OpenRefine for Social Science Data: All in One View

datacarpentry.org/openrefine-socialsci/aio.html

Content from Introduction

Last updated on 2023-07-19 | Edit this page

Overview

Questions

What is OpenRefine useful for?

Objectives

- Describe OpenRefine's uses and applications.
- Differentiate data cleaning from data organization.
- Experiment with OpenRefine's user interface.

Motivations for the OpenRefine Lesson

- Data is often very messy. OpenRefine provides a set of tools to allow you to identify and amend the messy data.
- It is important to know what you did to your data. Additionally, journals, granting agencies, and other institutions are requiring documentation of the steps you took when working with your data. With OpenRefine, you can capture all actions applied to your raw data and share them with your publication as supplemental material.
- All actions are easily reversed in OpenRefine.
- If you save your work it will be to a new file. OpenRefine always uses a copy of your data and *does not* modify your original dataset.
- Data cleaning steps often need repeating with multiple files. OpenRefine keeps track of all of your actions and allows them to be applied to different datasets.
- Some concepts such as clustering algorithms are quite complex, but OpenRefine makes it easy to introduce them, use them, and show their power.

Features

- Open source (source on GitHub).
- A large growing community, from novice to expert, ready to help. See Getting Help section below.
- Works with large-ish datasets (100,000 rows). Can adjust memory allocation to accommodate larger datasets.
- OpenRefine always keeps your data private on your own computer until you choose to share it. It works by running a small server on your computer and using your web browser to interact with it, but your private data never leaves your computer unless you want it to.

Before we get started

Note: this is a Java program that runs on your machine (not in the cloud). It runs inside your browser, but no web connection is needed.

Follow the Setup instructions to install OpenRefine.

If after installation and running OpenRefine, it does not automatically open for you, point your browser at http://127.0.0.1:3333/ or http://localhost:3333 to launch the program.

Key Points

- OpenRefine is a powerful, free, and open source tool that can be used for data cleaning.
- OpenRefine will automatically track any steps allowing you to backtrack as needed and providing a record of all work done.

Content from Working with OpenRefine

Last updated on 2023-09-19 | Edit this page

Overview

Questions

- How can we bring our data into OpenRefine?
- How can we sort and summarize our data?
- How can we find and correct errors in our raw data?

Objectives

- Create a new OpenRefine project from a CSV file.
- Understand potential problems with file headers.
- Use facets to summarize data from a column.
- Use clustering to detect possible typing errors.
- Understand that there are different clustering algorithms which might give different results.
- Employ drop-downs to remove white spaces from cells.
- Manipulate data using previous steps with undo/redo.

Creating a new OpenRefine project

If you have not started OpenRefine yet, follow the Setup instructions before continuing.

OpenRefine can import a variety of file types, including tab separated (`tsv`), comma separated (`csv`), Excel (`xls`, `xlsx`), JSON, XML, RDF as XML, and Google Spreadsheets. See the OpenRefine Create a Project by Importing Data page for more information.

In this first step, we'll browse our computer to the sample data file for this lesson. In this case, we will be using data obtained from interviews of farmers in two countries in eastern sub-Saharan Africa (Mozambique and Tanzania). If you haven't yet downloaded the data, see the instructions on downloading the data in Setup.

