Part VIII

Conclusion

Tutorial Summary
Introduction to Open-domain Question Answering

- Problem definition, motivation, applications
- Brief historical review
  - One of the earliest AI challenges
  - TREC QA tracks
  - IBM Watson Deep QA
  - Machine reading comprehension

Tutorial Summary
Latest development on QA

- Popular datasets for training and evaluating open-domain QA
- Retriever + Reader
  - DrQA - Chen et al. 2017. *Reading Wikipedia to Answer Open-domain Questions.*
- Dense retriever and end-to-end training
  - ORQA - Lee et al. 2019. *Latent Retrieval for Weakly Supervised Open Domain Question Answering.*
- Retrieval-free
  - T5 - Roberts et al. 2020. *How Much Knowledge Can You Pack Into the Parameters of a Language Model?*

Tutorial Summary
Open-domain QA using KBs and text

- Introduction to open-domain QA using KBs
  - Properties of entity-centric knowledge bases
  - Pros and cons of using KBs for open-domain QA

- Recent work on using both text and KBs
  - Constructing graphs of heterogeneous nodes & edges
    - Sun & Dhingra et al. 2018. *Open Domain Question Answering Using Early Fusion of Knowledge Bases and Text.*
  - Leverage graphs for passage retrieval
    - Min et al. 2020. *Knowledge Guided Text Retrieval and Reading for Open Domain Question Answering.*

Open problems and future directions

- Hot topic: the two open-domain QA paradigms:
  Explicit context retrieval vs. knowledge encoded in models
  - Pros/Cons & Trade-off
  - Impact of large pre-trained models
  - Efficiency & accuracy

- Complete user experience
  - Rationale and evidence to support answers
  - Answer triggering: knowing when it doesn't know

- User interaction and grounding
  - Multi-turn, conversational QA
  - Multi-modal interactions (e.g., VQA, virtual tour guide)

References

1. Danqi Chen, Adam Fisch, Jason Weston, Antoine Bordes. Reading Wikipedia to Answer Open-Domain Questions. ACL 2017.
2. Shuohang Wang, Mo Yu, Xiaoxiao Guo, Zhiguo Wang, Tim Klinger, Wei Zhang, Shiyu Chang, Gerald Tesauro, Bowen Zhou, Jing Jiang. R^3: Reinforced Reader-Ranker for Open-Domain Question Answering. AAAI 2018.
3. Shuohang Wang, Mo Yu, Jing Jiang, Wei Zhang, Xiaoxiao Guo, Shiyu Chang, Zhiguo Wang, Tim Klinger, Gerald Tesauro, Murray Campbell. Evidence Aggregation for Answer Re-Ranking in Open-Domain Question Answering. ICLR 2018.
4. Yankai Lin, Haozhe Ji, Zhiyuan Liu, Maosong Sun. Denoising Distantly Supervised Open-domain Question Answering. ACL 2018.
5. Haitian Sun, Bhuwan Dhingra, Manzil Zaheer, Kathryn Mazaitis, Ruslan Salakhutdinov, William Cohen. Open Domain Question Answering Using Early Fusion of Knowledge Bases and Text. EMNLP 2018.
6. Alec Radford, Jeffrey Wu, Rewon Child, David Luan, Dario Amodei, Ilya Sutskever. Language Models are Unsupervised Multitask Learners. OpenAI 2019.
7. Wei Yang, Yuqing Xie, Aileen Lin, Xingyu Li, Luchen Tan, Kun Xiong, Ming Li, Jimmy Lin. End-to-end Open-domain Question Answering with BERTserini. NAACL 2019 (demonstration).
8. Kenton Lee, Ming-Wei Chang, Kristina Toutanova. Latent Retrieval for Weakly Supervised Open Domain Question Answering. ACL 2019.
9. Minjoon Seo, Jinhyuk Lee, Tom Kwiatkowski, Ankur P. Parikh, Ali Farhadi, Hannaneh Hajishirzi. Real-Time Open-Domain Question Answering with Dense-Sparse Phrase Index. ACL 2019.
10. Sewon Min, Danqi Chen, Hannaneh Hajishirzi, Luke Zettlemoyer. A Discrete Hard EM Approach for Weakly Supervised Question Answering. EMNLP 2019.
11. Haitian Sun, Tania Bedrax-Weiss, William W. Cohen. PullNet: Open Domain Question Answering with Iterative Retrieval on Knowledge Bases and Text. EMNLP 2019.
12. Sewon Min, Danqi Chen, Luke Zettlemoyer, Hannaneh Hajishirzi. Knowledge Guided Text Retrieval and Reading for Open Domain Question Answering. arXiv 2019.
13. Jinhyuk Lee, Minjoon Seo, Hannaneh Hajishirzi, Jaewoo Kang. Contextualized Sparse Representations for Real-Time Open-Domain Question Answering. ACL 2020.
14. Akari Asai, Kazuma Hashimoto, Hannaneh Hajishirzi, Richard Socher, Caiming Xiong. Learning to Retrieve Reasoning Paths over Wikipedia Graph for Question Answering. ICLR 2020.
15. Kelvin Guu, Kenton Lee, Zora Tung, Panupong Pasupat, Ming-Wei Chang. REALM: Retrieval-Augmented Language Model Pre-Training. ICML 2020.

