Last Mile in Remote Sensing Poverty Prediction

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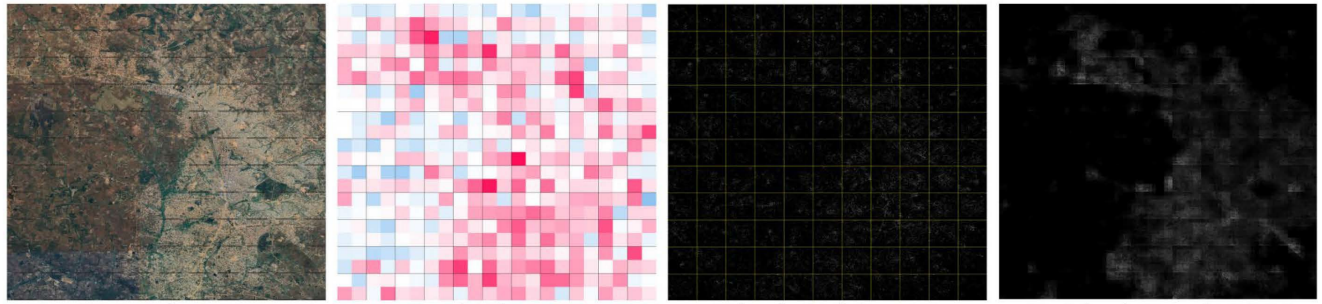
Can we improve remote sensing-based poverty predictions where baseline models using satellite imagery and nighttime light data fail?

- Explainability techniques: Integrated Gradients and Guided Grad-CAM, to visualize where the vision models (ResNet101, VGG16, ViT-B/16) focus and identify sources of failure.



[1] Jean et al. (2016)
DOI: 10.1126/science.aaf7894

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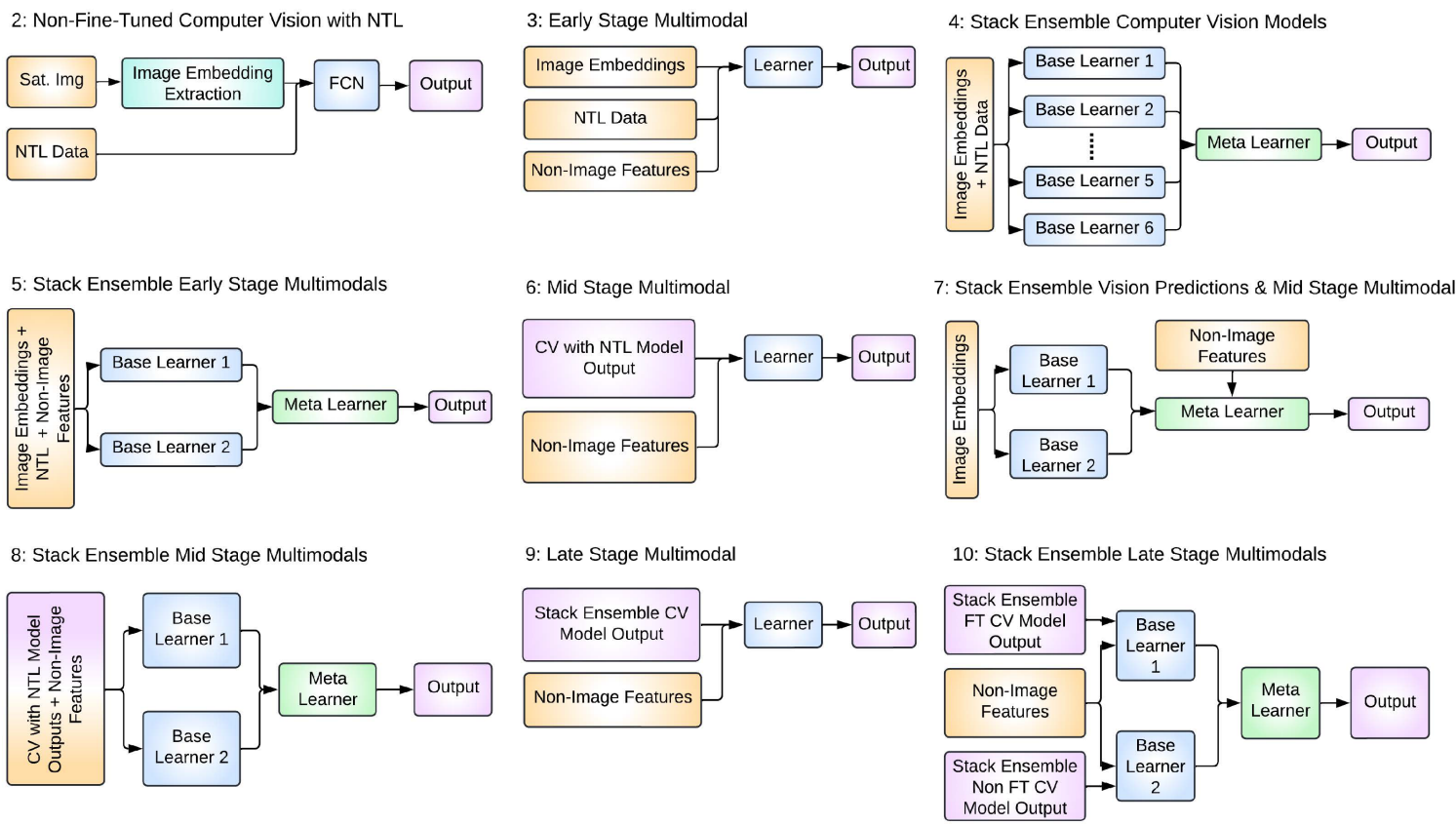
- The "last mile" refers to the challenge of making accurate poverty predictions in all sub-regions, addressing areas where baseline vision models consistently fail.

