

Xingbo Wang

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Summary

My research interests lie in the intersection of data visualization (VIS), human-computer interaction (HCI), and natural language processing (NLP). I design and develop interactive systems for **human-centered AI**, which 1) investigate the **multimodality** of human language expressions in communication from big data; 2) generate **relatable and scalable explanations** of AI models in downstream tasks by aligning model behavior with human reasoning; and 3) facilitate human-AI interactions with **natural communication and actionable feedback** such that users can better communicate intents to AI systems, and the systems can present users concrete guidance to make decisions.

Education

The Hong Kong University of Science and Technology (HKUST)

Hong Kong, China

PH.D. CANDIDATE IN DEPT. OF COMPUTER SCIENCE AND ENGINEERING

Aug. 2018 - Aug. 2022

- Advisor: *Prof. Huamin QU*.
- I am from *HKUST VisLab*, where I lead *Multimodal-VIS* team and I am affiliated with *XAI-VIS* group
- Research:
 - Understanding and analyses of multimodal human languages [P3, P6, P7, P8, P15, P10, P18]
 - Interpretability of machine learning models (esp., NLP models) [P5, P13, P2, P11, P1]
 - Human-AI collaboration in decision-making and writing [P4, P12, P14, P1]

Wuhan University (WHU)

Wuhan, China

B.ENG. IN GEOGRAPHICAL INFORMATION SYSTEM

Sep. 2014 - Jun. 2018

Research/Project Experience

VIS for User-centered NLP

Big Data Institute / VisLab, HKUST

RESEARCH PROJECTS

Sep. 2020 - Present

- Developed a visual explanatory system to help NLP experts explore and reason about what commonsense knowledge is (not) learned by language models. The system contextualizes model behavior for commonsense QA with external knowledge graphs.
- Collaborated with the CMU team to build a visual analysis benchmark for understanding multimodal models regarding unimodal importance, crossmodal interactions, multimodal representations and decisions on multimodal fusion, retrieval, and QA tasks ([📄 Demo](#), [</> Code](#)).
- Developed a visual analytics system to systematically explore shortcuts—spurious biases—in natural language understanding (NLU) datasets regarding statistical, structural, and semantic information of data instances.
- Developed an explanatory system for interpreting multimodal models for sentiment analysis by characterizing intra- and inter-modal interactions. The resulting work (*M²Lens*) received an **Honorable Mention** award @**IEEE VIS' 21** ([📄 Demo](#)), the top conference in visualization.
- Developed a prototype of a collaborative story generation system based on GPT-2. It enables multi-level controls of the storyline and content for story planning, writing, and revision ([📄 Demo](#), [📱](#)). Afterward, this system is extended to facilitate story-based ESL learning.
- Adapted BERT for hierarchical argument extraction and classification (e.g., pathos, logos). And built a visual analytics system for enhancing persuasiveness of argument in online discussion. And the resulting work is accepted to **CSCW' 22**, a top conference in HCI.

Natural Language Interface for Interactive Data Analysis

Technical Innovation Department,

Huawei Cloud

RESEARCH INTERN

Jun. 2021 - Sep. 2021

- Designed and implemented a natural language interface (NLI) that enables users to perform interactive data analysis using natural language. For example, a user asks a data-related question in NL, then the system retrieves the corresponding data in databases and generates a visualization to reveal data insights. In addition, the system provides users with sequential exploration guidance for deciding what to ask next. [📱](#)
- Proposed a log-based NL query recommendation model to produce *semantically relevant* and *context-aware* data queries to assist users in choosing an appropriate and insightful next-step exploration actions for data analysis ([</> Code](#)).
- Won **Rising Innovation Star Award** @Huawei Cloud.

AI-powered Visual Analytics for Communication and Presentation Training (Phase I)

OwnTheRoom

AI-powered Audience Engagement Analysis for Virtual Communication (Phase II)

PROJECT LEADER, ALGORITHM/SOFTWARE DEVELOPER

Apr. 2019 - Present

- Currently, I am working on multimodal engagement analysis during multi-party virtual communication (e.g., video conferencing). Built models and a visual analytics system to analyze emotional, behavioral, and speech features of individual students, as well as their engagement scores.
- Applied ML models for speech content assessment, including vocabulary usage, weak language and strong opening/closing detection, and audience interaction (e.g., laughter, applause) measurement.
- Built DL models for sentence classification in terms of rhetorical styles (e.g., joke), performed linguistic analysis of word usage and contextual build-ups of humorous texts, and developed a ML system to recommend voice modulation examples for speakers' speech practice.
- *EmoCo* (2019), *DeHumor* (2021) & *GestureLens* (2022) were accepted by **IEEE TVCG**, the top journal in visualization. *VoiceCoach* (2020) was accepted by **ACM CHI' 20**, a top conference in HCI.
- Our collaboration mobile app, [LifeHikes](#), was launched globally for personalized communication training.

