A Survey of Automatic Surface and Bedrock Detection Techniques

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Earth's climate change is a significant research topic in the context of environmental monitoring. In particular, the rise of Earth's temperature will greatly affect the subsurface dynamics of the Polar Regions; this requires an exhaustive investigation of the stratigraphy and basal conditions in Greenland and Antarctica. However, this requirement is often impossible due to the inaccessibility of the subglacial environment, which does not allow for continuous and in depth monitoring of the ice. To address this challenge, the Center for Remote Sensing of Ice Sheets (CReSIS) has used instruments capable of providing significant information about the deep parts of the ice sheets. Acquired data from these field campaigns are analyzed by manual investigation with intrinsically subjective and highly time consuming approaches, especially when considering large amounts of data. These issues allow for the development of automatic techniques in order to support both objective and extraction of relevant information from echograms.

The development of automatic techniques for data acquired from Earth's Polar Regions will allow for reliable tools, which could analyze a large quantity of echograms in a timely manner for the scientific community. In order to aid in developing innovative, automatic techniques, we will present novel related work and survey techniques for identifying surface and bedrock layers in radar imagery. For example, the use of hough transforms, are not suitable for echograms because layer boundaries do not support a parametric model. However, techniques, such as general-purpose image segmentation, graphical models, and active contour models, which combine image features with continuity constraints but requires a good initialization, would provide a solid foundation to layer identification.