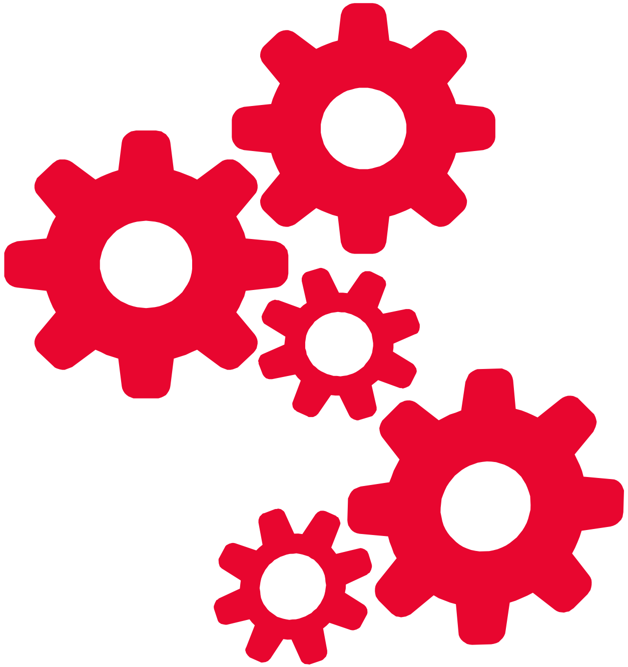
What's in our Backlogs?

A journey through Samvera Community Institutions' open issues with Natural Language Processing

presented by Anna Headley

project by Anna Headley and Eliot Jordan,
Princeton University Library

What's next for you?



