Hertie School of Governance

MAPPING POVERTY IN BANGLADESH WITH SATELLITE IMAGES & DEEP LEARNING

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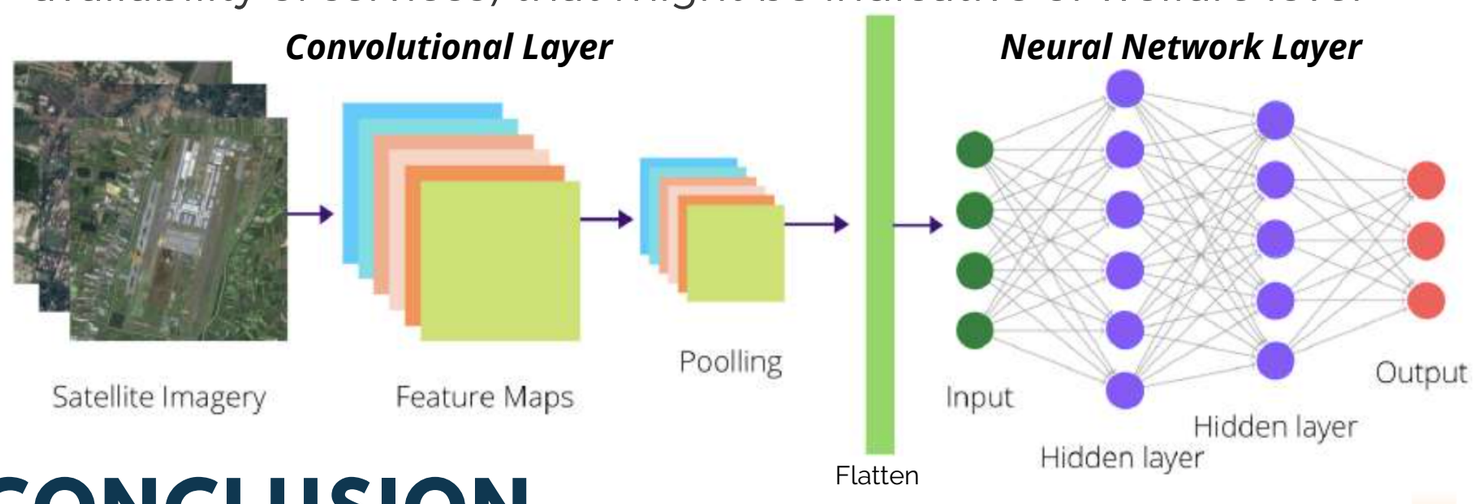
MOTIVATION

Identifying areas of poverty is a crucial step for aid targeting, financial inclusion and development goals. However, this is reliant on household surveys data which is complex and costly to implement. This research, therefore, explores the possibility of employing open source data such as nighttime and daytime satellite images and geospatial mapping to estimate wealth distribution, focusing on the country of Bangladesh.

METHODOLOGY

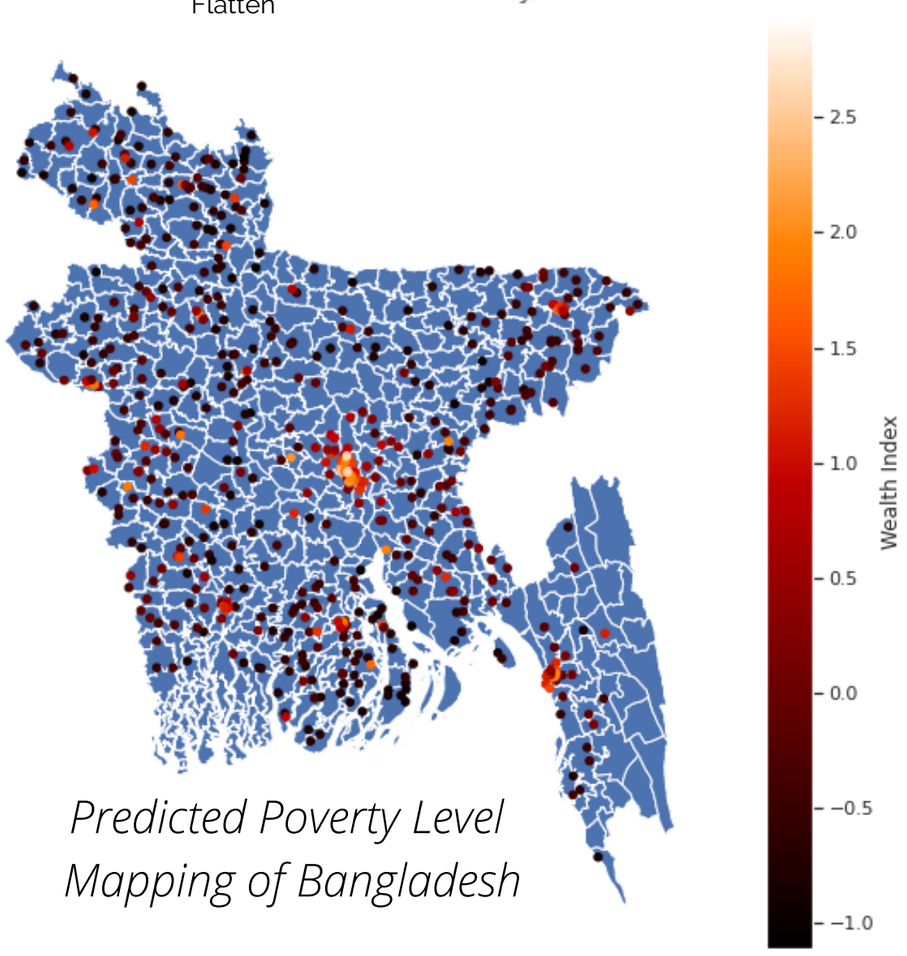
Three types of open source data were utilized as features to predict poverty and welfare level, using five Machine Learning models:

