

# Muhao Chen

Email: [muhaochen@ucla.edu](mailto:muhaochen@ucla.edu) Homepage: <https://muhaochen.github.io/>

Tel: (424)-324-0494 Address: 2400 Chestnut St, Apt 1912. Philadelphia, PA 19103

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## Research Interests

*Representation learning for complex multi-relational data. Machine learning and commonsense reasoning for natural language understanding. Deep learning approaches to computational biology.*

## EDUCATION

### University of California, Los Angeles, USA

*Ph.D. In Computer Science*

2014.9-2019.6

*Dissertation: Multi-relational Representation Learning and Knowledge Acquisition Advisor: Carlo Zaniolo Collaborators: Kai-Wei Chang, Wei Wang, Yizhou Sun*

### Fudan University, Shanghai, China

*B.S. in Computer Science*

2010.9-2014.6

*Advisor: X. Sean Wang*

## PUBLICATIONS

\*Indicating equal contributions. ✉Indicating contact authors. ^Indicating advisee students.

### Refereed Journal Publications

1. **Muhao Chen**<sup>✉\*</sup>, Chelsea J. T. Ju<sup>\*</sup>, Guangyu Zhou, Tianran Zhang, Kai-Wei Chang, Carlo Zaniolo, Wei Wang. Multifaceted Protein-Protein Interaction Prediction Based on Siamese Residual RCNN. *Bioinformatics*, Oxford University Press. Proceedings of ISMB/ECCB, 2019.
2. Carlo Zaniolo<sup>✉</sup>, Shi Gao, Maurizio Atzori, **Muhao Chen**, Jiaqi Gu. User-Friendly Temporal Queries on Historical Knowledge Bases. In *Information and Computation*. Elsevier, 2018.

### Refereed Publication in Conference Proceedings

3. **Muhao Chen**, Yingtao Tian, Haochen Chen, Kai-Wei Chang, Steve Skiena, Carlo Zaniolo. Learning to Represent Bilingual Dictionaries. In *Proceedings of the 23rd SIGNLL Conference on Computational Natural Language Learning (CoNLL)*, 2019
4. **Muhao Chen**, Chris Quirk. Embedding Edge-attributed Relational Hierarchies. In *Proceedings of the 42<sup>nd</sup> ACM SIGIR Conference on Research and Development in Information Retrieval (SIGIR)*, 2019.
5. Junheng Hao, **Muhao Chen**, Wenchao Yu, Yizhou Sun, Wei Wang. Universal Representation Learning of Knowledge Bases by Jointly Embedding Ontological Concepts and Instances. In *Proceedings of the 25<sup>th</sup> ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD)*, 2019. (Oral presentation)
6. Xuelu Chen, **Muhao Chen**, Weijia Shi<sup>^</sup>, Yizhou Sun, Carlo Zaniolo. Uncertain Knowledge Graphs Embeddings. In the 33<sup>rd</sup> International Conference on Artificial Intelligence (AAAI), 2019.
7. Weijia Shi<sup>\*\*</sup>, **Muhao Chen**<sup>\*</sup>, Pei Zhou<sup>^</sup>, Kai-Wei Chang. Retrofitting Contextualized Word Embeddings with Paraphrases. In *Proceedings of the 24th Conference on Empirical Methods in Natural Language Processing (EMNLP)*, 2019 (Oral presentation)
8. Pei Zhou<sup>^</sup>, Weijia Shi<sup>^</sup>, Jieyu Zhao, Kuan-Hao Huang, **Muhao Chen**, Ryan Cotterell, Kai-Wei Chang. Examining Gender Bias in Languages with Grammatical Gender. In *Proceedings of the 24th Conference on Empirical Methods in Natural Language Processing (EMNLP)*, 2019
9. Qingheng Zhang, Zequn Sun, Wei Hu, **Muhao Chen**, Lingbing Guo, Yuzhong Qu. Multi-view Knowledge Graph Embedding for Entity Alignment. In *Proceedings of the 28<sup>th</sup> International Joint Conference on Artificial Intelligence (IJCAI)*, 2019.

