Harnessing Generative AI to Support Exploration and Discovery in Library and Archival Collections

A Case Study to Incorporate Human-Centered Approaches for AI-Ready Data

Project Team

RQ1: **Richard Marciano (PI):** Professor
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Advanced Information Collaboratory

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COLLEGE OF INFORMATION STUDIES

Project Overview

➤ Proposal to the IMLS National Leadership Grant for Libraries (NLG-L) program (April 2024)

➤ NLG-L Goal 3 & Objective 3.2: **'Improve** *the ability of libraries and archives to provide broad* **access** *to and use of information and collections'* & **'Support** *innovative approaches to* **digital collection management**.'

➤ Community Partners/Collaborators:

    Maryland State Archives

     Legacy of Slavery Program

    Kennard African American Cultural Heritage Center

    (Queen Anne's County, Maryland)

Research Methodology: Exploratory Case-Study with Stakeholder Participation

Research Questions	Research Methods
(RQ1) How should we further curate library and archival collections to make them AI-ready?	Research collection curation techniques and AI-readiness to support generative AI work and refine GPT models to understand a collection's context.
(RQ2) How can we compare GPT models with traditional, non-AI exploratory data analysis models?	Interrogate the DTA dataset using traditional, non-AI approaches for comparison with GPT model results.
(RQ3) How can we incorporate socio-technical considerations to promote trustworthiness and mitigate potential bias arising from the use of GPT models with library and archival collections?	Engage domain experts and community members in GPT model design and evaluation via surveys and focus groups; and incorporate their contextual input for data preparation, prompt engineering, and model training.

Data: Domestic Traffic Ads
MSA Legacy of Slavery Project (1824 to 1864)

"[D]omestic traffic is defined as the interstate and intrastate trade of enslaved men, women, women and children. Similar to runaway ads and committal notices, domestic traffic ads were a means of communicating to the general public the subscriber's desire to buy or sell a slave(s). Ads could be placed by private slave dealers and agents, gentry in need of domestic help, yeomen in need of extra field hands, or a public sale of an estate by the orphan's court." MSA

Late Sheriff's Sale.

By Virtue of a writ of Ven. Exps. issued out of Queen Ann's County Court, to me directed, at the suit of George W. Marble, use of John L. Kerr, and William H. Martin, against Peter Foster, will be sold in Centrevilte, on *Tuesday the 12th day of August next,* between the hours of 10 o'clock, A. M. and 4 p. m. the following property to wit :

—Negro Boy Robert— negro Boy, William—

Seized and taken as the property of said Foster and will be sold to satisfy the above mentioned Writ, Debt, Interest and Cost, due and to become due thereon.

THO. ROBERTS, late shff.
July 19th 1828.

Valuable Negroes
AT PRIVATE SALE.

The subscriber will sell at private sale a family of as Valuable Negroes as any on the Eastern Shore, they will not be sold out of the county—viz. 1 woman & 2 children, 1 man 38 years old, 1 do 26 years, 1 do. 23 years, 1 boy 14 years, 1 do. 6 years, 2 do. 7 years, 1 woman & her 2 children one 2 and the other 5 years, 1 woman and her child 3 years, 2 girls 4 years, 1 do. 5 years, 1 do 16 years, they are all young and handsome, and will be sold to good masters very low.
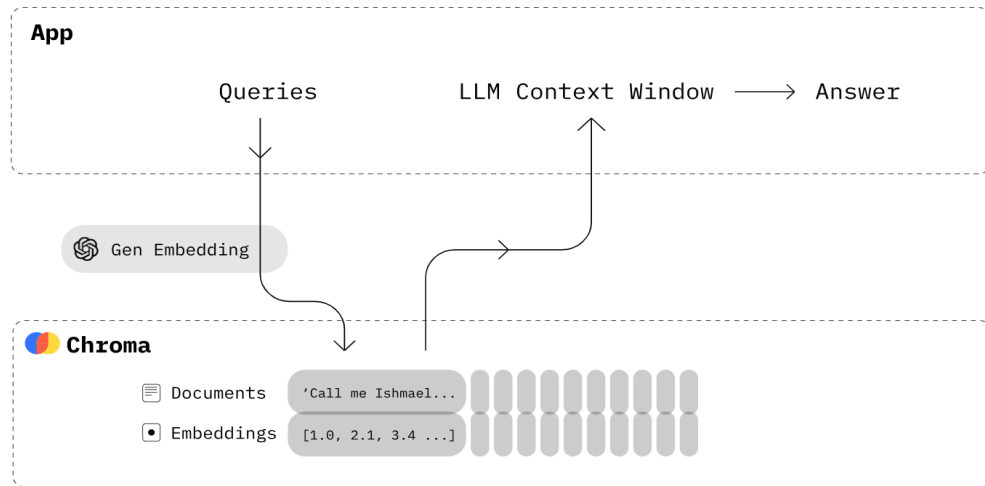
JOHN DONOVAN.

