

Predictive model for avalanche risk in gallatin backcountry

Objective

This project aims to develop a machine learning model to predict avalanche risk in Montana's backcountry areas. The model will leverage real-time weather, terrain, and historical avalanche data to assess avalanche risk on a continuous basis. The end goal is to provide a tool accessible to the public for informed decision-making, enhancing safety for winter recreation and transportation in avalanche-prone regions.

Data Requirements

Weather Data: Forecasted and current temperature, snowfall, wind speed, and precipitation data from sources like NOAA and OpenWeatherMap.

Snowpack and Terrain Data: Real-time snow depth and snow-water equivalent (SWE) data from SNOTEL, along with GIS terrain data for slope and elevation.

Historical Avalanche Data: Avalanche occurrence records, accessible from the U.S. Avalanche Center, including the date, location, and conditions of past avalanches.

Model

We'll begin with machine learning techniques (random forest, xgboost, logistic regression) as the primary model due to its robustness in handling diverse data types and nonlinear relationships.

The model will be trained on historical data, then validated using a holdout test set. Evaluation metrics such as accuracy and confusion matrices will assess model performance in classifying risk levels.

Prediction and Deployment

Once trained, the model will be deployed to make risk predictions. Based on new data feeds with predictions categorized into risk levels (e.g., Low, Moderate, High, Extreme).

Visualization and User Interface

Using shiny we will create an interactive dashboard that displays risk levels across Montana in real-time or for a given forecast period. This interface would offer several features, including an interactive map for spatial risk visualization, summary statistics, and the ability to toggle weather and snowpack conditions that impact avalanche risk.