10. Zequn Sun, Jiacheng Huang, Wei Hu, **Muhao Chen**, Yuzhong Qu. TransEdge: Translating Relation-contextualized Embeddings for Knowledge Graphs. In *the 18<sup>th</sup> International Semantic Web Conference (ISWC)*, 2019.
11. Haochen Chen, Syed Fahad Sultan, Yingtao Tian, **Muhao Chen**, Steven Skiena. Fast and Accurate Network Embeddings via Very Sparse Random Projection. In *Proceedings of the 28<sup>th</sup> ACM International Conference on Information and Knowledge Management (CIKM)*, 2019.
12. Changjun Fan, Yuhui Ding, Li Zeng, **Muhao Chen**, Yizhou Sun and Zhong Liu. Betweenness Centrality Estimation from Scratch: A Novel Graph Neural Network Based Approach. In *Proceedings of the 28<sup>th</sup> ACM International Conference on Information and Knowledge Management (CIKM)*, 2019.
13. **Muhao Chen**, Changping Meng, Gang Huang, Carlo Zaniolo. Learning to Differentiate Between Main-articles and Sub-articles in Wikipedia. In *IEEE International Conference on Big Data (BigData)*, 2019.
14. Yingtao Tian, Haochen Chen, Bryan Perozzi, **Muhao Chen**, Xiaofei Sun, Steven Skiena. Social Relation Inference via Label Propagation. In *the 40<sup>th</sup> European Conference on Information Retrieval (ECIR)*, 2019.
15. Qi Zhao, **Muhao Chen**, Pengyuan Du, Tuan Le, Mario Gerla. Towards Efficient Cellular Traffic Offloading via Dynamic MPTCP Path Configuration with SDN. In *IEEE International Conference on Computing, Networking and Communications (ICNC)*, 2019.
16. **Muhao Chen**, Gang Huang, Changping Meng, Carlo Zaniolo. Neural Article Pair Modeling for Wikipedia Sub-article Matching. In *the 29<sup>th</sup> European Conference on Machine Learning (ECML)*, 2018 (**Plenary Presentation**, ~1.7% acceptance rate)
17. **Muhao Chen**, Yingtao Tian, Kai-Wei Chang, Steven Skiena, Carlo Zaniolo. Co-training Embeddings of Knowledge Graphs and Entity Descriptions for Cross-lingual Entity Alignment. In *the 27<sup>th</sup> International Joint Conference on Artificial Intelligence (IJCAI)*, 2018.
18. **Muhao Chen**, Yingtao Tian, Xuelu Chen, Zijun Xue, Carlo Zaniolo. On2Vec: Embedding-based Relation Prediction for Ontology Population. In *Proceedings of the 17<sup>th</sup> SIAM International Conference on Data Mining (SDM)*. SIAM, 2018
19. Haochen Chen, Xiaofei Sun, Yingtao Tian, Bryan Perozzi, **Muhao Chen** and Steven Skiena. Enhanced Network Embeddings via Exploiting Edge Labels. In *the 27<sup>th</sup> ACM Conference on Information and Knowledge Management (CIKM)*. ACM 2018.
20. Pengyuan Du, Seunghyun Yoo, Qi Zhao, **Muhao Chen**, Mario Gerla. Towards Opportunistic Resource Sharing in Mobile Social Networks - an Evolutionary Game Theoretic Approach. In *Proceedings of the 19<sup>th</sup> ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc)*, ACM 2018.
21. **Muhao Chen**, Qi Zhao, Pengyuan Du, Carlo Zaniolo, Mario Gerla. Demand-driven Cache Allocation Based on Context-aware Collaborative Filtering. In *Proceedings of the 19<sup>th</sup> ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc)*, ACM 2018.
22. **Muhao Chen**, Yingtao Tian, Mohan Yang, Carlo Zaniolo. Multilingual Knowledge Graph Embeddings for Cross-lingual Knowledge Alignment. In *Proceedings of the 26<sup>th</sup> International Joint Conference on Artificial Intelligence (IJCAI)*. 2017.
23. **Muhao Chen**, Carlo Zaniolo. Learning Multi-faceted Knowledge Graph Embeddings for Natural Language Processing. In *Proceedings of the 26<sup>th</sup> International Joint Conference on Artificial Intelligence (IJCAI)*. 2017 (Extended abstract)
24. **Muhao Chen**, Shi Gao, X. Sean Wang. Converting Spatiotemporal Data Among Heterogeneous Granularity Systems. In *Proceedings of the 25<sup>th</sup> IEEE International Conference on Fuzzy Systems (FUZZ-IEEE)*. IEEE, 2016
25. **Muhao Chen**, Shi Gao, Jingheng Zhou, X. Sean Wang. Converting Spatiotemporal Data Among Multiple Granularity Systems. In *Proceedings of the 31<sup>st</sup> ACM SIGAPP Symposium on Applied Computing (SAC)*. ACM, 2016.