Dec. 31   3w

FOR SALE, a MULATTO MAN, 23 years of age, slave for life, and sold for no fault, only the present owner has no use for him. He is a first rate farm hand and a good miller. For further information apply at Lewis F. Scotti's, Intelligence, Agency and Collectors Office, No. 1 West Fayette st. Basement Ba... ma 7

Great Bargains.

The subscriber offers at private sale the following property, viz: two Negro Boys, one Negro Girl, about 14 years of age, two Yoke of Oxen, three Cows, thirty head of Sheep, one Still and Cap, one Whip Saw, one Gun, two Mares with fold, and one first rate Saddle Horse—All of which he will dispose of very low for cash.
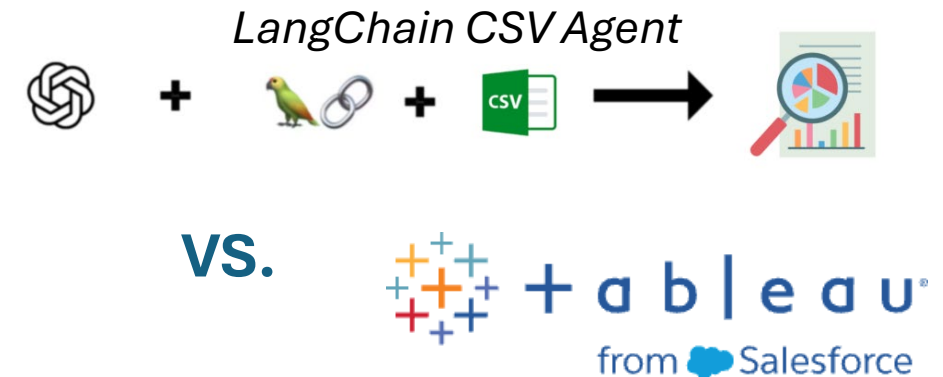
SHADROCK KEENE.

feb 12   St

Cash! Cash!! Cash!!!

THE subscribers wish to purchase a number of Young

NEGROES,

of both sexes, from the age of 12 to 25 years; for which they will pay as high prices in cash, as any other person that is now, or will hereafter be, on this Shore. One of the subscribers can be seen at all times in Cambridge. The other will be stationed in Easton, and will be in Centreville and Chestertown once every week. Those who have Negroes to dispose of will do well to give one of them a call *in person,* at any of the above named places; or a line addressed to them will meet with prompt attention.

C. S. & J. M. KNIGHT.
Jan. 19, 1833

DTA and Gen AI Pilot Project (2023)

Use DTA with LLM to create a Contextualized AI Chatbot (RQ1)

Perform Data Analysis on DTA dataset & Comparative Analysis (RQ2)

LangChain CSV Agent

VS.

tableau
from Salesforce

App

Queries   LLM Context Window ⟶ Answer

Gen Embedding

Chroma

Documents   'Call me Ishmael...

Embeddings   [1.0, 2.1, 3.4 ...]

Reference: "Conversing with the Past: Re-examining the Legacy of Slavery in Domestic Traffic Newspaper Advertisements with OpenAI's GPT3 LLM". **R. Kumar Gnanasekaran, C. E. Haley, and R. Marciano**. In UCL Press/AEOLIAN edited collection: *Artificial Intelligence for Cultural Heritage Organisations across the Atlantic* To be published in 2024.

PILOT FINDINGS:
DTA content was **not AI-ready** and needed **significant pre-processing** to lend itself to generative AI.
GPT models **need to understand the context** of the DTA collection and be further trained.
GPT models have parameters that allow for **some control of trustworthiness**.
GPT models seem to be able to duplicate some of the level of analysis seen in non-AI exploratory case studies.
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Incorporating a Human-Centered Approach For AI-Ready Data

