

arxivdl

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8/24/2020

Introduction

In **arxivdl** we create a package to facilitate responsibly downloading subsets of papers from arXiv. Our package makes use of and complements the **arXiv** package’s functions for getting paper metadata from the arXiv API.

This is useful for researchers interested in getting the full text of multiple PDFs, such as for text mining purposes. Current options for getting arXiv data either do not retrieve the full PDFs, do not allow querying, or involve writing more code. While geared towards downloading papers from arXiv, the package’s primary can be used to download other PDF collections as well.

The remainder of this paper is structured as follows: first, we introduce the package’s key functions and its supporting functions. Then we provide a longer example of **arxivdl**’s functionality. Finally, we outline limitations to the current package and future directions for its development.

Key function

The main function in **arxivdl** is **download_pdf()**, which downloads and saves PDFs to either a local folder or to an Amazon S3 bucket.

download_pdf() takes a data frame, such as one returned by **get_records()**, that contains the URLs of PDFs to download and file names to save PDFs under. It also optionally takes the name of the data frame column containing PDF URLs, the name of the column containing file names to use, and the directory or Amazon Web Services S3 bucket to download papers to. If the link column is not specified, the function looks for the “link_pdf” column. If the file name column is not specified, the function looks for the “id” column. If a save location is not specified, PDFs will be downloaded to the user’s current working directory.

Supporting functions

Supporting functions in **arxivdl** include **get_record_count()**, which can be used to understand how many papers were submitted to a specified arXiv subject area over a given timespan, and **get_records()**, which retrieves metadata for papers submitted to a specified arXiv subject area in a given timespan. The resulting data frame can then be passed to **download_pdf()** to download the full papers. A utility function, **clean_titles()**, that creates file names from paper titles is also included.

get_record_count() takes as arguments the arXiv categories to query and the time period over which to search, and returns the number of papers that fit those criteria. It helps scope out the number of papers to be downloaded.

get_records() takes as arguments the arXiv categories to query, the time span to search, and the maximum number of records to retrieve. If the function is called in interactive mode (e.g., from the R console), specifying

the limit is optional – the function will call `get_record_count()`, estimate the record retrieval time, and ask the user if they wish to proceed. `get_records()` returns a data frame containing metadata on all papers meeting the criteria, ordered from earliest submission date. An example use case for this is

`clean_titles()` takes a data frame and the name of the column to clean for use as file names. It converts text to lowercase, removes punctuation, and replaces spaces with underscores. These names provide a better sense of file contents than the default arXiv paper identifiers.

Vignette

All papers between certain dates in certain sub-groups

```
library(arxivdl)

# check how many computer science graphics papers from January 2020 will be returned
paper_count <- get_record_count("cs.GR", "20200101 TO 20200201")

# get metadata on all graphics papers in January 2020
metadata <- get_records("cs.GR", "20200101 TO 20200201", paper_count)

# download papers to data folder within working directory
download_pdf(metadata, directory = "./data")
```

Using AWS buckets

`download_pdf()` also supports saving files to an Amazon Web Service S3 bucket. S3 access credentials should be set up before calling `download_pdf()`; the easiest way to do this is by setting them with `Sys.setenv()`. See the Appendix for detailed instructions on setting up S3 storage and generating credentials.

```
# set up AWS credentials
Sys.setenv(
  "AWS_ACCESS_KEY_ID" = "your-key-here",
  "AWS_SECRET_ACCESS_KEY" = "your-secret-here",
  "AWS_DEFAULT_REGION" = "us-east-2" # replace region as appropriate
)

# get metadata for the first 20 graphics papers published in 2019
papers <- get_records("cs.GR", "2019 TO 2020", lim = 20)

# create file names based on paper titles
papers$file_name <- clean_titles(papers)

# download files to s3 bucket
download_pdf(papers, fname = "file_name", bucket = "my-s3-bucket")
```

Next steps and cautions

While the `arxivdl` package introduces delays between requests made to arXiv, it does not currently prohibit the user from making large requests of the site. Users are expected to exercise caution when calling

`download_pdf()`. One next step is to place limits on how large a data frame can be passed to `download_pdf()` and provide suggestions for users to break down large requests into smaller parts. However, if bulk data on all papers is required, arXiv's bulk PDF access option may be a better solution.