References

16. Vladimir Karpukhin, Barlas Oğuz, Sewon Min, Patrick Lewis, Ledell Wu, Sergey Edunov, Danqi Chen, Wen-tau Yih. Dense Passage Retrieval for Open-Domain Question Answering. arXiv 2020.
17. Adam Roberts, Colin Raffel, Noam Shazeer. How Much Knowledge Can You Pack Into the Parameters of a Language Model?. arXiv 2020.
18. Patrick Lewis, Ethan Perez, Aleksandara Piktus, Fabio Petroni, Vladimir Karpukhin, Naman Goyal, Heinrich Küttler, Mike Lewis, Wen-tau Yih, Tim Rocktäschel, Sebastian Riedel, Douwe Kiela. Retrieval-Augmented Generation for Knowledge-Intensive NLP Tasks. arXiv 2020.
19. Tom B. Brown, Benjamin Mann, Nick Ryder, Melanie Subbiah, Jared Kaplan, Prafulla Dhariwal, Arvind Neelakantan, Pranav Shyam, Girish Sastry, Amanda Askell, Sandhini Agarwal, Ariel Herbert-Voss, Gretchen Krueger, Tom Henighan, Rewon Child, Aditya Ramesh, Daniel M. Ziegler, Jeffrey Wu, Clemens Winter, Christopher Hesse, Mark Chen, Eric Sigler, Mateusz Litwin, Scott Gray, Benjamin Chess, Jack Clark, Christopher Berner, Sam McCandlish, Alec Radford, Ilya Sutskever, Dario Amodei. Language Models are Few-Shot Learners. arXiv 2020.
20. R. F. Simmons. Answering english questions by computer: a survey. Communications of the ACM, 8(1):53-70, 1965.
21. Green, Wolf, Chomsky & Laughery, BASEBALL: An automatic question answerer. Computers and Thought, 1963.
22. Krisch. Computer Interpretation of English Text and Picture Patterns. IEEE Transactions on Electronic Computers, 1964.
23. Bobrow. Natural Language Input for a Computer Problem Solving System. 1964. Phd Thesis.
24. E. Brill, S. Dumais, and M. Banko. An analysis of the AskMSR question-answering system. EMNLP 2002.
25. A. M. Gliozzo, A. Kalyanpur, and J. Fan. Natural language processing in Watson. NAACL-HLT 2012 Tutorial.
26. S. Harabagiu and D. Moldovan. Open-domain textual question answering. NAACL-HLT 2001 Tutorial.
27. M. Richardson, C. J. Burges, and E. Renshaw. MCTest: A challenge dataset for the open-domain machine comprehension of text. EMNLP 2013.
28. E. M. Voorhees and D. M. Tice. Building a question answering test collection. SIGIR 2000.
29. X. Li and D. Roth. Learning Question Classifiers. COLING 2002.
30. W. Yih, M. Chang, X. He, and J. Gao. Semantic parsing via staged query graph generation: Question answering with knowledge base. ACL 2015.

