CROWN: Conversational Passage Ranking by Reasoning over Word Networks

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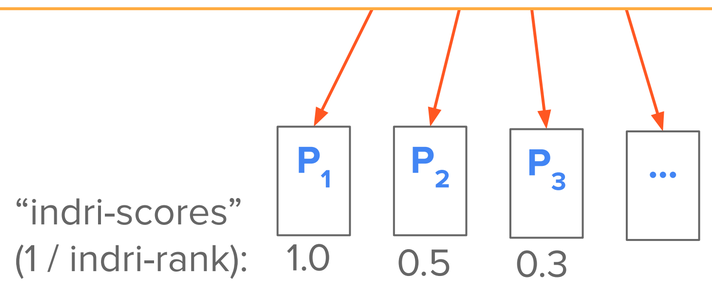
SAMPLE CONVERSATION

Turn 1: What flowering plants work for cold climates?
Turn 2: How much cold can pansies tolerate?
Turn 3: What's the UK hardiness rating?

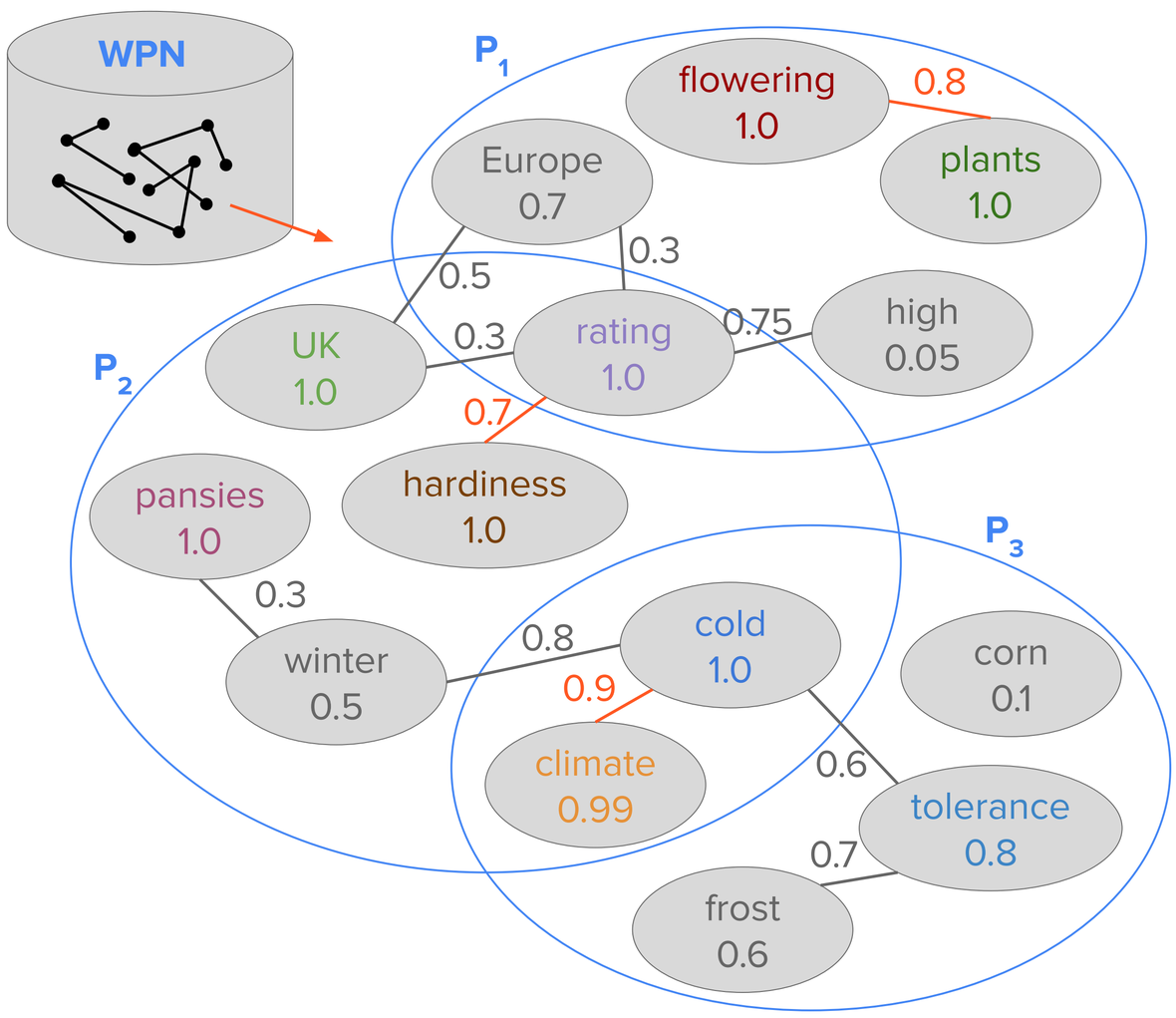
1. Query expansion

< $\mathbf{w_1}$ (flowering plants cold climates) $\mathbf{w_2}$ (pansies tolerate)
$\mathbf{w_3}$ (UK hardiness rating) >
with weights $w_1 = 1.0$, $w_2 = 0.5$, $w_3 = 1.0$

2. Candidate passage retrieval



3. Node and edge weight calculation



node-score(P_2) = $\mathbf{w_1}$* (0.99 + 1.0) + $\mathbf{w_2}$* 1.0 + $\mathbf{w_3}$* (1.0 + 1.0 + 1.0)
edge-score(P_2) = 0.9 + 0.7

4. Final passage scoring

score(P_i) = $\mathbf{h_1}$* indri-score(P_i) + $\mathbf{h_2}$* node-score(P_i) + $\mathbf{h_3}$* edge-score(P_i)
with hyperparameters h_1, h_2 and h_3

ANSWER:

"Winter pansies have a hardiness rating of H5 in the UK. They can survive cold climate. Furthermore, they..." [P_2]

MOTIVATION

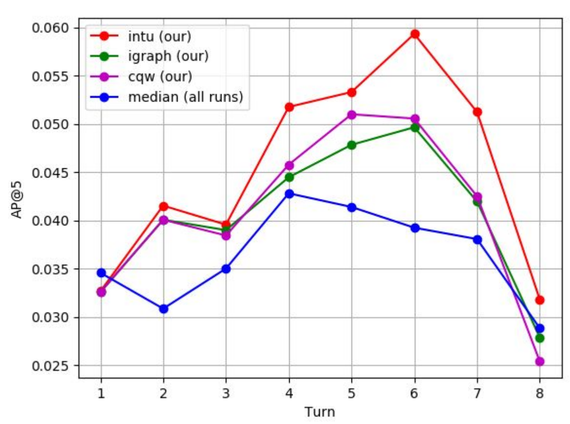
- ★ Information needs rarely one-off
- ★ Users ask several **follow-up queries** on a topic of interest
- ★ Follow-up queries possibly **incomplete** and **ungrammatical**, with references to previous turns
