



WEST UNIVERSITY OF TIMISOARA  
FACULTY OF MATHEMATICS AND COMPUTER SCIENCE

STUDY PROGRAM:  
COMPUTER SCIENCE IN ENGLISH

# MASTER DISSERTATION

**COORDINATOR:**

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FRÎNCU

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Timișoara  
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# Chapter 1

## Application

### 1.1 Dataset

In order to build the dataset, we made use of the freely available data from the Landsat Archive, specifically from collection 1, level 1. This consists of data products generated from Landsat 8 Operational Land Imager/Thermal Infrared Sensor, Landsat 7 Enhanced Thematic Mapper Plus, Landsat 4-5 Thematic Mapper, and Landsat 1-5 Multispectral Scanner instruments [C1L]. For the purpose of this paper, we will focus only on images collected from the Landsat 8 satellite.

#### 1.1.1 World Glacier Inventory

The World Glacier Inventory (WGI) proves to be a useful resource for building our dataset, since it contains information for over 130,000 glaciers. Inventory parameters include geographic location, area, length, orientation, elevation, and classification. The WGI is based primarily on aerial photographs and maps with most glaciers having one data entry only. Hence, the data set can be viewed as a snapshot of the glacier distribution in the second half of the 20th century. It is based on the original WGI (WGMS 1989) from the World Glacier Monitoring Service [WGI].

There are a number of ways to retrieve data from the inventory:

- download the entire database in a single ASCII text file (wgi\_feb2012.csv);
- search by parameter using the Search Inventory interface;
- extract regions through the Extract Selected Regions interface.

The ASCII text file will be used with the purpose to define which are the glaciers to be included in the dataset to be built. An example of how this file looks like can be found in Figure 1.1.

The *parameters* which will be extracted for the dataset construction are the following:

- *wgi\_glacier\_id*: unique id representing one glacier (or part of it, if the coverage area is larger);
- *glacier\_name*: name of the glacier (if it has one);

1	wgi_glacier_id	political_unit	continent_code	drainage_code	free_position_code	local_glacier_code	glacier_name	lat	lon
2	SU5X1430909	SU		5X143	9	90	Zyuruzamin	38.92	71.272
3	AT4J143OE00	AT		4J143	OE	6	ZWSELBACH W	47.112	11.038
4	AT4J143OE00	AT		4J143	OE	5	ZWSELBACH	47.11	11.052
5	CH4L01200008	CH		4L012	0	8	ZWISCHBERGEN GL	46.108	8.041
6	CN5N236I0001	CN		5N236	IO	1	Zuxuehui	31.828	94.675
7	CH4J14304001	CH		4J143	4	1	ZUORT VADRET DA	46.738	10.271
8	CN5O282B002	CN		5O282	B0	23	Zuogijupu	29.212	96.893
9	CN5O282A047	CN		5O282	A0	476	Zuoguzasan	29.958	95.92
10	SU5X1430831	SU		5X143	8	310	ZULUMART	39.13	72.78
11	CN5N224E001	CN		5N224	E0	12	Zuima	29.839	96.456
12	SU5X1430948	SU		5X143	9	489	Zotkin	38.649	71.244
13	SU5X1430949	SU		5X143	9	490	Zotkin	38.649	71.244
14	SU5X1430932	SU		5X143	9	326	Zordi-Birauso	38.673	71.664
15	NZ6B868B000	NZ		6B868	B0	7	ZORA	-43.739	169.823
16	SU5T09106366	SU		5T091	6	366	ZOPKHITO	42.88	43.43
17	IT4L01104020	IT		4L011	4	20	ZOCCA S	46.285	9.647
18	IT4L01104021	IT		4L011	4	21	ZOCCA E	46.292	9.653
19	AQ7SSI00012	AO		7SSI0	0	125	Znosko Glacier	-62.1005	-58.4865
20	SU4X0300190	SU		4X030	1	903	ZNAMENITYY	80.53	61.02

Figure 1.1: WGI ASCII

- *lat*: latitude of the glacier;
- *lon*: longitude of the glacier.

## 1.1.2 Asset Acquisition

Landsat 8 acquires about 740 scenes a day on the Worldwide Reference System-2 (WRS-2) path/row system and has been running since February 11, 2013 [LAN]. This means that there are over two million scenes available for download, either making use of already built user friendly tools or by simply querying for them directly.

### USGS Earth Explorer

One of the most popular services for satellite imagery downloading is USGS Earth Explorer. This is used for querying and ordering of satellite images, aerial photographs, and cartographic products through the U.S. Geological Survey. The tool is particularly useful when the main focus is to analyse a specific area rather than trying to acquire a large dataset of scenes. One can easily search for assets based on criteria such as world reference system path and row variables, latitude, longitude, cloud coverage, capture date and many others [USG].

However, downloading a large set of assets proves to be rather difficult by using this tool alone, since the parameters for each scene need to be manually set. On top of this, the query results have to be picked by hand and then passed for downloading through another application which handles their bulk download. This makes the process of building the dataset rather slow, frustrating and error prone. Such an example can be viewed in Figure 1.2, for the Belvedere glacier (45.9830, 6.888).