## Tutorial

26. **Muhao Chen**, Kai-Wei Chang, Dan Roth. Recent Advances in Transferable Representation Learning. **AAAI**, 2020 (accepted)

## Refereed Workshop and System Demonstration Papers

27. Weijia Shi<sup>^</sup>, **Muhao Chen**, Yingtao Tian, Kai-Wei Chang. Learning Bilingual Word Embeddings Using Lexical Definitions. In *Proceedings of ACL Workshop on Representation Learning for NLP (RepL4NLP)*, 2019.
28. Pei Zhou<sup>^</sup>, Weijia Shi<sup>^</sup>, Jieyu Zhao, Kuan-Hao Huang, **Muhao Chen**, Kai-Wei Chang. Examining Gender Bias in Languages with Grammatical Gender. In *ICML AI for Social Good Workshop (AISG)*, 2019.

29. Zhubo Deng<sup>^</sup>, Pei Zhou<sup>^</sup>, Weijia Shi<sup>^</sup>, **Muhao Chen**, Kai-Wei Chang. Computational Analysis of French-origin Reborrowing Process for English Loanwords. In *ICDM Workshop on Multilingual Cognitive Services (ICDMW)*, 2019
30. Changjun Fan, Yizhou Sun, Li Zeng, Yang-Yu Liu, **Muhao Chen**, Zhong Liu. Dismantle Large Networks through Deep Reinforcement Learning. In *ICLR Workshops*, 2019.
31. Yingtao Tian, Haochen Chen, Bryan Perozzi, **Muhao Chen**, Xiaofei Sun, Steven Skiena. Social Relation Inference via Label Propagation. In *the 14th KDD Workshop on Mining and Learning with Graphs (MLG)*, 2018.
32. Pei Zhou<sup>^</sup>, **Muhao Chen**, Kai-Wei Chang, Carlo Zaniolo. Quantification and Analysis of Scientific Language Variation by Research Fields. In *Proceedings of the ICDM Workshops (ICDMW)*, 2018.
33. **Muhao Chen**, Tao Zhou, Pei Zhou<sup>^</sup>, Carlo Zaniolo. Multi-graph Affinity Embeddings for Multilingual Knowledge Graphs. **Contributed talk** in the *6th Workshop on Automated Knowledge Base Construction at NIPS (AKBC)*. 2017.
34. Tao Zhou, **Muhao Chen**, Demetri Terzopoulos, Jie Yu. Attention-based Natural Language Person Retrieval. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops (CVPRW)*. IEEE, 2017.
35. Shi Gao, **Muhao Chen**, Maurizio Atzori, Carlo Zaniolo. SPARQL<sup>T</sup> and its User-Friendly Interface for Managing and Querying the History of Knowledge Bases. In *the 14<sup>th</sup> International Semantic Web Conference (ISWC)*, 2015 (demo).

## In Review

36. Guangyu Zhou<sup>\*</sup>, **Muhao Chen**<sup>\*</sup>, Chelsea J. T. Ju<sup>\*</sup>, Zheng Wang, Jyun-Yu Jiang, Wei Wang. Mutation effect estimation on protein-protein interactions using deep contextualized representation learning. In revision in *Nucleic Acids Res: Genom. & Bioinform.* Oxford University Press.
37. Xuelu Chen, **Muhao Chen**, Changjun Fan, Ankith Uppunda<sup>^</sup>, Yizhou Sun, Carlo Zaniolo. Cross-lingual Knowledge Graph Completion via Multi-embedding Ensemble Prediction. In review in *AAAI*, 2020.
38. Zequn Sun, Chengming Wang, Wei Hu, **Muhao Chen**, Jian Dai, Wei Zhang, Yuzhong Qu. Knowledge Graph Alignment Network with Gated Multi-hop Neighborhood Aggregation. In review in *AAAI*, 2020.
39. Changping Meng, **Muhao Chen**, Jie Mao, Bruno Ribeiro. ReadNet: A Hierarchical Self-Attention Framework for Readability Analysis. In review in *ECIR*, 2020.
40. Dat Duong, Ankith Uppunda<sup>^</sup>, Chelsea Ju, James Zhang, **Muhao Chen**, Eleazar Eskin, Jingyi Jessica Li, Kai-Wei Chang. Learning Representations for Gene Ontology Terms by Contextualized Text Encoders.

## PRESENTATIONS

1. Multi-relational representation learning and knowledge acquisition. *Invited talk at Stanford SNAP Seminar*. Jan 2019
2. Multi-relational representation learning and knowledge acquisition. *UCLA Machine Learning and Big Data Seminar*. Jan 2019
3. Neural Article Pair Modeling for Wikipedia Sub-article Matching. *Plenary talk at ECML 2018. Dublin, Ireland*. Sept 2018
4. Co-training Embeddings of Knowledge Graphs and Entity Descriptions for Cross-lingual Entity Alignment. *Conference talk at IJCAI 2018. Stockholm, Sweden*. July 2018
5. On2Vec: Embedding-based Relation Prediction for Ontology Population. *Conference talk at SDM 2018. San Diego, CA, USA*. May 2018
6. Multilingual Knowledge Graph Embeddings for Cross-lingual Knowledge Alignment. *Contributed talk at AKBC 2017. Longbeach, CA, USA*. Dec 2017
7. Neural Article Pair Modeling for Wikipedia Sub-article Matching. *Google Search Intelligence Seminar Talk*. Sept 2017
8. Multilingual Knowledge Graph Embeddings for Cross-lingual Knowledge Alignment. *Conference talk at IJCAI 2017. Melbourne, Australia*. Aug 2017
9. Converting Spatiotemporal Data Among Heterogeneous Granularity Systems. *Conference talk at FUZZ-IEEE 2016. Vancouver, Canada*. Aug 2016
10. Reasoning Across Multiple Spatiotemporal Granularity Systems. *Invited talk at Teradata Labs. El Segundo, CA, USA*. Mar 2015

## ACADEMIC SERVICES

### PC Member:

2020: AAAI, WSDM.

2019: AAAI, AKBC, NAACL, ACL, EMNLP-IJCNLP, IEEE BigData, NLPCC, WISE, ICSC.

2018: AAAI, EMNLP, IEEE BigData, IEEE WETICE, NLPCC, SoCal NLP, IEEE AIKE.

**Organization Committee:** 2019: IEEE AIKE (Doctoral Consortium Co-chair)

**Journal Reviewer:** TKDD, BMC Genomics, BMC Medical Genomics, Frontiers of Computer Science.

## WORK EXPERIENCES

### University of Pennsylvania, Philadelphia, USA

*Postdoctoral Fellow*

*2019.8-Present*

*CogComp Group*

**Research Intern,** Microsoft Research, Redmond, WA (NLP Group)

*2018.6-2018.9*

- *Embedding Edge-attributed Relational Hierarchies.* [4]

**Research Intern,** Google, Mountain View, CA (Google Knowledge Graph)

*2017.6~2017.9*

- *Neural Article Pair Modeling for Large-scale Sub-article Relation Extraction from Wikipedia.* [16,13]

**System SDE Intern,** Google, Mountain View, CA (Procella Real-time Data Infrastructure)

*2016.6~2016.9*

- *Dynamic Shard-partitioning for Large-scale Windowed Event Streams.*

**R&D Intern,** Teradata Labs, Los Angeles, CA (Optimizer Group)

*2015.6~2015.9*

- *Multi-task Learning for Cost-based Database Optimizers.*

## SELECTED AWARDS

*UCLA Dissertation Fellowship.* 2018-2019

*Google Research & Travel Support Archimedes Program.* 2018

*NSF Travel Grants.* 2016, 2017, 2018, 2019

*Research Grant of the National University Student Innovation Program.* Ministry of Education of China. 2014

*Tung OOCL Scholarships.* Tung's Foundation of Hong Kong & The Oriental Overseas Container Line. 2012, 2013

*Wang-Dao Fellowship.* President of Fudan University. 2013

*EMC Scholarship.* EMC Inc. 2013

*Chun-Tsung Fellowship.* Hui-Chun Chin and Tsung-Dao Lee Chinese Undergraduate Research Endowment. 2012

## TEACHING AND MENTORING EXPERIENCES

### Mentoring:

Pei Zhou (2017.6-2019.6, UCLA undergraduate student). Worked on semantic variation projects. Published in EMNLP'19\*2, ICDMW'18 '19, AKBC'17. Now Ph.D. student in USC.

Weijia Shi (2018.6-present, UCLA undergraduate student). Work on lexical semantics and knowledge graph projects. Published in EMNLP'19\*2, AAAI'19, Repl4NLP'19, ICDMW'19.

Chen, Muhao - CV

Ankith Uppunda (2019.3-2019.6, UCLA undergraduate student). Worked on knowledge graph and machine learning for proteins projects.

Zhubo Deng (2019.1-present, UCLA undergraduate student). Worked on bilingual loanwords detection projects. Published in ICDMW'19.

Xiaoshuang Wei (2016.10-2017.3, UCLA master student). Capstone project on machine learning for cost-based query optimizer. Now software engineer at Google.

**Teaching:**

Teaching assistant (2015.9-2016.6), associate (2016.9-2017.6), fellow (2017.9-2018.6) at UCLA (Data Structures; Introduction to Computer Science).

## ACADEMIC SOCIETY MEMBERSHIP BY NOMINATION

Sigma Xi (2019.9)