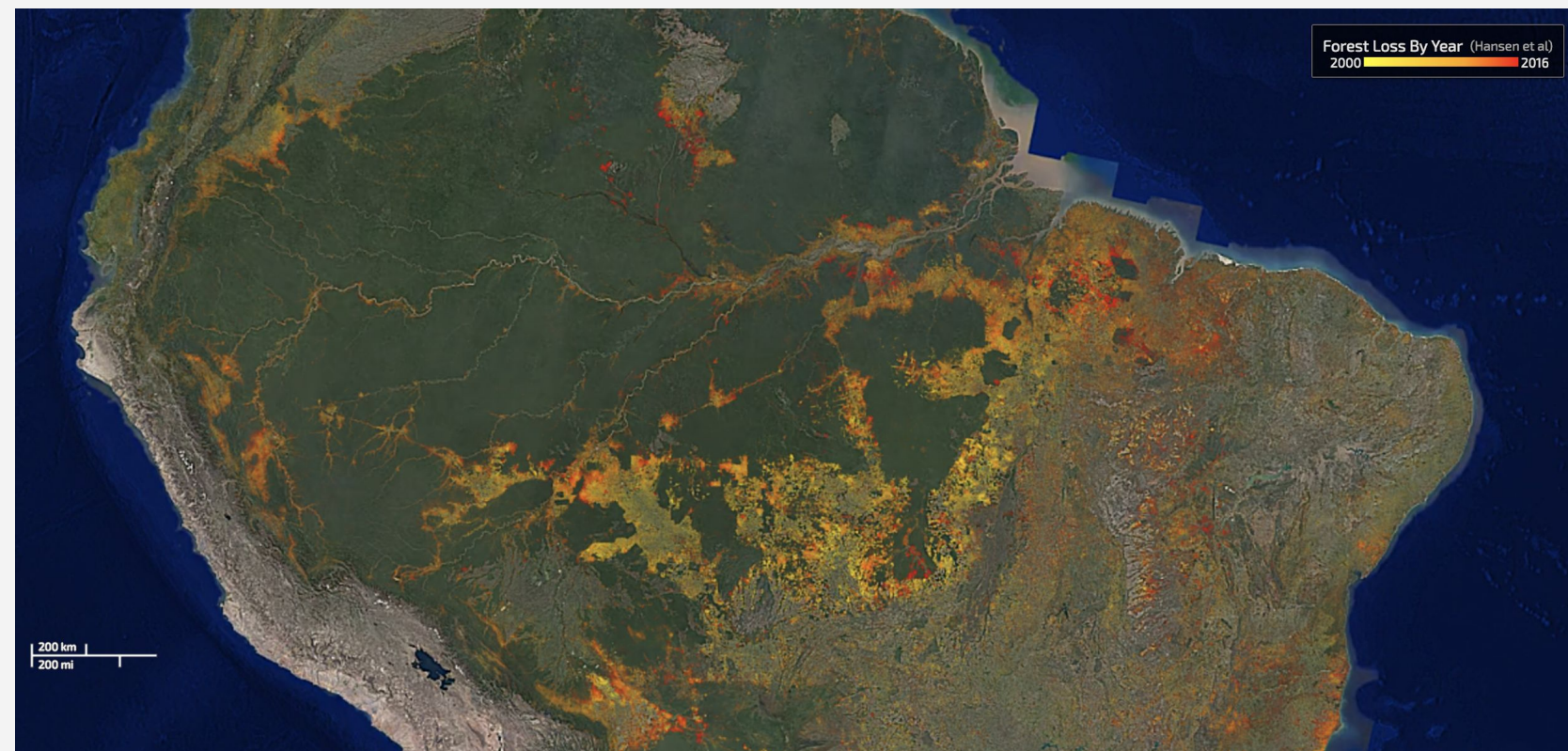


# GainForest

## Scaling Climate Finance for Forest Conservation using Interpretable Machine Learning on Satellite Imagery

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### Motivation

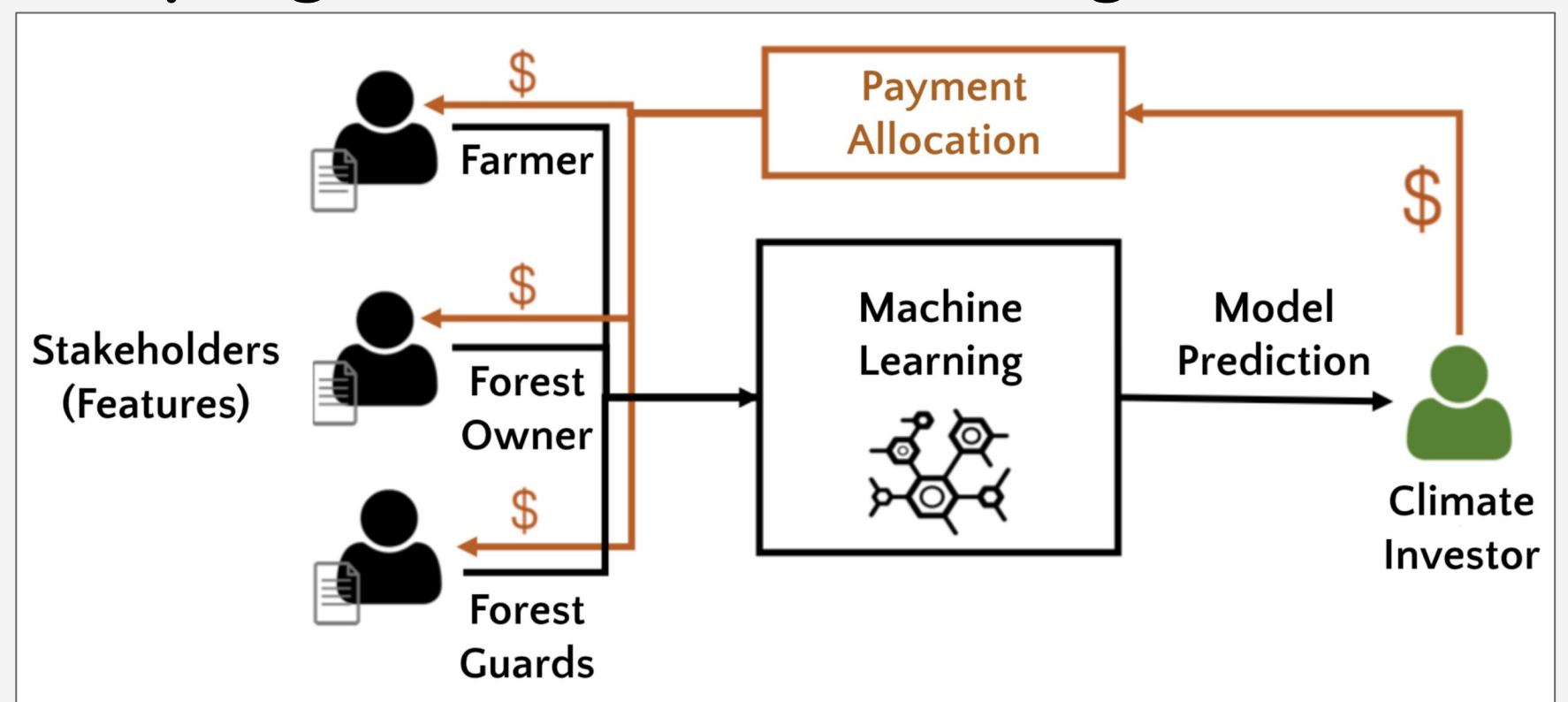


Main driver of deforestation: **Bad incentives** and **lack of governance**

- (1) More than **80% of Amazon deforestation** caused by local farmers, incentivized by illegal international beef and leather trades
- (2) Overlapping land claims cause existing payment schemes such as UN's REDD+ to have trouble identifying whom to pay.

Can we recommend **performance-based payments** for decision makers using interpretable machine learning?

### Shapley Values for Fair Payments



We use efficient Shapley Values [1] and a predictive model [2] to determine which feature contribute to deforestation prevention