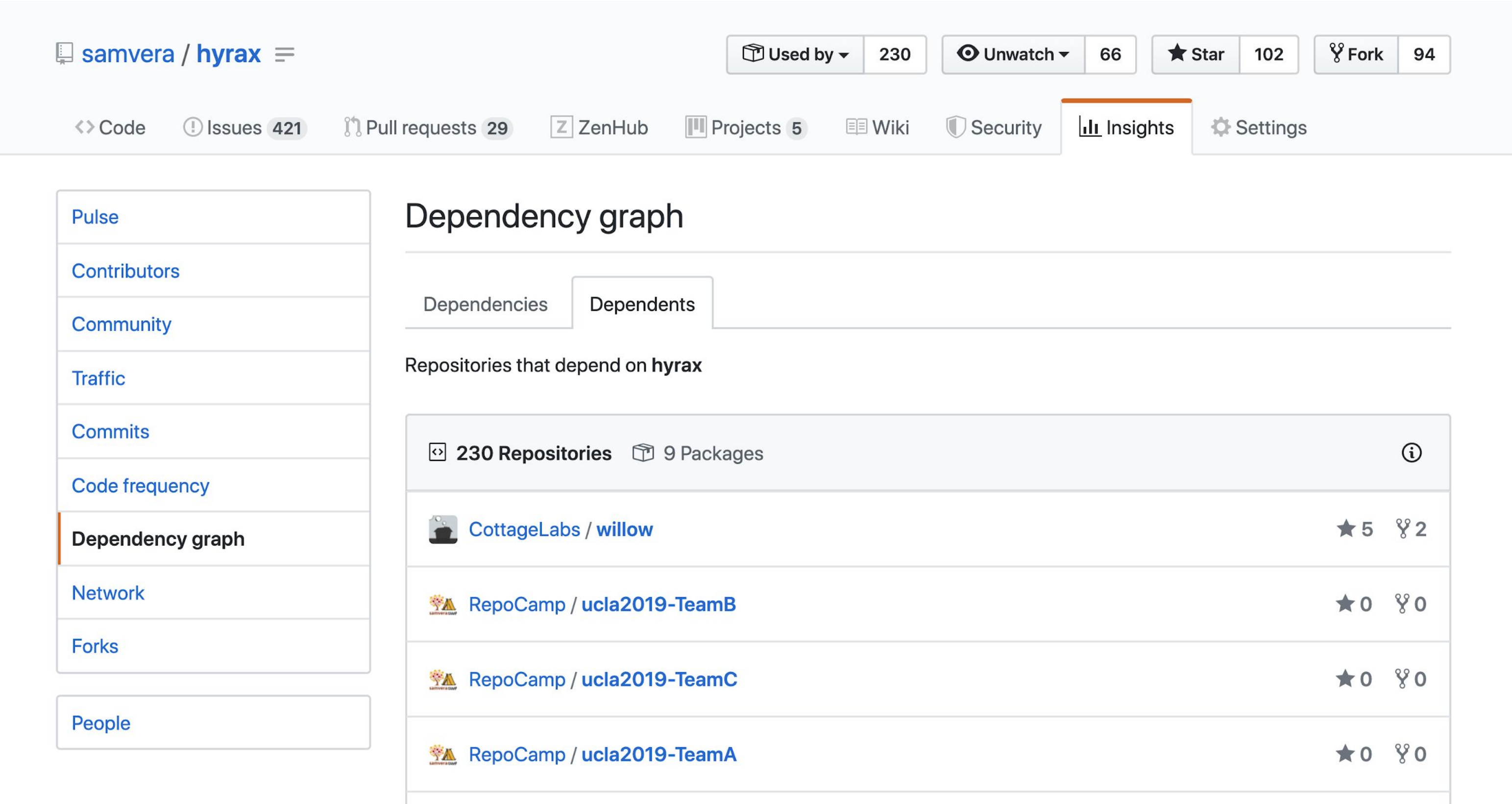
Question

What kinds of open issues do we have?

- Can we extract an interesting set of widely-desired features or widely-held use cases?
- Can we identify connections that might lead to collaboration across institutions?

Data Set

Collate a list of repositories



samvera / **hyrax**

Used by 230 | Unwatch 66 | Star 102 | Fork 94

Code | Issues 421 | Pull requests 29 | ZenHub | Projects 5 | Wiki | Security | Insights | Settings

- Pulse
- Contributors
- Community
- Traffic
- Commits
- Code frequency
- **Dependency graph**
- Network
- Forks