### SpatioTemporal Asset Catalog API

In order to fix the problem of excessive manual labour which appeared by using the USGS Earth Explorer, we rather implemented an endpoint of the SpatioTemporal Asset Catalog API, specifically, the following: [http://nsidc.org/data/glacier\\_inventory/index.html](http://nsidc.org/data/glacier_inventory/index.html) [STA]. The main idea of searching by using

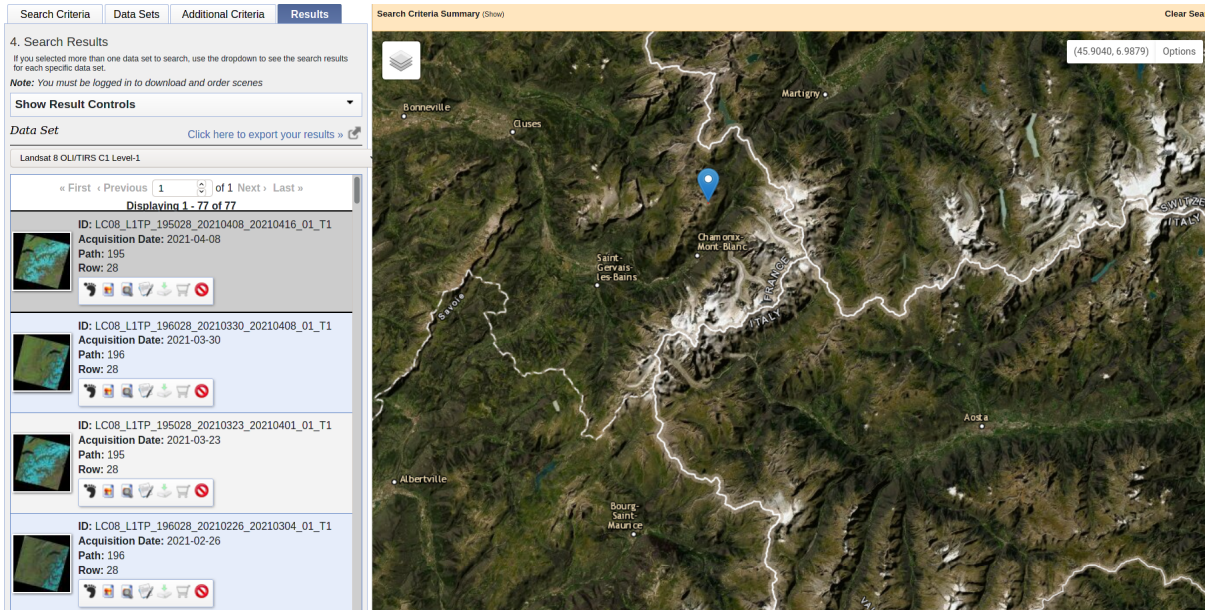


Figure 1.2: EarthExplorer

parameters still remains, but instead of manual inputting data for the search data, we rely on using the above-mentioned World Glacier Inventory ASCII text file, since it already has all the required information for each glacier.

By using this method we can pick which glaciers we want to download based on their coordinates and calculate a bounding box representing the area we want to search, required for the STAC API query. Since there might be clouds which could obfuscate the area of interest in the image, we also add a maximum allowed cloud coverage along the bounding box.

The STAC API query also requires a name for the collection of assets we want our queries to be made on, which for us is landsat-8-l1 (Landsat 8 Collection 1, Level 1). Using these three parameters we can now easily acquire a large number of assets with minimal manual labour, as compared to the more user friendly tool provided by USGS.

The downloaded assets will be stored at a user specified disk location and they will be structured as shown in the Figure 1.3.

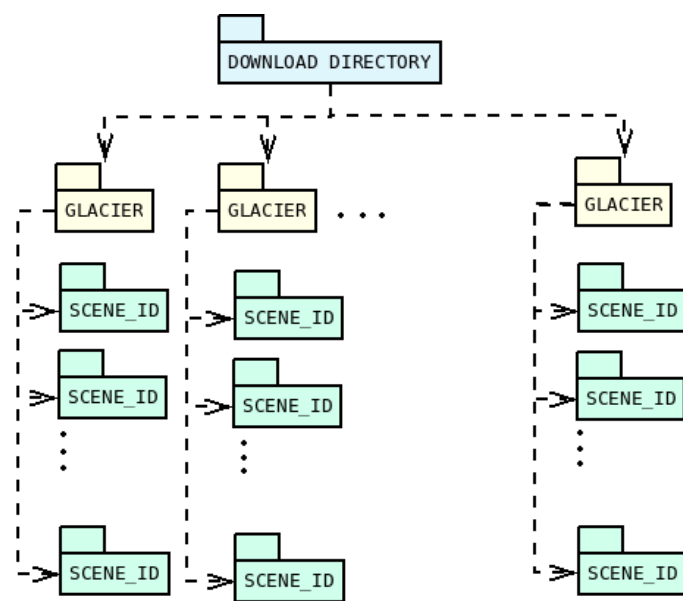


Figure 1.3: Download Directory

## Chapter 2

# Implementation

### 2.1 Download

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## Chapter 3

# Glossary

### 3.1 Acronyms

WGI	World Glacier Inventory
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Table 3.1: Acronyms table