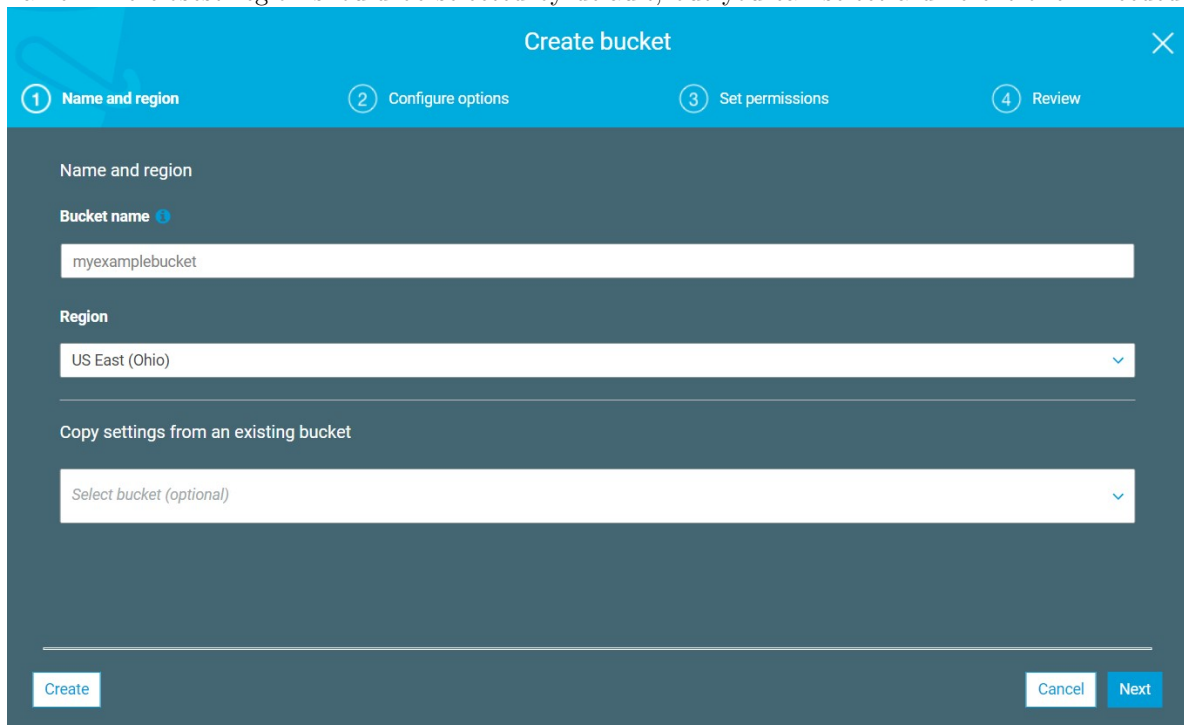
This package is geared towards facilitating paper downloads by submission time period and subject area. As such, it does not currently support other types of queries, such as searching for specific authors or searching by the date of last update.

Appendix: AWS S3 Setup

While AWS S3 storage can be public, storage buckets are private by default. The best practice is to set up security policies and credentials to control access to storage buckets. This appendix walks through S3 storage setup and credential creation. It assumes you have an AWS account but nothing more.

Creating a Bucket

1. In the AWS management console, navigate to the **S3 console** and click the **Create Bucket** button.
2. The key part of the Create Bucket wizard is the first screen, where you give the bucket a unique name. The closest region should be selected by default, but you can select a different one if needed.

The screenshot shows the 'Create bucket' wizard in the AWS Management Console. The title bar is blue with a white 'X' in the top right corner. Below the title bar is a progress bar with four steps: 1. Name and region (active), 2. Configure options, 3. Set permissions, and 4. Review. The main content area has a dark blue header 'Name and region'. Below this, there is a 'Bucket name' field with a blue information icon and a text input containing 'myexamplebucket'. Below that is a 'Region' dropdown menu showing 'US East (Ohio)'. Further down is a section 'Copy settings from an existing bucket' with a dropdown menu showing 'Select bucket (optional)'. At the bottom, there are three buttons: 'Create' (white with blue text), 'Cancel' (white with blue border), and 'Next' (blue with white text).

3. Step through the rest of the wizard. You can accept the defaults – they can be changed later if needed.

Creating Access Keys

Once the S3 bucket exists, the next steps are setting up an Identity and Access Management (IAM) policy, creating a user, and generating credentials to access the storage.

1. In the **IAM console**, navigate to **Policies**. AWS provides some pre-configured policies that provide access to all S3 buckets in the account. These include the `DataScientist`, `AmazonS3ReadOnlyAccess`, and `AmazonS3FullAccess` policies. If you choose to use one of these predefined policies, proceed to Step 5. However, if you want to limit access to a specific bucket, it's best to create a custom policy.

aws Services Resource Groups

Identity and Access Management (IAM)

Dashboard

Access management

- Groups
- Users
- Roles
- Policies**
- Identity providers
- Account settings

Create policy Policy actions

Filter policies Search

	Policy name	Type	Used as
<input type="radio"/>	AccessAnalyzerServiceRole...	AWS managed	None
<input type="radio"/>	AdministratorAccess	Job function	None
<input type="radio"/>	AlexaForBusinessDeviceSetup	AWS managed	None
<input type="radio"/>	AlexaForBusinessFullAccess	AWS managed	None
<input type="radio"/>	AlexaForBusinessGatewayEx...	AWS managed	None

- In the **JSON tab**, copy and paste the below policy, editing the bucket name as needed. This policy will allow a credential-holder to see the names of all the buckets owned by the AWS account and will grant full access to the specified bucket.

