Hyperparameter Optimization of the level set 2D layer tracker

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Abstract:

The Center for Remote Sensing of Ice Sheets (CReSIS) studies how the melting of ice sheets in Greenland and Antarctica might affect sea-level change. A key geophysical parameter for this research is the ice thickness, which can be estimated by calculating the exact location of the ice surface and subglacial topography beneath the ice in radar sounder imagery. In the past, identification of the surface and bottom of each of the layers is performed manually and is usually very time-consuming. As a solution to this, our project evaluates and tunes a level set algorithm to automatically track the ice surface and bottom.

The level-set method takes an initial contour or curve for the layer and builds it into a surface. It evolves the surface that intersects the 2D radar image instead of just evolving the contour – the contour is defined as the intersection of the surface with the 2D image. It starts with a best initial guess contour and iterates for a prescribed number of iterations until they accurately align with surface and bottom. The algorithm tracks the zero-level set of the surface and the number of iterations necessary using a mathematical function (Rahnemoonfar 2017). The main objective of this current work is to tune the hyperparameters for this level-set algorithm by optimizing the hyperparameters to produce the best match to the training data that we have. In this work, we parallelize the code, try different initial contours and numbers of iterations to improve the accuracy of detecting the ice bottom and surface as compared to the ground-truth images, and then assess the accuracy and precision with our test dataset. These results will be compared with other automated tracking algorithms as part of the NSF SPIDAL DIBBS project.

References: