



Ask Extension: Applying Artificial Intelligence to Extension Results of an initial landscape overview

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August, 2019

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Summary

U.S. Cooperative Extension provides useful, relevant, local, research-based, information to citizens throughout the country. Modern affordances like web searches, email, and instant messaging have built the expectation that information and services are available in real time and via the Internet--today's primary source of information.

The local, nuanced, time-sensitive information that Extension and the Land Grant Universities provide exists, but can be difficult to find. Even more, the best resources are currently distributed across many data sources: e.g. Land Grant University information pages, Cooperative Extension websites and databases, Regional Integrated Pest Management Centers, Regional Rural Development Centers, and even eXtension's massive "Ask an Expert" database of questions and answers.

This investigation looks at one solution to the problem of information fragmentation and "findability" of research-based answers with local relevance: the creation of a distributed Ask Extension data registry and search interfaces. This solution would pull together data sources from throughout the Extension ecosystem to answer questions directly and accurately and connect local citizens with their local Extension professionals, products, and services.

Advances in technology such as machine learning, Artificial Intelligence (AI), and related data tools present the possibility of capitalizing upon this opportunity, by offering smart and localized access to the addressable research-based information. In addition, they offer long-term scalability that will answer common questions immediately, providing 24/7/365 availability of Extension resources.

Ask an Expert

Today, eXtension's "Ask an Expert" provides answers to tens of thousands of questions per year asked by members of the public, Extension agents, and professionals. Ask An Expert receives an average of 1 million unique users per month, most of which are finding the content through organic search. It is powered by a network of over 2,000 expert representatives distributed among state Extension Services nationwide. This service allows people anywhere to ask questions via a web-based form, and to receive answers from Extension Experts. Ask an Expert's combination of high level of expertise and local-level knowledge has made it popular and in demand. However, being human-powered provides powerful access to localized knowledge, but limits capacity, availability and speed of response. As the demand for Ask an Expert has grown, its ability to meet the demand has diminished. Ask Extension is an attempt to

apply new solutions that will support and extend the high-impact results of today's Ask an Expert system.

Ask Extension

To scale Ask an Expert to meet the demands of American communities nationwide, eXtension plans to use natural language processing (NLP), and AI to build a query service “chatbot” to support commonly asked questions. This approach has shown to be successful in providing query-based medical guidance, training support, and in general services such as Alexa, Siri, and Cortana. A dialogue-based agent, trained on the large dataset of existing Ask an Expert questions, would offer the opportunity to provide significant positive impact to Extension users. Specifically, it could provide access to existing questions and answers, links to local resources and experts, Extension websites, videos, factsheets, and more, to be available in real-time, and through their preferred channel—for many, a smartphone.

This new “Ask Extension” service is positioned to empower Land-Grant University Research and Cooperative Extension to be even more embedded in their local citizen’s digital lifestyles. eXtension tools like Ask an Expert and the digital content at Land-Grant Universities, combined with machine learning and NLP, can catalyze ways to reach and engage new audiences for local impact. Ask Extension will connect commercial software with LGU research and Extension content, embedding that content even more in how citizens live their smart-device lifestyles.

The basis of such a service would be a distributed Extension Knowledge Registry (EKR) made up of content flowing into the Ask Extension registry from Land Grant University Research and Extension content, Integrated Pest Management Centers, Regional Rural Development Centers, USDA-NIFA grants, and more. Rather than create a single central repository of resources, this registry would contain links to resources tagged with important metadata to ensure that Ask Extension integrates nationally, but is delivered locally (e.g. with a local Land Grant University’s branding and local content).

Furthermore, by moving to an easy-to-expand distributed registry structure, new resources and information will continually improve the Ask Extension chatbot; providing more services and engagement with local communities over time. The Ask Extension backend query engine will be available for use by local apps and providers, allowing new innovative uses of the EKR and Ask Extension by products and services in local counties, regions, districts and states. We believe that this service will not only support the increased demand for Extension services, but will also grow the number of citizens engaging with local resources. Citizens will be able to use a nationally-informed and locally branded chat bot to discover local digital and in-person products and services.

Ad Hoc Advisory Group

An Ad Hoc Advisory Group composed of representatives of nine LGU Extension Services was brought together to provide input and direction for Ask Extension. The participating LGU Extension Services included: University of California, University of Georgia, University of Idaho, Kentucky State University, University of Minnesota, Mississippi State University, University of New Hampshire, Oklahoma State University, and Virginia Tech. The members of the Ad Hoc Advisory Group were mid to high level Extension experts with a broad spectrum of backgrounds, including: Associate Director for Program Development, Digital Content Strategist, Program Development Specialist, Senior Director of Integrated Digital Strategies, IT Manager, State Science Coordinator, Forestry Specialist, Community and School Garden Coordinator, Research Associate, Urban Program Development Coordinator, Associate Professor, and Director of the Southern Rural Development Center.

After discussion and deliberation, the Ask Extension chatbot concept was supported by the advisory group, but several concerns were raised. The largest concern, coming from the one participant who did not fully support the Ask Extension concept, was that a technological solution to scaling Ask an Expert would decrease the “personal touch” which has been a hallmark of Extension services. Others shared this concern, and agreed it was a legitimate issue, but felt that this could be mitigated through careful design and testing. In addition, they felt that the potential benefits of the Ask Extension service outweighed this perceived loss in personal connection. It was also agreed within the group that the general public will continue to adopt technology to solve problems, and that Extension Services must adapt to the changes in behavior of their clients, or risk being left behind.

The top concern identified by the Advisory Group was that Ask Extension must maintain the high-quality, timeliness and locally-sensitive answers of the current Ask an Expert system that routes online questions to a network of Extension professionals and volunteers. Group members agreed that availability and response time are important factors (e.g. answering a question about storm preparation after a storm has passed isn’t useful), but that providing answers that aren’t localized to the user could lead to inaccuracies which would be more harmful than no answer at all.

In a similar vein regarding quality and accuracy of responses, the importance of populating the EKR with high-quality, updated, and relevant content was emphasized. Finally, the advisory group identified a large set of data sources from their home universities to help illustrate the technical difficulties in bringing together the decentralized content at LGU’s. They emphasized that smooth technical integration is a key requirement and challenge since some of the most useful content is locked behind registration walls. These data sources were included in the data



deep dive performed as part of this report and were considered in the proposed initial architecture for Ask Extension.

The Ad Hoc Advisory Group offered near unanimous support for the proposed Ask Extension service. The members concurred that a significant need for research-based, useful answers to everyday questions exists, and the local impact that such a service could provide is substantial. Of critical importance would be Ask Extension's ability to operate at scale, in real time, with acceptable accuracy and at a reasonable cost. If these critical points are achieved, then the service could be a game changer for Extension Services, utilizing AI technology to increase the reach of Extension professionals and creating great positive impact for the American people.

