National Science Foundation's Industry/University Cooperative Research (I/UCRC) Program

V2-24: Immersive Space and High-Performance Analytics

Mission-Critical Computing
NSF CENTER FOR SPACE, HIGH-PERFORMANCE, AND RESILIENT COMPUTING (SHREC)

SHREC Annual Workshop (SAW23-24)

VIRGINIA TECH

January 17-18, 2024

Faculty

Chris North, Doug Bowman

Students

Sungwon In, Kylie Davidson, Ibrahim Tahmid, Xuxin Tang

Number of requested memberships ≥ 5

Task 1: Immersive Data Science

Mission-Critical Computing
NSF CENTER FOR SPACE, HIGH-PERFORMANCE, AND RESILIENT COMPUTING (SHREC)

SHREC Annual Workshop (SAW23-24)

Sungwon In

VIRGINIA TECH

January 17-18, 2024

V2

Data Transformations + Data Visualizations in Computational Notebook

Previously

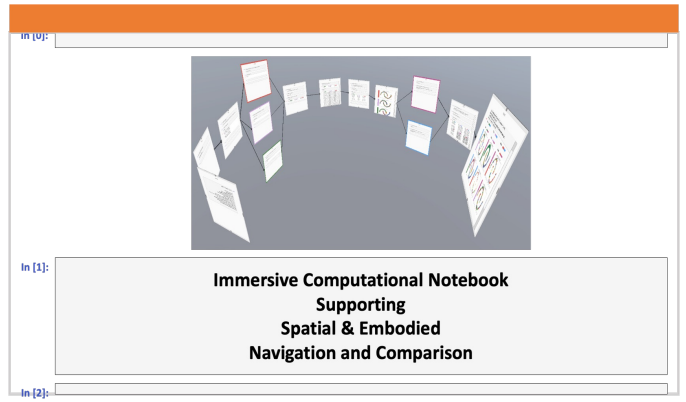
- Built computational notebook for virtual reality using embodied gesture and navigation

More matters in notebook

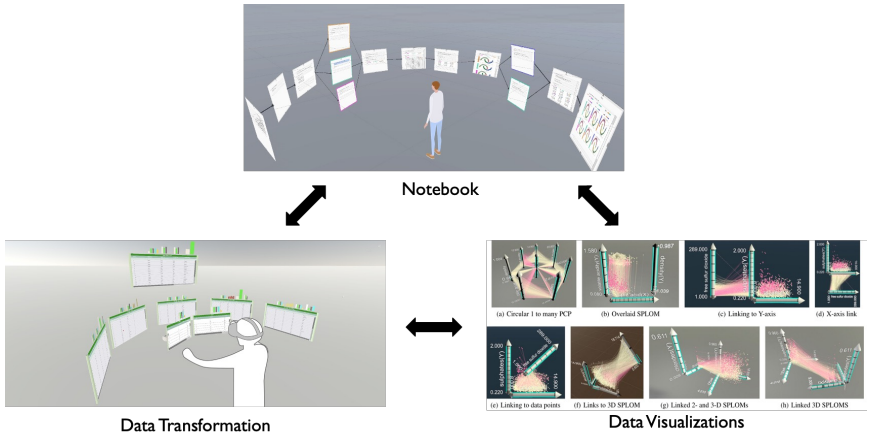
- Complicated transformations and visualizations process
- Transitioning between tasks in data science pipeline

Questions

- How can we create a comprehensive environment within notebook systems that effectively supports both data editing and visualization through embodied interaction?
- How effective is embodied interaction in facilitating the transition between different scenarios within a notebook environment?

