ADVANCING ADVERSE DRUG EVENT DETECTION IN SOCIAL MEDIA THROUGH KNOWLEDGE GRAPH AND GRAPHRAG LLM ARCHITECTURES

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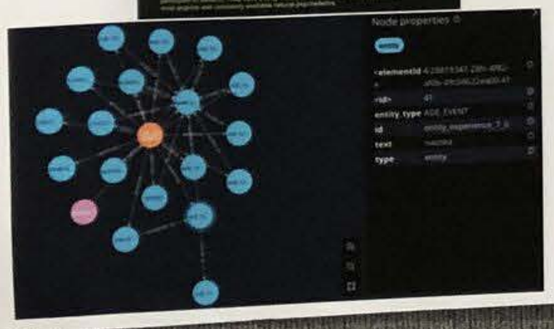
Key Terms

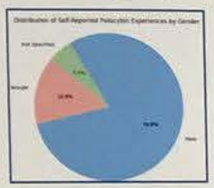
- **Psilocybin Mushrooms:** commonly referred to as "magic mushrooms", have been used by humans for millennia due to their psychoactive compound, psilocybin.
- **Knowledge Graphs (KGs):** structured representations of concepts and their interrelations, extracted from large-scale data; enable AI search engines to uncover novel attributes, reason over connections, and facilitate conversational interactions with relevant data entities.
- **Erowid:** a leading online resource for psychoactive substances, including psilocybin mushrooms, housing one of the most extensive collections of user-reported drug experiences spanning several decades.

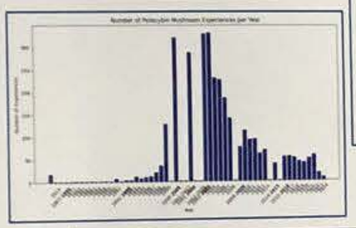
Erowid.org



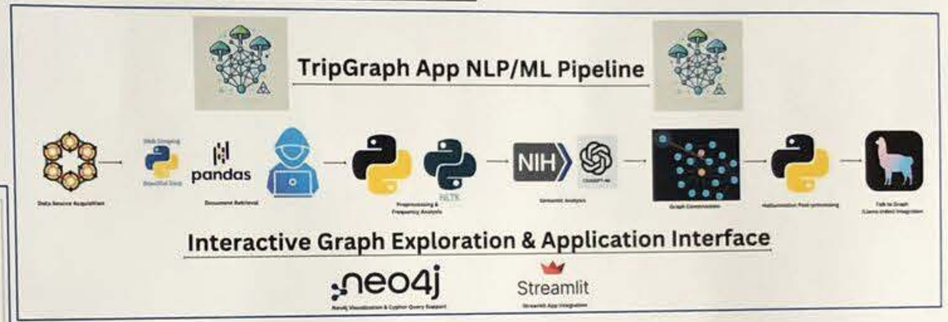
Background

Problem: The resurgence of psilocybin mushroom use, both recreationally and therapeutically, may potentially lead to an increase in adverse drug events (ADEs). However, traditional clinical and pharmacological studies often lack comprehensive first-person data on these experiences, hindering a full understanding of the associated risks and safety profiles.
Solution & Purpose: This study bridges that data gap on ADEs associated with psilocybin mushroom use by leveraging NLP and ML techniques to construct and analyze a KG from 3,270 self-reported experiences on Erowid to gain structured insights into ADEs and their attributes. This approach enhances pharmacovigilance, informing safer psilocybin use practices and contributing to public health strategies.