Report

This report contains a deep dive into existing eXtension and Cooperative Extension data sources, a sample of LGU content identified by the initial advisory group, and a brief discussion of how these data sources will form the backbone of Ask Extension. In addition, first thoughts about possible architecture for Ask Extension and how these architectures address the challenges, requirements, and concerns identified by the advisory group. As a precursor to the Ask Extension full project, we aim to define, describe, and discuss the potential data sources that will become the core of Ask Extension. In addition, we will examine how to align these data sources with common NLP datasets like Wikipedia and NYTimes. While these datasets are not useful for building the Extension and LGU domain knowledge maps, they are useful for building a robust link between common english vocabulary and the data sources detailed in this report.

Data Sources

This section provides an overview of data sources from both the current EKR as well as potential data sources from the larger Cooperative Extension system suggested by the advisory board. It is meant to expose both the breadth and richness of data available within this network. This discussion focuses on the features, types, size, and usage of the data in order to establish parameters for Ask Extension and to demonstrate that enough data is available to build a meaningful AI-based query engine.

Existing eXtension data sources

The current EKR includes four separate applications and databases containing data collected between 2006 to the present. They include over 500,000 questions and responses posted by eXtension members, 11,000 curated articles, 3,000 courses and webinars, and a network of over 18,000 eXtension members. These relational databases are:

- Ask an Expert, <https://ask.extension.org/> : a platform where citizens can post questions and receive answers from State Extension specialists and volunteers from across the United States
- Articles, <https://articles.extension.org/> : research-based information written by State Extension specialists across the country
- Learn, <https://learn.extension.org/> : professional development sessions and online webinars created by State Extension specialists across the country
- Campus, <https://campus.extension.org/> : online courses created by Extension specialists and university personnel

Potential university data resources

Today, LGUs and local providers create and maintain useful local resources that support their communities. To get a sense of the datatypes, sizes, and uses, we investigated sample data sources provided by an advisory group of LGU Extension professionals. These data sources are designed to merge expertise with the hyper-local nature of Extension work. For example, questions like “I have black bugs on my begonias, what should I do?” and “How deep should I plant garlic and what can I use as mulch?” require answers rooted in expert knowledge translated to the local climate and conditions of the asker. In order to understand how a future Ask Extension system can maintain this level of localization and community integration, the following datasets were investigated:

From the University of New Hampshire (UNH) Cooperative Extension, the data sources include:

- UNH Cooperative Extension search engine: a resource repository of curated fact sheets
- NH Bugs: a Drupal website and database of tagged images of native and invasive insects
- UNH YouTube channel: informational videos vetted by eXtension specialists
- UNH call records: database of questions and answers received via phone and recorded by an eXtension specialist
- UNH blog: an RSS feed, mostly answers and responses

From the Oklahoma Cooperative Extension Service at Oklahoma State University (OSU), the data sources include:

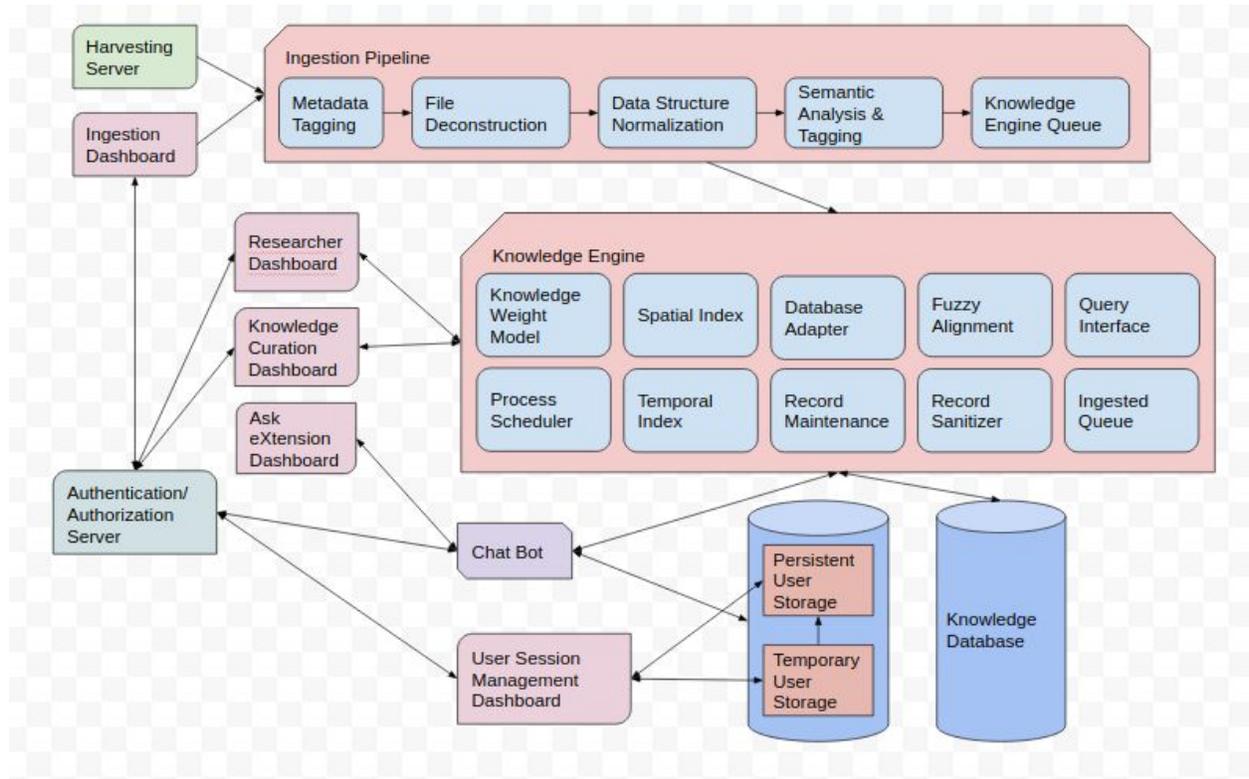
- OSU Extension Fact Sheets: research-based information on a wide variety of subjects
- SUNUP YouTube channel: educational videos produced by the Division of Agricultural Sciences and Natural Resources at OSU
- Oklahoma Gardening YouTube channel: research-based videos on gardening and other plant care produced by OSU
- Livestock and Livestock entomology: information presented by the Department of Animal Science at OSU pertaining to livestock and entomology related to livestock.
- Crop Variety Trials: website cataloguing the results of crop variety trials done by Division of Agricultural Sciences and Natural Resources at OSU
- Personnel directory: contact information for personnel in the Division of Agricultural Sciences and Natural Resources at OSU
- Weed Science: information about weed management in Oklahoma’s crop production systems, curated by the Department of Plant and Soil Sciences at Oklahoma State University
- Pesticide Fact Sheets: includes information about insects, plant diseases and safe pesticide use; maintained by OSU’s Entomology and Plant Pathology department

Various other sources include:

- ACP/HLB Distribution and Management: an interactive website on Asian Citrus Psyllid Management, maintained by the University of California
- Emerald Ash Borer Map: an interactive map of known occurrences of Emerald Ash Borer in Minnesota
- Early Detection and Distribution Mapping System: a Web-based mapping system for documenting invasive species distribution; includes local and national distribution maps
- iNaturalist: a crowdsourced species identification system
- Virginia Cooperative Extension site: Extensive list of educational resources from agriculture to home water quality

To make these datasets meaningful and applicable to future AEs Extension users, a cross-reference set of national data was also analyzed. These datasets include geographic and location data from the US Geographic Information Systems, and the National Oceanic and Atmospheric Administration's National Centers for Environmental Information. The full Ask Extension system will require the use of this locational metadata as well as climate and weather data, and possibly even current event information. Because weather and climate data is linked to GIS through shared location IDs, this report focuses on these two datasets. For a detailed explanation of each dataset (including size, ownership, quality, format, usage, and description), refer to Appendix 1 - Data Sources Analysis.

