Preprocessing event sequence descriptions

Jelke Bloem

Supervised by Manfred Pinkal, Michaela Regneri

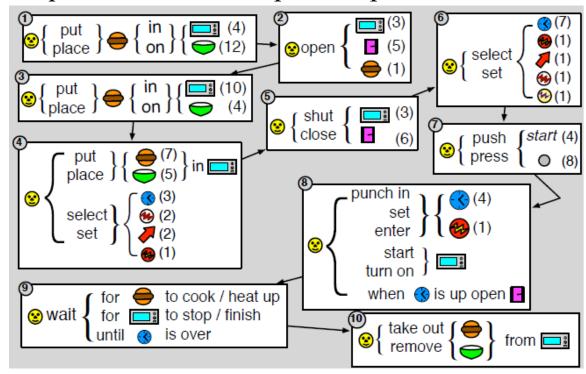# Scripts

- Temporal sequence of events

- Common sense knowledge

- Scripts describe scenarios

Eat in a restaurant – Go shopping – Cook pasta – Use a toaster

- In natural language, such information is generally left implicit
  - Assumed background knowledge

Modeling scripts

- Protagonist (you)

- Participants (food, microwave)

- Sequence of actions (place, open)

Regneri et al. (2010)

Data

- Obtaining 'implicit' data?
  - Ask people

- Collected 'Event Sequence Descriptions' on Amazon Mechanical Turk
  - Present a scenario
  - Ask for a temporally ordered description
  - Bullet point style
  - Max. 15 lines

Regneri et al. (2010)

Create a homepage

1. sit at the computer
2. pull up webpage software
3. write in content
4. find outside content
5. set up links to other content
6. FTP creation to your website
7. test your homepage
8. edit as necessary

1. Get web page builder account
2. Save images to hard drive
3. upload page images to account
4. write the content text
5. place images on page
6. add a web page visitor counter
7. add a guest book
8. save the page
9. place in search engines

Data

- Old data: 22 scenarios, various domains

- New data: 50 scenarios, cooking domain

- For each scenario, we now have a number of ESDs (20-30), written by different people

- Other forms of data gathering are being developed

The process

- Data collection

- Preprocessing

- Sequence alignment

- Modeling
  - Actions
  - Participants
  - …

Preprocessing

- Standardization/cleanup to make it easier to perform NLP tasks on the data

- Old data: Manual preprocessing
  - Costs time and HiWis
  - Not scalable

- New and future data: Automatic preprocessing
  - Also costs HiWis, but can be used on all future data

Preprocessing

- Spelling correction
- Outlier filtering
- Finding non-temporal events
- Part-of-speech tagging
- Pronoun resolution
- Splitting events
- Explicating other implicit information

Spelling

```
Prepare fresh ginger:
get fresh ginder
get a pealer and peal of the skin
get a microplane grater and grate the ginger
let the grated ginger fall into a bowl
```

- Aspell
  - Input a word
  - Aspell performs spell check
  - If incorrect: Aspell provides ranked suggestions from its dictionary
  - Suggestions can be used for spelling correction

Using other event descriptions

- Aspell is not perfect
- We have 20-30 descriptions of the same scenario

- Spell checking:
  - If a 'wrong' word occurs in enough other descriptions, maybe it is not wrong?
    - microplane grater, Parmesan cheese
- Spelling correction:
  - Only pick suggested words that are used in other descriptions
  - Splitting words

Evaluation

- Tried to compare to existing manual correction
- Spellcheck:
  - 21% false positives
- Spelling correction:
  - Precision (all): 63.6%
  - Precision (semantic): 75%
  - Precision on true positives: 83%

oarage -> orange   Good correction

downwards -> downward   Not correct, no semantic change

doneness -> oneness   Not correct, semantic change

Evaluation

- Recall?
  - Would have to annotate all the data, rather than just the errors

- For two files, compared to Microsoft Word
- Slice bread:
  - Word: 22 errors found, 10 false positive
  - Modified Aspell: 14 errors found, 5 false positive
- Zest a lemon:
  - Word: 14 errors found, 7 false positive
  - Modified Aspell: 6 errors found, 0 false positive

Outliers

Slice a loaf of bread:

take out the bread and a bread knife

we opened bags and bags of donated days old loaves of bread

place the bed lengthwise on the cutting board

swiped a big gob of mayo / mustard mix onto each slice and put two pieces of meat on one side made the sandwich and then bagged it .