Tutorial Summary
Introduction to Open-domain Question Answering

- Problem definition, motivation, applications
- Brief historical review
  - One of the earliest AI challenges
  - TREC QA tracks
  - IBM Watson Deep QA
  - Machine reading comprehension

Tutorial Summary
Latest development on QA

- Popular datasets for training and evaluating open-domain QA
- Retriever + Reader
  - DrQA - Chen et al. 2017. *Reading Wikipedia to Answer Open-domain Questions.*
- Dense retriever and end-to-end training
  - ORQA - Lee et al. 2019. *Latent Retrieval for Weakly Supervised Open Domain Question Answering.*
- Retrieval-free
  - T5 - Roberts et al. 2020. *How Much Knowledge Can You Pack Into the Parameters of a Language Model?*

Tutorial Summary
Open-domain QA using KBs and text

- Introduction to open-domain QA using KBs
  - Properties of entity-centric knowledge bases
  - Pros and cons of using KBs for open-domain QA

- Recent work on using both text and KBs
  - Constructing graphs of heterogeneous nodes & edges
    - Sun & Dhingra et al. 2018. *Open Domain Question Answering Using Early Fusion of Knowledge Bases and Text.*
  - Leverage graphs for passage retrieval
    - Min et al. 2020. *Knowledge Guided Text Retrieval and Reading for Open Domain Question Answering.*

Open problems and future directions

- Hot topic: the two open-domain QA paradigms:
  Explicit context retrieval vs. knowledge encoded in models
  - Pros/Cons & Trade-off
  - Impact of large pre-trained models
  - Efficiency & accuracy

- Complete user experience
  - Rationale and evidence to support answers
  - Answer triggering: knowing when it doesn't know

- User interaction and grounding
  - Multi-turn, conversational QA
  - Multi-modal interactions (e.g., VQA, virtual tour guide)

References

1. Danqi Chen, Adam Fisch, Jason Weston, Antoine Bordes. Reading Wikipedia to Answer Open-Domain Questions. ACL 2017.
2. Shuohang Wang, Mo Yu, Xiaoxiao Guo, Zhiguo Wang, Tim Klinger, Wei Zhang, Shiyu Chang, Gerald Tesauro, Bowen Zhou, Jing Jiang. R^3: Reinforced Reader-Ranker for Open-Domain Question Answering. AAAI 2018.
3. Shuohang Wang, Mo Yu, Jing Jiang, Wei Zhang, Xiaoxiao Guo, Shiyu Chang, Zhiguo Wang, Tim Klinger, Gerald Tesauro, Murray Campbell. Evidence Aggregation for Answer Re-Ranking in Open-Domain Question Answering. ICLR 2018.
4. Yankai Lin, Haozhe Ji, Zhiyuan Liu, Maosong Sun. Denoising Distantly Supervised Open-domain Question Answering. ACL 2018.
5. Haitian Sun, Bhuwan Dhingra, Manzil Zaheer, Kathryn Mazaitis, Ruslan Salakhutdinov, William Cohen. Open Domain Question Answering Using Early Fusion of Knowledge Bases and Text. EMNLP 2018.
6. Alec Radford, Jeffrey Wu, Rewon Child, David Luan, Dario Amodei, Ilya Sutskever. Language Models are Unsupervised Multitask Learners. OpenAI 2019.
7. Wei Yang, Yuqing Xie, Aileen Lin, Xingyu Li, Luchen Tan, Kun Xiong, Ming Li, Jimmy Lin. End-to-end Open-domain Question Answering with BERTserini. NAACL 2019 (demonstration).
8. Kenton Lee, Ming-Wei Chang, Kristina Toutanova. Latent Retrieval for Weakly Supervised Open Domain Question Answering. ACL 2019.
9. Minjoon Seo, Jinhyuk Lee, Tom Kwiatkowski, Ankur P. Parikh, Ali Farhadi, Hannaneh Hajishirzi. Real-Time Open-Domain Question Answering with Dense-Sparse Phrase Index. ACL 2019.
10. Sewon Min, Danqi Chen, Hannaneh Hajishirzi, Luke Zettlemoyer. A Discrete Hard EM Approach for Weakly Supervised Question Answering. EMNLP 2019.
11. Haitian Sun, Tania Bedrax-Weiss, William W. Cohen. PullNet: Open Domain Question Answering with Iterative Retrieval on Knowledge Bases and Text. EMNLP 2019.
12. Sewon Min, Danqi Chen, Luke Zettlemoyer, Hannaneh Hajishirzi. Knowledge Guided Text Retrieval and Reading for Open Domain Question Answering. arXiv 2019.
13. Jinhyuk Lee, Minjoon Seo, Hannaneh Hajishirzi, Jaewoo Kang. Contextualized Sparse Representations for Real-Time Open-Domain Question Answering. ACL 2020.
14. Akari Asai, Kazuma Hashimoto, Hannaneh Hajishirzi, Richard Socher, Caiming Xiong. Learning to Retrieve Reasoning Paths over Wikipedia Graph for Question Answering. ICLR 2020.
15. Kelvin Guu, Kenton Lee, Zora Tung, Panupong Pasupat, Ming-Wei Chang. REALM: Retrieval-Augmented Language Model Pre-Training. ICML 2020.

