Ahmad Al-Doulat

9233 Glenwater Drive, Charlotte, NC, 28262

Phone: (704) 499-7992 | Email: adoulat@uncc.edu | Website: https://webpages.uncc.edu/adoulat/

Introduction

My primary research interests lie in the broad area of data science with an emphasis on data analysis, machine learning, Human-Computer Interaction, data visualization, and data storytelling. My research focuses on analyzing big data, extracting insightful information, and facilitating this information's presentation to users. Effective presentation of large volumes of data and analytic results for sensemaking and decision making has been a major issue when dealing with large volumes of data. Typically, the heterogeneous data is presented in dashboard interfaces using different kinds of visualizations like charts and graphs. From a human-centered computing perspective, the user's interpretation of such visualizations is a critical challenge to design for, with empirical evidence already showing that 'usable' visualizations are not necessarily effective and efficient from a sensemaking perspective. Since a user's interpretation of the visualized data is fundamentally the construction of a narrative about the data.

On the other hand, as Artificial Intelligence in many fields becomes increasingly prominent, there is a growing need to consider augmented intelligence. This is the idea that AI can and should be used to enhance human intelligence and abilities rather than attempt to replace it. One aspect of human-centered AI is to create systems that help humans understand the system itself. Therefore, the goal is not simply to provide results through a black-box model. The focus is to help users understand those results and how those results are derived. Therefore, the central theme driving my work is to draw on the growing body of work on data storytelling as the inspiration for the development of systems that bridge the gap between humans and AI.

I believe the key to success is through constant communication and collaboration with domain experts from different areas as well as industrial practitioners. As a graduate student, I have had the opportunity of working with researchers from diverse fields such as data mining, machine learning, human-computer interaction, Natural Language Processing, information retrieval, and explainable AI. Apart from the synergy created from the combination of these different perspectives, these collaborations have given me a broader viewpoint of the applicability of my work, and also shed light on new directions of research.

Dissertation Research

An interactive narrative storytelling model for learning analytics can improve faculty leadership and advisors' sensemaking of student success or risk and reveal hidden insights not apparent in the visual analytics alone.

My dissertation presents an ethnographic study that reveals the importance of data storytelling to facilitate the sensemaking of heterogeneous data and reveal hidden insights not apparent in the visual analytics alone. I try to answer the following questions: 1) What are the benefits and features of storytelling when compared to visual analytics? 2) Which building blocks and story structures are meaningful for users?

Unlike standard visualization systems where diverse and heterogeneous data is presented using various forms of infographics and scientific charts. I envision that the presentation of such data using storytelling can make it easier and faster to understand. Typically, data presentation using infographics and scientific charts requires some level of expertise from the users. However, analyzing and interpreting these charts to convey and understand the information presented in them is a challenging task especially for users with a wide range of expertise or not data scientists. In my dissertation, I emphasize that presenting diverse and heterogeneous data in natural language stories can enable users with a wide range of expertise or not data scientists to understand complicated computational models. These stories should be produced automatically using Natural Language Generation (NLG) techniques. On

the other hand, my dissertation studies how to automatically generate explanations for data visualization components for the aggregated analytics to make it easier for users to understand the aggregated analytics results.

Another important aspect when generating stories about the data is to make the stories engaging and appealing to the users. My dissertation studies the potential of generating such stories by identifying the story structure. Story structure is about the plot of the story: the content of a story and the form used to tell the story. Typically, the story structure serves two main purposes: First, trying to determine the key conflicts, main characters, setting, and events. Second, trying to determine how, and at what stages, the key conflicts are set up, ordered, and resolved. Generally, story structures in the literature can be categorized into three main categories: (i) linear structure, where events are largely portrayed in chronological order, that is, telling the events in the order in which they occurred, (ii) nonlinear structure, where events are portrayed, out of chronological order or in other ways where the narrative does not follow the direct causality pattern, and (iii) interactive structure, which refers to works where the linear structure is driven by, rather than influenced by, the user's interaction, and it allows users to make choices that influence the story through their actions. Generally, identifying the story structure is a necessary task for two main goals; (i) story content determination, which is the selection of information that should be communicated in the story to be presented to the user, and (ii) story discourse planning, which is the structuring of the messages produced by the content determination process into a coherent text. It uses knowledge about how these messages should be organized and ordered into a story. My dissertation studies different methods for selecting the most important information to be presented to the user. On the other hand, users need to be part of the story generation process by enabling them to select the data that they are interested in. Furthermore, users should be able to interact with the resulting stories to enable them to have more information about what they found important. Another essential part of presenting important data is to try to detect causal and other relationships between different pieces of data. Aggregate analytics using clustering and outlier detection techniques are used to enable the system to reason about hidden information in the raw data.