- People

Dependency graph

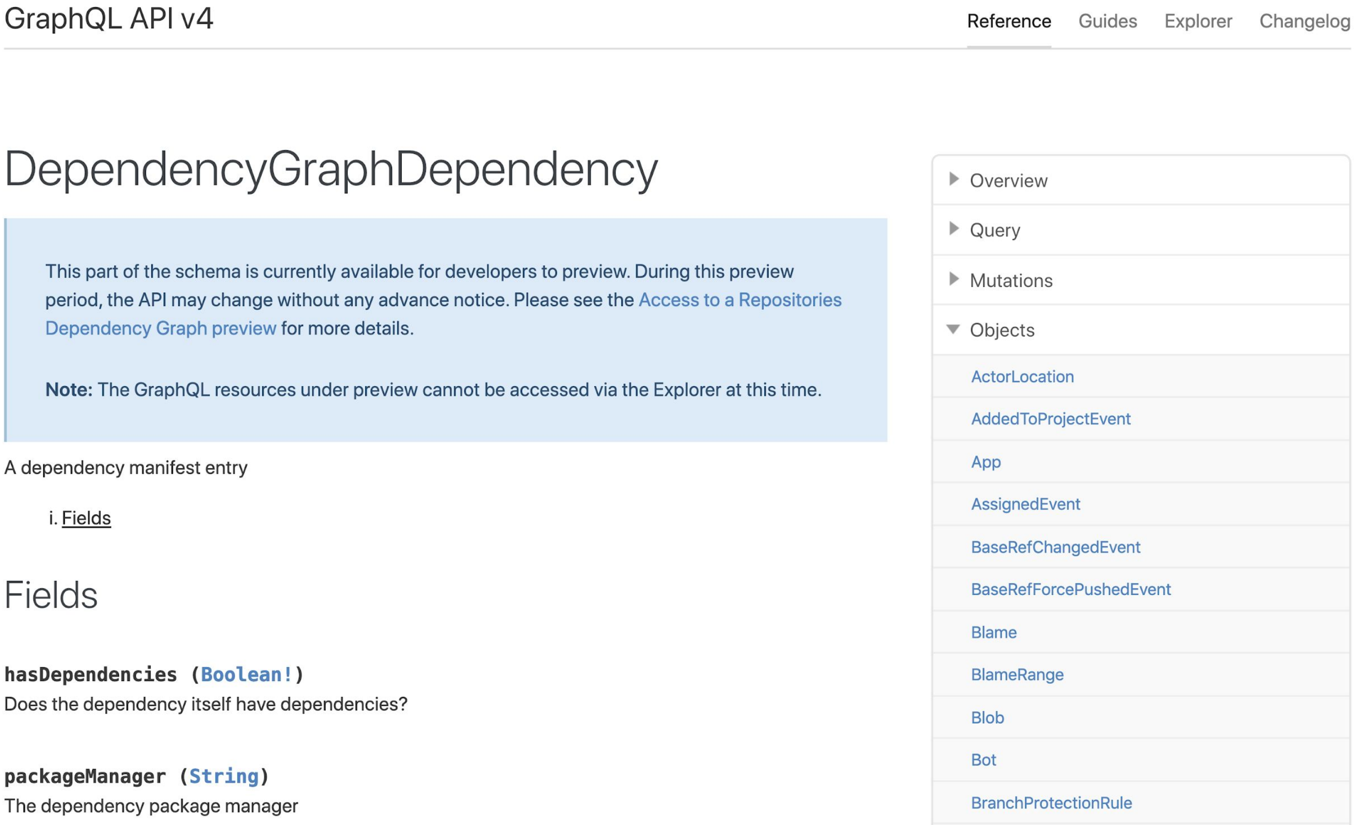
Dependencies | Dependents

Repositories that depend on **hyrax**

230 Repositories 9 Packages

Repository	Stars	Forks
CottageLabs / **willow**	★ 5	2
RepoCamp / **ucla2019-TeamB**	★ 0	0
RepoCamp / **ucla2019-TeamC**	★ 0	0
RepoCamp / **ucla2019-TeamA**	★ 0	0

Let's use github's graphql api



GraphQL API v4

DependencyGraphDependency

This part of the schema is currently available for developers to preview. During this preview period, the API may change without any advance notice. Please see the Access to a Repositories Dependency Graph preview for more details.

Note: The GraphQL resources under preview cannot be accessed via the Explorer at this time.

