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Talk2Hand: Knowledge board interaction in augmented reality easing analysis with machine learning assistants

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Abstract

Analysts now often use machine learning (ML) assistants, but find them difficult to use, since most have little ML expertise. Talk2Hand improves the usability of ML assistants by supporting interaction with them using knowledge boards, which intuitively show association, visually aid human recall, and offer natural interaction that eases improvement of displayed associations and addition of new data into emerging models. Knowledge boards are familiar to most and studied by analytics researchers, but not in wide use, because of their large size and the challenges of using them for several projects simultaneously. Talk2Hand uses augmented reality to address these shortcomings, overlaying large but virtual knowledge boards onto typical analyst offices, and enabling analysts to switch easily between different knowledge boards. This paper describes our Talk2Hand prototype. (see http://www.acm.org/about/class/class/2012)

CCS Concepts

• ***Human-centered computing*** → ***Visual analytics;*** *Mixed / augmented reality;* • ***Theory of computation*** → *Semi-supervised learning;*

1. Introduction

Analysts have always struggled with the volume of their data. In the past, they used physical displays called knowledge boards to aid them, but these boards were too large and unwieldy to rely on regularly, particularly when analysts worked on several projects simultaneously. As technology increased data flows further, analysts began to use technology to deal with them, using machine learning (ML) during analysis. Unfortunately, training ML models can often add difficulty and require analysts to have ML expertise.

We describe *Talk2Hand*, a new interface designed to broaden access to ML analytic assistants. Rather than explicitly labeling data and controlling ML models, analysts communicate with them implicitly by manipulating familiar knowledge boards. To fit these knowledge boards into typical workplaces and workflows without compromising privacy, we implement them in augmented reality (AR). The resulting system increases the utility of ML and knowledge boards in sensemaking.

2. Related work

Due to the complexity of analytic workflows in intelligence [GM18] and the growing data flows analysts are facing, machine learning is taking on a growing role during analysis. Yet as surveys of this work note [ERT*17, SKKC18], analyst-ML interaction must become much richer and more transparent, moving beyond simple labeling schemes and avoiding ML concepts and jargon so that collaboration with ML assistants does not disrupt workflows.

Figure 1: *Analog knowledge board [Vor09]*

Knowledge boards (e.g. Figure 1) are well-known tool in analysis of all kinds, which predate not only ML but even computers [SIMM95]. They make a natural match to the early stages of intelligence sensemaking [AR96, PC05], in which data are organized into groups or "shoeboxes." They also bring many of the significant advantages of large displays [CSR*03, AEN10], and could help address the spatial and layout problems observed in ML analytic systems such as CHISSL [ASW*19]. Indeed, although it does not incorporate ML, the ForceSPIRE project and its notion of "se-

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