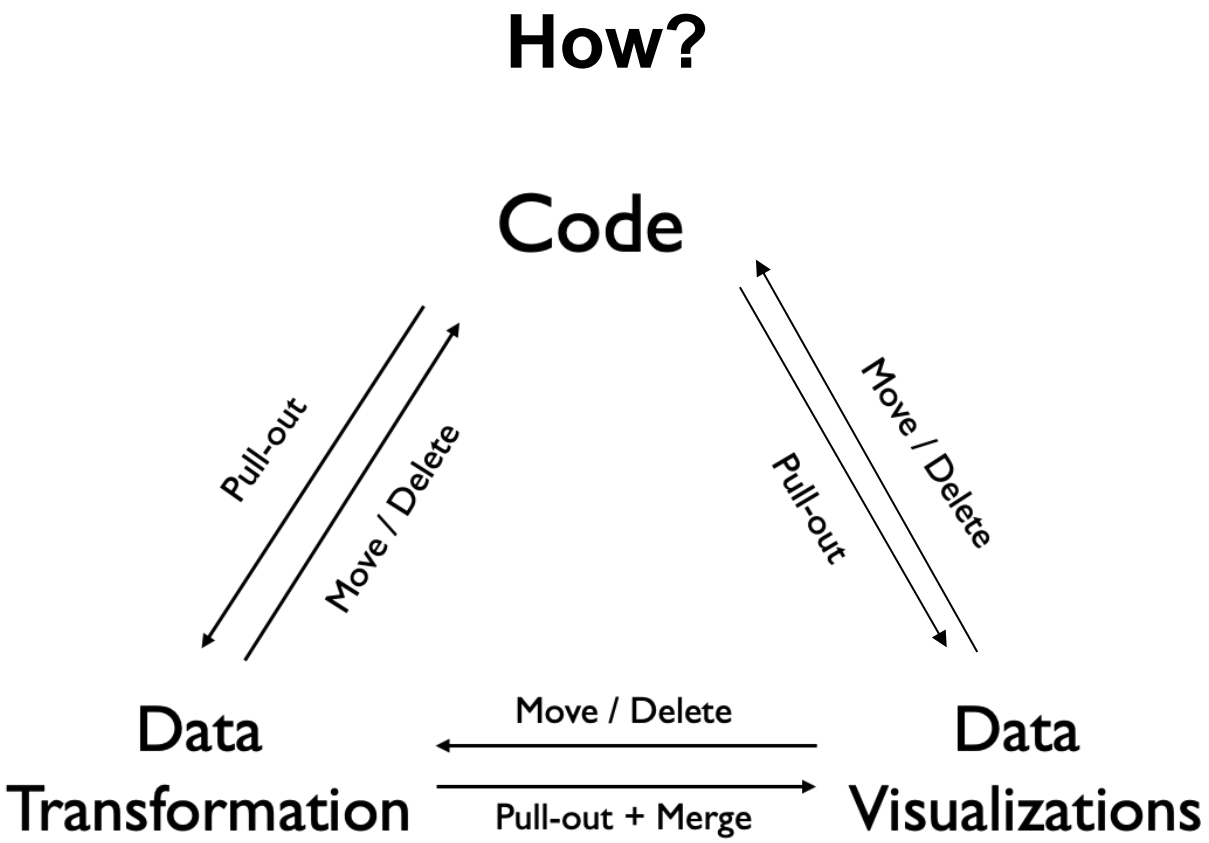


Previous



Expected comprehensive environment

Data Transformations + Data Visualizations in Computational Notebook



V2

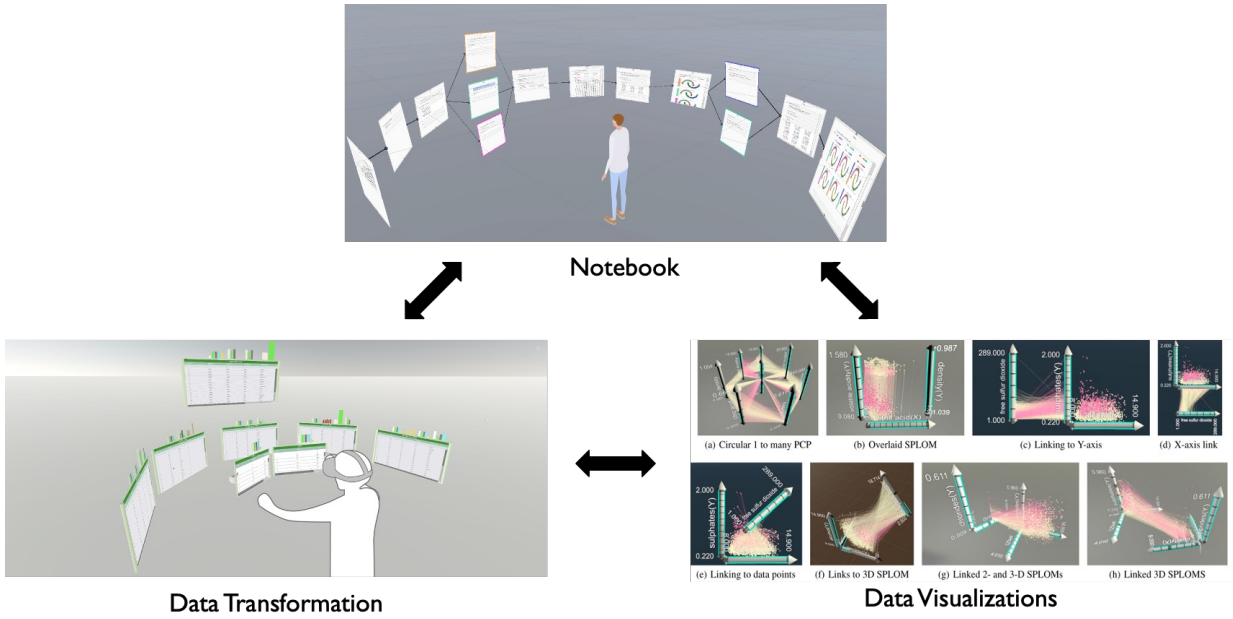
Data Transformations + Data Visualizations in Computational Notebook

Plan

- Embodied transitioning between
  - Notebook (code)
  - Data transformation
  - Data visualizations

- Enabling intuitive data transformation and authoring data visualizations

