Yuancheng Shen —— Personal Statement

Since my earliest days in elementary school, a deep fascination with mathematics has been an intrinsic part of my journey and those formative years introduced me to the world of mathematical concepts through the visual aids in my textbooks—illustrations that gracefully revealed the elegance inherent in mathematical relationships. This is so effective that even a young child could quickly grasp intricate data patterns. This introduction to visual data representation sowed the seeds of my enduring passion for data, igniting a flame that would shape my academic journey.

As I progressed through middle and high school, the complexity of data representation expanded, including expressions, functions, and even matrices etc. At times, employing more abstract forms indeed enhances the expression of complex data. However, it simultaneously increases the cost of comprehending data. This sparked an idea in me — a determination to make data more accessible, comprehensible, and usable for a wide range of people. In middle school, my outstanding academic achievements earned me summer exchange opportunities. In 2012, I visited South Korea and Hong Kong, where the widespread use of smartphones and 4G networks left a profound impact on me. It was then that I decided to pursue a career in computer-related fields, driven by the desire to use technology to help people access, analyze, and apply data effectively.

Transitioning to undergraduate studies, I initially chose marine engineering due to its status as the premier program at our university. I soon realized it wouldn't realize my dream of making data more accessible, comprehensible, and usable in everyday situations. Achieving top honors in my major, I seized the opportunity to transition to computer science in my sophomore year. In my computer science studies, I excelled in various computer-related courses, mastering mainstream programming languages such as JavaScript, C++, Python, etc. In parallel to my studies, I got involved in various competitions and outside-of-class activities. I participated in the Jiangsu Provincial Mathematics Competition, securing a second prize, and consistently earned top-tier scholarships. My GPA consistently ranked within the top 2% of my class. These achievements were accompanied by a solid commitment to campus activities, where I took on leadership roles in organizing diverse events.

In my second year, a course on human-computer interaction (HCI) with Professor *Guoliang Jing* ignited my academic fascination and motivated me to ponder the essential role that humans play in the realm of computing. Subsequently, I joined a project led by Professor *Jing* where we evaluated a QR code-based subway app for user-friendliness. Using collected user data, we developed a new application through in-depth modeling. This experience highlighted the importance of human-centered design and fueled my curiosity about user behavior and interaction patterns. My undergraduate years were a time of exploration and learning not only in the realm of computer science but also beyond. I often went to other cities, observing how people harnessed technology to simplify and enhance their lives. This era of digital transformation impressed upon me the increasing significance of data in modern living—from precise subway arrival predictions to dynamic data-driven news narratives. However, I also noticed a gap in usability and comprehensibility, particularly for those from diverse professional backgrounds. From that point forward, I started on the research journey with unwavering determination, focusing on human-centered design, to make data more accessible, comprehensible, and usable. During my senior year, I shared my vision with Professor *Chunlong Hu* and joined a project that embedded information in word clouds using Glyph Perturbation. I used Glyph Perturbation and CNN to encode and recognize variations. This experience enhanced my research skills and deepened my passion for interactive data analysis. It inspired me to further specialize in designing human-centered interactive tools for exploring and analyzing data.

Thus, I joined the Ideas Lab at Shandong University where I worked with Professor *Yunhai Wang*. Here, I immersed myself in the exploration of HCI, data animation, and human-centered design. As I entered graduate studies in 2021, I first joined the project of network anomaly detection,

exploring novel approaches to detect anomalies in network configuration files. As the student leader in the project, I introduced the concept of abstracting configuration files into configuration statement trees and proposed utilizing clustering analysis for anomaly detection. I published a paper in "*Computer Science*" titled "*Anomaly Detection Algorithm for Network Device Configuration based on Configuration Statement Tree*" as the first author. During this time, as I worked with complex configuration file data using Python and statistical knowledge, attempting to uncover their underlying patterns, I was also constantly pondering, "How can we enable more intuitive interaction with complex structured data?" I shared this question with Prof. *Wang* and expressed my willingness to pursue research in interactive data analysis, a dream I've held for a long time. Then I embarked on the path of data animation working with Prof. *Wang* and *Bongshin Lee* from Microsoft Research. This journey has led me to develop the Canis grammar for creating data animations and designing an interactive system called CAST which provides easy access to authoring expressive chart animations, especially for people who lack programming skills. I published a paper in "*IEEE Transactions on Visualization and Computer Graphics*" titled "*Authoring Data-driven Chart Animations.*" This was my first opportunity to truly engage in interactive data analysis research, realizing a dream I've had since childhood. It was also my first experience of human-centered design and interactive data analysis, which I found to be both challenging and fascinating. I'm dedicated to becoming a researcher in this field! Additionally, my exploration of pen-touch interaction systems for authoring data animations uncovered a challenge I could not overlook: facilitating accurate target selection within complex SVG charts—a fundamental aspect of interactive data analysis. This revelation fueled my curiosity to explore not only high-level research in visual grammar and interactive systems but also foundational aspects of data interaction, including input-output methods and universal file formats. The selection ways in the pen-touch system have become my main working project now.

Currently, I'm also participating in two other research projects. The first involves static visualization grammar and reverse engineering, where we aim to reverse-compile existing charts into our designed target grammar, allowing users to make modifications conveniently. Additionally, the emergence of ChatGPT has sparked global changes. Interactive data analysis is no exception. Under the guidance of Prof. *Wang* and *Bongshin Lee*, I'm actively participating in a project that leverages Large Language Model(*LLM*) to generate charts. Our goal is to create a natural language-based intermediate system based on ChatGPT to convert user inputs into mainstream grammar like Python's Matplotlib and D3. These two diverse projects have not only broadened my research experience but also underscored the importance of leveraging *LLMs* to simplify the process of interactive data analysis. My academic pursuits have been complemented by extracurricular activities, scholarships, and teaching assistant positions. Moreover, I seized the opportunity to contribute to the peer-review process of an article in the "*Computer-Aided Design*" journal, honing my evaluative skills.

Today, as I reflect upon my academic journey, I am driven by a relentless desire to make data more accessible, comprehensible, and usable. I yearn to continue my academic journey, designing innovative tools and methodologies that empower users to explore data with fluidity and ease. The convergence of data, technology, and human-computer interaction lies at the heart of my ambition, driving me to explore the realm of interactive data analysis, visualization, and human-computer interaction. My journey has only just begun, and I am eager to contribute my skills, creativity, and passion to the ongoing transformation of how we engage with data.