Yuan Sui

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Research Interests

[1] **Knowledge+NLP (K+NLP)**: Natural Language Processing, Deep Learning & Reasoning, Semantic Parsing, Transfer Learning, Big Model Probing
[2] **Data, Knowledge and Intelligence (DKI)**: Semi-structured Data Reasoning, Big Data Processing & Reasoning, Causal Inference, Knowledge Representation Learning

Education

Shandong Normal University, Jinan, China Sep. 19 – Expected Jul. 23
Bachelor of Engineering in Computer Science and Technology

- GPA: **3.78/5.0, 87.8/100** | Rank in major: 10/126 | First Prize Scholarship

Publications

Published:

[1] **Sui, Y**, Feng, S, Zhang, H, Cao, J, Hu, L & Zhu, N 2022, 'Causality-aware Enhanced Model for Multi-hop Question Answering over Knowledge Graphs', Knowledge-Based Systems, vol. 250, p. 108943. **[SCI-1, IF:8.139]**
[2] **Sui, Y**, Bu, F, Hu, Y, Zhang, L & Yan, W n.d., Trigger-GNN: A Trigger-Based Graph Neural Network for Nested Named Entity Recognition, 2022 International Joint Conference on Neural Networks (IJCNN '22), **[Oral, Core-ranking:B]**
[3] **Sui, Y**, Bu, F, Shao, X & Yan, W n.d., 'Optimization simulation of reflow welding based on prediction of regional center temperature field', Computer Simulation.
[4] **Sui, Y** 2021, 'Question answering system based on tourism knowledge graph', Journal of Physics: Conference Series, vol. 1883, no. 1, p. 012064.

Under-review:

[1] Yan, W, Shi, Y, **Sui, Y**, Tian, Z, Wang, W & Cao, Q, 'Intelligent Predictive Maintenance of Hydraulic Systems based on Virtual Knowledge Graph', Robotics and Computer Integrated Manufacturing. **[SCI-1, IF:10.103]**
[2] Yan, W, **Sui, Y**, Cao, Q & Zhang, L, 'Automatic Relation Recognition for Inventive Design.', Knowledge-Based Systems **[SCI-1, IF:8.139]**

Arxiv:

[1] **Sui, Y**, Ma, W, Lou, R, Zhang, K, Vosoughi, S, 'Trustworthy-transformer: Probing Transformer Attention Heads in Multi- and Cross-lingual Tasks', Prepared to submit to ACL'23 **[Core-ranking:A]**
[2] **Sui, Y**, Wang, S, Cheng, Reynold, 'Learning Causal Representations for Knowledge Graph-based Question Answering', Prepared to submit to ACL'23 **[Core-ranking:A]**

Patents:

[1] **Sui, Y**, Shi, Y, Niu, S, Liang, N & Cheng, X, Intelligent Q&A method and system based on tourism knowledge graph., CN: CN202110739738, 2022-6-21.
[2] Song A, Li, Z, **Sui, Y**, Jiang X & Hu Q, Named Entity Recognition Method for Resume, CN:CN202123275, 2022-5-28.

Research Experience

Learning Causal Representations for Knowledge Graph-based Question Answering
Advisors: Dr. Shuhui Wang (ICT, VIPL) & Dr. Reynold Cheng (HKU) Feb. 21 - Mar. 22

- Proposed a causal interference-based model (causal filter, CF) using clustering methods to reduce the spurious entity relations and missing link problems in Knowledge Graph-based Question Answering (KGQA) tasks
- Devised a new mechanism based on their causal correlations produced by CF whose performance achieves the SOTA on MetaQA (1-hop and 3-hop), Webqsp and OpenbookQA in 2021.
- Authored one paper published by Knowledge-Based Systems (SCI-1, IF:8.139, first author)

Semantic Parsing for Knowledge Graph-based Question Answering
Advisors: Dr. Shuhui Wang Mar. 22 - July. 22

- Proposed a semantic parsing method for KGQA using subgraph matching to alleviate semantic hierarchy challenges of the unstructured natural language questions: 1) Spurious entity relations; and 2) Query graph composition
- Built a seq2seq model to realize the transformation from query to logic chain, and using prompt tuning to tackle the decoupling challenge between the logical form and the corresponding KGs
- Prepared to submit our work to ACL'23.

Trigger-GNN: A Trigger-Based Graph Neural Network for Nested Named Entity Recognition
Advisors: Dr. Wei Yan (SDNU) & Dr. Liang Zhang (SDU) May. 21 - Feb. 22

- Developed a trigger-based graph neural network (GNN) using recursive aggregation mechanisms to tackle the uncertain rules for discontinuous token sequences and overlapping input rules for nested NER tasks
- Used the prompt-based method (entity-trigger) to bring the complementary annotation to the GNN model, helping the nested-NER models to learn and generalize more efficiently and cost-effectively
- Authored one paper published by IJCNN 2022 (Core ranking: B, Selected as oral, First Author)

Contributions of Transformer Attention Heads in Multi- and Cross-lingual Tasks
Advisors: Dr. Soroush vosoughi & Weicheng Ma (Dartmouth College) Jun. 22 - Present

- Built an evaluation-probing model using Huggingface to discover the extent of the pre-trained models learned from sketch
- Designed head-wise & layer-wise experimental procedure to verify the effectiveness and efficiency of the method
- Illustrated positive impact on cross-lingual and multi-lingual tasks arising from pruning attention heads in cross-lingual and multi-lingual tasks
- Demonstrated gradient-based ranking of attention heads for pruning and the attention heads to be pruned can be ranked using gradients and identified with a few trial experiments
- Prepared to submit our work to ACL'23

