A Machine Learning Approach to Map the Poor and Non-Poor Buildings in Developing Countries

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Introduction

Characteristics of poor people living in developing countries

In poor neighborhoods:

- Buildings are low-rise, corrugated iron roofs, very narrow footpaths.
- Lack of local services like schools, hospitals, stations, etc.
- Residing closer to the river.

Hypothesis and Research Goal

Hypothesis

- Physical factors like Area of the House, Elevation, DBR, DBNS influence the distribution of poor people.
- Rooftops, the visual indicator of the buildings from the satellite imagery, can measure poverty.

DBR → Distance of the Building from River

DBNS → Distance of the Building from Nearest Station

Research Goal

Methodology

Comparison between the study areas

Aspects	Myanmar	Nicaragua	Thailand
Region	Southeast Asia	Central America	Southeast Asia
Economy	Lower-middle income country	Lower-middle income country	Upper-middle income country
% of population living in poverty [< $5.50/day]	54% [2017]	35% [2014]	6% [2019]
Roof Type	thatch/bamboo, corrugated sheets, brick/concrete	wooden planks with clay tiles, corrugated sheets, brick/concrete	thatch/bamboo, tile, corrugated sheets, brick/concrete

Guidelines to classify poverty using international poverty lines

Common guidelines to all study areas irrespective of country.

International Poverty Lines given by World Bank

- $1.90 per person/day — in 33 low-income countries.
- $3.20 per person/day — in 32 lower-middle-income countries, such as Myanmar and Nicaragua.
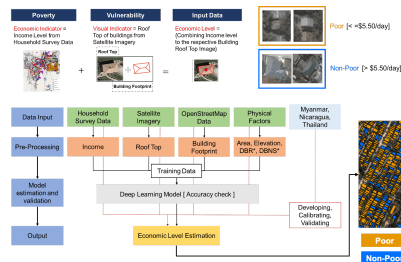- $5.50 per person/day — in 32 upper-middle-income countries, such as Thailand.
- $21.70 per person/day — in 29 high-income countries.

Economic Level	Income Level
Poor	< = $5.50/day
Non-Poor	> $5.50/day

Schematic overview of the methodology

Results

Accuracies of the model when trained on one Country [City] and evaluated on another Country [City] : only rooftop image is used.

→ 95% of the training data is non-poor, and only 5% is poor

Biased model towards non-poor

	[Yangon]	[Bago]	[Managua]	[BPA]
Thailand [BPA]				
Nicaragua [Managua]	54%	42%	62%	
Myanmar [Bago]	70%	69%	43%	
Myanmar [Yangon]	75%	59%	45%	
	Myanmar	Myanmar	Nicaragua	Thailand

Country [City] trained on →

The best possible case is when the model is trained on Yangon and evaluated on other study areas.

**BPA = Bangkok & Pathum Thani + Ayuthaya

Nicaragua [Managua]	54%
Myanmar [Bago]	70%
Myanmar [Yangon]	75%

Country [City] trained on →

→ The difference in roofing materials' color for Managua and Yangon and poor quality of OpenStreetMap data for Managua.

→ In Bago, the poor people's houses are mostly under or nearer to the trees (more vegetation) compared to Yangon.

Reasons for the fall in accuracy

Accuracies of the model when trained on Myanmar [Yangon] : rooftop image + physical factors are used.

Myanmar [Yangon] trained on →	75%	69%	65%	62%	59%
	Image	(+Area)	(+Elevation)	(+DBR)	(+DBNS)

Discussion

Generation of Economic Level Estimation Maps

Conclusion

Using household survey data, the economic level of each building is estimated with an accuracy of 75% in Yangon, 70% in Bago, and 54% in Managua.

- The model travels well intra-regionally { Myanmar (Yangon & Bago) }.
- The model's accuracy can be improved inter-regionally { Myanmar (Yangon) & Nicaragua (Managua) }.

So, for a model to travel well intra-regionally and inter-regionally, it should satisfy the

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