks for listening!

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