A dependency manifest entry

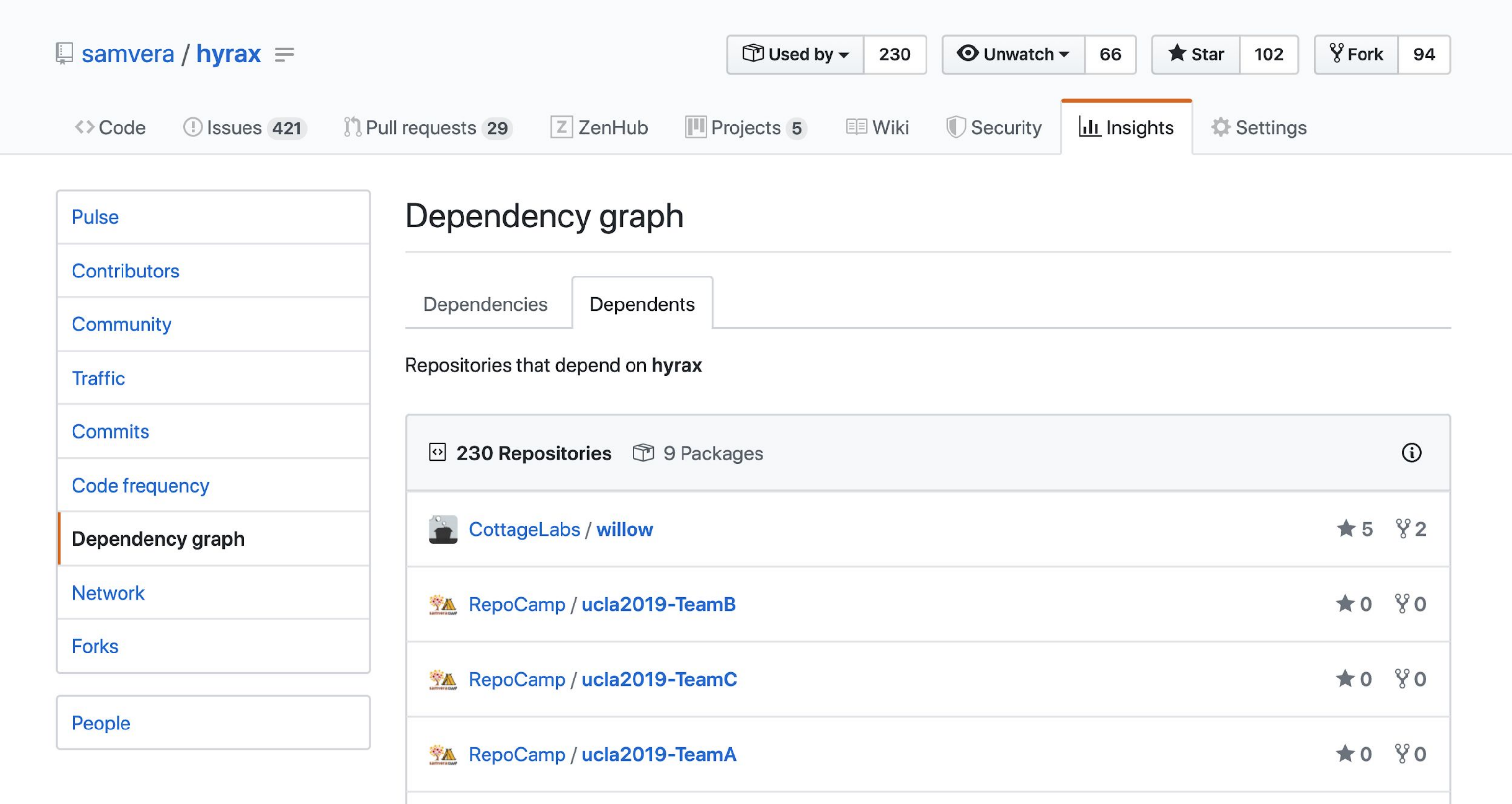
i. Fields

Fields

`hasDependencies (Boolean!)`
Does the dependency itself have dependencies?

`packageManager (String)`
The dependency package manager

Collate a list of repositories



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Dependency graph

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RepoCamp / **ucla2019-TeamC**	★ 0	0
RepoCamp / **ucla2019-TeamA**	★ 0	0

Acceptance criteria

- Code is hosted on github
- Github repository contains 1 or more issues
- Code powers a staff or public application at a specific institution or consortium
- Not in a samvera github organization
- Has a commit in the past 6 months

36 Repositories included in the data set

cul/ldpd-hyacinth
curationexperts/laevigata
curationexperts/tenejo
dibbs-vdc/ccql
digital-york/arch1
digital-york/ncelp
digital-york/oasis

DigitalWPI/digitalwpi
duke-libraries/ddr-public
emory-libraries/dlp-curate
galterlibrary/digital-repository
gwu-libraries/scholarspace-hyrax
LafayetteCollegeLibraries/spot
mlibrary/heliotrope