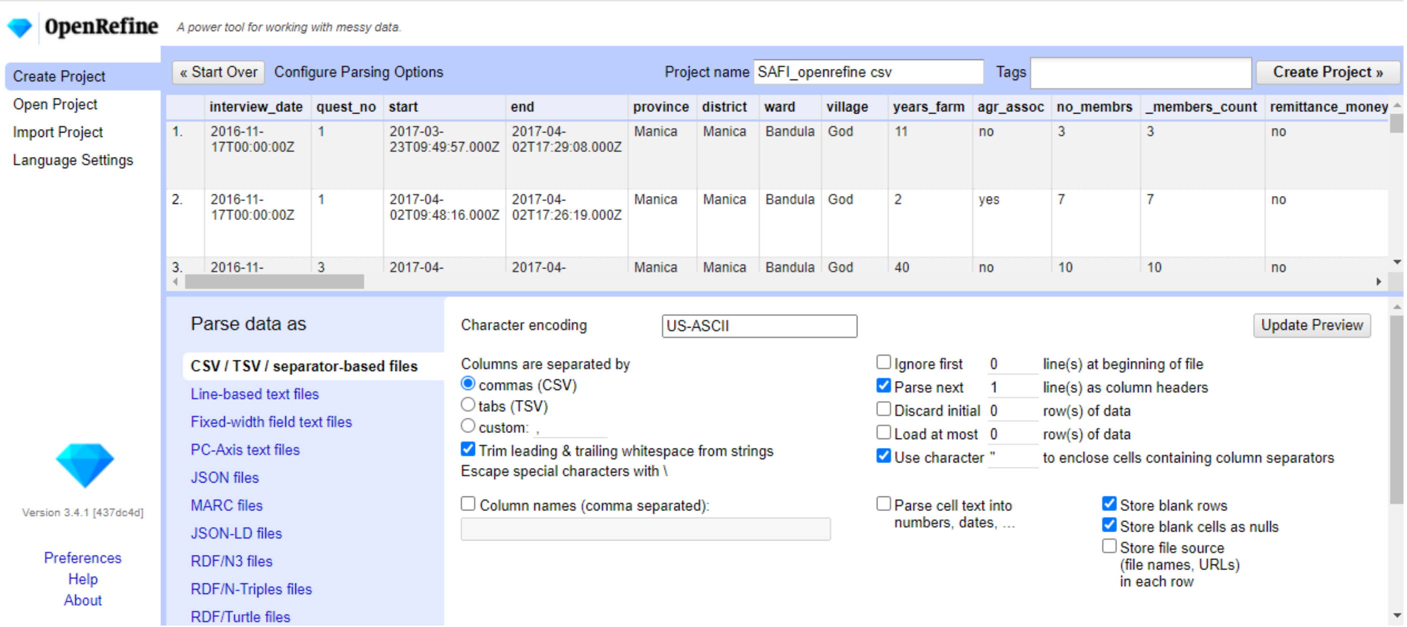
Once OpenRefine is launched in your browser, the left margin has options to `Create Project`, `Open Project`, or `Import Project`. Here we will create a new project:

1. Click `Create Project` and select `Get data from This Computer`.

2. Click `Choose Files` and select the file `SAFI_openrefine.csv` that you downloaded in the setup step. Click `Open` or double-click on the filename.

3. Click `Next>>` under the browse button to upload the data into OpenRefine.

4. OpenRefine gives you a preview - a chance to show you it understood the file. If, for example, your file was really tab-delimited, the preview might look strange. You would then choose the correct separator in the box shown and click `Update Preview` (middle right). If this is the wrong file, click `<<Start Over` (upper left). There are also options to indicate whether the dataset has column headers included and whether OpenRefine should skip a number of rows before reading the data.



Project name SAFI_openrefine csv

Tags

	interview_date	quest_no	start	end	province	district	ward	village	years_farm	agr_assoc	no_membrs	_members_count	remittance_money
1.	2016-11-17T00:00:00Z	1	2017-03-23T09:49:57.000Z	2017-04-02T17:29:08.000Z	Manica	Manica	Bandula	God	11	no	3	3	no
2.	2016-11-17T00:00:00Z	1	2017-04-02T09:48:16.000Z	2017-04-02T17:26:19.000Z	Manica	Manica	Bandula	God	2	yes	7	7	no
3.	2016-11-	3	2017-04-	2017-04-	Manica	Manica	Bandula	God	40	no	10	10	no

Character encoding US-ASCII

Columns are separated by
● commas (CSV)
○ tabs (TSV)
○ custom: ,
☑ Trim leading & trailing whitespace from strings
Escape special characters with \
□ Column names (comma separated):

□ Ignore first 0 line(s) at beginning of file
☑ Parse next 1 line(s) as column headers
□ Discard initial 0 row(s) of data
□ Load at most 0 row(s) of data
☑ Use character " to enclose cells containing column separators

□ Parse cell text into numbers, dates, ...

