Our Contributions

- Extend the existing neural grid model, propose a novel coherence model for written asynchronous conversations (e.g., forums, emails), and show its applications in coherence assessment and thread reconstruction tasks.

Entity Grid and Its Extensions

Barzilay and Lapata (2008)
- Model grammatical role transmission of nouns (heads of NPs) across sentences
- Represent documents as distributions defined over entity transition (vectors of $i^t$ transitions probabilities $\{S, O, X, i\}$)
- Assessment of text coherence as a ranking problem in an SVM preference ranking framework

Nguyen and Joty (2017)
- A neural version of the grid model
- Transform each grammatical role in grid into distributed representation, then employ 1D convolution to model entity transitions
- Train in end-to-end fashion on target tasks

Limitations of entity grid models and their extensions
- Do not consider any lexical information regarding the entities
- Only focus on monologic discourse (e.g., news article)

Lexicalized Neural Entity Grid
- Attach the entity name with the grammatical roles
- Initialize entity-role embeddings randomly, or with pre-trained word embeddings for the entity

Coherence Models for Asynchronous Conversations

(a) Thread structure of a conversation
(b) Entity role transition
(c) 2D role transition matrix

Our Proposed Tree-level Model

Figure: Conversational Neural Grid model for assessing coherence in asynchronous conversations

- Key hypothesis: In coherent conversations, entities exhibit certain local patterns in the conversation tree in terms of their distribution and syntactic realization
- Model conversational discourse structure using tree representation
- A 3D grid (entities, tree-depth and paths) for representing entity roles
- Employ 2D convolution to model two-dimensional spatial entity transitions in a conversation tree

Baseline:
- Temporal: disregarding tree structure, and consider a conversation as a monologue
- Path-level: disregarding left-to-right (breadth) structure of a tree
  - Consider each path in a conversation separately
  - Coherence score is computed by averaging scores of its paths

Thread Reconstruction Task

- Goal: building a predictive model to uncover the thread structure of a conversation from its posts
  - A model can recover the tree structure in Figure (a) from the sequence of posts $\{p_1, p_2, \ldots, p_6\}$
- Training: a tree-level coherence model that distinguishes a gold tree (original reply structure) from a set of false candidate trees (respecting chronological order of the comments but false reply structure)
- Inference: selecting the structure with the highest coherence score

Evaluation on Thread Reconstruction

Table: Discrimination results on the WSJ dataset.

<table>
<thead>
<tr>
<th>Model</th>
<th>Emb.</th>
<th>Std</th>
<th>Inv</th>
<th>($P_i$)</th>
</tr>
</thead>
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<tr>
<td>Grid (E&amp;C)</td>
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<td>Ext. Grid (E&amp;C)</td>
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<tr>
<td>Ext. Neural Grid (N&amp;J)</td>
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<td>88.56</td>
<td>88.23</td>
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</table>

Table: Discrimination results on the CNET dataset

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<th>Inv</th>
<th>($P_i$)</th>
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</table>

Conclusion

- Extend existing neural grid model by lexicalizing its entity transitions
- Adapt the model to conversational discourse
- Design a 3D grid representation for capturing spatio-temporal entity transitions in a conversation tree
- Yield state-of-the-art results on standard coherence assessment tasks in monologues and conversations

Future work:
- Generate new conversations based on coherence degree

Code and Data

https://ntunlpsg.github.io/demo/project/coherence/n-coh-acl18/