MPLSFedResearch/cypripedium

ndlib/curate_nd

nulib/donut

nycrecords/gpp-hyrax

OregonDigital/OD2

OregonDigital/oregondigital

osulp/Scholars-Archive

psu-libraries/cho

psu-stewardship/scholarsphere

pulibrary/figgy

research-technologies/hyrax_leaf

sciencehistory/chf-sufia

sul-dlss/hydrus

UB-Bern/solonline

UCLALibrary/californica

uclibs/gdja

uclibs/ucrate

ucsblibrary/alexandria

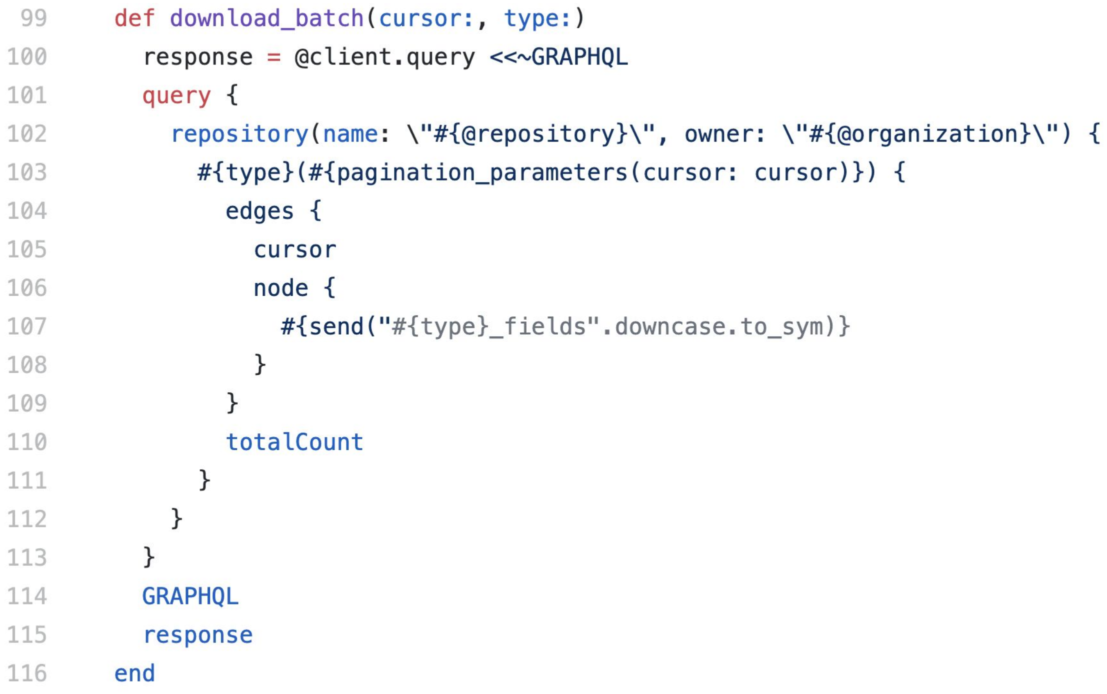
UCSCLibrary/ucsc-library-digital-collections

ucsdlib/damspas

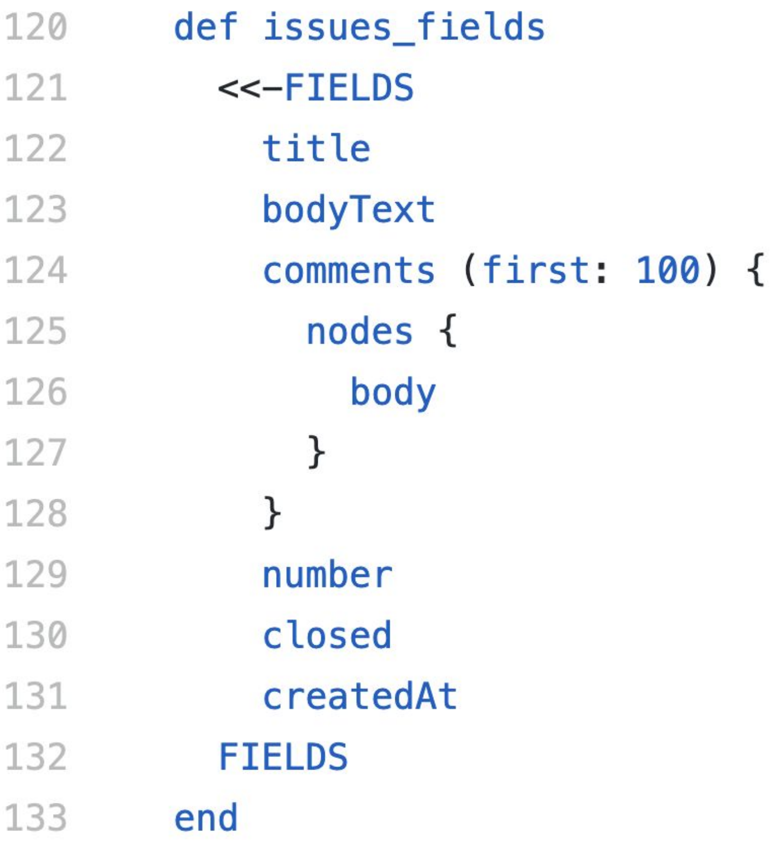
UW-Libraries/druw

WGBH-MLA/ams

Collect and save the documents



```
def download_batch(cursor:, type:)
  response = @client.query <<~GRAPHQL
  query {
    repository(name: \"#{@repository}\", owner: \"#{@organization}\") {
      #{type}(#{pagination_parameters(cursor: cursor)}) {
        edges {
          cursor
          node {
            #{send("#{type}_fields".downcase.to_sym)}
          }
        }
        totalCount
      }
    }
  }
  GRAPHQL
  response
end
```



```
def issues_fields
  <<-FIELDS
    title
    bodyText
    comments (first: 100) {
      nodes {
        body
      }
    }
    number
    closed
    createdAt
  FIELDS
end
```