- ★ **Key challenge:** Understand context left **implicit** by user

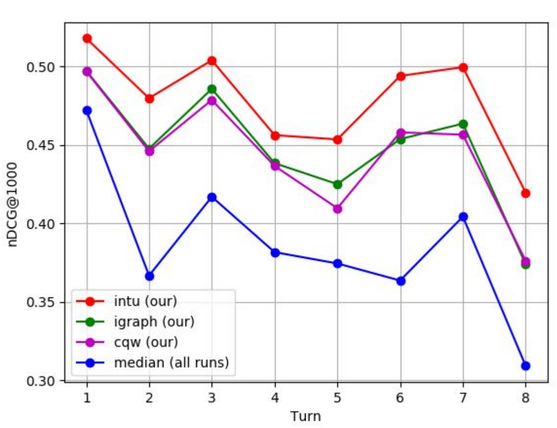
METHOD

- ★ CROWN is an **unsupervised** method for passage ranking
- ★ Pseudo-relevant passages obtained with any standard retrieval system (e.g. Indri) using an **expanded conversational query**
- ★ CROWN models passage relevance as a combination of **similarity** and **coherence**
- ★ Creates a **Word Proximity Network** (WPN) from any large corpus as backbone for passage scoring
- ★ The WPN stores statistically **significant co-occurrences** of words, **within a context window**, as measured by Normalized Pointwise Mutual Information (NPMI)
- ★ Similarity between query and passage terms measured in terms of **embedding vectors (node weights)**
- ★ Coherence measured using proximities of **significant pairs** of passage terms, that are similar to a query term **(edge weights)**

RESULTS

- ★ Method is **robust** with respect to **turn depth**
- ★ Submitted four runs that explored variations of CROWN
- ★ **Three out of four** were **better than median** performance over all submitted runs (with respect to **AP@5** and **nDCG@1000**) on evaluation data





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