Neural AMR: Sequence-to-Sequence Models for Parsing and Generation

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What is AMR

AMR – Abstract Meaning Representation

A method to define “Who did what to whom?”

Forms:

Conjunctions of logical triples

Rooted, labeled, directed, graph

English sentence: "I do not understand", said the little prince.

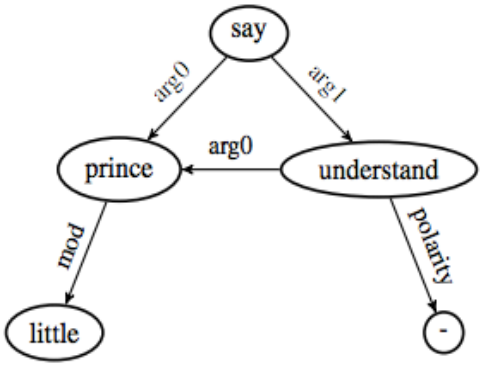
Logic format:

∃ s, p, l, u, -:
instance(s, say-01) ∧ instance(p, prince) ∧ instance(l, little) ∧ instance(u, understand) ∧ instance(-, -) ∧ arg0(s, p) ∧ arg1(s, u) ∧ (u, p) ∧ mod(p, l) ∧ polarity(u, -)

AMR format (PENMAN notation):

```
(s / say-01
  :arg0 (p / prince
           :mod (l / little))
  :arg1 (u / understand-01
           :arg0 p
           :polarity -))
```

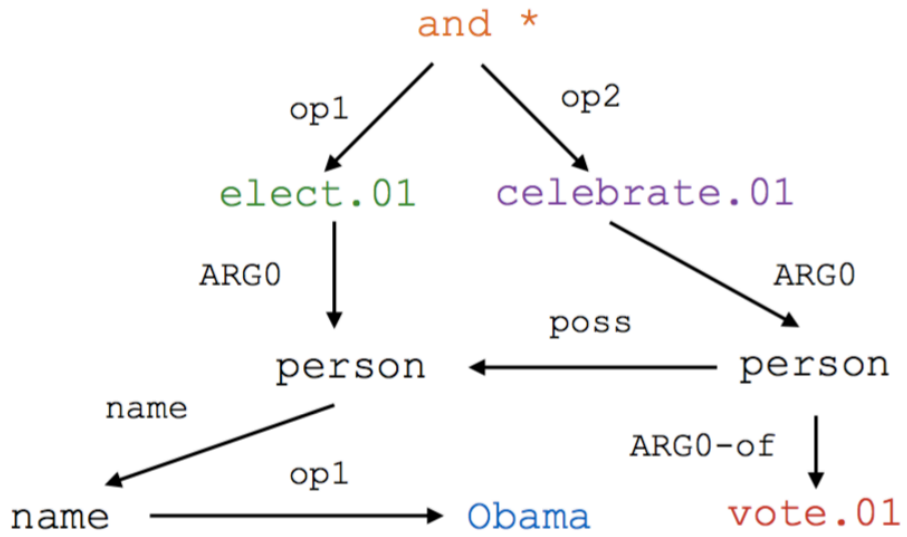
Graph format:



1. Variables (graph nodes) for entities, events, and states.
2. Each node in the graph represents a semantic concept.
3. Concepts can either be English words (prince), PropBank framesets (say-01),or special keywords