pick up the knife and line it up with the bread

we made two boxes of 60 sandwiches each

saw the bread to the bottom

as we opened loaf after loaf i noticed that some loaves give you 8 sandwiches some give you seven and some give you ten .

repeat in 1 / 4 inch slices

Outliers

- Not sequential:
  - Checklist style
  - General instructions
  - Scrambled
  - List of different ways to perform the task
- List of scenarios (too high level)
- Numbered steps
- Wrong task
- Irrellevant steps

Prepare carrots and potatoes

```
boil a pot of water
place cleaned carrots into pot
place quartered potatos into pot
remove potatos and carrots when tender
```

Outliers

- Similarity problem
  - Bag-of-words model: outliers contain different words
  - Using alignment cost of sequence alignment step
  - Semantic similarity measures
- Feature-based classification problem
  - Number of spelling mistakes
  - Length of sequence
  - Number of discourse connectives
  - …

- The cooking data has few outliers

Non-temporal events

Carve a chicken:

cut by the breast bone with a sharp knife .

gently pull knife down repeating this till you get close to the bone .

cut in half in thick slices .

be cafeful knives are sharp . ask an adult for help !

enjoy !

first cook your chicken .   carving is for cooked chickens . breaking down a raw chicken is a whole different thing .

Part-of-speech tagging

- Retrained Stanford parser
  - 50% normal data
  - 50% sentences without subject

- Part-of-speech tags and dependencies are used for some pre-processing tasks

Pronouns

```
place the kiwi onto a cutting board.
cut it in slices horizontally.
```

- Find out which antecedent the pronouns refer to

- Tried EM-based pronoun resolution system (Charniak & Elsner, 2009)
  - Low recall
  - Tendency to use the same referent for all pronouns in an ESD
- Domain-specific heuristics

Pronouns

- Domain-specific heuristics

- 1st and 2nd person pronoun always refers to the protagonist
- 3rd person pronouns can refer to:
  - Previous direct object (most probable)
  - NP in the scenario title ('prepare a kiwi fruit')
  - Earlier direct object up to the last unbound one
- Long distance references occur rarely

- Grammatical constraints?
- Selectional constraints?

Pronouns and references

take your onion and remove the outer skin.

take you knife and chop it in half.

get a cutting board

get a bread knife

put the bread on the cutting board

hold onto the middle and cut the heel off

keep slicing at whatever thickness you want

keep moving your holding point so you can slice it until the end

- For modeling, each reference should be clear
  - 'the cutting board' is fine, 'it' is not

Splitting events

- One temporal event per bullet point

trim off the wingtips with a chef's knife and then cut the wing pieces from the body .

use meat scissors to cut the wings and legs

leave as is or dice depending on needs .

after the chicken has been cooked, you should lay it on a cutting board .

- Split by sentence boundaries

- Conjunction of VPs with the word 'and' should be split

- Commas with other temporal discourse connectives?

Other implicit information

Take a loaf of bread, a cutting board, and a knife
Hold the bread and the knife

- How many events?

remove wings from rested chicken .
position carving knife slightly angled at the side
  of one breast .
slowly cut half in thick slices until at breast bone .
turn chicken over and repeat with other breast
remove drumsticks .
the rest of the meat can be sliced off or pulled .

Conclusions

- Task-specific heuristics seem to do better

- Bullet point style limits complexity of the language used

  - Natural language is messy

- Can't say if automatic preprocessing improves script modeling yet

  - Model is also being worked on

Preprocessing

- Spelling correction
- Outlier filtering
- Finding non-temporal events
- Part-of-speech tagging
- Pronoun resolution
- Splitting events
- Explicating other implicit information

Discussion

- More heuristics?
  - Handling disjunctions
    - Take off the stove or boil for longer, depending on softness
  - Handling other semantic relations (part-whole)
    - Slice your bread. Put one half away, and the other half…
  - Handling non-temporal events (verb aspect, keywords)
    - Be careful, knives are sharp!
  - Handling other forms of ellipsis
  - Verb semantics for pronoun resolution
  - Domain-specific dictionary for spelling correction

References

Eugene Charniak and Micha Elsner. 2009. EM works for pronoun anaphora resolution. In *Proceedings of EACL*, Athens, Greece.

M. Regneri, A. Koller, and M. Pinkal. Learning script knowledge with web experiments. In *Proceedings of the 48th Annual Meeting of the Association for Computational Linguistics*, pages 979–988. Association for Computational Linguistics, 2010.

M. Regneri, A. Koller, J. Ruppenhofer and M. Pinkal. Learning Script Participants from Unlabeled Data. *Proceedings of RANLP*, 2011.