

Simultaneous Multi-Task Learning Strategies for Satellite Precipitation Estimates

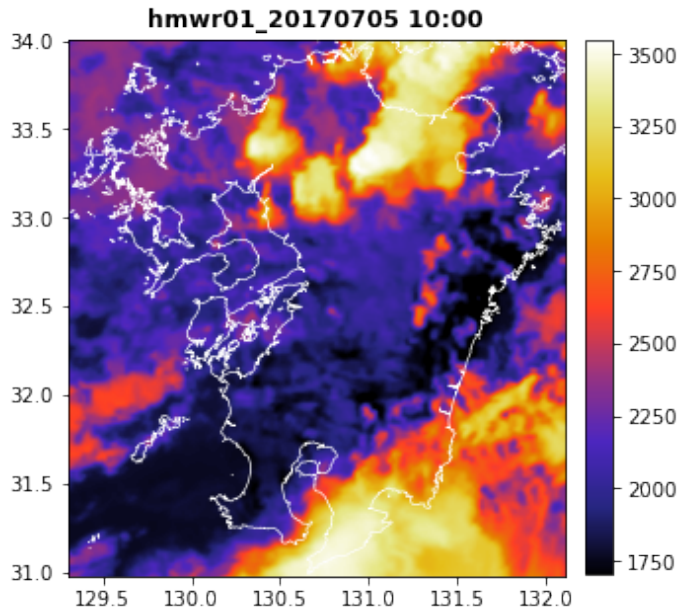
Takumi BANNAI



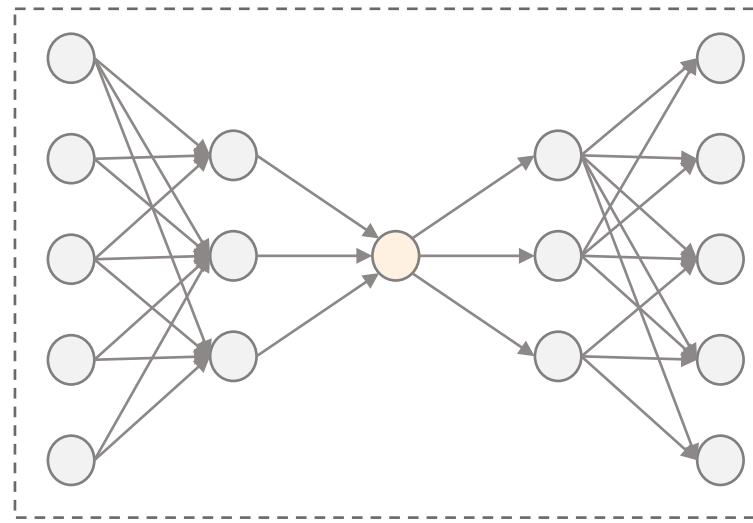
Introduction

Many machine learning methods have been proposed for satellite precipitation retrieval. However, ML approaches face challenges due to their technical characteristics.

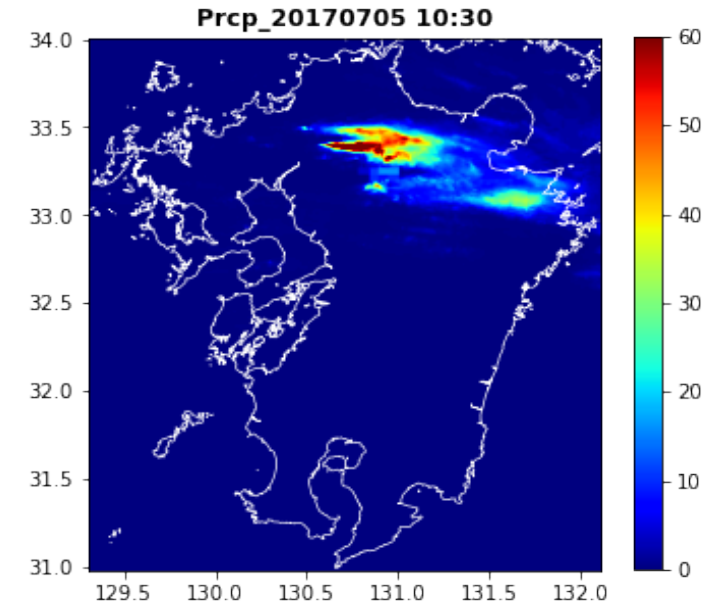
Input: Satellite observation



Machine learning model



Output: Precipitation



Limitation

- ✓ Extensive training data requirements
- ✓ Inconsistency with physical laws
- ✓ Limited generalizability to out-of-sample scenarios