Create policy

1 2

A policy defines the AWS permissions that you can assign to a user, group, or role. You can create and edit a policy in the visual editor and using JSON. [Learn more](#)

Visual editor JSON Import managed policy

```

1 {
2   "Version": "2012-10-17",
3   "Statement": [ ]
4 }

```

Character count: 39 of 6,144.

Cancel Review policy

```

{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "s3:ListAllMyBuckets"
      ],
      "Resource": [
        "arn:aws:s3:::*"
      ]
    }
  ]
}

```

```

    },
    {
      "Effect": "Allow",
      "Action": [
        "s3:*"
      ],
      "Resource": [
        "arn:aws:s3:::myexamplebucket",
        "arn:aws:s3:::myexamplebucket/*"
      ]
    }
  ]
}

```

3. (Optional) If you switch to the **Visual editor** tab, you will see warnings as full access permissions include some resources that haven't been set up, but they can be ignored. You can also expand the actions menu here and fine-tune permissions.
4. On the **Review policy** screen, give the policy a name. The summary might show a notice that the policy defines some actions, resources, or conditions that do not provide permissions. You can ignore this notice and click **Create policy**.
5. Head to the **Users** section of the IAM console and **Add user**. Give the user a name. For AWS access type, select **Programmatic access**.

Add user

1
2
3
4
5

Set user details

You can add multiple users at once with the same access type and permissions. [Learn more](#)

User name*

+ Add another user

Select AWS access type

Select how these users will access AWS. Access keys and autogenerated passwords are provided in the last step. [Learn more](#)

Access type*

☒ **Programmatic access**
Enables an **access key ID** and **secret access key** for the AWS API, CLI, SDK, and other development tools.

☐ **AWS Management Console access**
Enables a **password** that allows users to sign-in to the AWS Management Console.

* Required


Cancel
Next: Permissions


6. In the **Set permissions** screen, choose **Add user to group**, then **Create group**.


Add user

1 2 3 4 5

▼ Set permissions

 Add user to group

 Copy permissions from existing user

 Attach existing policies directly

Add user to an existing group or create a new one. Using groups is a best-practice way to manage user's permissions by job functions. [Learn more](#)

Add user to group

Create group

Refresh

Q Search

Showing 1 result

Group ▼	Attached policies
---------	-------------------

7. In the Create group dialogue box, give the group a name, then search for and attach the chosen policy and create the group.

Create group ✕

Create a group and select the policies to be attached to the group. Using groups is a best-practice way to manage users' permissions by job functions, AWS service access, or your custom permissions. [Learn more](#)

Group name

Create policy

Refresh

Filter policies ▼

Q p

Showing 1 result

	Policy name ▼	Type	Used as	Description
<input checked="" type="checkbox"/>		Customer managed	Permissions policy (2)	Allow access to the bucket containing te...


Cancel

Create group

8. Click through the Tags screen, review and **Create user**.
9. The next screen will provide the access key and secret key.

Add user


- 1
- 2
- 3
- 4
- 5



Success

You successfully created the users shown below. You can view and download user security credentials. You can also email users instructions for signing in to the AWS Management Console. This is the last time these credentials will be available to download. However, you can create new credentials at any time.

Users with AWS Management Console access can sign-in at:

 Download .csv

	User	Access key ID	Secret access key
▶	✓ s3user	<div></div>	***** Show

10. The secret key won't be shown again, but if you need you can generate a new key at any time via the **Users** section. Click on the user name, then the **Security credentials** tab to create a new access key or deactivate an old one.

Identity and Access Management (IAM)

Dashboard

Access management

Groups

Users

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Identity providers

Account settings

Access reports

Access analyzer

Archive rules

Analizers

Settings

Credential report

Organization activity

Service control policies (SCPs)

User ARN

Path /

Creation time

PermissionsGroups (1)TagsSecurity credentialsAccess Advisor


Sign-in credentials

Summary

User does not have console management access

Console passwordDisabled | [Manage](#)

Assigned MFA deviceNot assigned | [Manage](#)

Signing certificatesNone 

Access keys

Use access keys to make secure REST or HTTP Query protocol requests to AWS service APIs. For your protection, you should never share your secret keys with anyone. As a best practice, we recommend frequent key rotation. [Learn more](#)

Create access key

Access key ID	Created	Last used	Status	
<div></div>			Active	Make inactive 