Architecture



The Ask Extension system is composed of two separate pieces; one for ingesting and analyzing content “Ingestion Pipeline”, and the other for recommending resources to Ask Extension users “Knowledge Engine”. The Ingestion Pipeline is used by Extension to train and update the Ask Extension AI. To do this, the Ingestion Pipeline ingests, cleans, and analyzes data sources using NLP and machine learning techniques. The Knowledge Engine uses the outputs of the Ingestion Pipeline to provide answers to user queries. The Knowledge Engine, plus the Knowledge Database will be the future Extension Knowledge Registry. This architecture improves on the current Extension system by shifting to a linked data architecture using a modular, extensible, design.

Linked Data

To support a larger ecosystem of knowledge and resources, beyond those owned or created by eXtension, it is necessary to use a data architecture that maintains ownership and traceability at every step. To do this, we intend to move to a linked data registry architecture. A registry architecture is a datastore that holds references to objects rather than the objects themselves.

For example, a card catalogue is a registry for a library. It holds metadata like title, author, and subject as well as a location for the book, but does not contain the book itself. Linked data is a method for publishing and sharing structured data by using Universal Reference Indicators (URIs). The most common form of linked data are weblinks (URLs), which are URIs that refer to a location on the web. For Ask Extension, this means using links to the source materials as the reference ID at all times. Doing so ensures that resource ownership and provenance is part of every transaction that involves a resource. Linked data is quickly becoming the standard storage method and is integral to the semantic web. For Ask Extension, this helps address advisory board concerns about data ownership and control by guaranteeing that resources themselves will never be persistently stored. It is important to note that resources will be temporarily stored only in the Ingestion Engine during the initial analysis phase, but Ask Extension will not house a repository of external resources.

In addition to moving to a linked data architecture, we plan to use URIs to allow for persistent and cross-referenceable IDs throughout the Ask Extension system. This will break down current data silos within Extension. For example, the People UserID is a unique identifier in Extension's People, Ask an Expert, and Learn databases; however, it is not present in Articles and resources. This means that it is not possible to trace an expert to articles they have written within the current Extension data structure. Migrating to URIs will solve not only this problem, but will also allow for cross referencing resources outside of Extension. For example, the sample data sources identified by the Advisory group contained text, images, video, audio, and more. To make sure that resources recommended by Ask Extension are both relevant and recent, it will be necessary to spot-test resources referenced by Ask Extension. This testing and validation is made possible by the use of URIs.

Modular Design

Future growth and changes within the eXtension Network will alter data storage and accessibility. The eXtension ecosystem and surrounding technologies are rapidly advancing. There are current and planned updates to the eXtension ecosystem, like moving course content in the Campus system from being held in more than 70 different university servers behind a paywall. In addition, new technologies like the semantic web, improvements in NLP, and the spread of web-based applications will continue to emerge. The new Ask Extension must be scalable so that future updates will not require complete redesign. To achieve this, Ask Extension will be built as a set of separate services called by discrete modules. In the architecture above, each input into the Ask Extension AI is designed to be its own module. This allows the AI and other services to be independently updated as better approaches are uncovered.

Risks and Mitigations

There are tradeoffs for moving to a modular, linked data, design. Ask Extension will manage links to resources and metadata about them, but will not store or host the external resources, retaining their full local attribution. However, means that it is possible for resources to be updated without the knowledge of Ask Extension. To address this, two approaches will be taken. First, fully digital resources, like NHBugs or the SUNUP YouTube channel, maintain edit and update timestamps that make identifying changes to the resource very easy. Physical or partially digital resources, like OSU Fact Sheets, are more difficult. These resources will be periodically audited to ensure that they are still recent and relevant to Ask Extension users.

Overall, the linked data architecture increases the complexity of maintaining and updating metadata, AI understanding, and management of distributed datasets, but provides better extensibility, ownership, and access to external tools built on the semantic web.

Moving to a modular architecture increases complexity and adds new points of failure. Thankfully, these designs have become the standard for modern development and developer tools and test suites are now as capable of building and maintaining modular architectures as they are of traditional monolithic design.

Ask Extension - Chat Bot

Users will interact with Ask Extension through a search interface powered by an AI dialog agent. This AI is responsible for combining data representations stored in the EKR to identify the best resources to meet a user's needs.

Dialog Agents

The Ask Extension system will be built using NLP and AI technologies originally derived from the Lucida project at the University of Michigan, and similar to those that currently power conversational agents in the banking and insurance sectors, where a higher degree of precision and technical accuracy is needed, but within a narrower domain. If desired, this technology can be combined with a general agent, using technology commonly seen in Alexa or Siri. In that case, queries outside of the EKR domain would be handled by the general agent and EKR queries would be handled by a more technically oriented query engine optimized for the EKR domains. This integration would occur in the background, with the user experiencing the interface as a single agent.

This class of AI tools is often called a "Chat Bot". There are two types of chat bots that will be involved in Ask Extension: a dialog agent and a query engine. Dialog agents provide natural language interfaces that allow users to find and refine answers to complex questions or series of questions. These dialog agents may be classified in several ways (e.g. embodied,

disembodied, embedded vs. stand-alone, domain of use, etc.). From a technical standpoint, one of the most useful classification systems is based on the types of interactions (goals) that the dialog agent is designed to support. Major categories of dialog agents include discrete task versus continuous task agents.

Discrete agents focus on limited to one-off tasks and exchanges - duration of a 'conversation' is limited to a single task (usually three or fewer exchanges), beyond which conversational context is not sustained. The natural language interface in a discrete dialog agent is used to clarify and refine the task, which is then executed by the agent. This means that the agent executes each task independently, but may or may not maintain user or task-specific data to simulate contextual knowledge and improve future query results. Some examples of this kind of agent are Interactive query engines, Natural language search engines, and one-time virtual assistants (e.g. make a restaurant booking).

Continuous task agents, on the other hand, can engage in longer dialog exchanges that are designed to mimic interaction with a human agent to complete a sustained task or achieve a specific conversational goal. These agents rely heavily on retaining user and task-specific knowledge, and make some attempt to maintain contextual knowledge of the current conversation. Some examples of these are teaching, tutoring, and counseling. In general, this technology is less mature due to the larger human factor involved.

