Cloud Spotting From Space:

Enhancing Infrared Imagery Classification

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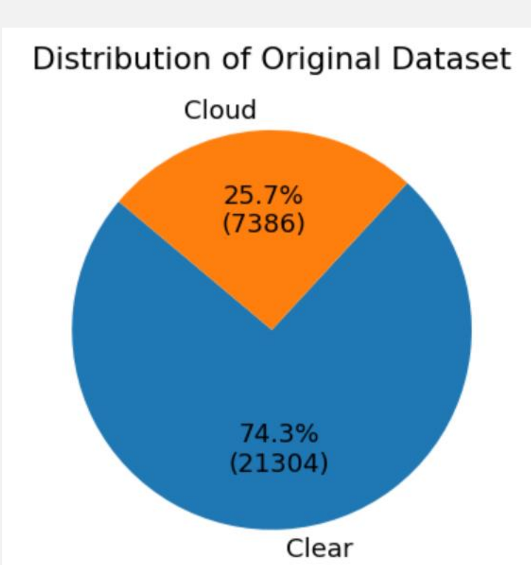
Introduction

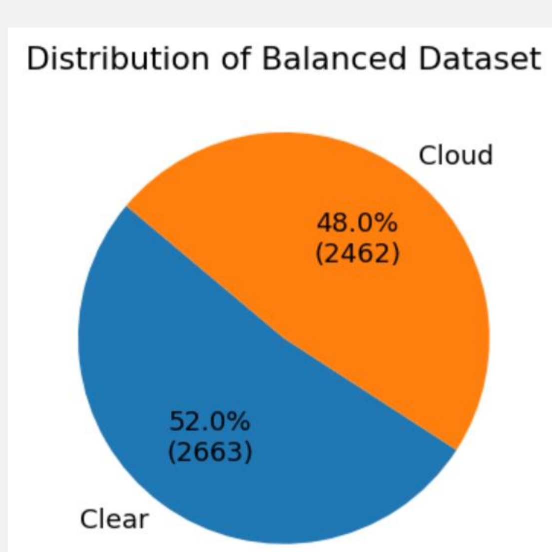
Objective: Understanding Earth's weather influences on space weather through the study of atmospheric gravity waves.

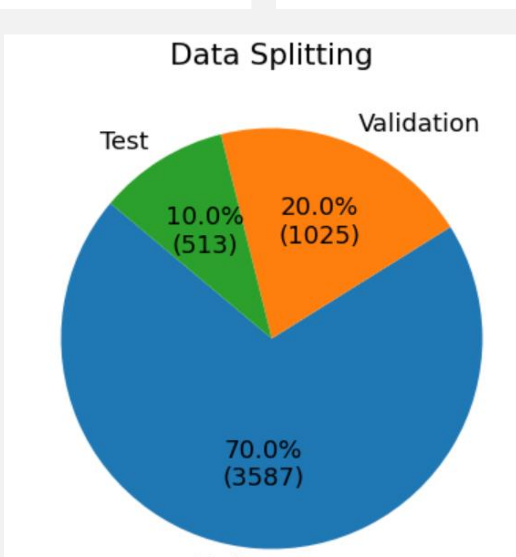
Task: Ensuring reliable temperature measurements by using Machine Learning to accurately classify satellite infrared imagery as Cloud or Clear.