Context

Pre-processing

Trustworthiness

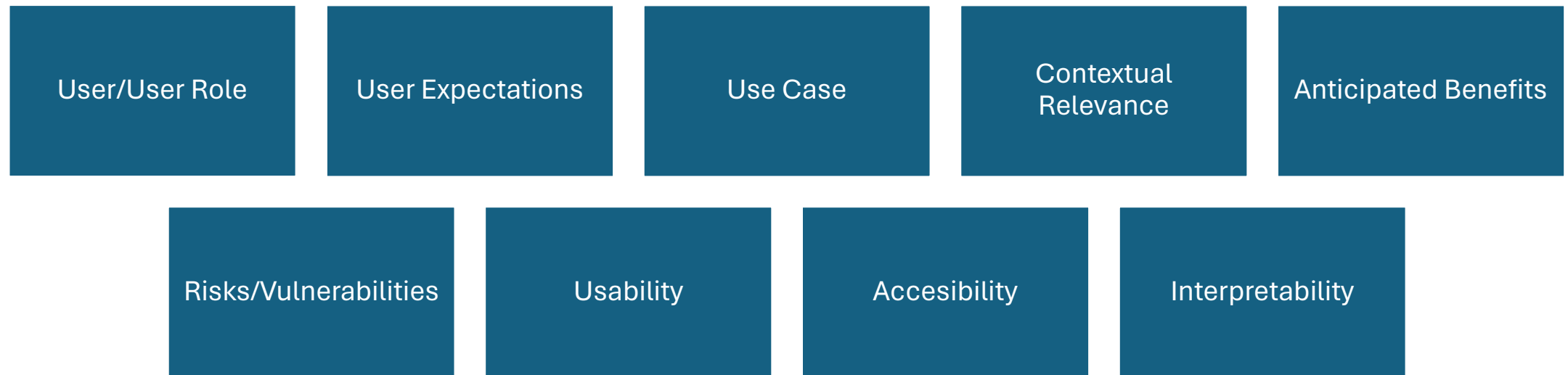Stakeholder Participation
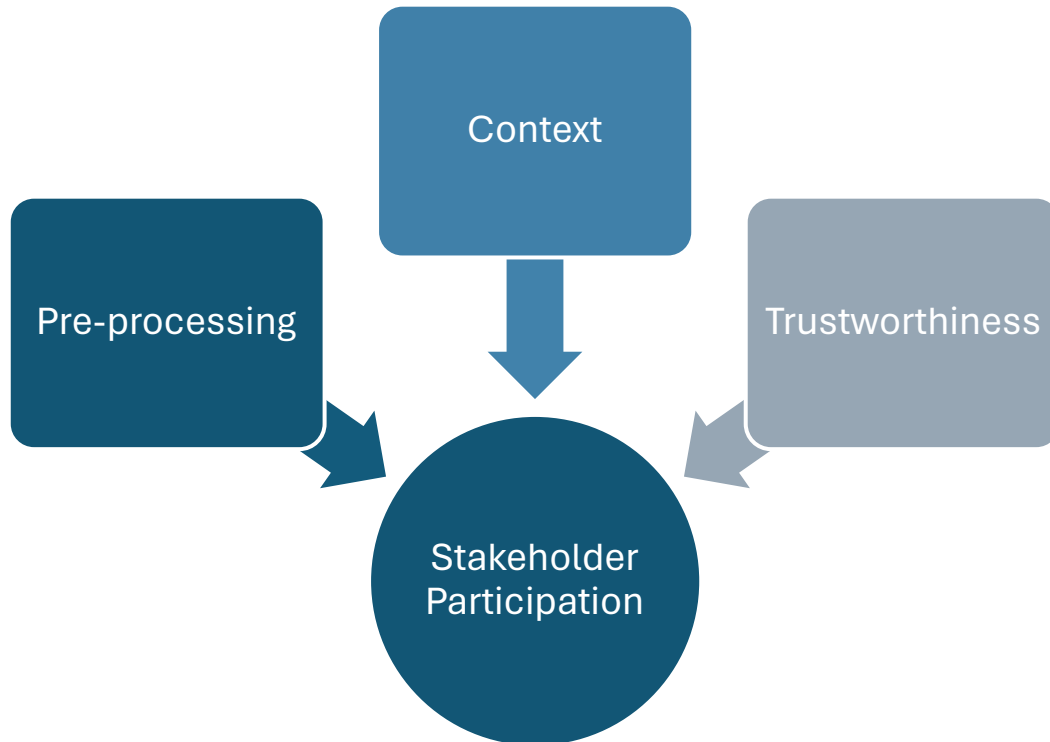
Quality * Access* Documentation

RQ3 - How can we incorporate socio-technical considerations to promote trustworthiness and mitigate potential bias arising from the use of GPT models with library and archival collections?