For Ask Extension, we anticipate using a discrete task agent. One major driver for this is the ability to use the agent both with and without past user data. It is important that Ask Extension be able to handle user logins, preferably using single sign-on from Google, LinkedIn, Facebook, or an Extension ID. However, there are also use cases where a user may wish to use the service anonymously.

The Ask Extension agent will be composed of multiple components:

Interface Layer

- Embedding layer: API interface permits rapid embedding of the Ask Extension agent in multiple user environments, including web pages and mobile applications; a webhook for deployment through SMS can be added, and deployment through commercial messaging platforms (e.g. Google Chat, Facebook Messenger) is also possible;
- Dialog Agent Layer: The dialog agent layer interacts with the user through text-based conversational exchange. The goal orientation of the dialog layer is assisting the user to make and refine a query that can be submitted to the query engine. Refinement of a query request may include disambiguation of terms or collection of additional data to provide a context for the query (e.g. location, time, weather, other conditions, etc.)
- Command Center: Checks query for completeness and coherence; if applicable, interacts with the query engine to identify missing contextual data and request that the

dialog layer further assist the user in refining or modifying their query. (E.g. 35,000 resources were found that match this query (“What are the best apples?”); request further information: “locale”, “variety”, and “use case”)

Query Engine

- Query Classifier: Receives a query from the command center, extracts information in machine-readable formats, and forwards each piece to the correct processing and extraction service;
- Processing Services: Multiple services are possible and the service architecture is fully extensible, allowing for future extension and upgrades. A given input query may be passed through multiple services in parallel or successively to perform full query translation and interpretation:

Examples of possible services:

Text-Based: Named Entity Extraction, entity extraction, condition extraction, time extraction;

Other: image matching, image object detection, video transcription, mapping

- Engine Command Center: Coordinates data flows between the query classifier, processing services, knowledge base, and query response services.
- Knowledge Base: Indexed EKR Interface
- Query Response: Organizes query results as a package for delivery through the dialog layer and user interface; possible formats include resource links (e.g. urls) with accompanying dialog, images, and natural language formulation of text extracted from resources and converted to dialog formats.

Integration with existing community resources and local apps is a key requirement of the new Ask Extension system. To support this, Ask Extension intends to provide API access to its dialogue agent. However, not all integrations will use the same front-end Chatbot interface. To support this, the public APIs will allow direct queries into the EKR.

Privacy

The local and community-based resources within the Extension and LGU systems include potentially sensitive topics; in addition, personally identifiable information (PII) is increasingly regulated and protected. To align with university initiatives and ensure that Ask Extension meets future rigorous privacy standards, we will target the EU’s General Data Protection Regulation (GDPR) as a minimum threshold for protecting the data of Ask Extension users. Beyond digital data storage security and privacy, there are also cases where users may want to share their information with local extension agents or other services. Because of these two needs, Ask Extension will include extensive user-level security options. This will allow users to opt-in to sharing their contact information with local Extension services.

Conclusion

Ask Extension is necessary for the reach and impact of Extension to scale to meet the growing needs and modern expectations of its users. However, there are several hurdles that must be overcome in order for Ask Extension to be successful. First, it must maintain the quality services and “personal touch” that Extension is known for. Second, the recommendations and resources it provides must be correct, relevant, up-to-date, local and locally branded. Third, it must respect the privacy of its users while also connecting them to local services and resource providers. Finally, it must respect provenance, ownership, and attribution of all resources. Each of these requirements is addressed in the technical discussion and supported by the proposed architecture. By examining existing Ask an Expert data sets, other eXtension data sources, and a wide variety of resources provided by the advisory group, we have determined that it is feasible to build an Extension Knowledge Registry using linked data that will bring together all of these information sources. In addition, the Ask Extension described in this investigation is built using current best practices and leveraging existing open-source tools so that it can modularly incorporate new data sources and meet future requirements. This will provide short-term value by utilizing existing services, medium term value by extending the reach and impact of current Extension programs, and long-term value by providing a scalable framework that can address future needs without being rebuilt.

Appendix 1- Data Sources Analysis

Below is a brief technical report for each data source uncovered in the discovery process for both current resources in the EKR and potential university and public sources. For each, the source, owner, quality, format, size, frequency of use, and a brief description are included. The frequency of use (high, medium or low) is an estimation of how often members in each community use the specific resource. For example, specialized websites that target a very specific topic may be used less than fact sheets with a wide range of information. Publicly available questions and answers - like the current Ask an Expert database - have a higher frequency of use than phone calls that are responded to on a one-to-one basis and are neither scalable nor recorded for reference. The quality (high, medium or low) is based on a brief preliminary analysis of the completeness, consistency, uniqueness, timeliness, validity and accuracy of the data.

Existing eXtension data sources

- Ask an Expert
 - Source: MySQL database, supports semi-structured data exports
 - Owner: eXtension Foundation - information is publicly accessible
 - Quality: High
 - Format: text
 - Size: 554,665 entries for questions and 582,401 entries for responses
 - Frequency of Use: High
 - Description: A collection of publicly posted questions from all over the United States. Questions are answered by Cooperative Extension specialists and volunteers. Tables in this database also include the state and county of the questioners and responders, and the date that a question or response was posted. The data collected spans from 2006 to the present.
- Articles
 - Source: MySQL database, supports semi-structured data exports
 - Owner: eXtension Foundation - information is publicly accessible
 - Quality: High
 - Format: html (text, image)
 - Size: 11,890 entries
 - Frequency of Use: High

- Description: Research-based information in html web pages. Fields in this database include the title, summary and source url of each fact sheet. The data collected spans from 2008 to the present. Articles are currently being migrated to a new domain and can be tracked here:
https://articles.extension.org/migration/migrated_communities/
- Learn (Events)
 - Source: MySQL database, supports semi-structured data exports
 - Owner: eXtension Foundation - information is publicly accessible
 - Quality: Medium
 - Format: html (text, video)
 - Size: 3,573 entries
 - Frequency of Use: Medium
 - Description: Webinars posted by Extension professionals; only about a quarter of past webinars have been recorded. Fields include title, description and a link to the webinar. Webinars were formerly hosted on an eXtension custom platform, however a new system is being put in place. The data collected spans from 2010 to the present.
- Campus
 - Source: MySQL database, supports semi-structured data exports
 - Owner: eXtension Foundation - metadata is publicly accessible, however not all course content is publicly accessible
 - Quality: High
 - Format: html (text, video)
 - Size: 453 entries
 - Frequency of Use: Medium to Low
 - Description: Courses offered by institutions within the eXtension Network. The content of each course is usually only accessible after either logging into the network, or paying a fee. Fields include associated institution, instructor's name, title and description of the course. Source url is accessible via the course id.

