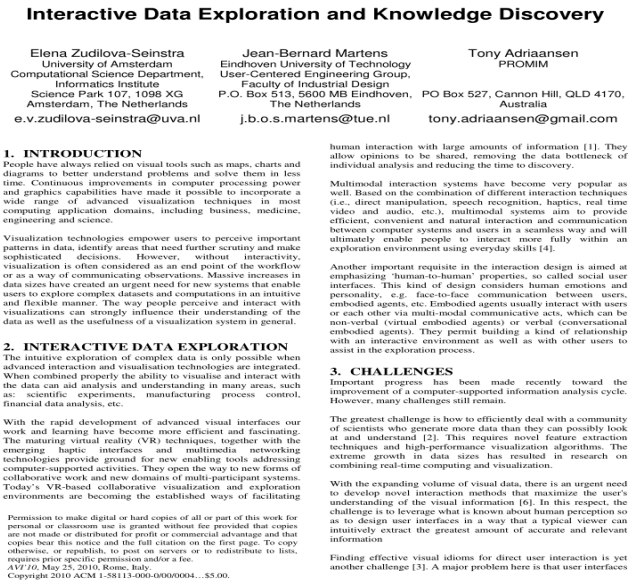
Exploration In Speech Communication



Interactive Data Exploration and Knowledge Discovery

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1. INTRODUCTION

People have always relied on visual tools such as maps, charts and diagrams to better understand problems and solve them in less time. Continuous improvements in computer processing power and graphics capabilities have made it possible to incorporate a wide range of advanced visualization techniques in most computing application domains, including business, medicine, engineering and science.

Visualization technologies empower users to perceive important patterns in data, identify areas that need further scrutiny and make sophisticated decisions. However, without interactivity, visualization is often considered as an end point of the workflow or as a way of communicating observations. Massive increases in data sizes have created an urgent need for new systems that enable users to explore complex datasets and computations in an intuitive and flexible manner. The way people perceive and interact with visualizations can strongly influence their understanding of the data as well as the usefulness of a visualization system in general.

2. INTERACTIVE DATA EXPLORATION

The intuitive exploration of complex data is only possible when advanced interaction and visualisation technologies are integrated. When combined properly the ability to visualise and interact with the data can aid analysis and understanding in many areas, such as: scientific experiments, manufacturing process control, financial data analysis, etc.

With the rapid development of advanced visual interfaces our work and learning have become more efficient and fascinating. The maturing virtual reality (VR) techniques, together with the emerging haptic interfaces and multimedia networking technologies provide ground for new enabling tools addressing computer-supported activities. They open the way to new forms of collaborative work and new domains of multi-participant systems. Today's VR-based collaborative visualization and exploration environments are becoming the established ways of facilitating human interaction with large amounts of information [1]. They allow opinions to be shared, removing the data bottleneck of individual analysis and reducing the time to discovery.

Multimodal interaction systems have become very popular as well. Based on the combination of different interaction techniques (i.e., direct manipulation, speech recognition, haptics, real time video and audio, etc.), multimodal systems aim to provide efficient, convenient and natural interaction and communication between computer systems and users in a seamless way and will ultimately enable people to interact more fully within an exploration environment using everyday skills [4].

Another important requisite in the interaction design is aimed at emphasizing 'human-to-human' properties, so called social user interfaces. This kind of design considers human emotions and personality, e.g. face-to-face communication between users, embodied agents, etc. Embodied agents usually interact with users or each other via multi-modal communicative acts, which can be non-verbal (virtual embodied agents) or verbal (conversational embodied agents). They permit building a kind of relationship with an interactive environment as well as with other users to assist in the exploration process.

3. CHALLENGES

Important progress has been made recently toward the improvement of a computer-supported information analysis cycle. However, many challenges still remain.

The greatest challenge is how to efficiently deal with a community of scientists who generate more data than they can possibly look at and understand [2]. This requires novel feature extraction techniques and high-performance visualization algorithms. The extreme growth in data sizes has resulted in research on combining real-time computing and visualization.

With the expanding volume of visual data, there is an urgent need to develop novel interaction methods that maximize the user's understanding of the visual information [6]. In this respect, the challenge is to leverage what is known about human perception so as to design user interfaces in a way that a typical viewer can intuitively extract the greatest amount of accurate and relevant information

Finding effective visual idioms for direct user interaction is yet another challenge [3]. A major problem here is that user interfaces

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