- Assess the impact of an comprehensive notebook environment incorporating embodied transitions



History tracking in Computational Notebook

V2

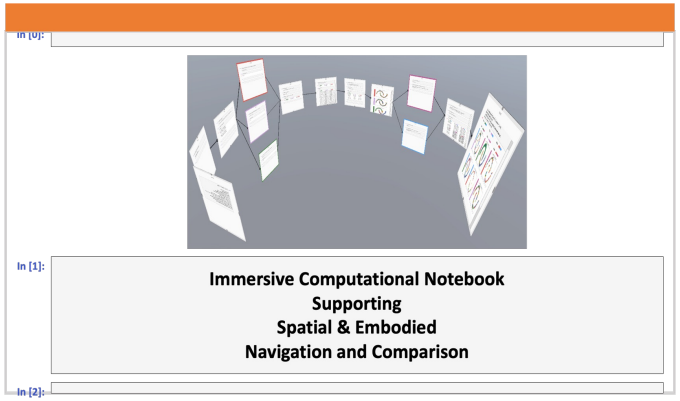
Previously

- Built computational notebook for virtual reality using embodied gesture and navigation

More matters in notebook

- Many things to keeping track of
  1. Codes
  2. Results
  3. Execution order
  4. Kernel state

Gets lot more complicated when number of notebooks/codes increase!