☑ Store blank rows
☑ Store blank cells as nulls
□ Store file source (file names, URLs) in each row

5. If all looks well, click `Create Project>>` (upper right).

Note that at step 1, you could upload data in a standard form from a web address by selecting `Get data from Web Addresses (URLs)`. The URLs must point to data in a file type that OpenRefine understands, just like the types that you could upload. Instead of downloading the dataset file as you did during setup and uploading it from your computer, you could have submitted its URL here. Fully understanding this functionality is out of scope for this lesson. The OpenRefine manual's section on importing from Web addresses (URLs) provides further information.

Using Facets

Exploring data by applying multiple filters

Facets are one of the most useful features of OpenRefine and can help both get an overview of the data in a project as well as help you bring more consistency to the data. OpenRefine supports faceted browsing as a mechanism for

- seeing a big picture of your data, and
- filtering down to just the subset of rows that you want to change in bulk.

A ‘Facet’ groups all the like values that appear in a column, and then allows you to filter the data by these values and edit values across many records at the same time.

One type of Facet is called a ‘Text facet’. This groups all the identical text values in a column and lists each value with the number of records it appears in. The facet information always appears in the left hand panel in the OpenRefine interface.

Here we will use faceting to look for potential errors in data entry in the `village` column.

Finding (potential) errors

1. Scroll over to the `village` column.
2. Click the down arrow and choose `Facet` > `Text facet`.
3. In the left panel, you’ll now see a box containing every unique value in the `village` column along with a number representing how many times that value occurs in the column.
4. Try sorting this facet by name and by count. Do you notice any problems with the data? What are they?
5. Hover the mouse over one of the names in the `Facet` list. You should see that you have an `edit` function available.
6. You could use this to fix an error immediately, and OpenRefine will ask whether you want to make the same correction to every value it finds like that one. But OpenRefine offers even better ways to find and fix these errors, which we’ll use instead. We’ll learn about these when we talk about clustering.

Interview collection dates

1. Using faceting, find out how many different `interview_date` values there are in the survey results.

2. Is the column formatted as Text or Date?

3. Use faceting to produce a timeline display for `interview_date`. You will need to use `Edit cells` > `Common transforms` > `To date` to convert this column to dates.

4. During what period were most of the interviews collected?

Other types of Facets

Please see the OpenRefine Manual section on Facets for reference information on all types of facets.

Besides ‘Text facets’ OpenRefine also supports several other types of facet. These include:

- Numeric facets
- Timeline facets (for dates)
- Custom facets
- Scatterplot facets

Numeric and Scatterplot facets display graphs instead of lists of values. The numeric facet graph includes 'drag and drop' controls you can use to set a start and end range to filter the data displayed. A scatterplot facet allows you to visualise values in a pair of numeric columns as a scatterplot, so that you can filter by two-value combinations.

Custom facets are a range of different types of facets. Some of the default custom facets are:

- Word facet - this breaks down text into words and counts the number of records each word appears in
- Duplicates facet - this results in a binary facet of 'true' or 'false'. Rows appear in the 'true' facet if the value in the selected column is an exact match for a value in the same column in another row
- Text length facet - creates a numeric facet based on the length (number of characters) of the text in each row for the selected column. This can be useful for spotting incorrect or unusual data in a field where specific lengths are expected (e.g. if the values are expected to be years, any row with a text length more than 4 for that column is likely to be incorrect)
- Facet by blank - a binary facet of 'true' or 'false'. Rows appear in the 'true' facet if they have no data present in that column. This is useful when looking for rows missing key data.

Bookmark a project with facets and filters

OpenRefine saves the project continuously so that you can close the browser and use "Open Project" from the start page to continue the work. However, any facets and filters (discussed in the next episode) are not saved. To save the exact view, you can bookmark the "Permalink" that is to the right of the project name in the top left corner of the screen.

Using clustering to detect possible typing errors

In OpenRefine, clustering means "finding groups of different values that might be alternative representations of the same thing". For example, the two strings `New York` and `new york` are very likely to refer to the same concept and just have capitalization differences. Likewise, `Gödel` and `Godel` probably refer to the same person. Clustering is a very powerful tool for cleaning datasets which contain misspelled or mistyped entries. OpenRefine has several clustering algorithms built in. Experiment with them, and learn more about these algorithms and how they work.