NLP Methods

The Google NLP APIs can

- Identify parts of speech
- Parse dates and contact information
- Identify corporate logos
- Perform sentiment analysis
- Categorize docs to a pre-defined list
- Train custom models to do document categorization based on a training set you provide.

Consult an expert

Thank you Rebecca Koeser, lead developer, and other helpful staff at Princeton's Center for Digital Humanities!

K-means clustering

Clean data

Tokenize, stem, TF-IDF

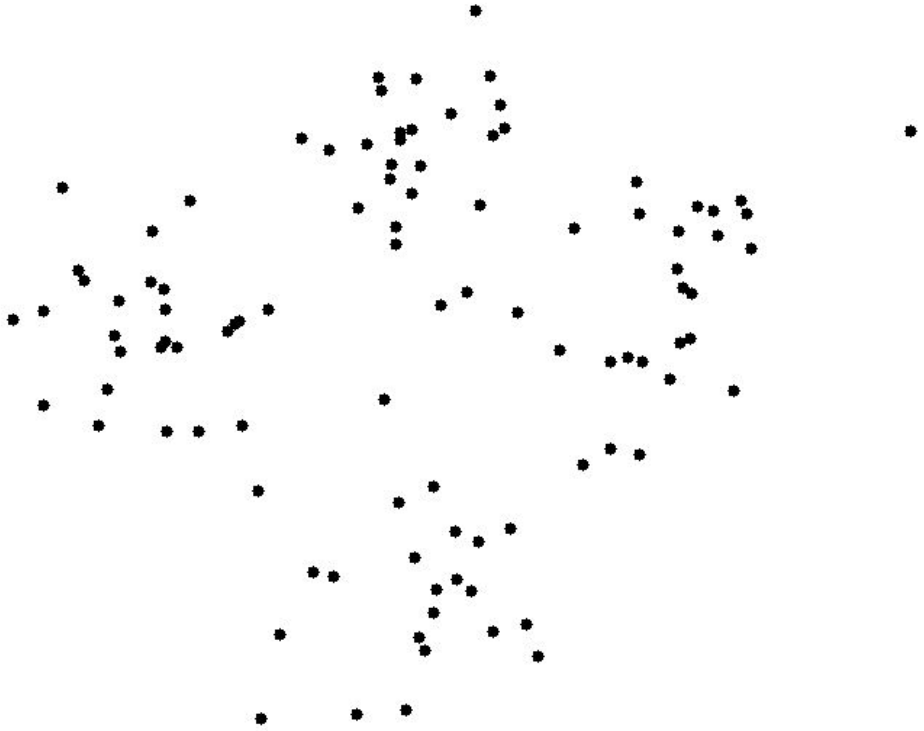
Cluster

Stripped out all github usernames and created a stopwords list with institution-specific keywords that showed up in our clusters.

Used an nltk algorithm called WordNetLemmatizer to tokenize and stem the documents. Passed this tokenizer and our stopwords list with our documents into the SciKit TfidfVectorizer to get word frequency vectors.

Pass the vectors to SciKit's k-means algorithm and piece the cluster numbers back together with the filenames so we can see what it did.

K-means clustering



Results

Cluster 0:

error test email job work run log message user server

229 issues in 28 repositories

Cluster 1:

page view link publisher line backtrace user add object admin

162 issues in 25 repositories

Cluster 2:

user work image need add use ingest item like resource

1166 issues in 34 repositories

Cluster 3:

collection work page user add item object need metadata search

182 issues in 22 repositories

Cluster 4:

file work upload set thumbnail version user preservation need csv

214 issues in 25 repositories

Cluster 5:

search result advanced page term text user field like item

94 issues in 23 repositories

Cluster 6:

field metadata work value form display record data need collection

255 issues in 28 repositories

Cluster 7:

date embargo range year field collection work facet visibility need

75 issues in 20 repositories

Helpful clusters

Cluster 39: Fixity checks

task rake fixity check file run cron running fedora job

29 issues in 11 repositories

Cluster 9: Full text search

search text result searching pdf document extracted term full fulltext

26 issues in 14 repositories

Cluster 12: User roles

user dashboard press role page registered admin menu hyrax login

30 issues in 10 repositories

Cluster 15: bagit

bag visibility file validation work extracted import export archival badge

28 issues in 10 repositories

Cluster 16: Thumbnail images, representative images

thumbnail file image set blank representative fileset work resource manager

35 issues in 13 repositories

Cluster 17: Embargoes

embargo visibility expired work expiring notification embargoed object prod rake

26 issues in 11 repositories

Cluster 58: IIIF

image viewer riiif iiif 308 tiff jp2 f derivative work

49 issues in 18 repositories

Cluster 30: more IIIF

manifest url iiif link viewer collection mirador sammelband image like

36 issues in 13 repositories

Cluster 26: Blacklight range limit

blacklight limit year fix range search autocomplete view facet byte

16 issues in 9 repositories

Cluster 36: date facets

facet date year sort result search decade az show field

25 issues in 14 repositories

Cluster 23: Linked data, SPARQL

allow sufia rdf format triple regular user thing caption sparql

23 issues in 8 repositories

Cluster 27: User account interactions

email password contact address reset send user notification form department

36 issues in 14 repositories

Cluster 49: Controlled vocabularies

term vocabulary controlled field search local use query deprecated json

28 issues in 13 repositories

Cluster 43: Controlled vocabularies for places

uris controlled geonames string osu vocabulary value move place location

16 issues in 5 repositories

Cluster 63: File characterization

fit config characterization file use update performance ffmpeg script currently

22 issues in 14 repositories

Cluster 60: Front end

label location uri accessibility element input add form field content

44 issues in 16 repositories

Cluster 18: Workers and resque

job worker run derivative fixity server resque error new queue

26 issues in 12 repositories

Cluster 7: Deployment concerns

server monitoring cap production deploy deployment task capistrano staging add

29 issues in 13 repositories

Cluster 34: Universal Viewer

object viewer video audio universal user like view digitized able

44 issues in 11 repositories

Cluster 44: Browse Everything

google drive file browseeverything meta oauth dropbox content browse transcription

19 issues in 9 repositories

Unhelpful clusters

Cluster 1: Institution specific language

form update get put base rail changelog 8 unpaywall beavernetes

15 issues in 10 repositories

Cluster 2: Too broad

error file 500 message log 404 fatal info work import

66 issues in 21 repositories

Cluster 8: Probably need more stop words

add use data button link title need work set like

307 issues in 33 repositories

Cluster 35: Very general within our domain

field metadata value collection form display data related dictionary add

86 issues in 21 repositories

Next steps

Automate data cleaning

- Find more stop words. Exclude any word that's only found in issues from a single repository.
- Automate removal of user names by checking the github api when we strip tokens beginning with `@`.

Look more closely at clusters

- For the clusters we identified, look at the actual issues that belong to them and see how cohesive they feel

Run and analyze issues and PRs together

- If we introduce more robust cleaning mechanisms, we could try clustering issues and PRs together to see whether we could match working code to backlog issues across institutions.

Is this helpful?

Final thoughts

- We weren't able to get issues for every relevant project in the community.

Final thoughts

- We were able to characterize some sets of issues that seem to be related, and surface current directions of work in our community

Final thoughts

- Currently we do this type of discovery by asking one another
  - A method like this offers a path to a list of issues or institutions to contact.
  - Might allow us to catch potential collaborations where communication methods have missed them.

Final thoughts

- The time it takes to review clusters with meaningfully small sets of issues may be prohibitively great.

Final thoughts

- A data set of open issues in our backlogs might in and of itself be helpful to product owners and maybe others to grep against.

Contact

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- hackmaster.a (slack)

Resources

- Our code: https://github.com/hackmastera/samvera-backlogs
- SciKit: https://scikit-learn.org/stable/index.html
- NLTK: https://www.nltk.org
- k-means animation: http://shabal.in/visuals/kmeans/6.html
- Presentation template by SlidesCarnival