I have applied the aforementioned hypotheses in the Learning Analytics domain. In which, I played an active role in understanding the faculty leadership and advisors' roles in students' success, designing interactive tools, developing prototypes, and testing and evaluating technology for academic and professional advisors. I was immersed in the student advising process and conducted a longitudinal study as an intervention along with a diary study, self-reports, in-depth pre- and post-interviews, and focus group discussions to investigate the potential impact of student data storytelling on academic and professional advising. I analyzed the data using a thematic analysis qualitative method. In my dissertation, I present the data analytics, the data storytelling model, and the design findings that have the potential to lead to successful designs and the adoption of storytelling models for faculty leadership and advisors. My research has the potential to address problems in multiple domains ranging from summarizing statistical results, stock market trends, healthcare reporting and analytics, and environmental data.

Other Research

Outside my dissertation, during my Ph.D. program, I have diverse research experiences that spanned many different fields.

Surprise, Satisfaction, and Curiosity Inspiration in a Recommender System

The growing amount of online information today has increased the opportunity to discover interesting and useful information. Various recommender systems have been designed to help people discover such information. No matter how accurately the recommender algorithms perform, users' engagement with recommended results has been complained of being less than ideal. This research touched on two human-centered objectives for recommender systems: user satisfaction and curiosity, both of which are believed to play roles in maintaining user engagement and sustain such engagement in the long run. Specifically, we leveraged the concept of surprise and used an existing computational model of surprise to identify relevantly surprising health articles aiming at improving user satisfaction and inspiring their curiosity. In this research, I have designed a user study to first test the validity of the surprise model in a health news recommender system, called LuckyFind. Then user satisfaction and curiosity were evaluated.

Contradiction Detection in User Opinionated Text

The rapid growth and wide popularity of social media have brought the challenge of digesting and understanding large amounts of user-generated text. Automatically finding contradictions from user opinionated text is a potential solution to help sense-making and decision-making process from those user opinions. This research presents a computational approach to detecting contradictions in user opinionated text. Specifically, a typology of contradictions was proposed, and then the state-of-art deep learning models were adopted and enhanced by incorporating sentiment analysis. The enhanced models were evaluated using two different datasets (Amazon's customer reviews and Twitter dataset) and the results demonstrate the model's usefulness in understanding contradiction semantically and quantitatively in a large amount of user opinionated text.

Future Work

Natural language generation is a promising technology that automatically turns data into human-friendly prose. Explainable AI, on the other hand, aims to make the outcome of an AI system more understandable and interpretable by humans, either through introspection or through a generated explanation. These research areas will provide ample collaboration opportunities with multidisciplinary teams, with strong partnerships in engineering, computer science, psychology, and health and medical research in both the public and private sectors. I plan to extend the scope of data storytelling and explainable AI models in various directions, including LA dashboards, business intelligence dashboards, real estate market property descriptions, and healthcare reporting and analytics. I plan to apply for the National Science Foundation grants in the areas of interactive data storytelling, Explainable AI, and Learning Analytics. I will also publish in tier-one conferences and journals for these domains. As a graduate student at the University of North Carolina at Charlotte, I had the opportunity to network and collaborate with faculty from the College of Computing and Informatics with various experiences and backgrounds. These opportunities gave me perspectives on the applicability of my research and its potential broader impacts on academia and the industry to improve efficiency, quality, and effectiveness of Human-Computer Interaction systems.