Furui **Cheng**

Data Visualization · Human-Computer Interaction

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Summary

I am a Ph.D. candidate from HKUST VisLab, advised by **Prof. Huamin Qu**. My research interest lies in the field of **Human-Center AI** with data visualization. I design and develop **Interactive Visualization Systems** to support users with no Machine Learning (ML) background in understanding and exploring ML models. I also focus on clinical scenarios and design visualization tools to support **Human-AI-Collaborated decision-making**. I have worked with amazing researchers, developers, and designers from MIT, Bosch Research, and the Children's Hospital of Zhejiang University and made awarded publications in top visualization conferences.

Education

Hong Kong University of Science and Technology

Hong Kong, China

Ph.D. in Computer Science and Engineering — *2018 - present*

- *Advisor*: Prof. Huamin Qu.
- *Research interests*: Data Visualization, Explainable AI, Human-AI Collaboration, Healthcare.

Beihang University

Beijing, China

B.Eng. in Computer Science and Engineering — *2014 - 2018*

Experience

HKUST VisLab

Hong Kong, China

Lab Member Advised by **Prof. Huamin Qu** — *Aug 2018 - Present*

- Designed visualization techniques to support novice users to explore, understand and improve ML models (**DECE**, **ProtoSteer**).
- Developed and deployed systems for R&D projects funded by the Hong Kong government.
- Coordinated a reading group (around 10 Ph.D. students) sharing advanced researches on Explainable AI in weekly seminars.

MIT Data to AI Group (Affiliated to LIDS)

MA, USA

Visiting Researcher (Remote) Advised by **Dr. Kalyan Veeramachaneni** — *Sep 2020 - Present*

- Developed an AI-enabled clinical decision support system, **VBridge**, with tailored explainable ML techniques and visualizations evaluated in a real-world scenario of post-operative complication predictions.
- Reported the findings of clinicians' perspectives and behaviors of using ML model predictions and explanations for clinical decision-making in the field study with clinicians from a children's hospital.
- Contributed to **Cardea**, an open source AutoML library for using ML with Electronic Health Records.

Microsoft Research Asia

Beijing, China

Research Intern Advised by **Dr. Weiwei Cui** — *Apr 2017 - Jul 2017*

- Contributed to developing a visual analytics system for probing, analyzing, and monitoring Convolutional Neural Networks.

Featured Projects

VBridge

Leader

- Researched how to integrate explainable ML into clinicians' decision-making workflows.
- Identified the **challenges** in adapting existing explainable ML techniques (i.e., feature attributions) in clinical scenarios from pilot studies with clinicians from a children's hospital. One of the major findings is that **the unfamiliarity of engineered features** hinders clinicians' understanding of model explanations.
- Developed VBridge, a **visual analytics system** that connects the dots between features and data to support Human-AI-Collaborated decision-making in clinical scenarios.

DECE

Leader

- Researched on **counterfactual explanations** (i.e., *how to alter an ML model prediction with minimal changes to the data input*) as probes to help humans understand the ML models' decision boundaries (DBs).
- Designed an **analysis workflow** of mentally approximating model's DBs with iterative hypothesizing (i.e., *what the users think the DBs should be*) and counterfactuals-guided refinements (i.e., *understanding the difference from the actual cases*).
- Developed DECE, a **visual analytics system** with novel visual representation designs for population-level counterfactual explanations that enable the iterative mitigation of the gaps between the human mental model and the ML model's actual DBs.

Publications

- **VBridge: Connecting the Dots Between Features and Data to Explain Healthcare Models**
  Furui Cheng, Dongyu Liu, Fan Du, Yanna Lin, Alexandra Zytek, Haomin Li, Huamin Qu, Kalyan Veeramachaneni
  IEEE Transactions on Visualization and Computer Graphics (IEEE VIS'21), 2021. **Honorable Mention Award**
- **DECE: Decision Explorer with Counterfactual Explanations for Machine Learning Models**
  Furui Cheng, Yao Ming, Huamin Qu
  IEEE Transactions on Visualization and Computer Graphics (IEEE VAST'20), 2020.
- **ProtoSteer: Steering deep sequence model with prototypes**
  Yao Ming, Panpan Xu, **Furui Cheng**, Huamin Qu, Liu Ren
  IEEE Transactions on Visualization and Computer Graphics (IEEE VAST'19), 2019.
- **Pulse: Toward a Smart Campus by Communicating Real-time Wi-Fi Access Data**
  Aoyu Wu, Bon Kyung Ku, **Furui Cheng**, Xinhuan Shu, Abishek Puri, Yifang Wang, and Huamin Qu
  Workshop on Visualization for Communication, the IEEE Visualization Conference (IEEE VIS'18), 2018.

Selected Awards

2021	**Honorable Mention Award,** IEEE VIS 2021 For the paper "VBridge: Connecting the Dots Between Features and Data to Explain Healthcare Models"
2016	**Academic Excellence,** School of Computer Science and Engineering (Top 10%)
2015	**Academic Excellence,** School of Mathematical Sciences (Top 10%)
2013	**First Price (3rd Place),** 30th Chinese Physics Olympiad (CPhO) Regional (Shannxi, China) with over 15,000 participants. Invited to the 30th CPhO Final and got **Bronze Award**.

Presentation

VBridge: Connecting the Dots Between Features and Data to Explain Healthcare Models — *Virtual*
Conference Presentation at **IEEE VIS 2021** (To Appear) — *Oct. 2021*
Invited talk at **ChinaVis 2021** — *Jul. 2021*

Visual Analytics on Explainable Machine Learning for Informed Decision Making — *Hangzhou, China*
Invited talk at **State Key Lab of CAD&CG, Zhejiang University** — *Jul. 2021*

DECE: Decision Explorer with Counterfactual Explanations for Machine Learning Models — *Virtual*
Conference Presentation at **IEEE VAST 2020** — *Oct. 2020*

Services

Paper Review

- IEEE VIS: Visualization & Visual Analytics, 2021
- China Visualization and Visual Analytics Conference (ChinaVis), 2021
- IEEE Visual Analytics Science and Technology (VAST), 2020

Teaching Assistant

- COMP1941 - Exploring and Visualizing Data, 2020-2021 Spring
- COMP3711 - Design and Analysis of Algorithms, 2019-2020 Fall

Skills

Programming Language

- **[Backend]** Python, C/C++, Java
- **[Frontend]** Javascript (Typescript), HTML/CSS

Tools & Platforms

- **[ML]** Scikit-learn, Pytorch, Tensorflow
- **[Web]** D3.js, React, Vue, Three.js
- **[Database]** MongoDB, MySQL