1. In the `village` Text Facet we created in the step above, click the `Cluster` button.

2. In the resulting pop-up window, you can change the `Method` and the `Keying Function`. Try different combinations to see what different mergers of values are suggested.
3. Select the `key collision` method and `metaphone3` keying function. It should identify two clusters.
4. Click the `Merge?` box beside each cluster, then click `Merge Selected and Recluster` to apply the corrections to the dataset.
5. Try selecting different `Methods` and `Keying Functions` again, to see what new merges are suggested.
6. You should find that using the default settings, no more clusters are found, for example to merge `Ruaca-Nhamuenda` with `Ruaca` or `Chirdozo` with `Chirodzo`. (Note that the `nearest neighbor` method with `ppm` distance, `radius` ≥ 4, and `block chars` ≤ 4 will find these clusters, as well as other settings with `levenshtein` distance)
7. To merge these values we will hover over them in the village text facet, select edit, and manually change the names. Change `Chirdozo` to `Chirodzo` and `Ruaca-Nhamuenda` to `Ruaca`. You should now have four clusters: `Chirodzo`, `God`, `Ruaca` and `49`.

Important: If you `Merge` using a different method or keying function, or more times than described in the instructions above, your solutions for later exercises will not be the same as shown in those exercise solutions.

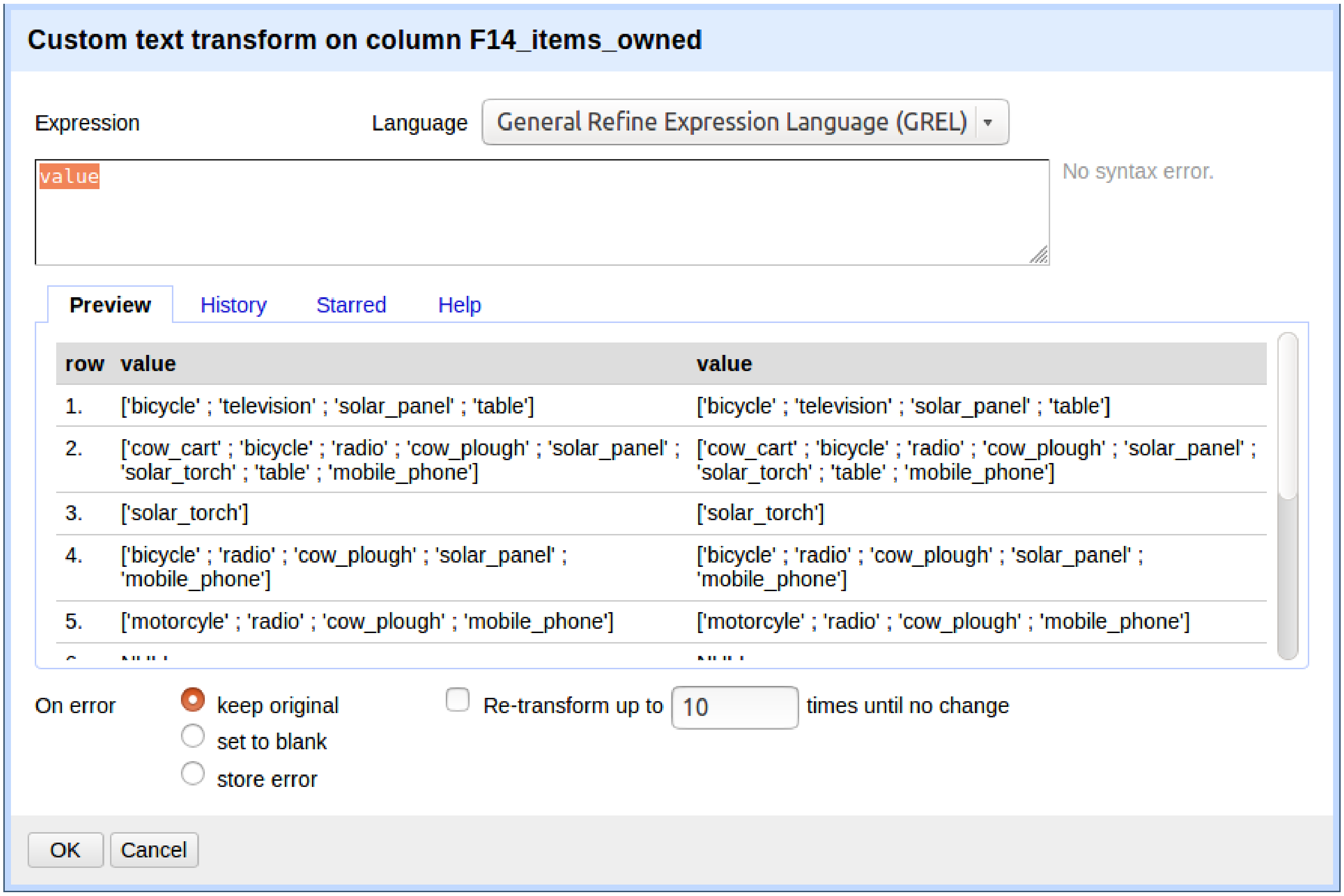
The manual’s section on clustering provides technical details on how the different clustering algorithms work.