- **Nightlight Luminosity**: a proxy for wealth level as theoretically, higher luminescence corresponds to more electricity usage, infrastructure investment and thus economic activity;
- **Daytime Satellite Images**: processed with Convolutional Neural Network to extract deep features on the map of Bangladesh that are correlated with poverty and wealth distribution;
- **OpenStreetMap Geo-mapping Features**: natural and artificial landscape features (roads, buildings, landuse, points of interest, availability of services) that might be indicative of welfare level



CONCLUSION

The research demonstrated the feasibility of estimating poverty and welfare level, through the use of open source data when survey data is scarce. With further improvement, it can be an useful tool for policy makers, and development practitioners in identifying impoverished areas for aid and financial inclusion programs.

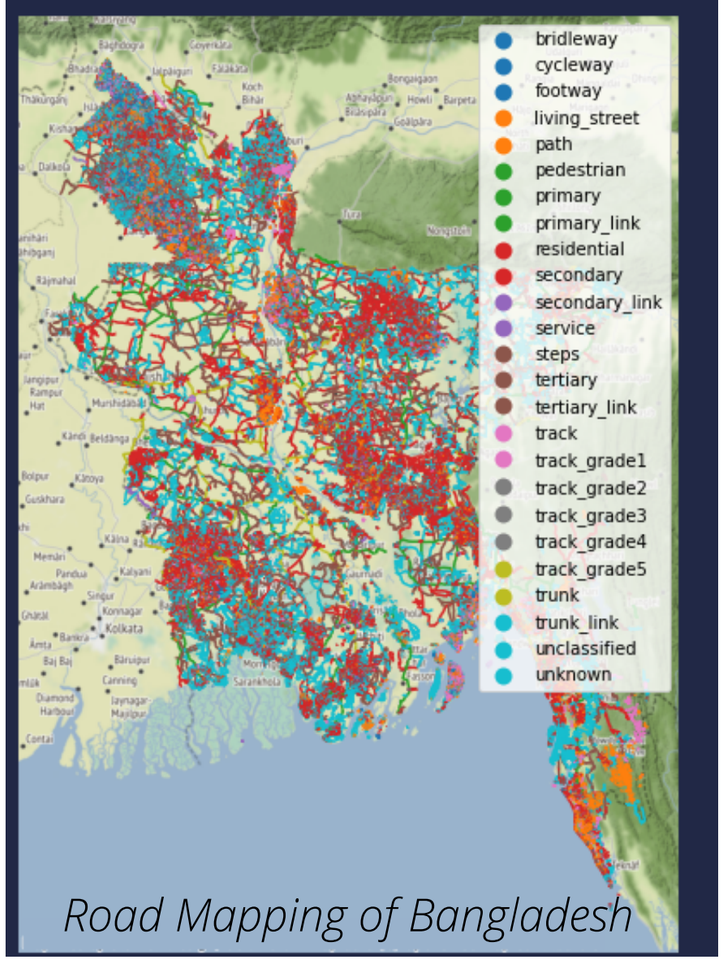


Predicted Poverty Level Mapping of Bangladesh

RESULTS

Five distinct models (Ridge, Lasso, ElasticNet, Random Forest and XGBoost) taking different combination of features were explored to identify the best result for poverty estimation. The state-of-the-art transfer learning approach with daytime and nighttime satellite images captures the most of the welfare variation at 72 percent R-squared.

The model relying on open-source data of nightlight intensity and geo-spatial mapping also presents a promising alternative that achieves similar result at 70 percent R-quared while maintaining ease of access and no incurring cost for acquisition



Road Mapping of Bangladesh