- Developed bayesian latent tree models for high-dimensional feature (questionnaire) clustering and representation, which helps automatically identify and interpret the most significant features for mental disorders.
- Implemented, compared, and explained baseline ML models for prediction of ADHD, ASD and Developmental Delay.
- Designed & built system prototypes for psychologists and psychiatrists to interactively and effectively diagnoses kids with mental health issues.
- Won **Student Team Award, HKSTP Science and Technology Entrepreneur Programme (Top 6)** in HKUST-Sino One Million Dollar Entrepreneurship Competition 2019. And the project received HKD\$ 150,000 funding for the start-up.
- Won **First Prize** in the 6th Hong Kong University Student Innovation and Entrepreneurship Competition.
- Won **Silver Awards** in the 6th China International College Students' "Internet+" Innovation and Entrepreneurship Competition & the 12th "Challenge Cup" National College Student Business Plan Competition.

Honors & Awards

MERITS

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|-----------|---|-----------------------|
| Oct. 2022 | Research Travel Grant, IEEE VIS 2022 | HKUST |
| Oct. 2021 | Best Paper Honorable Mention Award, IEEE VIS 2021 | IEEE Computer Society |
| Sep. 2021 | Rising Innovation Star Award, | Huawei Cloud BU |
| Sep. 2020 | SENG Academic Award for Continuing PhD Students, 20,000 HKD | 2019 - 2020, HKUST |
| Dec. 2019 | Research Travel Grant, IEEE VIS 2019 | 2019, HKUST |
| Aug. 2018 | Postgraduate Studentships, PhD scholarship | 2018 - 2022, HKUST |
| Dec. 2017 | Role Models of WHU, 4/408 national scholarship winners | 2016 - 2017, WHU |
| Oct. 2017 | China National Scholarship(1.6%), 8,000 CNY | 2016 - 2017, WHU |
| Oct. 2016 | Wang Zhizhuo Innovative Talents Scholarship (2%, highest major scholarship) & Invited Talk, 6,000 CNY | 2015 - 2016, WHU |
| Oct. 2015 | China National Scholarship(2%), 8,000 CNY | 2014 - 2015, WHU |
| 2015-2017 | Merit/Excellent Student, Excellent Student Cadre, WHU | 2014 - 2017, WHU |

COMPETITIONS

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|-----------|---|-----------------|
| Jan. 2021 | Silver Award, The 6th China International College Students' "Internet+" Innovation and Entrepreneurship Competition | Co-founder, CTO |
| Dec. 2020 | Silver Award, The 12th "Challenge Cup" National College Student Business Plan Competition | Co-founder, CTO |
| Jun. 2020 | First Prize, The 6th Hong Kong University Student Innovation and Entrepreneurship Competition, Hong Kong New Generation Cultural Association (HKNGCA) | Co-founder, CTO |
| Jun. 2019 | Student Team Award, HKSTP Science and Technology Entrepreneur Programme, HKUST-Sino One Million Dollar Entrepreneurship Competition, HKUST | Co-founder, CTO |
| Apr. 2017 | Meritorious Winner, The Mathematical Contest in Modeling (MCM) | Team Leader |
| Nov. 2016 | National Third Prize, National University GIS Skill Competition, secondary development | Team Leader |
| Dec. 2015 | National Second Prize, The Chinese Mathematics Competitions (CMC) | Individual |