Transforming data

The data in the `items_owned` column is a set of items in a list. The list is in square brackets and each item is in single quotes. Before we split the list into individual items in the next section, we first want to remove the brackets and the quotes.

1. Click the down arrow at the top of the `items_owned` column. Choose `Edit Cells` > `Transform...`

2. This will open up a window into which you can type a GREL expression. GREL stands for General Refine Expression Language.



Custom text transform on column F14_items_owned

Expression

Language: General Refine Expression Language (GREL)

```
value
```

No syntax error.

Preview | History | Starred | Help

row	value	value
1.	['bicycle' ; 'television' ; 'solar_panel' ; 'table']	['bicycle' ; 'television' ; 'solar_panel' ; 'table']
2.	['cow_cart' ; 'bicycle' ; 'radio' ; 'cow_plough' ; 'solar_panel' ; 'solar_torch' ; 'table' ; 'mobile_phone']	['cow_cart' ; 'bicycle' ; 'radio' ; 'cow_plough' ; 'solar_panel' ; 'solar_torch' ; 'table' ; 'mobile_phone']
3.	['solar_torch']	['solar_torch']
4.	['bicycle' ; 'radio' ; 'cow_plough' ; 'solar_panel' ; 'mobile_phone']	['bicycle' ; 'radio' ; 'cow_plough' ; 'solar_panel' ; 'mobile_phone']
5.	['motorcyle' ; 'radio' ; 'cow_plough' ; 'mobile_phone']	['motorcyle' ; 'radio' ; 'cow_plough' ; 'mobile_phone']

On error: ● keep original ○ set to blank ○ store error

□ Re-transform up to 10 times until no change

3. First we will remove all of the left square brackets (`[`). In the Expression box type `value.replace("[", "")` and click `OK`.

4. What the expression means is this: Take the `value` in each cell in the selected column and replace all of the “[” with “” (i.e. nothing - delete).

5. Click `OK`. You should see in the `items_owned` column that there are no longer any left square brackets.

Remove unwanted characters

Use this same strategy to remove the single quote marks (`'`), the right square brackets (`]`), and spaces from the `items_owned` column.

Now that we have cleaned out extraneous characters from our `items_owned` column, we can use a text facet to see which items were commonly owned or rarely owned by the interview respondents.

1. Click the down arrow at the top of the `items_owned` column. Choose `Facet` > `Custom text facet...`
2. In the `Expression` box, type `value.split(";")`.
3. Click `OK`.

You should now see a new text facet box in the left-hand pane.

Commonly owned items

Which two items are the most commonly owned? Which are the two least commonly owned?

Month(s) with farmers lacking food

Perform the same clean up steps and customized text faceting for the `months_lack_food` column. Which month(s) were farmers more likely to lack food?

Clean up other columns

Perform the same clean up steps for the `months_no_water`, `liv_owned`, `res_change`, and `no_food_mitigation` columns. Hint: To reuse a GREL command, click the `History` tab and then click `Reuse` next to the command you would like to apply to that column.

Using undo and redo

It's common while exploring and cleaning a dataset to discover after you've made a change that you really should have done something else first. OpenRefine provides `Undo` and `Redo` operations to make this easy.

Explore undo and redo

1. Click where it says `Undo / Redo` on the left side of the screen. All the changes you have made so far are listed here.
2. Click on the step that you want to go back to, in this case go back several steps to before you had done any text transformation.
3. Visually confirm that those columns now contain the special characters that we had removed previously.