References

16. Vladimir Karpukhin, Barlas Oğuz, Sewon Min, Patrick Lewis, Ledell Wu, Sergey Edunov, Danqi Chen, Wen-tau Yih. Dense Passage Retrieval for Open-Domain Question Answering. arXiv 2020.
17. Adam Roberts, Colin Raffel, Noam Shazeer. How Much Knowledge Can You Pack Into the Parameters of a Language Model?. arXiv 2020.
18. Patrick Lewis, Ethan Perez, Aleksandara Piktus, Fabio Petroni, Vladimir Karpukhin, Naman Goyal, Heinrich Küttler, Mike Lewis, Wen-tau Yih, Tim Rocktäschel, Sebastian Riedel, Douwe Kiela. Retrieval-Augmented Generation for Knowledge-Intensive NLP Tasks. arXiv 2020.
19. Tom B. Brown, Benjamin Mann, Nick Ryder, Melanie Subbiah, Jared Kaplan, Prafulla Dhariwal, Arvind Neelakantan, Pranav Shyam, Girish Sastry, Amanda Askell, Sandhini Agarwal, Ariel Herbert-Voss, Gretchen Krueger, Tom Henighan, Rewon Child, Aditya Ramesh, Daniel M. Ziegler, Jeffrey Wu, Clemens Winter, Christopher Hesse, Mark Chen, Eric Sigler, Mateusz Litwin, Scott Gray, Benjamin Chess, Jack Clark, Christopher Berner, Sam McCandlish, Alec Radford, Ilya Sutskever, Dario Amodei. Language Models are Few-Shot Learners. arXiv 2020.
20. R. F. Simmons. Answering english questions by computer: a survey. Communications of the ACM, 8(1):53-70, 1965.
21. Green, Wolf, Chomsky & Laughery, BASEBALL: An automatic question answerer. Computers and Thought, 1963.
22. Krisch. Computer Interpretation of English Text and Picture Patterns. IEEE Transactions on Electronic Computers, 1964.
23. Bobrow. Natural Language Input for a Computer Problem Solving System. 1964. Phd Thesis.
24. E. Brill, S. Dumais, and M. Banko. An analysis of the AskMSR question-answering system. EMNLP 2002.
25. A. M. Gliozzo, A. Kalyanpur, and J. Fan. Natural language processing in Watson. NAACL-HLT 2012 Tutorial.
26. S. Harabagiu and D. Moldovan. Open-domain textual question answering. NAACL-HLT 2001 Tutorial.
27. M. Richardson, C. J. Burges, and E. Renshaw. MCTest: A challenge dataset for the open-domain machine comprehension of text. EMNLP 2013.
28. E. M. Voorhees and D. M. Tice. Building a question answering test collection. SIGIR 2000.
29. X. Li and D. Roth. Learning Question Classifiers. COLING 2002.
30. W. Yih, M. Chang, X. He, and J. Gao. Semantic parsing via staged query graph generation: Question answering with knowledge base. ACL 2015.