Simulating Action Dynamics with Neural Process Networks

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Understanding by Simulation

• Label syntactic and semantic categories for surface words
• Strong focus on what is explicitly stated in text

1) Slice apples into pieces.  3) Lay them in the pie sheet.
2) Saute them until browned.  4) Bake for 30 minutes.

Understanding by Simulation

• Simulation of causal effects of descriptions in text
• Strong focus on what is implied in text
• MemNNs (Sukhbaatar et al., 2015; EntNet (Henaff et al., 2016)

Action-Oriented Simulation

“Wash and slice the apples”

Action Function

Embeddings

Action Applicator

Entity State

Embeddings

Approach:
• Action function embeddings transform entity state embeddings
• Entity states tracked through time by embedding representation
• Current state of entity encoded in state embedding
• Crowdsourced end state labels induced by actions
• Errors in predicting state backpropagate to action functions

• (2a) Select Entities
  • Step Attention: Compute individual attention weight for each entity embedding
  • Recurrent Attention: Attend over step’s attention weights and previous step’s attention
  • Use combined attention to compute entity vector

• (2b) Select Actions
  • Compute unnormalized attention weights over action embeddings
  • Compute action vector by weighing action embeddings by their attention weight

• (3) Apply action to entity
  • Compute bilinear projection of action and entity vectors

• (4) Predict state changes
  • Individual classifiers predict state changes of new entity

• (5) Update Entity Memory
  • Entity embeddings updated relative to attention weight during selection (2a)

• (1) Encode sentence