Metrics	Baseline Approach	Our Best Model (Arch. 10)
Test R^2	0.762	0.844
Var of Error^2	0.353	0.084
Exclusion error	6.37%	4.46%
Inclusion error	12.84%	7.34%



CV stands for computer vision. FT stands for fine-tuning.

*Accepted for publication in *ACM Journal on Computing and Sustainable Societies*

Overview of Additional Projects

Detecting Human-Interpretable Features From Satellite Imagery to Support Poverty Mapping

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- Initial Results:

  water bodies > paved roads > building footprints > unpaved roads > huts

Multimodal Poverty Mapping and Resource Optimization in Zambia

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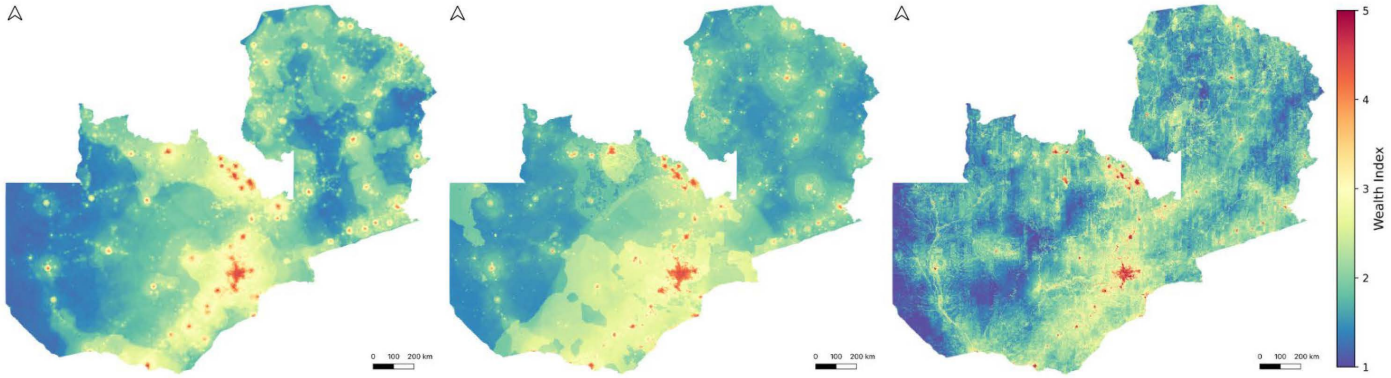
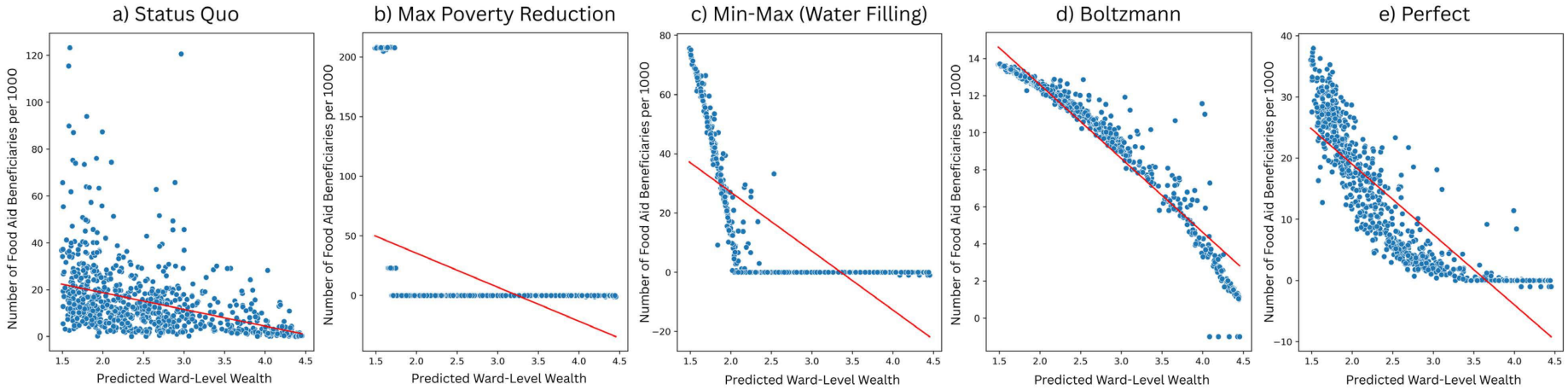
- Multimodal Poverty Maps:



(a) Unimodal (b) Uniform Multimodal (c) Optimized Buffer & Feature Selection: ViT Model

- Aid Allocation Based on Poverty Predictions and Optimization Objectives:



Efficiency and Robustness for Spatial Poverty Prediction and Data-Driven Resource Allocation

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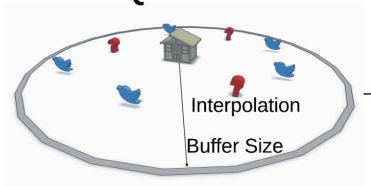
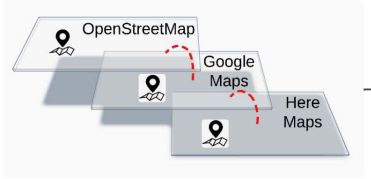
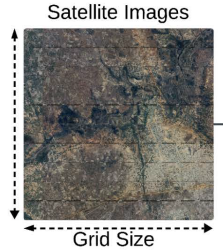
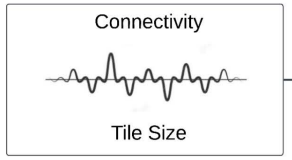
Efficient Imputation of Spatial Data and Uncertainty Quantification

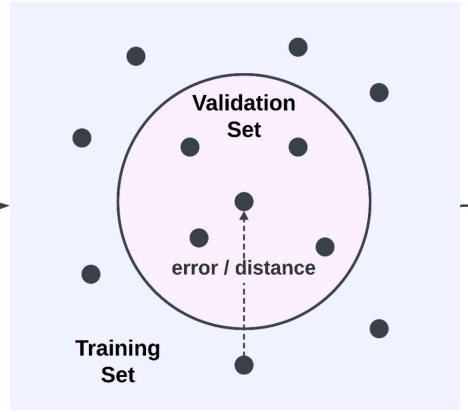




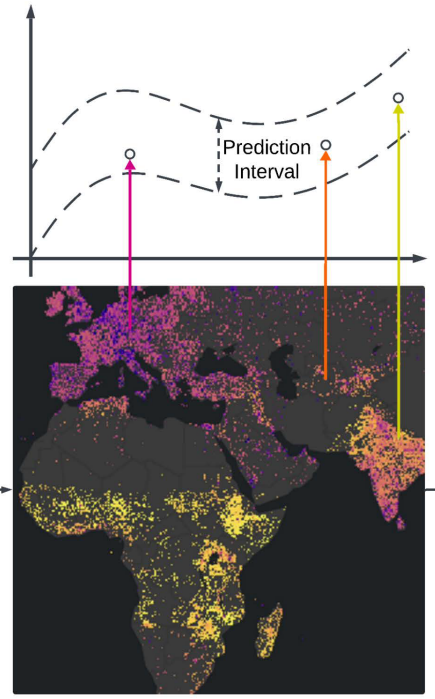




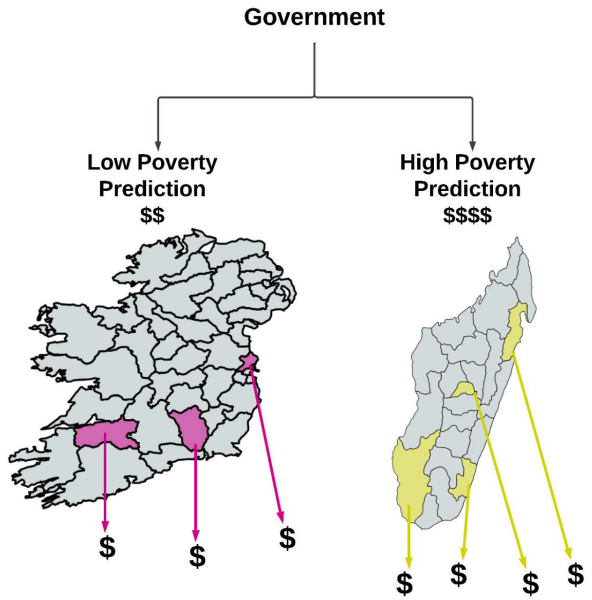
Adaptive Buffered Cross Validation



Robust Prediction of Spatial Poverty and Debiasing



Resource Optimization Under Uncertainty



- Statistically rigorous, computationally efficient, and practically applicable AI/ML methods
- help practitioners make data-driven policy decisions with statistical confidence that yields maximum impact.

Potential Collaborations

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- Applications of AI/ML in my field:
  - AI/ML facilities poverty identification and optimizes resource allocation.
- Grants:
  - NSF Human-Environment Geo Sciences
  - NSF Methods, Measurement, and Statistics
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