Potential university data resources

UNH Cooperative Extension

- UNH Cooperative Extension search engine
 - Source: MySQL database, supports semi-structured data exports

- Owner: UNH Cooperative Extension
- Quality: High
- Format: pdf (text, image)
- Size: 5,069 entries
- Frequency of Use: High
- Description: Search feature on the UNH Cooperative Extension website that points users to publicly accessible resources curated and maintained by UNH eXtension specialists. Fields include title, description and a link to the pdf
- NH Bugs
 - Source: Drupal site and database
 - Owner: UNH Cooperative Extension
 - Quality: High
 - Format: html (text, image)
 - Size: ~200 images
 - Frequency of Use: Low
 - Description: A website that allows users to upload an image of an insect which will then be tagged by either the state entomologist or an eXtension specialist. Tagged images also include the county or town where the insect was photographed. The site also contains fact pages to identify and manage common damaging insects and plant diseases in NH.
- UNH YouTube channel
 - Source: <https://www.youtube.com/user/unhce>, public YouTube channel
 - Owner: UNH Cooperative Extension
 - Quality: High
 - Format: html, pdf
 - Size: 437 uploads
 - Frequency of Use: Medium (1,160 subscribers, 484,509 video views)
 - Description: Publicly accessible, vetted videos containing educational information about agriculture, forestry and wildlife, and a variety of other topics. The videos are uploaded by eXtension specialists.
- UNH call records
 - Source: relational database

- Owner: UNH Cooperative Extension
- Quality: Low
- Format: html, pdf
- Size: 2,162 entries
- Frequency of Use: Low
- Description: Volunteer Master Gardeners answer questions via phone and email between Monday to Friday, 9AM - 2PM. Although calls are not recorded, many responders - but not all - document a very brief summary of the question as well as the resource/answer provided. Email correspondences are not stored.
- UNH blog
 - Source: RSS Feed of UNH Extension's blog
 - Owner: UNH Cooperative Extension
 - Quality: High
 - Format: xml
 - Size: 855 blog posts
 - Frequency of Use: Medium
 - Description: The UNH Extension blog contains mostly questions and answers, local news stories, and factual articles. The RSS feed offers a way to monitor the current information in the system.

Oklahoma Cooperative Extension Service

- OSU Extension Fact Sheets
 - Source: <http://factsheets.okstate.edu/>
 - Owner: Oklahoma Cooperative Extension Service
 - Quality: High
 - Format: html (text, image)
 - Size: 1,300 fact sheets
 - Frequency of Use: High
 - Description: Fact sheets include research-based information on a wide variety of subjects from agriculture to youth development
- SUNUP YouTube channel
 - Source: <https://www.youtube.com/user/SUNUPTV>, public YouTube channel
 - Owner: Division of Agricultural Sciences and Natural Resources at OSU

- Quality: High
- Format: video (transcriptions available)
- Size: 3,483 uploads
- Frequency of Use: High (8,375 subscribers, 6,520,668 video views)
- Description: Educational videos about Oklahoma agriculture intended for farmers and ranchers
- Oklahoma Gardening YouTube channel
 - Source: <https://www.youtube.com/user/OklahomaGardening>, public YouTube channel
 - Owner: Oklahoma Cooperative Extension Service (as part of the Division of Agricultural Sciences and Natural Resources at OSU)
 - Quality: High
 - Format: video (transcriptions available)
 - Size: 1,828 uploads
 - Frequency of Use: High (49,113 subscribers, 15,131,154 video views)
 - Description: A weekly television program with research-based informative segments on topics like gardening, tree care, and landscaping design
- Livestock and Livestock entomology
 - Source: <http://livestockbugs.okstate.edu/> and <http://afs.okstate.edu/breeds>
 - Owner: Department of Entomology and Plant Pathology, Department of Animal Science at OSU
 - Quality: High
 - Format: html (text, image)
 - Size: 11 categories and over 500 breeds of livestock; 8 insect fact sheets
 - Frequency of Use: Medium
 - Description: Informational resources on breeds of livestock around the world as well as fact sheets on livestock entomology. The information is curated by OSU.
- Crop Variety Trials
 - Source: <http://croptrials.okstate.edu/>
 - Owner: Division of Agricultural Sciences and Natural Resources at OSU
 - Quality: High
 - Format: html (text, image)

- Size: 11 crop varieties
- Frequency of Use: Medium
- Description: The results of all of the crop variety testing done each year by the OSU Division of Agricultural Sciences and Natural Resources. The collected data ranges from 1997 to the present.
- Personnel directory
 - Source: <https://apps.dasnr.okstate.edu/directory/>
 - Owner: Division of Agricultural Sciences and Natural Resources at OSU
 - Quality: High
 - Format: html (text)
 - Size: +1,000 contacts
 - Frequency of Use: Medium
 - Description: Email contacts including first and last name of each person for Oklahoma State University's Division of Agricultural Sciences and Natural Resources
- Weed Science
 - Source: <http://weedsience.okstate.edu/>
 - Owner: Department of Plant and Soil Sciences at OSU
 - Quality: High
 - Format: html (text, image)
 - Size: ~100 records
 - Frequency of Use: Low
 - Description: Provides current information regarding extension and research activities in weed management for all of Oklahoma's crop production systems, resources for weed identification, and contact information for the weed science personnel at OSU. The list of weed species is alphabetized by their Latin names.
- Pesticide Fact Sheets
 - Source: <http://pested.okstate.edu/>
 - Owner: Department of Entomology and Plant Pathology at OSU
 - Quality: High
 - Format: html (text, image), pdf (text, image)
 - Size: +100 fact sheets

- Frequency of Use: Medium
- Description: Resources and information about pesticides, treatment of bugs, and diagnosis of bugs and plant diseases.

Other university sources:

- ACP/HLB Distribution and Management
 - Source: <https://ucanr.edu/sites/ACP/>
 - Owner: Dept. of Entomology, UC Riverside, UC Agricultural Issues Center, UC Davis Informatics and GIS Statewide Program at the Kearney Agricultural Center
 - Quality: High
 - Format: html (text, image, video), interactive map
 - Size: +12 pages of information
 - Frequency of Use: High
 - Description: Resources for homeowners, master gardeners and citrus growers to help locate and manage Asian citrus psyllids.
- Emerald Ash Borer Map
 - Source: <https://mnag.maps.arcgis.com/apps/webappviewer/index.html?id=63ebb977e2924d27b9ef0787ecedf6e9>
 - Owner: US Department of Agriculture
 - Quality: High
 - Format: interactive map (ArcGIS)
 - Size: 1 map
 - Frequency of Use: Medium
 - Description: Displays known occurrences of Emerald Ash Borer in Minnesota.
- Early Detection and Distribution Mapping System
 - Source: <https://www.eddmaps.org/>
 - Owner: Center for Invasive Species and Ecosystem Health at the University of Georgia
 - Quality: High
 - Format: html (text, image), interactive maps
 - Size: +4,000 species
 - Frequency of Use: Medium

- Description: Real time tracking of invasive species (plants, insects, diseases, wildlife) occurrences that includes local and national distribution maps. The site also has a library of identification and management information.
- iNaturalist
 - Source: <https://www.inaturalist.org/>
 - Owner: California Academy of Sciences and the National Geographic Society
 - Quality:
 - Format: html (text, image), interactive maps
 - Size: +19,000,000 images
 - Frequency of Use: High
 - Description: A crowdsourced species identification system and an organism occurrence recording tool. Users can search by 'species' and 'location'.
- Virginia Cooperative Extension site
 - Source: <https://www.pubs.ext.vt.edu/>
 - Owner: Virginia Cooperative Extension with Virginia State University and Virginia Tech
 - Quality: High
 - Format: html (text, image), pdf, video, ebooks
 - Size: +4,000 individual resources
 - Frequency of Use: High
 - Description: Publications and education resources that include an extensive list of resources from agriculture to home water quality.

