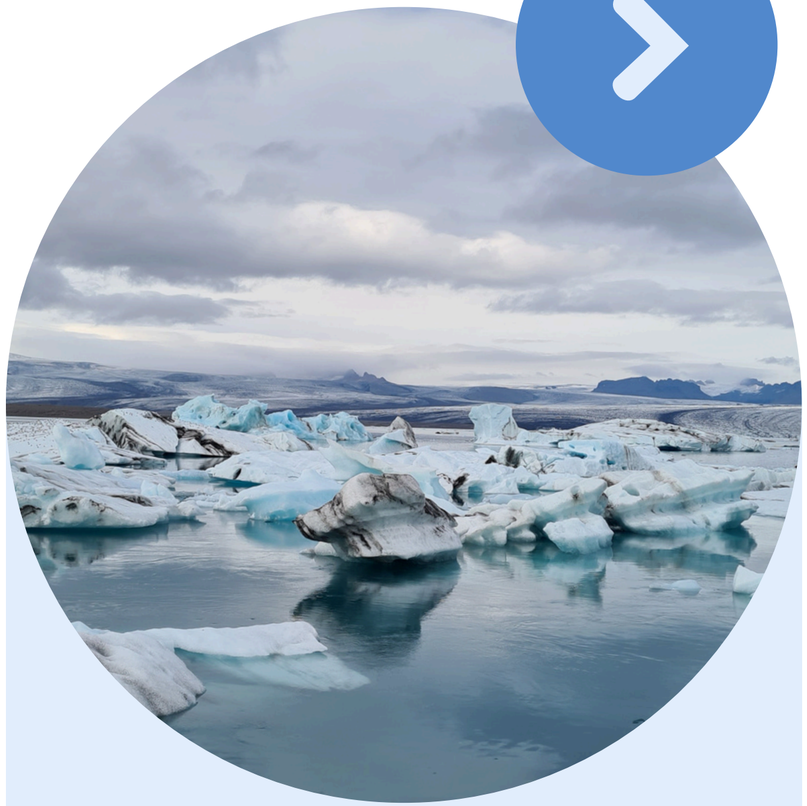
GLACIER GUARDIAN

Monitoring and prediction of ice melting patterns in Greenland



The Problem

- Climate change is causing glaciers to melt at an alarming rate.
- Glaciers are vital freshwater sources; their loss contributes to sea level rise.
- Monitoring glacier melt is essential, but traditional methods are slow and manual.

Why AI Can Help?

AI enables automated, scalable, and accurate analysis of satellite data.

Machine learning can detect subtle changes in snow and ice cover.

Historical data can be used to model and predict future melting trends.

Existing Research

Study 1: Predicting Ice Flow Using ML

- **Data: LANDSAT 8**
- **Method: ConvLSTM + GAN**
- **Result: Accurate modeling of ice motion and small texture changes**

Study 2: Sea Ice Monitoring from Satellites

- **Data: Sentinel-1 SAR**
- **Method: SVM, VAE, k-NN**
- **Result: High classification accuracy (up to 89%), seasonal transitions detected**

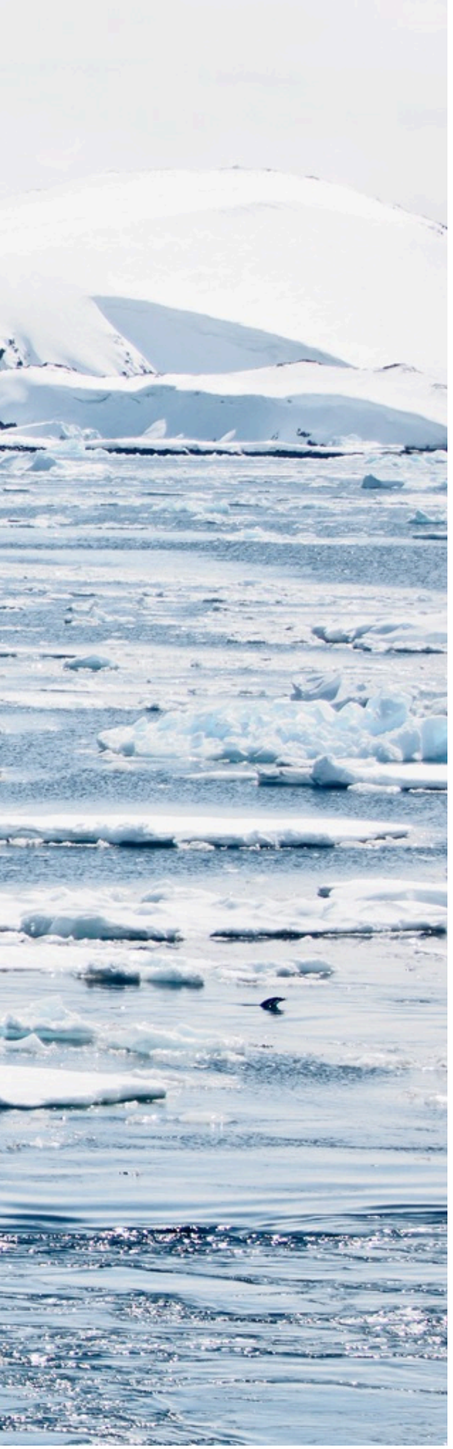
Datasets Used

LANDSAT 8

Multispectral satellite imagery at 30m resolution

GLIMS DATASET

Glacier metadata—location, size, and topography



Machine Learning Models

Suport Vector Machine

- Used LANDSAT 8 bands and NSI as input features
- Achieved an accuracy of 76.6%
- Performed moderately well but had noticeable misclassifications

Random Forest

- Used the same input features as SVM
- Achieved a significantly higher accuracy of 97.9%
- Lower risk of overfitting due to ensemble structure
- Demonstrated strong generalization and reliability for this task

Project Workflow

Data Collection from Google Earth Engine (GEE)

Labeling: Merged “snow” and “no_snow” classes

Model Training: Used SVM and Random Forest

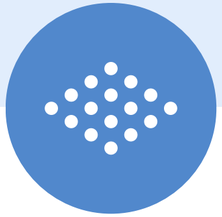
Evaluation: Confusion matrix + accuracy scores

Deployment: Created GEE app to visualize classified snow and ice loss

DEMO

Conclusion

- The project demonstrated that AI, specifically machine learning, is effective for monitoring glacier melt using satellite imagery.
- Random Forest classifier achieved high accuracy (97.9%) in snow cover classification, outperforming SVM significantly.
- The Google Earth Engine application enables efficient visualization of ice loss trends with user-selected timeframes.



THANK YOU!