Backcountry Skiing Routes Properties Dataset (BSRPD)

User Manual

Günter Schmudlach

20. November 2022

(V1.0.1)

Abstract

The document introduces a training dataset, that enables the modeling of **foot sections** and **extra caution sections** of backcountry skiing routes in Switzerland.

The dataset contains points along the **Swiss Alpine Club (SAC) / Swisstopo** Backcountry Skiing network. For each point dependent variables and independent variables were sampled.

Content

1 Introduction

The Swiss Alpine Club (SAC) maintains in collaboration of Swisstopo a network about backcountry routes in Switzerland. The network is published on the Geo-Portal of Swisstopo and on physical maps.
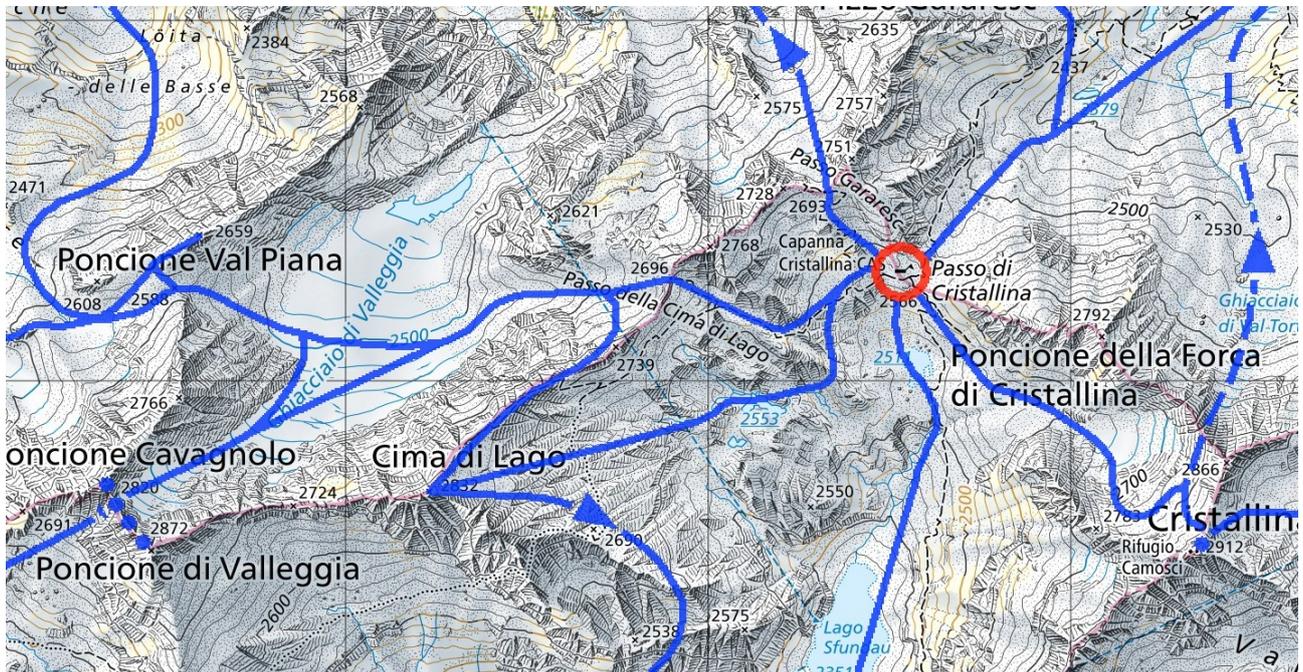

Figure 1: Example of the SAC/Swisstopo Backcountry Skiing Network

Figure 1 shows an example of the map. The map uses the following symbols:

- Dashed line: Extra caution is needed (increased attention).
- Dashed line: Foot section (only by foot)
- Arrow: Suggested direction

In the past decades the network was generated and maintained by a couple of authors. Generally the authors published also guide books for the SAC editor.

According to our knowledge there are no guidelines, that specifies the process of the digitization. Also no detailed definition of **foot section** or **caution section** is known.

The purpose of the dataset is the development of models able to derive **foot sections** and/or **caution sections** from the independent properties:

foot = f (properties)

caution = f (properties)

If the independent variables are sufficient to power such models is not clear. Eventually more meaningful variables have to be added.

2 Data description

2.1 Format

The data is provided as an OGC-compliant vector dataset in the ESRI Shape file format and a CSV file format. The vector data can be visualized with Geographical Information Systems (GIS) like qGis or ArcGis.

The vector dataset has the type Point-Geometry. Points were sampled in a 10 m distance along the SAC/Swisstopo network. The point coordinates are expressed with the projection EPSG=21781.

2.2 Data quality

Little is known about the data quality. There are some reasons we must suppose the data holds an elevated amount of noise:

- Data collection started several decades ago.

- Many authors edited the data during this time.