Publications

Peer-reviewed Conferences and Journal Publications

- P1. Yingchaojie Feng, **Xingbo Wang**, Bo Pan, Jason K. Wong, Yi Ren, Shi Liu, Zihan Yan, Yuxin Ma, Huamin Qu, and Wei Chen. "XNLI: Explaining and Diagnosing NLI-Based Visual Data Analysis." *IEEE Transactions on Visualization and Computer Graphics (To Appear)*. TVCG 2023 (To Appear)
- P2. Zhihua Jin, **Xingbo Wang**, Furui Cheng, Chunhui Sun, Qun Liu, Huamin Qu. "ShortcutLens: A Visual Analytics Approach for Exploring Shortcuts in Natural Language Understanding Dataset." *IEEE Transactions on Visualization and Computer Graphics*. TVCG 2023
- P3. Haipeng Zeng, **Xingbo Wang**, Yong Wang, Aoyu Wu, Ting-Chuen Pong, Huamin Qu. "GestureLens: Visual Analysis of Gestures in Presentation Videos." *IEEE Transactions on Visualization and Computer Graphics*. TVCG 2022 [📄 Demo](#)
- P4. Meng Xia, Qian Zhu, **Xingbo Wang**, Fei Nie, Huamin Qu, Xiaojuan Ma. "Persua: A Visual Interactive System to Enhance the Persuasiveness of Arguments in Online Discussion." *The 25th ACM Conference On Computer Supported Cooperative Work And Social Computing*. CSCW 2022
- P5. **Xingbo Wang**, Jianben He, Zhihua Jin, Muqiao Yang, Yong Wang, Huamin Qu. "M²Lens: Visualizing and Explaining Multimodal Models for Sentiment Analysis." *IEEE Transactions on Visualization and Computer Graphics (VIS' 21)*. TVCG 2021 (**Best Paper Honorable Mention@VIS'21** 🏆) [📄 Demo](#), [🌐 Project Page](#)

P6. **Xingbo Wang**, Yao Ming, Tongshuang Wu, Haipeng Zeng, Yong Wang, Huamin Qu. “DeHumor: Visual Analytics for Decomposing Humor.” *IEEE Transactions on Visualization and Computer Graphics*.

TVCG 2021  Demo

P7. **Xingbo Wang**, Haipeng Zeng, Yong Wang, Aoyu Wu, Zhida Sun, Xiaojuan Ma, Huamin Qu. “VoiceCoach: Interactive Evidence-based Training for Voice Modulation Skills in Public Speaking.” *The 2020 Conference on Human Factors in Computing Systems*.

CHI 2020

P8. Haipeng Zeng, **Xingbo Wang**, Aoyu Wu, Yong Wang, Quan Li, Alex Endert, Huamin Qu. “EmoCo: Visual Analysis of Emotion Coherence in Presentation Videos.” *IEEE Transactions on Visualization and Computer Graphics (VAST 2019)*.

TVCG 2019

P9. Yahui Liu, Jian Yao, Xiaohu Lu, Menghan Xia, **Xingbo Wang**, Yuan Liu. “RoadNet: Learning to Comprehensively Analyze Road Networks in Complex Urban Scenes From High-Resolution Remotely Sensed Images.” *IEEE Transactions on Geoscience and Remote Sensing*.

TGRS 2019  Code

Preprints and Manuscripts

P10. Jason K. Wong, **Xingbo Wang**, Yong Wang, Jianben He, Rong Zhang, Huamin Qu. “Anchorage: Visual Analysis of Satisfaction in Customer Service Videos via Anchor Events.” *Submitted to IEEE Transactions on Visualization and Computer Graphics*.

Received minor revision at TVCG


P11. Paul Pu Liang, Yiwei Lyu, Gunjan Chhablani, Nihal Jain, Zihao Deng, **Xingbo Wang**, Louis-Philippe Morency, Ruslan Salakhutdinov. “MultiViz: An Analysis Benchmark for Visualizing and Understanding Multimodal Models.”

Accepted to NeurIPS 2022 Workshop on Human in the Loop Learning.

Submitted to the Eleventh International Conference on Learning Representations.

Under review at ICLR'23 (received 8,6,6,6)  Demo  Code

P12. **Xingbo Wang**, Furui Cheng, Yong Wang, Ke Xu, Jiang Long, Hong Lu, Huamin Qu. “Interactive Data Analysis with Next-step Natural Language Query Recommendation.” *Submitted to IEEE Transactions on Visualization and Computer Graphics*.

Under review at TVCG  Code

P13. **Xingbo Wang**, Renfei Huang, Zihua Jin, Tianqing Fang, Huamin Qu. “CommonsenseVIS: Visualizing and Understanding Commonsense Reasoning Capabilities of Natural Language Models.” *(Ongoing)*.

Ongoing work

P14. **Xingbo Wang**, Zhenhui Peng, Huamin Qu, Xiaojuan Ma. “Vocabulary Learning with Story Generation Models.” *(Ongoing)*.

Ongoing work

P15. Jianben He, Rui Sheng, **Xingbo Wang**, Xinhuan Shu, Jason K. Wong, Huamin Qu. “Engager: A Visual Analytics System for Multi-person and Multimodal Engagement Analysis in Online Teaching Videos.” *Submitted to IEEE Transactions on Visualization and Computer Graphics*.