4. Notice that you can still click on the later steps to `Redo` the actions. Before moving on to the next lesson, redo all the steps in your analysis so that all of the columns you modified are lacking in square brackets, spaces, and single quotes.

Trim Leading and Trailing Whitespace

Sometimes spaces (or tabs, or newline characters) will be present at the beginning or end of a text cell. They may have been in the dataset that was imported, or appear when you perform operations on the data, such as splitting text. While we as humans cannot always see or notice these (especially if they are at the end of a word), a computer always sees them. These spaces are often unwanted variations that should to be removed.

As of version 3.4, OpenRefine provides the option to trim (i.e. remove) leading and trailing whitespace during the import of data (see image at the top of this page). This is then applied to the data in all columns.

OpenRefine also provides a menu option to remove blank characters from the beginning and end of any entries in the column that you choose.

Remove a trailing space

1. Edit the `village` on the first row to introduce a space at the end, set to `God`.
2. Create a new text facet for the `village` column. You should now see two different entries for `God`, one of which has a trailing whitespace.
3. To remove the whitespace, choose `Edit cells` > `Common transforms` > `Trim leading and trailing whitespace`.
4. You should now see only four choices in your text facet again.

Key Points

- OpenRefine can import a variety of file types.
- OpenRefine can be used to explore data using filters.
- Clustering in OpenRefine can help to identify different values that might mean the same thing.
- OpenRefine can transform the values of a column.

Content from Filtering and Sorting with OpenRefine

Last updated on 2023-06-12 | Edit this page

Overview

Questions

- How can we select only a subset of our data to work with?
- How can we sort our data?

Objectives

- Filter to a subset of rows by text filter or include/exclude.
- Sort table by a column.
- Sort by multiple columns.

Filtering

There are many entries in our data table. We can filter it to work on a subset of the data in the list for the next set of operations. Please ensure you perform this step to save time during the class.

Using a Text Filter

1. Click the down arrow next to `respondent_roof_type` > `Text filter`. A `respondent_roof_type` facet will appear on the left margin.
2. Type in `mabat` and press return. There are 58 matching rows of the original 131 rows (and these rows are selected for the subsequent steps).
3. At the top, change the view to `Show` 50 `rows`. This way you will see most of the matching rows.
4. Answer these questions:
    1. What roof types are selected by this procedure?
    2. How would you restrict this to only one of the roof types?

Excluding entries

In addition to the simple text filtering we used above, another way to narrow our filter is to `include` and/or `exclude` entries in a facet. You will see the `include` or `exclude` options if you hover over the name in the facet window.

If you still have your facet for `respondent_roof_type`, you can use it, or use drop-down menu > `Facet` > `Text facet` to create a new facet. Only the entries with names that agree with your `Text filter` will be included in this facet.

Faceting and filtering look very similar. A good distinction is that faceting gives you an overview description of all of the data that is currently selected, while filtering allows you to select a subset of your data for analysis.

Including and excluding rows using a facet

Use `include / exclude` to select only entries from one of these two roof types.

Remove the filter before moving on so that you again have the full dataset of 131 records.

Sort

You can sort the data by a column by using the drop-down menu in that column. There you can sort by `text`, `numbers`, `dates` or `booleans` (`TRUE` or `FALSE` values). You can also specify what order to put `Blanks` and `Errors` in the sorted results.

If this is your first time sorting this table, then the drop-down menu for the selected column shows `Sort...`. Select what you would like to sort by (such as `numbers`). Additional options will then appear for you to fine-tune your sorting.

Finding GPS Altitude outliers

Sort the data by `gps_Altitude`. Do you think the first few entries may have incorrect altitudes?

If you try to re-sort a column that you have already used, the drop-down menu changes slightly, to > `Sort` without the `...`, to remind you that you have already used this column. It will give you additional options:

- `Sort` > `Sort...` - This option enables you to modify your original sort.
- `Sort` > `Reverse` - This option allows you to reverse the order of the sort.
- `Sort` > `Remove sort` - This option allows you to undo your sort.

Sorting by multiple columns

You can sort by multiple columns by performing sort on additional columns. The sort will depend on the order in which you select columns to sort. To restart the sorting process with a particular column, check the `sort by this column alone` box in the `Sort` pop-up menu.

