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DECI

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DECI: A Tutorial on Designing Effective Conversational Interfaces

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ABSTRACT

Conversational User Interfaces (CUIs) have been argued to have advantages over traditional GUIs due to having a more human-like interaction. The growing popularity of conversational agents has enabled humans to interact with machines more naturally. There is an increasing familiarity among people with conversational interactions mediated by technology due to the widespread use of mobile devices and messaging services and a hungry market for conversational agents. Based on the recent advances in conversational AI, as a result of the proliferation of large language models, the signs are that the future of human-computer interaction will have a significant conversational component. Today, over two-thirds of the population on our planet has access to the Internet, with ever-lowering barriers to accessibility. This tutorial will showcase the benefits of employing novel conversational interfaces for *crowd computing*, *human-AI decision making*, *health and well-being*, and *information retrieval*. Given the widespread adoption of AI systems across several domains, we will discuss the potential of conversational interfaces in facilitating and mediating people's interactions with AI systems. The tutorial will include interactive elements and discussions and provide participants with insights to inform the design of effective conversational interfaces.

CCS CONCEPTS

• **Human-centered computing** → **Human computer interaction (HCI)**; **Interaction paradigms**; *Interaction techniques*; *Empirical studies in HCI*;

KEYWORDS

conversational user interfaces, conversational crowdsourcing, human-AI interaction, human-AI decision making, conversational AI

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1 RELEVANCE OF CONVERSATIONAL USER INTERFACES

Virtual companions, intelligent assistants, and task focused chatbots have become prevalent in our daily lives [8], serving various purposes, from customer service to automation in smart environments. The rise of conversational user interfaces (CUIs) can be attributed to several factors, including the increased use of messaging apps, the growing popularity of voice assistants, and the need for more efficient and personalized communication [12]. In addition, the advancements in artificial intelligence and natural language processing have made conversational interfaces more intelligent and responsive, allowing them to understand user intents better and respond effectively to natural language queries [17]. With the increasing demand for seamless and efficient communication, conversational interfaces are poised to become even more commonplace. They offer a convenient and accessible way to interact with technology, making them a valuable tool in numerous industries, from healthcare [1, 16, 18] to finance [10, 23, 26] to retail [14]. Overall, the ease of use and potential for personalization make conversational interfaces an attractive option for many consumers [13, 24], increasing their popularity and widespread adoption.

This tutorial is fundamentally relevant to the IUI community owing to its relation to intelligent conversational interfaces. More recently, researchers in IUI have been drawn to investigate CUIs for a variety of application domains, including learning a second language [25], sexual harassment prevention [5], qualitative interviews [3], and music production [4], among others. Furthermore, this tutorial will emphasize the distinctive characteristics of CUIs, ushering the IUI community to redefine and expand the scope of CUIs. For instance, we will provide detailed insights and hands-on training on employing conversational interfaces to improve worker engagement and satisfaction across the microtask crowdsourcing landscape. In addition, we will expand on the possibilities of allowing people to learn new affective support skills through CUIs and how these affective support tasks can be delivered in near real-time through embodied conversational agents by leveraging real-time human computation. We will also demonstrate how CUIs can better support individuals in information retrieval (IR) tasks.

Furthermore, this tutorial will discuss opportunities to build conversation-based Explainable AI (XAI) methods that can facilitate interactive two-way communication between AI systems and users to increase the intelligibility of AI systems and foster *appropriate trust* and *reliance* [2]. Recent works in the HCI and AI suggest that human interaction with AI systems can be enhanced by leveraging conversational interfaces to improve engagement, and build trust [7]. This tutorial will synthesize design concepts and recommendations for developing more effective conversational

interfaces based on many creative application domains of CUIs that have not been fully investigated.