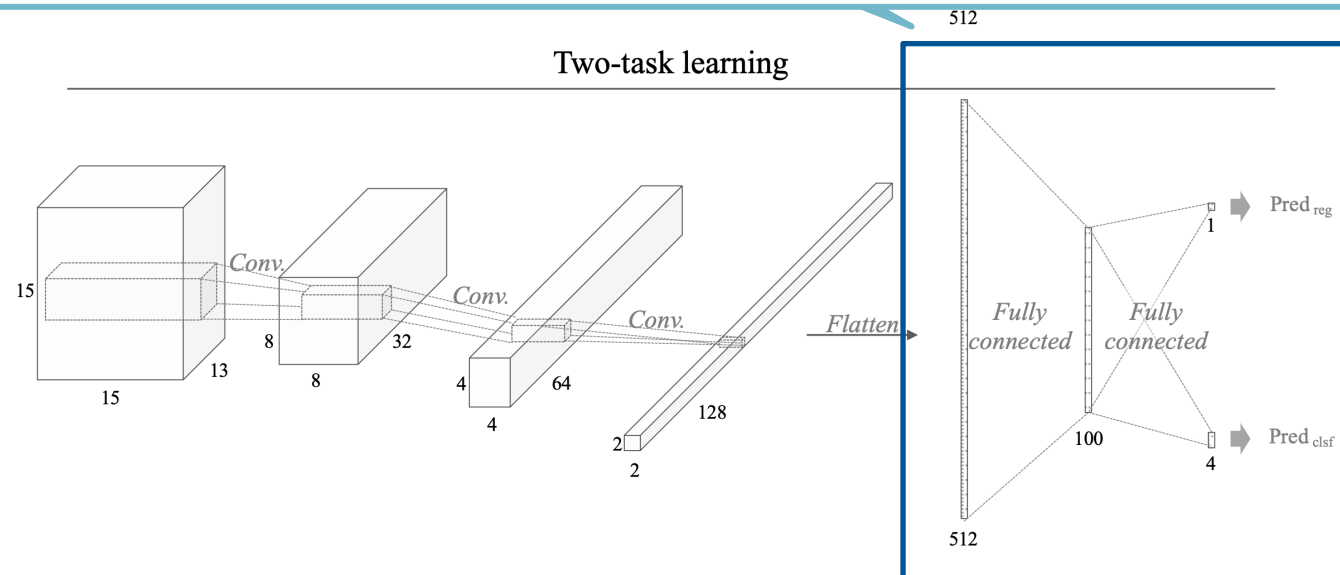
Solution

Physics-Guided Machine Learning

Multi-task learning that flexibly incorporates physics knowledge into the ML model

By implementing multitasking (parallelizing the output layers), the design of loss functions becomes more flexible.

This flexibility enables the installation of physical knowledge into ML models.