Data Overview

- **Data Source:** Images from 15 satellite orbits on January 1st, 2024

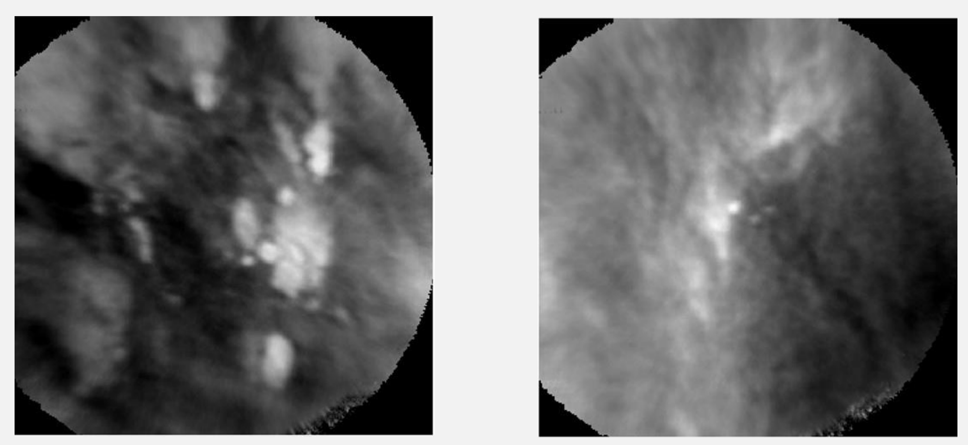




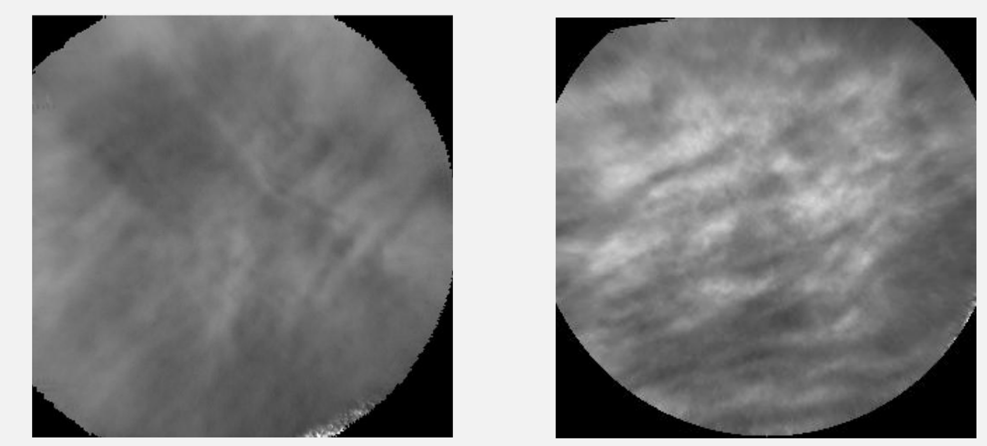


Example Images

Cloud Images



Clear Images