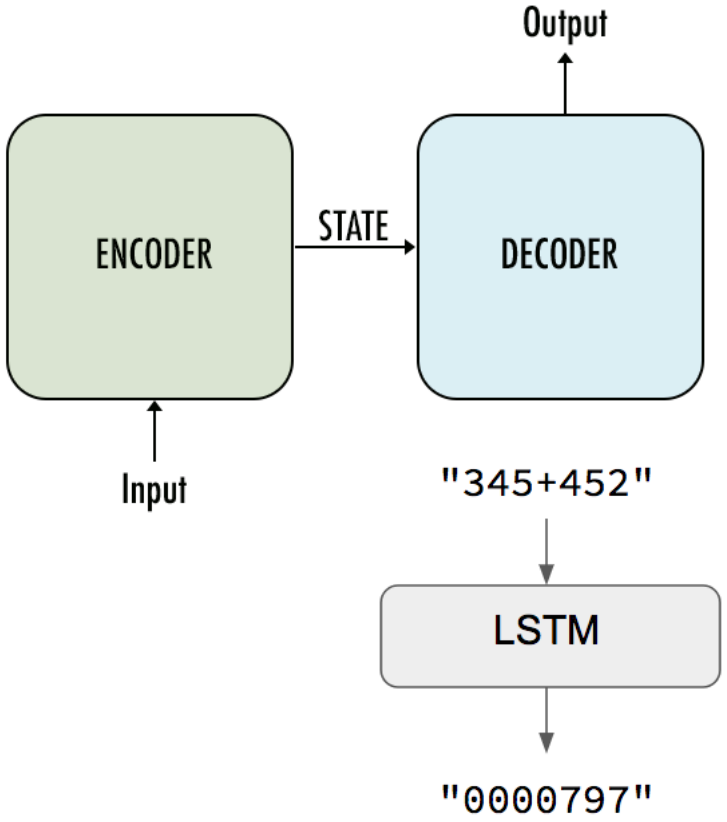
AMR – Example

Obama was elected and his voters celebrated



Seq2seq Model

Sequence-to-sequence learning (Seq2Seq) is about training models to convert sequences from one domain to sequences in another domain, by constructing an encoder and decoder.



Method Outline - Tasks

With a pair of natural sentence s, and AMR a, train an AMR parser to predict AMR a for sentence s, and a AMR generator to predict sentence s with AMR a.

Method Outline – Seq2seq Model

- Stacked bidirectional-LSTM Encoder and Decoder
- Encode an input sequence and to decode from the hidden states produced by the encoder.
- Concatenate the forward and backward hidden states at every level of the stack instead of at the top of the stack.
- Introduce dropout in the first layer of the encoder

Method Outline - Pair Training

1. Input: Training set of sentences and associated AMR graphs
2. Output: AMR parser and AMR generator
3. Self-training: (1) parse samples from a large, unlabeled corpus, (2) create a new set of parameters by training on the previous iteration, and (3) tuning parameters. AMR Parser
4. Use Parser to label AMRs for corpus

Method Outline - Pair Training

1. Generated expensive AMR associated corpus
2. Increased the sample size for Seq2Seq Model
3. Reduced Sparsity

Method Outline – AMR Preparation

1. Graph Simplization
2. Dates Anonymization
3. Name Entity Clustering

Methods Outline – AMR Preparation

US officials held an expert group meeting in **January 2002** in **New York**.

```
(h / hold-04
  :ARG0 (p2 / person
    :ARG0-of (h2 / have-org-role-91
          :ARG1 (c2 / country
            :name (n3 / name
              :op1 "United" op2: "States"))
          :ARG2 (o / official)))
  :ARG1 (m / meet-03
    :ARG0 (p / person
          :ARG1-of (e / expert-01)
               :ARG2-of (g / group-01)))
  :time (d2 / date-entity :year 2002 :month 1)
  :location (c / city
    :name (n / name :op1 "New" :op2 "York")))
```

(a) **US** officials held an expert group meeting in **January 2002** in **New York**.

```
hold
  :ARG0 person :ARG0-of have-org-role :ARG1 country :name name :op1
United :op2 States :ARG2 official
  :ARG1 meet :ARG0 person :ARG1-of expert :ARG2-of group
  :time date-entity :year 2002 :month 1
  :location city :name name :op1 New :op2 York
```

(b) country_0 officials held an expert group meeting in month_0 year_0 in city_1.

```
hold
  :ARG0 person :ARG0-of have-org-role :ARG1 country_0 :ARG2 official
  :ARG1 meet :ARG0 person :ARG1-of expert :ARG2-of group
  :time date-entity year_0 month_0
  :location city_1
```

(c) loc_0 officials held an expert group meeting in month_0 year_0 in loc_1.

```
hold
  :ARG0 person :ARG0-of have-org-role :ARG1 loc_0 :ARG2 official
  :ARG1 meet :ARG0 person :ARG1-of expert :ARG2-of group
  :time date-entity year_0 month_0
  :location loc_1
```

(d) loc_0 officials held an expert group meeting in month_0 year_0 in loc_1.

```
hold
  :ARG0 ( person :ARG0-of ( have-org-role :ARG1 loc_0 :ARG2 official ) )
  :ARG1 ( meet :ARG0 ( person :ARG1-of expert :ARG2-of group ) )
  :time ( date-entity year_0 month_0 )
  :location loc_1
```

Methods Outline – AMR Preparation

1. Reduced complexity
2. Addressed open domain vocabulary entries, such as named entities.

Key Takeaways

1. A novel approach of using Seq2seq model on AMR decoding and encoding though details to be dicussed.
2. Reduced Sparsity by paired training
3. Open-domain capability for unlabeled dataset

Thank You