- No guidelines were used during the digitization.

In particular we must suppose noise is a problem for the additional information like **foot sections**, **caution sections**, or **direction indications**.

2.3 Data description scheme

The features of the vector dataset contain a collection of properties. Each property is described with a table as follows:

Name	Abbreviation	Name	
Description	Description of the property.		
Comment	A comment about the property.		
Values	Data type	Value range	No data value ([1])
Reference	Reference to more information about the property.		
Usage	0-3 Stars	Recommendations for the usage of the property.	
Copyrights	Copyrights of the raw data		

---

1 YES, if the raster effectively holds no-data values, else NO.

3 Dependent variables

3.1 Segment Identifier (ID)

Name	ID	Segment identifier	
Description	An identifier that specifies to which network segment the point belongs.		
Comment			
Values	Integer	0..x	NO
Reference			
Usage			
Copyrights	© SAC/Swisstopo		

3.2 Foot Section (FOOT)

Name	FOOT	Foot Section	
Description	A binary variable that indicates, whether the point is part of a foot section (1) or the point is not part of a foot section (0).		
Comment			
Values	Integer	0..1	NO
Reference			
Usage			
Copyrights	© SAC/Swisstopo		

3.3 Extra Caution Section (CAUTION)

Name	CAUTION	Extra Caution Section	
Description	A binary variable that indicates, whether the point is part of an extra cation section (1) or the point is not part of an extra caution section (0).		
Comment			
Values	Integer	0..1	NO
Reference			
Usage			
Copyrights	© SAC/Swisstopo		

4 Independent variables

4.1 Slope Angle (SLOPE)

Name	SA	Slope Angle	
Description	The slope angle derived from a DEM with 10 m resolution.		
Comment			
Values	Decimal	0..90°	-9999 (NO)
Reference	gdaldem (slope)		
Usage	***		
Copyrights	© Swisstopo		

4.2 Plan Curvature (PLANC7)

Name	PLANC	Plan Curvature	
Description	The planar curvature calculated from a DEM with resolution 10 m.		
Comment	Negative values indicates convexity (n), positive values indicate concavity (u). The property indicates if a spot is located on a ridge, in a valley or on a homogeneous slope.		
Values	Decimal	-100..100	-9999 (NO)
Reference	r.param.scale(size=7, method=planc)		
Usage	**		
Copyrights	© Skitourenguru		

4.3 Terrain Fold (FOLD)

Name	FOLD	Terrain Folds	
Description	Slope normal discontinuity raster. The raster shows folds (edges) in the terrain. Calculated from a DEM with 10 m resolution.		
Comment	Negative values indicates concavity (u), positive values indicate convexity (n).		
Values	Decimal	-180..180°	-9999
Reference			
Redundancy	PLANC, TR		
Usage	**	If used, give priority to this property over PLANC.	
Copyrights	© Skitourenguru		

4.4 Forest Density (FD)

Name	FD	Forest Density	
Description	Forest Density (in %) and a resolution of 10 m.		
Comment			
Values	Decimal	0..100%	-9999 (NO)
Reference	Tree Cover Density (2018)		
Usage	**		
Copyrights	© ESA		

4.5 Maximal Fall down Velocity (FD_MAXV)

Name	FD_MAXV	Maximal Velocity	
Description	Maximal velocity on a downfall trajectory.		
Comment			
Values	Decimal	0..80 m/s	-9999
Reference	Avalanche terrain maps for backcountry skiing in Switzerland		
Redundancy	FD_*		
Usage	***	Important property.	
Copyrights	© Skitourenguru		

4.6 Elevation (ELE)

Name	ELE	Elevation	
Description	Elevation according to the DEM with 10 m resolution.		
Comment			
Values	Decimal	0..5000 m	-9999 (NO)
Reference	swissALTI3D-10m		
Usage	***		
Copyrights	© Swisstopo		

4.7 Terrain Indicator (TI)

Name	TI	Terrain Indicator	
Description	TI indicates how suitable a terrain point is to trigger an avalanche (MRSAR=100 m).		
Comment			
Values	Decimal	0..1	-9999 (YES)
Reference	[Method for an Automatized Avalanche Terrain Classification](#)		
Usage	**	The no-data value -9999 means that there is no avalanche risk Therefore -9999 should be replaced by 0.	
Copyrights	© Skitourenguru		

4.8 Street (STREET)

Name	STREET	Street
Description	Category, that indicates distance to the next street: • 1: Next street in distance 0...5 m • 2: Next street in distance 5...15 m • 3: Next street in distance 15...25 m • 4: Next street in distance 25...35 m • 0: No street nearby	
Comment	A street is defined as a roadway that can be managed by an agricultural vehicle.	
Values	Binary	0,1,2,3,4
Reference		
Usage	**	Consider 1,2,3 on the street.
Copyrights	© OSM	