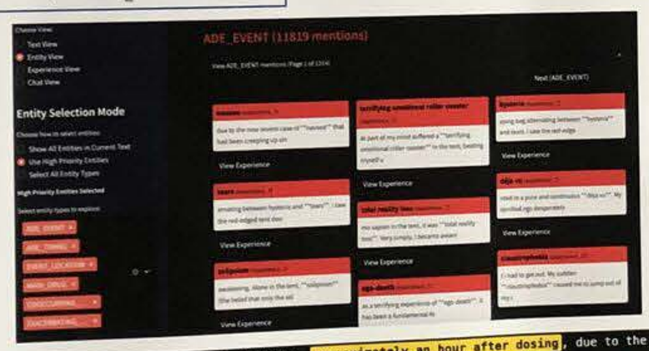


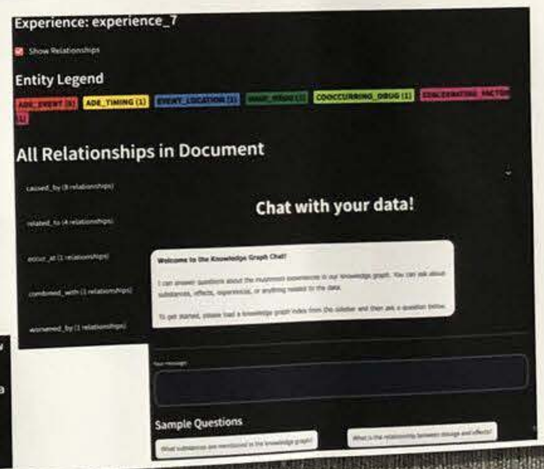


Materials & Methods



Application Interface





I was pulled out of this mind trip however, **approximately an hour after dosing**, due to the now severe case of **nausea** that had been creeping up since the beginning. The acute sensation brought me into a darker, grouchy emotional state as I stalked through the forest looking for a place to throw up. I had stamped about for about ten minutes wondering what to do when my friends appeared on the look out for me. They were also experiencing **nausea** and suggested we go smoke some pot to kill the feeling. It sounded like the best idea to me.

Results

Structured Summary Table for Psilocybin Experience Analysis

Category	Identified Entities
Co-occurring Drugs	Etizolam, Painkillers, LSD, Trazodone, Vitamin C, OxyContin, Ecstasy, 5-MeO-MIPT, Alprazolam, 2C-I, Valium, Syrian Rue, Coke, Banisteriopsis caapi, Paxil, Acetaminophen, Ketamine, Clonazepam, 2C-B, Alcohol, Caffeine, Diazepam, Codeine, Tramadol, Zyban, Cocaine, Mescaline
Common ADEs	Agitated, Extremely Emotional, Ideal Dose, Regret, Scared, Restless, Loss of Identity, Sadness, Tingle, Slight Paranoia, Dread, Paranoia, Vomited, Hung over for Several Days, Paralyzed, Deathly Feeling, Vomited Violently, Shivering, Cold Chills, Dizziness, Paranoid, Chronic Fatigue, Violent Dreams, High Pitched Ringing, Heavy Lethargy, Motion
Practical Harm Reduction Strategies	Ensure a Safe Environment, Trusted and Experienced Guide, Low Initial Dose, No Mixing of Substances, Stable Mental and Physical Health, Medical Support Availability
Impact of Location/ Setting	Nature Trails/Forests enhance tranquility and nature connection; Parties/Concerts amplify social interaction and sensory experiences; Context significantly impacts mood, perception, and psychological outcomes

Public Health Impacts

KGs trained on high-quality, abundant, unstructured, and user-generated data from people with lived experiences enables real-time interaction with drug surveillance efforts, making event detection efficient, data-driven and actionable across contexts. The following are of direct interest to public health:

- Automated adverse event detection: Querying KGs for increasing reports of negative reactions for certain drugs and drug classes
- Dynamic Drug Interaction Warning Signs: The KGs' relationships between substances can help researchers identify dangerous interactions in real time
- KGs trained on user-generated data from people with a history of drug use can help public health officials track shifting user patterns, including emerging street names

Pursuing KGs and other advanced AI approaches can significantly impact public health drug surveillance in an effort to understand US drug patterns and behaviors while promoting safety, knowledge, and education.