Previous

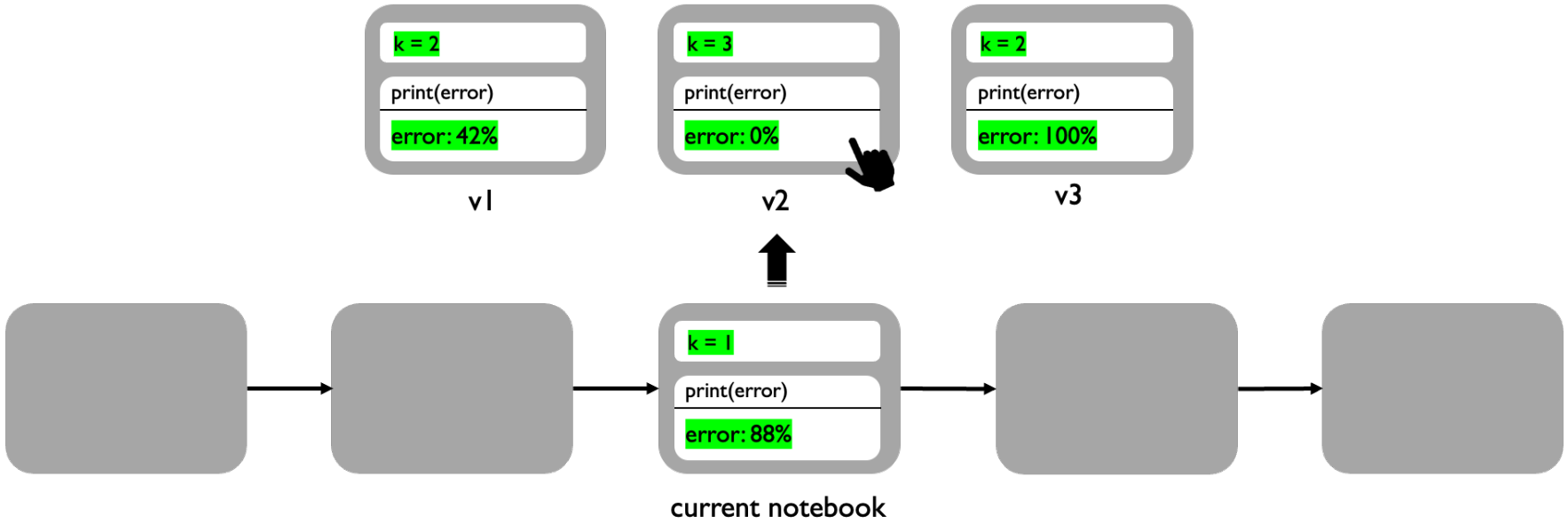
History tracking in Computational Notebook

Questions

- How does the integration of enhanced visualizations in a VR notebook impacting data analysis performance efficiency?

Plan

- **Enable environment that can easily track of**
  1. Codes
  2. Results
  3. Execution order
  4. Kernel state



Task 2: Immersive Sensemaking

Mission-Critical Computing
NSF CENTER FOR SPACE, HIGH-PERFORMANCE, AND RESILIENT COMPUTING (SHREC)

SHREC Annual Workshop (SAW23-24)