#### Group Rationality

Value of the feature set is completely distributed among all users

#### Additivity

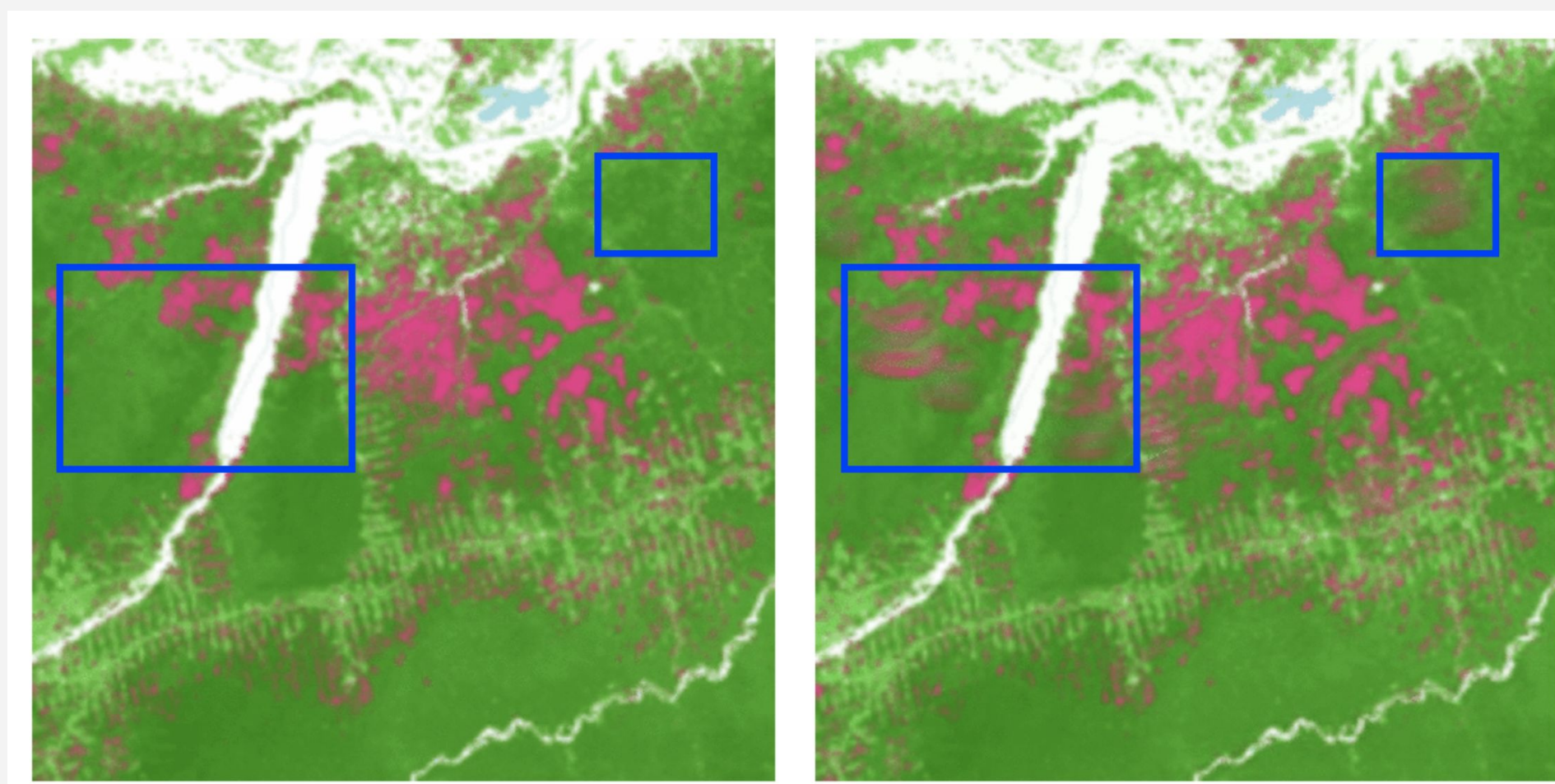
Values under multiple utilities sum up to the value under a utility that is the sum of all these utilities

#### Fairness

- (1) Symmetry
- (2) Zero contribution  $\Leftrightarrow$  Zero Payout

=> **Intuitive properties** for pricing - and it's **unique!**

### Machine Learning Techniques on Satellite Imagery



Given past deforestation (pink) patterns from Global Forest Watch (left image), a video prediction model is able to forecast in which regions a deforestation pattern is likely going to spread to in the near future (blue boxes, right image)

- (1) **Remote sensing** serves nowadays as **alert system** for forest loss - however no current alert system is leveraging the rich spatial information within images due to the fact of label scarcity
- (2) **Video Prediction** can train on the immense plethora of spatial and temporal images available and learn a visual forecasting model in an unsupervised way
- (3) **Segmentation** can then classify and segment (predicted) images into forested and deforested areas and thus predict the spread of deforestation
- (4) **Active Learning** queries **local stakeholders** for correct labels can be used as an additional machine learning reward system to raise awareness of deforestation areas and improve the model accuracy

### Literature

[1] Jia, R., Dao, D., Wang, B., Hubis, F. A., Hynes, N., Gurel, N. M., Li, B., Zhang, C., Song, D., and Spanos, C. J. "Towards efficient data valuation based on the shapley value". arXiv preprint arXiv:1902.10275, 2019.

[2] Lee, A. X., Zhang, R., Ebert, F., Abbeel, P., Finn, C., and Levine, S. "Stochastic adversarial video prediction". arXiv preprint arXiv:1804.01523, 2018.

More information

[gainforest.app](https://gainforest.app)