If you go back to one of the already sorted columns and select > `Sort` > `Remove sort`, that column is removed from your multiple sort. If it is the only column sorted, then data reverts to its original order.

Finding village "49"

We discovered in an earlier lesson that the value for one of the `village` entries was given as 49. This is clearly wrong. By looking at the GPS coordinates for the entries of the other villages can we decide what village the data in that column was collected from?

1. Sort on `gps_Latitude` as a number with the smallest first.
2. Add a sort on `gps_Longitude` as a number with the smallest first.
3. Using the drop down arrow on the `village` column, select `Edit column` > `Move column to end`. This will allow you to compare village names with GPS coordinates.
4. Scroll through the entries until you find village `49`. Can you tell from it's GPS coordinates which village it belong to?
5. Now sort only by `interview_date` as date. Move the `village` column to the start of the table. Does the row where village is `49` group with one particular village? Is it the same village as when comparing GPS coordinates?

Perform a text facet on the `village` column and change `49` to the village name that was determined in the previous exercise. You should now have only three village names.

Key Points

OpenRefine provides a way to sort and filter data without affecting the raw data.

Content from Exporting and Saving Data from OpenRefine

Last updated on 2023-07-24 | Edit this page

Overview

Questions

- How can we get our cleaned data out of OpenRefine?
- How can we save the whole project with all history as a file?

Objectives

- Export cleaned data from an OpenRefine project.
- Save an OpenRefine project as a shareable file.

Exporting Cleaned Data

When you completed the cleaning steps, you probably want to save the cleaned dataset as a new file, so that you can further analyse the data using other applications. OpenRefine allows you to do so by *exporting* the data in various file formats.

1. Click `Export` in the top right and select the file type you want to export the data in. `Tab-separated values` (`tsv`) or `Comma-separated values` (`csv`) would be good choices.
2. OpenRefine creates a file whose name is based on the project name and asks the browser to download it. Depending on your browser settings, this file is automatically saved in the default location for downloaded files, or you see a dialog window to choose where you want to save the file.

The downloaded file can then be opened in a spreadsheet program or imported into programs written in R or Python, for example.

Remember from our lesson on Spreadsheets that using widely-supported, non-proprietary file formats like `tsv` or `csv` improves the ability of yourself and others to use your data.

Only matching rows are exported

OpenRefine only operates on rows that match all enabled filters. This is also true for exporting data. So if you want to export a selection from a larger dataset, you can use filters and facets to select what data you want to export.

However, if you wanted to export all data and forget to reset all facets and filters, the exported dataset may appear to be incomplete. OpenRefine does not provide a warning about enabled filters when you export data.

Saving a Project as a File

Next to exporting the data, you can export the project as well. When you export the project, OpenRefine creates a single file that includes the data and all the information about the cleaning and data transformation steps that you have taken.

You can use this file as a project backup, transfer it to another computer to continue working on the data or share it with a collaborator who can open it to see what you did and continue the work.

Saving happens automatically

By default OpenRefine is saving your project continuously while you work on it. If you close OpenRefine and open it up again, you can see a list of your projects when you select “Open Project” on the start screen. You can open an existing project by clicking on its title.

Exporting and examining the project

In this exercise, we will export the project and examine the contents of the exported file.

1. Click the `Export` button in the top right and select `OpenRefine project archive to file`.
2. OpenRefine then presents a `tar.gz` file for download. Depending on your browser you may have to specify where you want to save the file, or it may be downloaded to your default directory for downloaded files. The `tar.gz` extension tells you that this is a compressed file. The downloaded `tar.gz` file is actually a folder of files which have been compressed. Linux and Mac machines will have software installed to automatically expand this type of file when you double-click on it. For Windows based machines you may have to install a utility like ‘7-zip’ in order to expand the file and see the files in the folder.
3. After you have expanded the file, look at the files that appear in this folder. What files are here? What information do you think these files contain?

Importing a Project

You can import an existing project into OpenRefine by clicking `Open...` in the upper right, then opening the `Import Project` tab and selecting the `tar.gz` project file.

Key Points

- Cleaned data, or selected data, can be exported from OpenRefine for use in other applications.
- Projects can be exported to files that contain the original data and all data cleaning steps you performed.