Kylie Davidson

VIRGINIA TECH

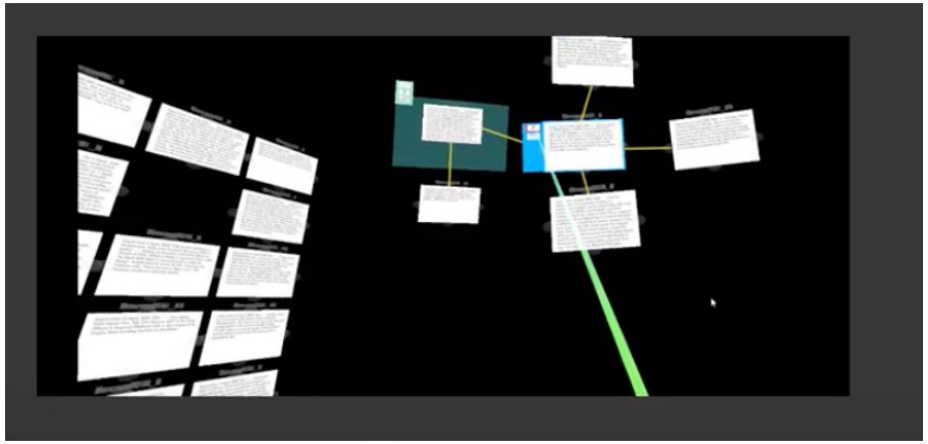
January 17-18, 2024

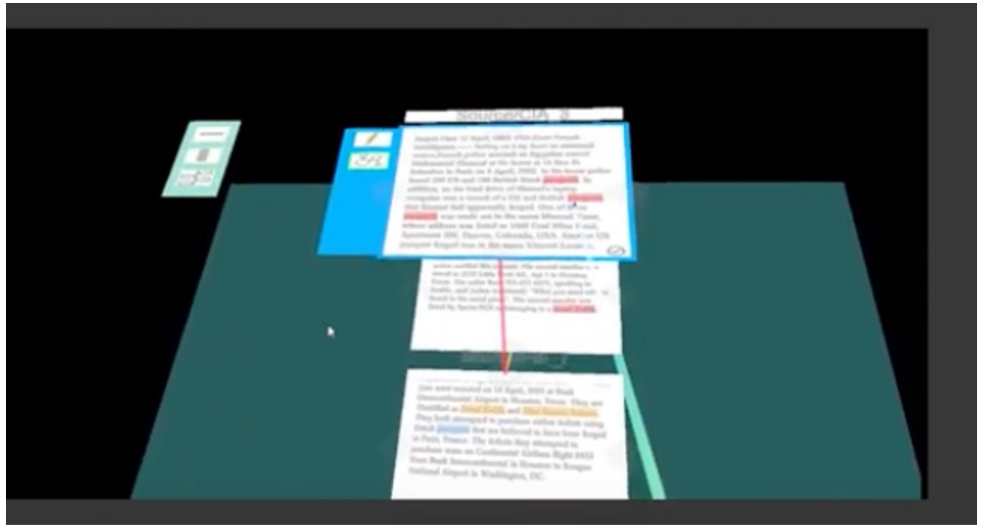
V2

Building Support for Immersive Sensemaking

Question:
How do we develop organizational tools to allow users to offload cognition into the immersive environment?

Plan:
Evaluate effects of new organizational features on the sensemaking process





Task 3: Immersive Semantic Interaction

Mission-Critical Computing
NSF CENTER FOR SPACE, HIGH-PERFORMANCE, AND RESILIENT COMPUTING (SHREC)

SHREC Annual Workshop (SAW23-24)