2 ORGANIZERS

Dr. ir. Ujwal Gadiraju[†] is a tenured Assistant professor in the Software Technology Department of the EEMCS Faculty, Delft University of Technology. He co-directs the TU Delft “Design@Scale” AI Lab and is a member of the program management team of the TU Delft AI Labs. In addition, Ujwal co-leads a research line on Crowd Computing and Human-Centered AI at the Web Information Systems group. His research interests lie at the intersection of Human-Computer Interaction (HCI), Artificial Intelligence (AI), and Information Retrieval (IR). Ujwal has published over 135 peer-reviewed articles, including at premier venues such as ACM CHI, ACM CSCW, ACM TOCHI, AAAI HCOMP, ACM TheWebConf, ACM SIGIR, ACM UBICOMP, ACM CIKM, ACM WSDM, ACM HT, ACM UMAP, ACM IUI, among others. His work has been recognized with honors, including best paper awards at top-tier HCI and AI conferences. Ujwal’s prior work in Crowd Computing has explored methods to improve the effectiveness of the crowdsourcing paradigm, running large-scale human-centered experiments to understand the interaction between humans and machines and the societal impact of algorithmic decision-making. His current research focuses on creating novel methods, interfaces, systems, and tools to overcome existing challenges on our path toward building trustworthy AI systems and facilitating better reliance of humans on AI systems.

Dr. Tahir Abbas is a Postdoctoral Researcher in the Web Information Systems group at the Delft University of Technology. His research interests include Conversational User Interfaces (CUI), real-time Human Computation (HCOMP), Artificial Intelligence, and Human-Computer Interaction (HCI). His Ph.D. dissertation addressed important challenges in crowd-powered conversational systems, and he previously worked as a lecturer at a public sector university in Pakistan. Tahir has published scientific articles at premier venues, such as ACM/IEEE HRI, ACM CHI, AAAI HCOMP, PACMHCI journal, ACM CSCW, MDPI Sensors journal, and the international journal of HCI. Tahir focused on leveraging CUIs to address crowd workers’ work-related and emotional needs, leveraging real-time HCOMP for building affective crowd-powered conversational systems, and utilizing crowd creativity for the internet of things.

Garrett Allen is a Ph.D. candidate in the Web Information Systems group at Delft University of Technology. Garrett is an avid learner with a BS and MS degrees in Computer Science from Boise State University. His Master’s thesis focused on re-ranking search results for children in the K-4th Grades (using the American education system). He is an experienced investigator with exposure to the intersections of Human-Computer Interaction, Natural Language Processing, Information Retrieval, and Education and has published at top international conferences such as AAAI HCOMP, ACM RecSys and ECIR. Before choosing the path of academia, Garrett worked as a software engineer/developer for a collection of startups.

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3 TUTORIAL FORMAT

3.1 A Primer on CUIs

The tutorial starts with a primer on conversational interfaces in different domains. During this session, we will give participants an overview of the state of the art of conversational user interfaces (CUIs). We will also compare conversational interfaces with traditional interfaces, vet the context and scope for CUIs, and discuss what makes good conversational interfaces.

3.2 CUIs for Crowd Computing

In the second part of this tutorial, we will introduce the logic and workflow of conversational agent design for quickly deploying crowdsourcing tasks in customizable conversational interfaces. We will compare conversational crowdsourcing with the traditional web-based microtask crowdsourcing to explain the advantages of conversational crowdsourcing in terms of increasing user satisfaction, improving user engagement, and decreasing perceived workload [15, 20]. Next, we will explain the effect of using different conversational styles [27, 28], and share empirical insights into how we can define a conversational style, how to estimate the conversational style, and how to exploit the conversational style to facilitate an effective task design [19]. Finally, we will showcase conversational crowdsourcing in a variety of domains, such as supporting microtask execution and aiding informational web search [22]. In this session, we will also provide a step-by-step breakdown of implementing a conversational crowdsourcing interface using TickTalkTurk [21] for different crowdsourcing task types [6] and reflect on the metaphorical representation of conversational agents [11].

3.3 CUIs for Affective Crowdsourcing, Applications in Mental Health, and Human-AI Decision Making

In this part of the tutorial, we will first present the Trainbot CUI and discuss how effectively it can teach non-experts motivational interviewing skills essential for providing mental health support [1]. We will then showcase some different ways conversational agents have been proposed to tackle various challenges in healthcare. We will also review the opportunities and concomitant challenges of using CUIs for human-AI decision-making and the potential that CUIs offer to foster appropriate trust and reliance in AI systems, in comparison to traditional interfaces [9, 29, 30].

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