Public Reference data resources

The publicly available datasets below have been included to support data-driven discovery as well as providing a structured semantic knowledge base.

- US Geographic Information Systems (GIS)
 - Source: <https://data.usgs.gov/datacatalog>
 - Owner: US Geological Survey
 - Quality: High
 - Format: csv, xml, shapefiles, metadata, etc
 - Size: +15,000 datasets

- Description: Publicly accessible datasets from USGS research and monitoring data nationwide.
- National Oceanic and Atmospheric Administration's National Centers for Environmental Information (NOAA NCDC)
 - Source: <https://www.ncei.noaa.gov/access>
 - Owner: NOAA NCDC
 - Quality: High
 - Format: csv, xml, shapefiles, geoJSON, pdf, etc
 - Size: 20 petabytes of digital data
 - Description: Provides public access to the world's largest archive of environmental data.

AI and NLP training Data Sources

The publicly available datasets below have been included to support data-driven discovery as well as providing a structured semantic knowledge base. They are standard datatsources used to train AI and NLP.

- Wikipedia
 - Source: <https://dumps.wikimedia.org/>
 - Owner: Wikimedia Foundation
 - Quality: High
 - Format: xml, sql
 - Size: 16 GB (over 5.8 million English language articles)
 - Description: Multilingual online encyclopedia with free content.

Appendix 2 - Schemata and Images

People Db schem

| | | | |
|---|---|---|--|
| People people id : int(11) idstring : varchar(80) password_hash : varchar(255) legacy_password : varchar(40) password_reset : text first_name : varchar(255) last_name : varchar(255) email : varchar(96) previous_email : varchar(96) title : varchar(255) phone : varchar(255) time_zone : varchar(255) email_confirmed_at : datetime contributor_agreement : tinyint(1) contributor_agreement_at : datetime account_status : int(11) last_activity_at : datetime last_account_reminder : datetime account_reminders : int(11) position_id : int(11) location_id : int(11) county_id : int(11) institution_id : int(11) vouched_by : int(11) vouched_at : datetime email_confirmed : tinyint(1) is_admin : tinyint(1) announcements : tinyint(1) retired : tinyint(1) base_login_string : varchar(255) login_increment : int(11) primary_account_id : int(11) affiliation : varchar(255) biography : text involvement : text invitation_id : int(11) reset_token : varchar(40) aae_id : int(11) learn_id : int(11) created_at : datetime updated_at : datetime google_apps_email : tinyint(1) tou_accepted_at : datetime slack_user_id : varchar(255) avatar : varchar(255) is_systems_account : tinyint(1) display_extension_email : tinyint(1) campus_id : int(11) retired_at : datetime connect_to_google : tinyint(1) next_signin_required : tinyint(1) backup_email : varchar(96) | People locations id : int(11) fipsid : int(11) entrytype : int(11) name : varchar(255) abbreviation : varchar(10) office_link : varchar(255) | People activities id : int(11) person_id : int(11) activityclass : int(11) activitycode : int(11) reasoncode : int(11) community_id : int(11) ip_address : varchar(255) colleague_id : int(11) site : varchar(255) is_private : tinyint(1) additionalinfo : varchar(255) additionaldata : text created_at : datetime | People admin_roles id : int(11) person_id : int(11) applabel : varchar(255) created_at : datetime |
| | People counties id : int(11) fipsid : int(11) location_id : int(11) state_fipsid : int(11) countycode : varchar(3) name : varchar(255) censusclass : varchar(2) | | People retired_accounts id : int(11) person_id : int(11) retiring_colleague_id : int(11) explanation : varchar(255) communities : text created_at : datetime updated_at : datetime |
| | People extension_regions id : int(11) shortname : varchar(255) label : varchar(255) association_url : varchar(255) created_at : datetime updated_at : datetime | | |
| | People institutional_regions id : int(11) extension_region_id : int(11) institution_id : int(11) created_at : datetime | | |
| | People person_interests id : int(11) interest_id : int(11) person_id : int(11) created_at : datetime | | |
| | People interests id : int(11) name : varchar(255) created_at : datetime | | |
| | | People communities id : int(11) entrytype : int(11) name : varchar(255) description : text created_by : int(11) memberfilter : int(11) shortname : varchar(255) publishing_community : tinyint(1) location_id : int(11) connect_to_drupal : tinyint(1) drupal_node_id : int(11) active : tinyint(1) created_at : datetime updated_at : datetime community_masthead : varchar(255) primary_contact_id : int(11) membership_level : int(11) | |
| | | People positions id : int(11) entrytype : int(11) name : varchar(255) created_at : datetime updated_at : datetime | |
| | | People community_connections id : int(11) person_id : int(11) community_id : int(11) connectiontype : varchar(255) sendnotifications : tinyint(1) created_at : datetime updated_at : datetime | |

Ask an Expert db schema:

| Ask questions | Ask responses | Ask question_events | Ask users | Ask geo_names | Ask groups |
|--|---|---|--|---|--|
| <ul style="list-style-type: none"> id : int(11) current_resolver_id : int(11) status : varchar(255) body : text title : varchar(255) is_private : tinyint(1) is_private_reason : int(11) assignee_id : int(11) assigned_group_id : int(11) duplicate : tinyint(1) external_app_id : varchar(255) submitter_email : varchar(255) resolved_at : datetime question_updated_at : datetime current_response : text initial_response_id : int(11) initial_response_time : int(11) initial_response_at : datetime initial_responder_id : int(11) question_fingerprint : varchar(255) submitter_firstname : varchar(255) submitter_lastname : varchar(255) county_id : int(11) location_id : int(11) spam_legacy : tinyint(1) user_ip : varchar(255) user_agent : text status_state : int(11) zip_code : varchar(255) original_group_id : int(11) submitter_id : int(11) last_assigned_at : datetime last_opened_at : datetime is_api : tinyint(1) evaluation_sent : tinyint(1) created_at : datetime updated_at : datetime original_location_id : int(11) original_county_id : int(11) working_on_this : datetime featured : tinyint(1) featured_at : datetime submitter_is_extension : tinyint(1) widget_parent_url : text cached_tag_hash : text rejection_code : int(11) source : int(11) | <ul style="list-style-type: none"> id : int(11) resolver_id : int(11) submitter_id : int(11) question_id : int(11) body : text sent : tinyint(1) signature : text user_ip : varchar(255) user_agent : varchar(255) created_at : datetime updated_at : datetime is_expert : tinyint(1) previous_expert : tinyint(1) time_since_submission : int(11) time_since_last : int(11) | <ul style="list-style-type: none"> id : int(11) question_id : int(11) submitter_id : int(11) initiated_by_id : int(11) recipient_id : int(11) recipient_group_id : int(11) event_state : int(11) response : text event_id : int(11) tags : text additional_data : text previous_event_id : int(11) duration_since_last : int(11) previous_recipient_id : int(11) time_since_submission : int(11) previous_initiator_id : int(11) previous_handling_event_id : int(11) duration_since_last_handling_event : int(11) previous_handling_event_state : int(11) previous_handling_recipient_id : int(11) user_id : int(11) previous_tags : text previous_group_id : int(11) changed_group_id : int(11) created_at : datetime updated_at : datetime updated_question_values : text is_extension : tinyint(1) changed_tag : varchar(255) auto_assignment_log_id : int(11) group_logs : text | <ul style="list-style-type: none"> id : int(11) darmok_id : int(11) kind : varchar(255) login : varchar(80) first_name : varchar(255) last_name : varchar(255) public_name : varchar(255) email : varchar(255) title : varchar(255) position_id : int(11) location_id : int(11) county_id : int(11) unavailable : tinyint(1) is_admin : tinyint(1) auto_route : tinyint(1) phone_number : varchar(255) away : tinyint(1) time_zone : varchar(255) is_question_wrangler : tinyint(1) vacated_aae_at : datetime first_aae_away_reminder : tinyint(1) second_aae_away_reminder : tinyint(1) bio : text signature : text routing_instructions : varchar(255) avatar_file_name : varchar(255) avatar_content_type : varchar(255) avatar_file_size : int(11) avatar_updated_at : datetime created_at : datetime updated_at : datetime needs_search_update : tinyint(1) has_invalid_email : tinyint(1) invalid_email : varchar(255) open_question_count : int(11) last_question_touched_at : datetime last_question_assigned_at : datetime unavailable_reason : int(11) openid : varchar(255) institution_id : int(11) last_activity_at : datetime | <ul style="list-style-type: none"> id : int(11) feature_name : varchar(121) feature_class : varchar(51) state_abbreviation : varchar(3) state_code : varchar(3) county : varchar(101) county_code : varchar(4) lat_dms : varchar(8) long_dms : varchar(9) lat : float long : float source_lat_dms : varchar(8) source_long_dms : varchar(9) source_lat : float source_long : float elevation : int(11) map_name : varchar(255) create_date_txt : varchar(255) edit_date_txt : varchar(255) create_date : date edit_date : date | <ul style="list-style-type: none"> id : int(11) name : varchar(255) description : text widget_public_option : tinyint(1) assignment_outside_locations : tinyint(1) individual_assignment : tinyint(1) created_by : int(11) is_test : tinyint(1) widget_fingerprint : varchar(255) unused_widget_show_location : tinyint(1) widget_show_title : tinyint(1) widget_enable_tags : tinyint(1) widget_location_id : int(11) widget_county_id : int(11) old_widget_id : int(11) old_widget_url : varchar(255) darmok_expertise_id : int(11) created_at : datetime updated_at : datetime avatar_file_name : varchar(255) avatar_content_type : varchar(255) avatar_file_size : int(11) avatar_updated_at : datetime group_active : tinyint(1) ignore_county_routing : tinyint(1) send_evaluation : tinyint(1) |
| | <ul style="list-style-type: none"> id : int(11) demographic_question_id : int(11) user_id : int(11) response : text value : int(11) created_at : datetime updated_at : datetime | | | <ul style="list-style-type: none"> id : int(11) prefable_id : int(11) group_id : int(11) question_id : int(11) prefable_type : varchar(30) classification : varchar(255) datatype : varchar(255) value : varchar(255) created_at : datetime updated_at : datetime | <ul style="list-style-type: none"> id : int(11) name : varchar(255) user_id : int(11) group_id : int(11) connection_type : varchar(255) created_at : datetime updated_at : datetime |
| | <ul style="list-style-type: none"> id : int(11) fipsid : int(11) location_id : int(11) state_fipsid : int(11) countycode : varchar(3) name : varchar(255) censusclass : varchar(2) created_at : datetime updated_at : datetime | <ul style="list-style-type: none"> id : int(11) fipsid : int(11) entrytype : int(11) name : varchar(255) abbreviation : varchar(10) office_link : varchar(255) county_id : int(11) created_at : datetime updated_at : datetime | | | <ul style="list-style-type: none"> id : int(11) user_id : int(11) created_by : int(11) event_code : int(11) updated_user_attributes : text created_at : datetime updated_at : datetime |
| | <ul style="list-style-type: none"> id : int(11) county_id : int(11) group_id : int(11) | <ul style="list-style-type: none"> id : int(11) location_id : int(11) group_id : int(11) is_primary : tinyint(1) created_at : datetime updated_at : datetime | <ul style="list-style-type: none"> id : int(11) name : varchar(255) created_at : datetime | | |
| | <ul style="list-style-type: none"> id : int(11) location_id : int(11) group_id : int(11) | | | | |

Articles Db schema:

Articles pages

- id : int(11)
- datatype : varchar(255)
- indexed : int(11)
- title : text
- url_title : varchar(101)
- content : longtext
- content_length : int(11)
- content_words : int(11)
- original_content : longtext
- source_created_at : datetime
- source_updated_at : datetime
- source : varchar(255)
- source_url : text
- source_url_fingerprint : varchar(255)
- is_dpl : tinyint(1)
- migrated_id : int(11)
- has_broken_links : tinyint(1)
- coverage : text
- state_abbreviations : text
- created_at : datetime
- updated_at : datetime
- page_source_id : int(11)
- old_source_url : text
- alternate_source_url : text
- summary : text
- keep_published : tinyint(1)
- create_node_id : int(11)
- redirect_page : tinyint(1)
- redirect_url : text

Articles people

- id : int(11)
- uid : varchar(255)
- first_name : varchar(255)
- last_name : varchar(255)
- is_admin : tinyint(1)
- retired : tinyint(1)
- last_active_at : datetime
- created_at : datetime
- updated_at : datetime

Articles geo_names

- id : int(11)
- feature_name : varchar(121)
- feature_class : varchar(51)
- state_abbreviation : varchar(3)
- state_code : varchar(3)
- county : varchar(101)
- county_code : varchar(4)
- lat_dms : varchar(8)
- long_dms : varchar(9)
- lat : float
- long : float
- source_lat_dms : varchar(8)
- source_long_dms : varchar(9)
- source_lat : float
- source_long : float
- elevation : int(11)
- map_name : varchar(255)
- create_date_txt : varchar(255)
- edit_date_txt : varchar(255)
- create_date : date
- edit_date : date