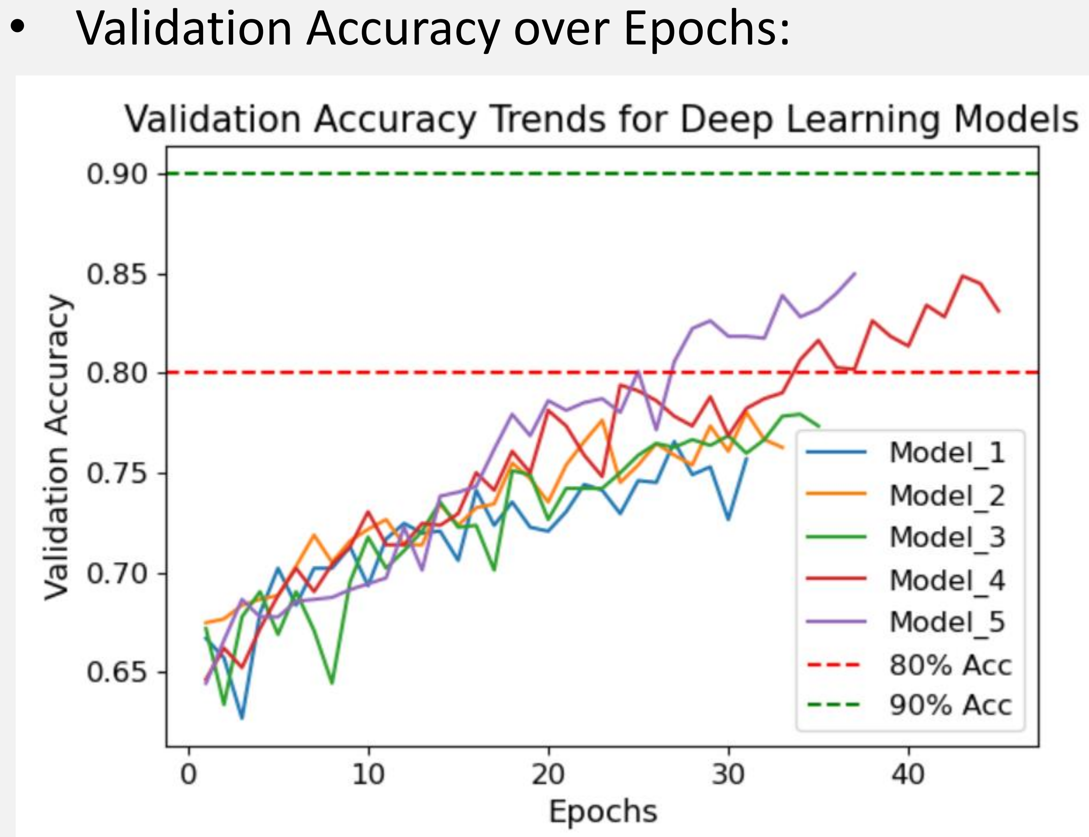


Methodology and Results

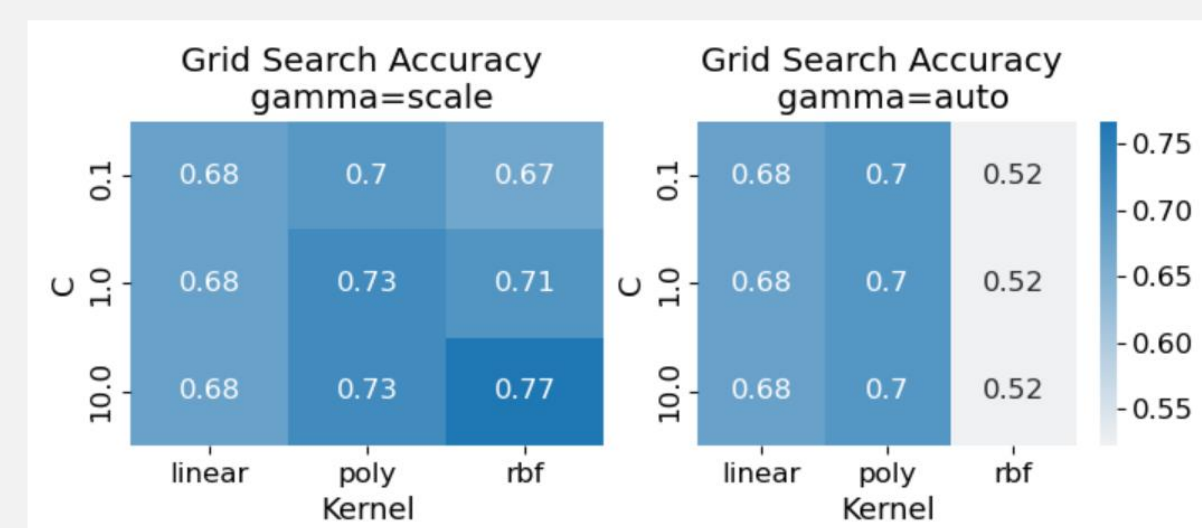
To determine the most effective model for cloud detection, we compared the performance of several machine learning models:

Logistic Regression
- Baseline Performance
- Accuracy: 72%

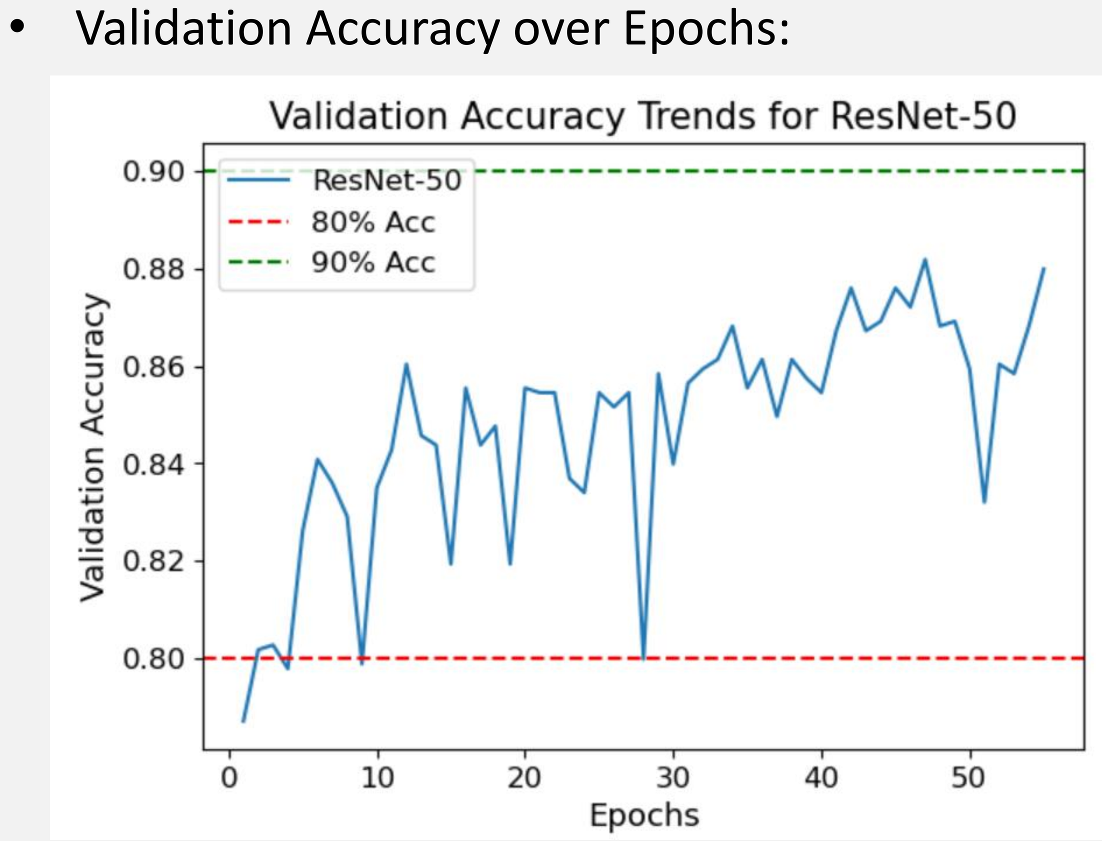
Deep Learning
- Using five different Convolutional Neuron Network (CNN) models
- Accuracy: 85% for the best CNN model
- Validation Accuracy over Epochs:



Support Vector Machine (SVM)
- Trying 18 different combinations of parameters
- Accuracy: 77% for the best SVM model
- Results: Shown in grid search graphic



Transfer Learning using ResNet-50
- Adapting Pre-trained Models
- Accuracy: 88%
- Validation Accuracy over Epochs:



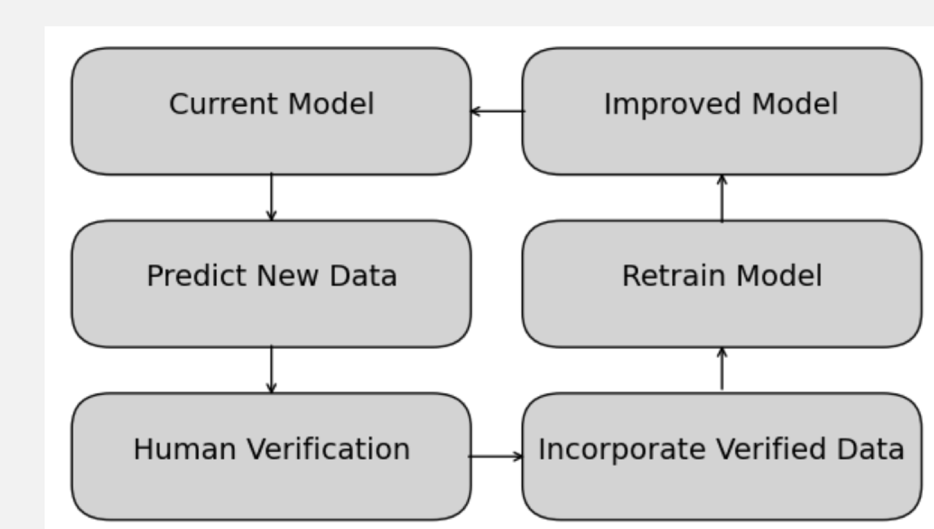
Conclusion

Key Findings

- **Progress**: Improved cloud classification in satellite infrared imagery through expanded dataset, refined model architectures, and incorporation of additional contextual data.
- **Model Comparison**: Various machine learning models were tested, with deep learning and transfer learning showing the highest accuracy.
- **Novelty**: While there are existing models for ground-based airglow images, there are currently no models for satellite-based airglow images.
- **Scalability**: With millions of images captured in a few months, manual categorization is nearly impossible. Our automated approach is crucial for handling large datasets efficiently.

Future Directions

- **Creating a Pipeline**: Develop a pipeline for future data processing and model updates.



- **Motion Analysis**: Enhance cloud detection using consecutive images.