# Abstract

The aim of this thesis is to propose a method for detecting glacier area changes, with emphasis on distinguishing between false positive changes, such as shadows, surface moisture change, or debris cover on glacier surface, and real changes (transition between land cover classes). The key part is to choose appropriate features and a machine learning model to distinguish problematic glaciation areas (debris, shadow) based on different surface properties and to analyze the contribution of each feature for glaciation change detection. The main data source is Landsat multitemporal imagery capturing Disko Island, located west of Greenland. Six main classes were investigated: glaciated areas, shaded glaciated areas, debris-covered glaciers, unglaciated areas, shaded unglaciated areas and water bodies. In addition to spectral features, spectral indices, thermal band, textural and topographic features, and glacier surface velocity were used to distinguish these classes. Three machine learning models were tested to classify the land cover for each year: *k-Nearest Neighbours, Random Forest* and *Gradient Boosted Decision Trees*. Random Forest proved to be a suitable model as it was able to deal with the complex data structure and was able to distinguish problematic classes with >95 % overall accuracy. Image algebra-based, classification-based, and hybrid techniques were investigated for change detection, with very good results achieved using post-classification comparison and direct multi-date classification of changes. The most important features for change detection were spectral features, spectral indices (NDSI, NBR), and thermal band. The results showed a decrease of 239,4 $km^2$ in glaciated areas between 1985 and 2021, which is about 22,69 % of the total glaciated areas. On average, the area of glaciers is decreasing by 6,6 $km^2$ per year, with twice as much loss between 2000 and 2021 as between 1985 and 2000. Glacier area decreased by 8,9 % between 1985–2000 and 18,55 % between 2000–2021.



**Keywords:** land cover change, remote sensing, change detection, machine learning, glacier retreat, climate change