Articles links

- id : int(11)
- linktype : int(11)
- page_id : int(11)
- host : varchar(255)
- source_host : varchar(255)
- path : text
- fingerprint : varchar(255)
- url : text
- alias_fingerprint : varchar(255)
- alias_url : text
- alternate_fingerprint : varchar(255)
- alternate_url : text
- created_at : datetime
- updated_at : datetime
- status : int(11)
- error_count : int(11)
- last_check_at : datetime
- last_check_status : int(11)
- last_check_response : tinyint(1)
- last_check_code : varchar(255)
- last_check_information : text

Articles page_sources

- id : int(11)
- name : varchar(255)
- uri : varchar(255)
- page_uri : varchar(255)
- page_uri_column : varchar(255)
- demo_uri : varchar(255)
- demo_page_uri : varchar(255)
- active : tinyint(1)
- retrieve_with_time : tinyint(1)
- default_datatype : varchar(255)
- default_request_options : text
- latest_source_time : datetime
- last_requested_at : datetime
- last_requested_success : tinyint(1)
- last_requested_information : text
- created_at : datetime
- updated_at : datetime

Articles locations

- id : int(11)
- fipsid : int(11)
- entrytype : int(11)
- name : varchar(255)
- abbreviation : varchar(10)
- office_link : varchar(255)

Articles counties

- id : int(11)
- fipsid : int(11)
- location_id : int(11)
- state_fipsid : int(11)
- countycode : varchar(3)
- name : varchar(255)
- censusclass : varchar(2)

Articles tags

- id : int(11)
- name : varchar(255)
- created_at : datetime

Articles topics

- id : int(11)
- name : varchar(255)

Articles migrated_urls

- id : int(11)
- alias_url : varchar(255)
- alias_url_fingerprint : varchar(255)
- target_url : varchar(255)
- target_url_fingerprint : varchar(255)

Articles zip_codes

- id : int(11)
- zip_code : int(11)
- city : varchar(255)
- state : varchar(255)
- county : varchar(255)
- area_code : int(11)
- city_type : varchar(255)
- city_alias_abbreviation : varchar(255)
- city_alias_name : varchar(255)
- latitude : float
- longitude : float
- time_zone : int(11)
- elevation : int(11)
- county_fips : int(11)
- day_light_savings : varchar(255)

Articles branding_institutions

- id : int(11)
- name : varchar(255)
- location_id : int(11)
- public_uri : varchar(255)
- referer_domain : varchar(255)
- logo_id : int(11)
- created_at : datetime
- updated_at : datetime
- is_active : tinyint(1)

Articles update_times

- id : int(11)
- datasource_id : int(11)
- datasource_type : varchar(25)
- datatype : varchar(25)
- last_datasourced_at : datetime
- created_at : datetime
- updated_at : datetime
- additionaldata : text

Articles link_stats

- id : int(11)
- page_id : int(11)
- total : int(11)
- external : int(11)
- internal : int(11)
- wanted : int(11)
- local : int(11)
- broken : int(11)
- warning : int(11)
- redirected : int(11)
- created_at : datetime
- updated_at : datetime

Learn (Events) db schema:

| Learn events | Learn event_activities | Learn learners | Learn zoom_webinars | Learn taggings |
|--|---|--|---|---|
| <ul style="list-style-type: none"> id : int(11) title : text description : text session_start : datetime session_end : datetime session_length : int(11) location : text recording : text creator_id : int(11) last_modifier_id : int(11) time_zone : varchar(255) created_at : datetime updated_at : datetime is_canceled : tinyint(1) is_expired : tinyint(1) event_type : varchar(25) featured : tinyint(1) featured_at : datetime evaluation_link : varchar(255) cover_image : varchar(255) followers_count : int(11) attendees_count : int(11) viewers_count : int(11) provided_presenter_order : text is_deleted : tinyint(1) requires_registration : tinyint(1) reason_is_deleted : text registration_description : text primary_audience : int(11) location_webinar_id : int(11) zoom_webinar_id : int(11) zoom_webinar_status : int(11) is_mfln : tinyint(1) redirect_event : tinyint(1) redirect_url : text | <ul style="list-style-type: none"> id : int(11) learner_id : int(11) event_id : int(11) activity : int(11) trackable_id : int(11) trackable_type : varchar(30) activity_count : int(11) updated_at : datetime | <ul style="list-style-type: none"> id : int(11) email : varchar(255) name : varchar(255) time_zone : varchar(255) mobile_number : varchar(255) bio : varchar(255) avatar : varchar(255) has_profile : tinyint(1) darmok_id : int(11) retired : tinyint(1) is_admin : tinyint(1) created_at : datetime updated_at : datetime needs_search_update : tinyint(1) openid : varchar(255) institution_id : int(11) last_activity_at : datetime | <ul style="list-style-type: none"> id : int(11) event_id : int(11) webinar_id : int(11) webinar_type : int(11) recurring : tinyint(1) has_registration_url : tinyint(1) last_api_success : tinyint(1) webinar_created_at : datetime webinar_start_at : datetime duration : int(11) uidlist : text webinar_info : mediumtext created_at : datetime updated_at : datetime registered_count : int(11) attended_count : int(11) | <ul style="list-style-type: none"> id : int(11) tag_id : int(11) taggable_id : int(11) taggable_type : varchar(255) created_at : datetime updated_at : datetime |
| | <ul style="list-style-type: none"> Learn recommendations id : int(11) learner_id : int(11) day : date created_at : datetime updated_at : datetime | | | <ul style="list-style-type: none"> Learn presenter_connections id : int(11) learner_id : int(11) event_id : int(11) created_at : datetime added_by_api : tinyint(1) |
| | <ul style="list-style-type: none"> Learn event_connections id : int(11) learner_id : int(11) event_id : int(11) connectiontype : int(11) created_at : datetime added_by_api : tinyint(1) | | | |
| | <ul style="list-style-type: none"> Learn preferences id : int(11) prefable_id : int(11) prefable_type : varchar(30) group : varchar(255) name : varchar(255) datatype : varchar(255) value : varchar(255) created_at : datetime updated_at : datetime | | | |
| | <ul style="list-style-type: none"> Learn tags id : int(11) name : varchar(255) created_at : datetime | | | |
| | | <ul style="list-style-type: none"> Learn recommended_events id : int(11) recommendation_id : int(11) event_id : int(11) viewed : tinyint(1) created_at : datetime updated_at : datetime | | |
| | | <ul style="list-style-type: none"> Learn event_registrations id : int(11) event_id : int(11) first_name : varchar(255) last_name : varchar(255) email : varchar(255) created_at : datetime | | |
| | | <ul style="list-style-type: none"> Learn images id : int(11) event_id : int(11) file : varchar(255) created_at : datetime updated_at : datetime | <ul style="list-style-type: none"> Learn zoom_connections id : int(11) zoom_webinar_id : int(11) event_id : int(11) learner_id : int(11) event_connection_id : int(11) zoom_uuid : varchar(255) zoom_user_id : varchar(255) first_name : varchar(255) last_name : varchar(255) email : varchar(255) panelist : tinyint(1) registered : tinyint(1) attended : tinyint(1) time_in_session : int(11) additionaldata : mediumtext registered_at : datetime attended_at : datetime created_at : datetime updated_at : datetime | |