Intelligent Predictive Maintenance of Hydraulic Systems based on Virtual Knowledge Graph
Advisors: Dr. Wei Yan & Dr. Qiushi Cao (Swansea Uni.) Aug. 21 - Mar. 22

- Assisted in proposing a virtual knowledge graph-based approach for the digital modeling and intelligent predictive analytic of hydraulic systems
- Evaluated the functionality and effectiveness of predictive maintenance approaches in real-world industrial contexts
- Demonstrated implementation feasibility of predictive maintenance with digital modeling, data access, data integration, and predictive analytic
- Part-authored paper under review by Robotics and Computer-Integrated Manufacturing (SCI-1, IF:10.103, Third Author)

Reflow Soldering Optimization Simulation based on Zone Center Temperature Prediction
Advisor: Dr. Wei Yan Aug. 21 - Mar. 22

- Designed a set of reflow optimization strategies for reflow soldering of integrated electronic products

- Obtained a set of optimal process parameters for real-production scenarios
- Simulated the process using a first-order ordinary differential equation of the central temperature curve in the welding area
- Authored paper accepted by Computer Simulation (Peking University Core Journals, First Author)

IngeniousMatch: Automatic Entity Matching for TRIZ knowledge
Advisor: Dr. Wei Yan Oct. 20 - Jun. 22

- Reviewed and reproduced some of the SOTA methods of semantic matching
- Designed regression strategies for performance estimation to evaluate and quantify without groundtruth
- Identified the matchers and their common correspondences which are instantiated automatically in the TRIZ knowledge graph
- Experimentally verified the accuracy and effectiveness of the proposed matching mechanism
- Authored paper under-review by Knowledge-based Systems (SCI-1, IF:8.139, Second Author)

Working Experience

Microsoft Research Asia (MSRA), Beijing, China Aug. 22 - present
Visiting fellow @ Software Analytics Group, DKI || Mentor: Dr. Mengyu Zhou

- Responsible for building up Metadata model pipeline for inferring tabular analysis by infusing distribution and knowledge information, and transfer the related APIs to *Excel* team to specific function which will be accessible to users in 2023
- Collect (pre-processing) multilingual tables from Webs, spreadsheets, and synthetic datasets and build up a new benchmark for tabular metadata evaluation; Tuning Metadata model to achieve the 85% accuracy shipping bar and verify the multilingual capabilities over the new benchmark
- Investigate large language models like MT-530B, BLOOM, GPT-3 for semi-structured data prediction, reasoning and combinatorial generalization; Also, involved in the exploration of the numerical reasoning especially towards tabular information learning

Dartmouth College, Hanover, United States Jun. 22 - present
Research Internship @ Minds, Machines and Society Lab || Mentor: Dr. Soroush vosoughi

- Responsible for building up the pipeline of evaluation probing to investigate the exact content does large language model (LLMs) learn from scratch, like dependency, pos-tagging, and NER
- Conduct head-wise & layer-wise experiments to verify the effectiveness and patterns of each component of LLMs; Try smart ideas on multilingual capabilities of LLMs performance on pos-tagginbg and dependecy-tagging task to verify the impact of language setting
- Convert from full-time to part-time since Aug.

ICT, Chinese Academy of Sciences, Beijing, China Mar. 21 - Jun. 22
Research Internship @ VIPL Group || Mentor: Dr. Shuhui Wang

- Responsible for full project pipeline implementation of KGQA based on semantic parsing, and realize the transformation from query to logical chain to alleviate the semantic hierarchy challenges of the unstructured natural language questions;
- Tuning our seq2seq model to achieve the 85% accuracy shipping bar with the process of intermediate few shots generation, smart idea design and relevant experiments design like hyper-parameters searching
- Propose a causal interference-based model (causal filter, CF) using clustering methods to reduce the spurious entity relations and missing link problems in KGQA; The new mechanism based on the causal correlations produced by CF increased the performance of KGQA and obtain the SOTA performance on MetaQA (1hop and 3hop), Webqsp and OpenbookQA in

2021, and the results have been published by Knowledge-Based Systems (SCI-1, IF:8.139, first author); Other paper related to semantic parsing is ready to submit to ACL'23
- Remote before Mar. 22, and convert to onsite since Apr. 22

Extracurricular Activity

Founder & Leader, Robotics Lab, SDNU, Jinan, China Mar. 20 - Jun. 21

Started a school-level robotics lab and recruited 30 like-minded lab members, and did many interesting things together as follows:

- Organized an "open day" where we invited 20 elementary school students to the lab and by explaining some of the basics of robotics. From which, we hoped to stimulate their interest and exploration of mechanical, computer and scientific problem
- Hosted a reading festival open to the whole campus. We built an integrated book recommendation system using voice recognition, image classification and some other technologies for recommending the prospective books to the participates

Skills and Others

- Software & Programming Languages: C++, C, Java, Python & Protégé, Neo4j, Visio, Origin, Latex
- Deep learning framework: PyTorch, Tensorflow, Huggingface, Onnx
- English Proficiency (TOEFL-iBT): **111** (R: 29, L: 28, S: 28, W: 26)
- Graduate Record Examination (GRE): **328+4.5** (V: 159, Q: 169, W: 4.5)