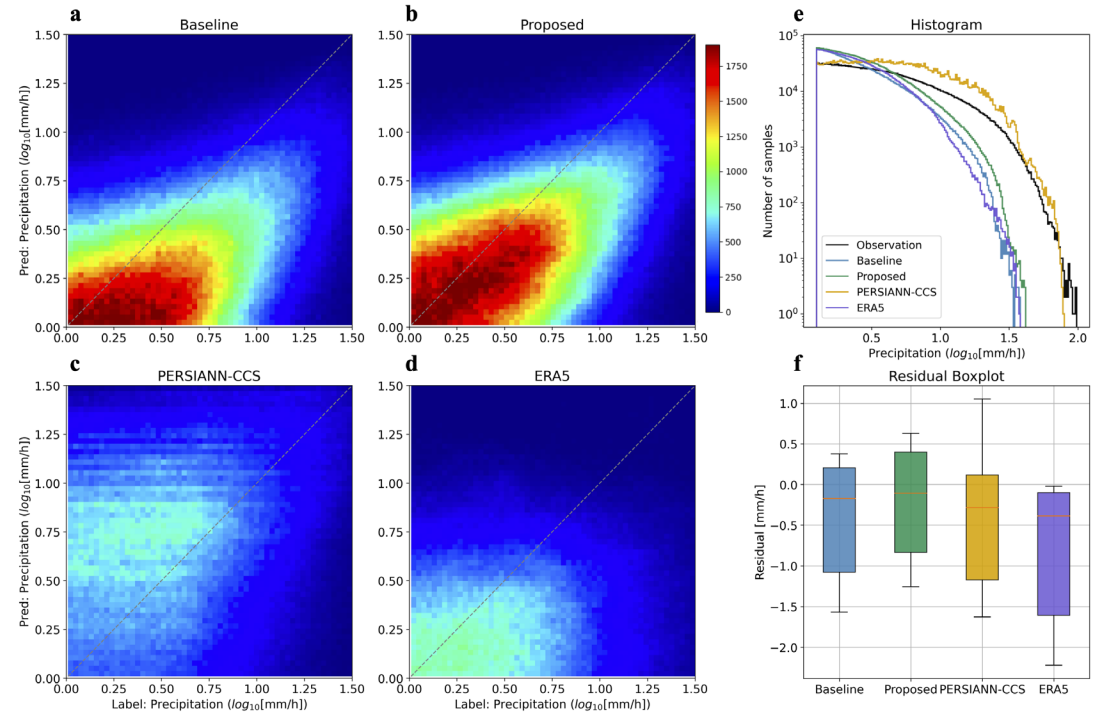
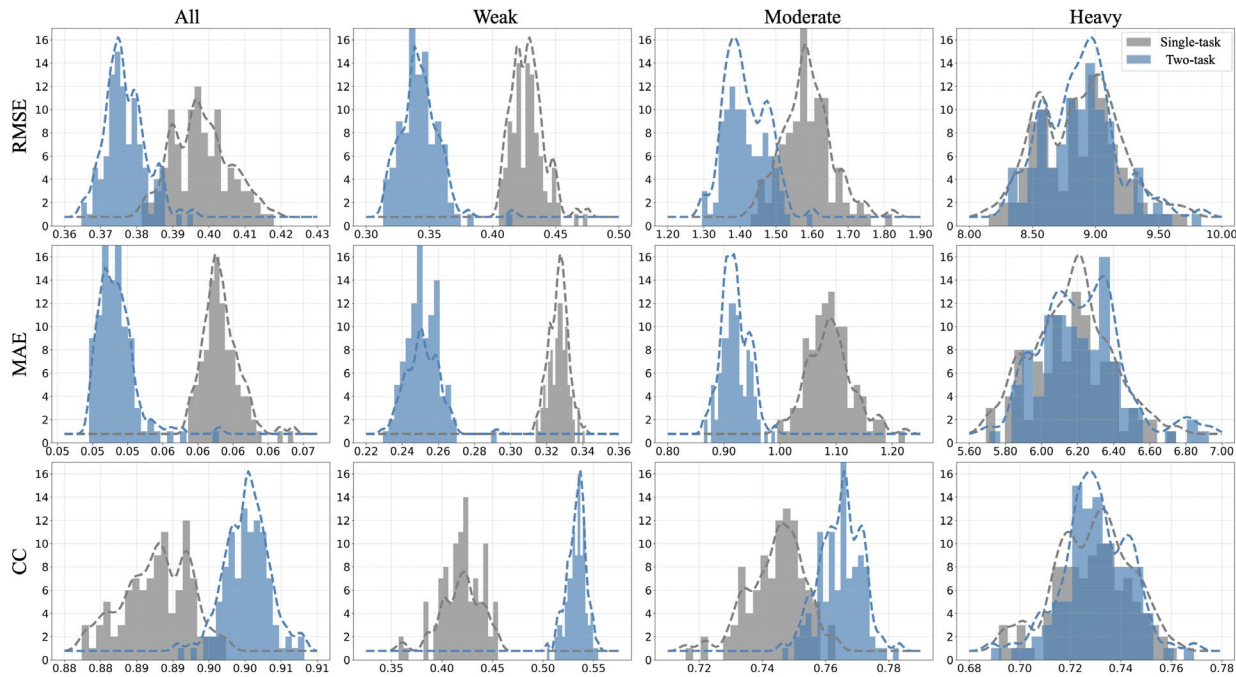
Application

1 *Passive Microwave (PMW)*

Multi-Task Learning for Simultaneous Retrievals of Precipitation Estimates and Classification

2 *Infrared (IR)*

Simultaneous Learning for Physically Constrained Infrared-based Satellite Precipitation Estimation



An aerial satellite-style photograph of a large hurricane or tropical storm. The storm's eye is visible in the center, surrounded by dense, swirling cloud bands. The text "End of File" is superimposed in the middle of the image.

End of File