



## Using interactive object segmentation to derive avalanche outlines from webcam imagery

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Safety related applications like avalanche warning or risk management depend on timely information on avalanche occurrences. Today, this is gathered in a non-systematic way by observers in the field, even though remote sensing already proved capable of providing spatially continuous information on avalanche occurrences over large regions. Satellite imagery has the big advantage of large coverage, however the information is available only on selected dates. Depending on the application, a better temporal resolution is necessary. Webcams are ubiquitous and capture numerous avalanche prone slopes several times a day. The cameras mounted in a stable position may even be georeferenced to allow for an exact transfer of the location from the image to a map. To complement the knowledge about avalanche occurrences with more precise release time information, we propose making use of this webcam imagery for avalanche mapping.

For humans, avalanches are relatively easy to identify in imagery, but the manual mapping of their outlines is cumbersome and time intensive. To counter this, we propose automating the process with deep learning. Relying on interactive object segmentation we want to extract the avalanche outlines from those images in a time efficient manner with feedback from human experts (in the form of few corrective clicks on an image). We test existing models, searching for the best fit for avalanche outline segmentation. By adapting the best model where necessary we are aiming for outlines of good quality with a low number of clicks. For imagery we rely on current and archive data from our 14 webcams covering the Dischma valley near Davos, Switzerland with imagery available every 30 minutes during the day. Since the images are georeferenced, we may import identified avalanches directly into designated databases and therefore make them available for the relevant stakeholders.

On a more long-term perspective, the resulting avalanche outlines will enlarge the webcam training, test and validation dataset and consequently help to fully automate the avalanche outline identification from webcam imagery with object segmentation.