Under review at IEEE TVCG

P16. Shiyi Liu, Gongyan Chen, Shiyong Ni, Ruofei Ma, Chenyi Zhang, Fei Luo, **Xingbo Wang**, Quan Li. “FashionCook: Visual Analytics for Design and Content Marketing Strategies of New Fashion Products for Better Sales in E-commerce.” *Submitted to 25th EG Conference on Visualization*.

Submitted to EuroVIS' 23

P17. Zihua Jin, Xin Jiang, **Xingbo Wang**, Qun Liu, Yong Wang, Xiaozhe Ren, Huamin Qu. “NumGPT: Improving Numeracy Ability of Generative Pre-trained Models.”

arXiv Preprint

Posters, Extended Abstracts, and Workshop Papers

P18. Ka Yan Fung, Zikai Alex Wen, Haotian Li, **Xingbo Wang**, Shenghui Song, Huamin Qu. “Designing a Data Visualization Dashboard for Pre-Screening Hong Kong Students with Specific Learning Disabilities.” *Proceedings of the 24th International ACM SIGACCESS Conference on Computers and Accessibility*.

ASSETS 2022 Poster

Patents

PT1. Jason K. Wong, **Xingbo Wang**, Yong Wang, Jianben He, Rong Zhang, Huamin Qu. “Method and System for Visual Analysis and Evaluation of Customer Satisfaction Levels in Service Videos.”

US Provisional Patent, 2022

Filing a China Patent, 2022

PT2. Haipeng Zeng, **Xingbo Wang**, Yong Wang, Aoyu Wu, Ting Chuen Pong, Huamin Qu. “System and Method for Visual Analysis of Gestures in Videos.”

Filing a US patent, 2022

PT3. **Xingbo Wang**, Jianben He, Zihua Jin, Huamin Qu, Rong Zhang. "A System for Visualizing and Explaining Multimodal Models for Sentiment Analysis."

US Provisional Patent, 2021

Under review of China Patent, 2022

PT4. Haipeng Zeng, **Xingbo Wang**, Aoyu Wu, Yong Wang, Quan Li, Huamin Qu. "System and Method for Visual Analysis of Emotional Coherence in Videos."

EU Patent, 2021

PT5. **Xingbo Wang**, Ruixing Shi. "System and Method for Stereo-Inertial SLAM for Trajectory Recovery and 3D Wireframe Reconstruction."

China Patent, 2021

Invited Talks

Interactive Visual Analytics for Multimodal Human Communication

+ Ubicomp Lab, National University of Singapore (Jul., 2022)

Visualizing and Explaining Multimodal Models for Sentiment Analysis

+ ChinaVis 2021, Wuhan, China (Jul., 2021)

+ IEEE VIS China Pre-conference Sharing, Virtual, China (Oct., 2021)

Intelligent User Interface for Natural Language Analysis

+ Intelligent Data Group (IDG), Zhejiang University, China (Jul., 2021)

Mentoring Experience

- 2022 - Present **YingChaojie Feng**, ZJU CSE PhD student. Co-advised with Prof. Wei Chen.
Research: Natural Language Interface for Data Visualization
- 2021 - Present **Rui Sheng**, HKUST CSE PhD student. Co-advised with Prof. Huamin Qu.
Research: Visual Analytics for Data-driven Decision Making
- 2021 - Present **Zihua Jin**, HKUST CSE PhD student. Co-advised with Prof. Huamin Qu.
Research: Explainable Deep Learning in NLP
- 2021 - Present **Chuhan Shi**, HKUST CSE PhD student. Co-advised with Prof. Xiaojuan Ma.
Research: HCI for Supporting Systems in High-level Thinking Tasks
- 2020 - Present **Jianben He**, HKUST CSE PhD student. Co-advised with Prof. Huamin Qu
Research: Visual Analytics for Intelligent Video Understanding and Analysis
- 2019 **Xiaoxue Ma**, HKUST CSE MSc student. First position: PhD student at CityU.
Thesis: Text Sentiment Analysis in Videos

Activities & Services

Conference Reviewer: NeurIPS' 22; CHI' 21-23; UIST' 22; CSCW' 22; VIS' 21, 22; EuroVis' 21; PacificVis' 21-23; ChinaVis' 19-22; CHI LBW' 22

Journal Reviewer: IEEE TVCG

Student Volunteer Captain: VIS' 22

Student Volunteer: VIS' 21

Technical Skills

Programming: Python, Javascript, C/C++, Matlab, C#, SQL

Machine Learning: PyTorch, Scikit-Learn, TensorFlow/Keras

Web: Flask, VueJS, D3JS, MongoDB