Ibrahim Tahmid

VIRGINIA TECH

January 17-18, 2024

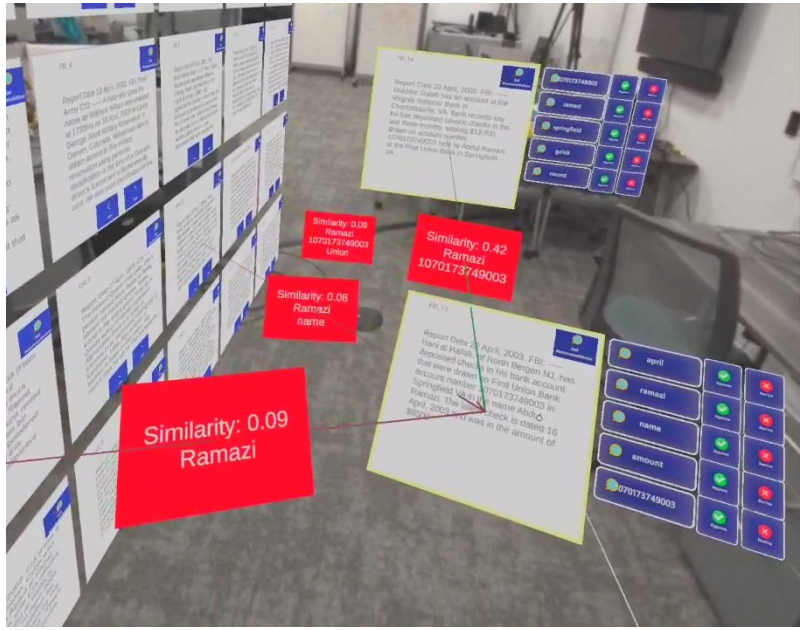
V2

Task 3: Immersive Semantic Interaction

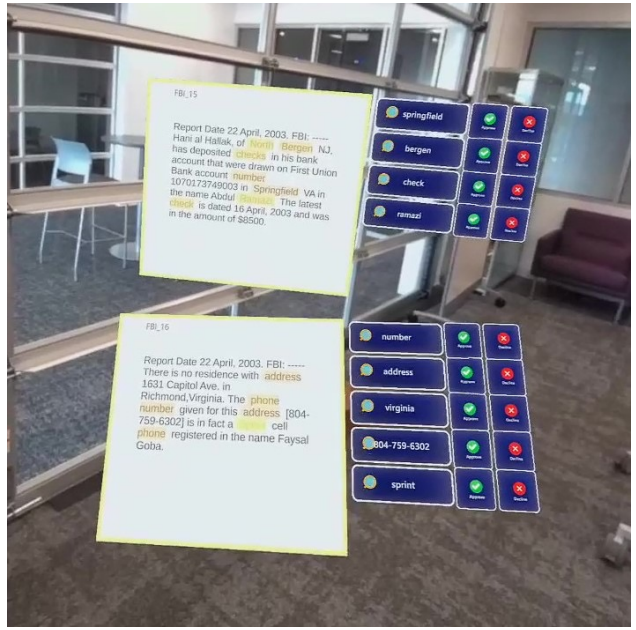
Previously Gaze data can predict the information relevance as perceived by the human analyst

Research Question How can we use the gaze data to help analysts in real time during sensemaking tasks?

Plan for This Year



Suggesting new information based on gaze data



Offloading mental concept by leveraging gaze data

Task 4: Interactive LLM for High-Performance Sensemaking

Mission-Critical Computing
NSF CENTER FOR SPACE, HIGH-PERFORMANCE, AND RESILIENT COMPUTING (SHREC)

SHREC Annual Workshop (SAW23-24)

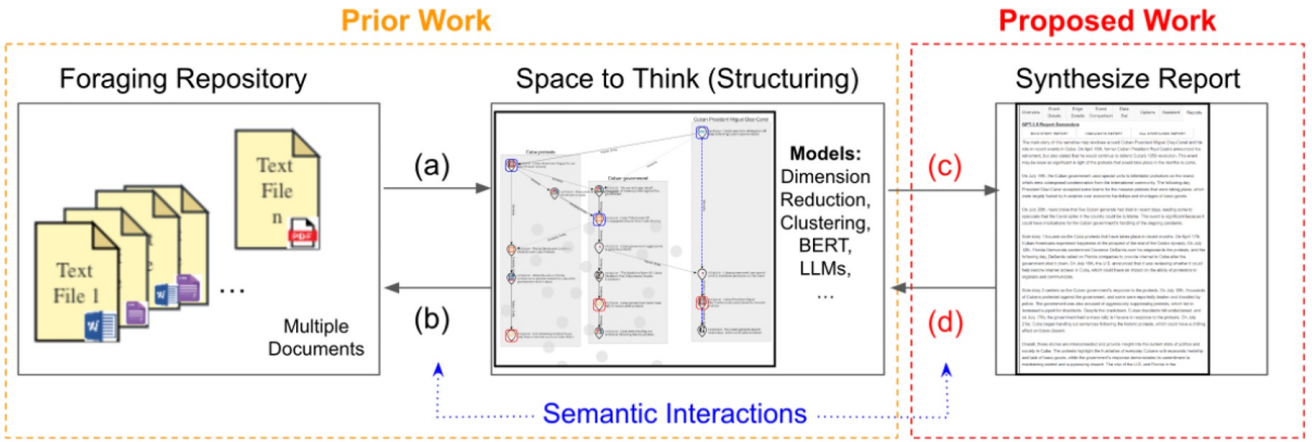
Xuxin Tang

VIRGINIA TECH

January 17-18, 2024

V2

LLMs-powered semi-automatic AI assistance for sensemaking



Question:
How can **Large Language Models (LLMs)** increase human performance for synthesizing meaningful reports from collections of documents using interactive-AI assistance?

Plan:

- Interactive AI prototype for LLMs-powered report generation.
- Evaluate the effect of LLMs and AI assistance on human performance in sensemaking and summarization tasks.