WSDM 2023 Tutorial

Concluding Remarks: Knowledge-Augmented Methods for NLP

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Three Slides: Integrating Knowledge in NLP

- **Augment Knowledge for What? (a) Natural Language Understanding**
  - Text classification: Sentiment analysis, Fact verification
  - Information extraction: NER, Entity linking, Slot filling, Relation prediction
  - Question answering: Open-domain QA, Commonsense QA, Knowledge-base QA
- **Obtain Knowledge from Where?**
  - Wiki-based: Wikipedia, WikiData, Wiktionary
  - General domain: Freebase, DBpedia, YAGO
  - Specific domains: UMLS, ArnetMiner, DBLP
  - Commonsense: OMCS, ConceptNet
- **Use Knowledge via How?**
  - Entity linking based methods
    - ERNIE (ACL'19), KEAR (IJCAI'22), EaE (EMNLP'20), FILM (ACL'21), K-BERT (AAAI'20)
  - Retrieval based methods
    - DPR (EMNLP'20), REALM (ICML'20), REINA (ACL'22), RETRO ('21), WebGPT ('21)

Three Slides: Integrating Knowledge in NLP

- **Augment Knowledge for What? (b) Natural Language Generation**
  - Question answering: Question generation and Answer generation
  - Dialog systems: Response generation
  - Reasoning: Explanation generation
  - Machine translation; Summarization; Paraphrasing
- **Obtain Knowledge from Where?**
  - Structured knowledge (Knowledge graph): WikiData, Freebase, DBPedia, YAGO, ConceptNet
  - Unstructured knowledge (Grounded document): Wikipedia, Wiktionary, ArnetMiner, OMCS
- **Use Knowledge via How?**
  - Knowledge graph based methods
    - GRF (EMNLP'20), CCM (IJCAI'18), MoKGE (ACL'22)
  - Grounded document based methods
    - RAG (NeurIPS'20), RE-T5 (ACL'21), CMR (ACL'19)

Three Slides: Integrating Knowledge in NLP

- **Augment Knowledge for What? (c) Commonsense Reasoning**
  - "commonsense reasoning is a human-like ability to make presumptions about the type and essence of ordinary situations humans encounter every day."
  - Human-level AI
- **Obtain Knowledge from Where?**
  - Commonsense: OMCS, ConceptNet
- **Use Knowledge via How?**
  - KagNet (EMNLP'19), MHGRN (EMNLP'20), QA-GNN (NAACL'21)
  - GreaseLM (ICLR'22), GSC (ICLR'22)
  - CommonGen (EMNLP'20), KFCNet (EMNLP'21), KG-BART (AAAI'21), I&V (ICLR'22)
  - DrFact (NAACL'21): Concept-Fact Hypergraph, Dense fact embeddings

Future Directions

- Augment Knowledge for What?
  - **Desired properties: Accuracy, Diversity, Interpretability, etc.**
  - **Specialized domains: Technical support, Online education, Emotional support, Scientific discovery, etc.**
- Obtain Knowledge from Where?
  - **Heterogeneity: Multiple types of knowledge source data**
  - **Interconnectivity: Multiple knowledge fragments that are complementary or interconnected**
  - **Veracity: Multiple levels of reliability of information sources (Beyond verified information)** | **Scalability, etc.**
- Use Knowledge via How? **Your MAGIC!**

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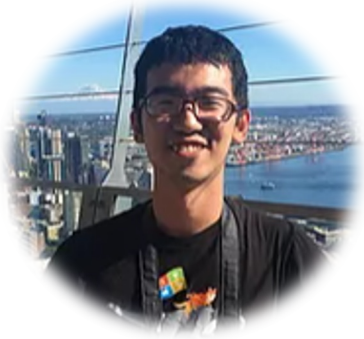

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