- Involve user communities *throughout design and development pipeline*
- Capture user communities' *expectations, concepts, relationships* concerning the archival collection and use of gen AI
- Incorporate feedback through regular workshops *(human-human)*
- Implement feedback receiving mechanisms from the chatbot *(machine-human)*
- Implement solutions and guardrails in place to address *ethics, privacy, and cultural sensitivity*

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Ontology/Metadata Exploration in Our Research Design (1)

**Phase 1:** GPT Selection & Focus Group Input for Model Design

- Capture user expectations of usability and benefits; establish baselines for risks or vulnerabilities (e.g. racial or gender bias, historical or cultural inaccuracies, privacy, etc.) ➔ **ONTOLOGY DEVELOPMENT/SPECIFICATION**

User/User Role	User Expectations	Use Case	Contextual Relevance	Anticipated Benefits

Risks/Vulnerabilities	Usability	Accesibility	Interpretability

Ontology/Metadata Exploration in Our Research Design (2)

Phase 2: – Data Preparation & Model Training

- Explore operationalization of focus group expectations and concerns as metadata, features, or functionality to be used in the initial data preparation and/or model training. **→METADATA SPECIFICATION & USE IN PRE-PROCESSING FOR AI-READINESS**
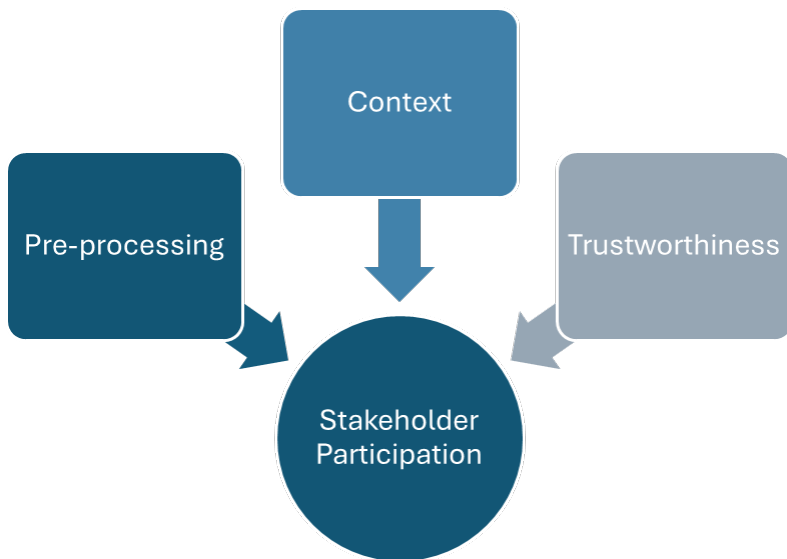
- Metadata added during pilot (*record*)
  (1) Terms of Service,
  (2) Trade Reason
  (3) Features
  (4) Terms of Sale
  (5) Owner
  (6) Optical Character Recognition (OCR) text of each DTA ad image.

- Examples of potential metadata developed through stakeholder participation (*context/use/trustworthiness focus*)

  - Metadata for specific use cases (e.g. historical research, K-12 education, higher education, look-up services in libraries or archives, interactive cultural heritage displays in museums, personal and professional genealogy, etc)
  - Historical contextual information
  - Labels reflecting evolution of knowledge Culturally aware labels
  - Labels reflecting user sensitivities or risk tolerances

Ontology/Metadata Exploration in Our Research Design (3)

Phase 3: Focus Group Working Meeting

- Exploring and evaluating the usability, contextual accuracy, cultural bias, and use case relevance of the chatbot➔ **REFINE ONTOLOGY & METADATA SPECIFICATION**

Phase 4: GPT Performance Analysis & Re-tuning

- Targeted adaptation and retuning with respect to data annotation, metadata, model features, and model functionality, based on stakeholder feedback ➔ **REVISED METADATA FOR DATA PROCESSING & MODEL RE-TUNING**

Phase 5: Focus Group Working Meeting II

- Real-time evaluation of usability, contextual accuracy, bias mitigation, and use case relevance; identify technical and governance needs; areas for future research. ➔ **EVALUATION: PARTICIPATORY APPROACH/SPECIFICATION/TECHNICAL**

Status/Opportunities/Challenges

- Status: Pending funding decision
- Opportunities
  - "Strengthen the ability of libraries and archives to serve the public and research communities by unlocking new dimensions of access, discovery, and understanding within their collections."
  - Support FAIR (Findable, Accessible, Interoperable, and Reusable) principles and reproducible computational research (RCR)
  - Prototype participatory methods that may have more general application (the broader AI community can learn from library/archive practices)
  - Contribute to generalizing use of ontologies that incorporate stakeholder participation
- Challenges
  - Adopting/adapting methods for human-human along with human-tech feedback
  - Operationalizing stakeholder feedback in data processing and/or model functionality – limitations? conceptual integrity?
  - Potential complexity and contradiction in stakeholder input
  - Misuse of GenAI to obscure the cultural record

We welcome your comments, discussion, and questions.

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