

Comparative Approaches for Detecting Critical Transitions in Food Crises

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Motivation

- **295 million** people face food insecurity globally; crises can escalate from Stressed to Emergency within weeks
- The standard framework (IPC) relies on expert panels convened **semi-annually** → systematic blind spot for sudden deteriorations
- WFP collects **daily household survey data** across 33 countries → high-frequency signal exists
- **Key question:** Can Change Point Detection algorithms (CPD), calibrated on synthetic data, identify food crises from noisy daily measurements?

Data

- Real-World Data:
 - WFP HungerMaps Real-Time Monitoring
 - Food Consumption Score (FCS) $\in [0,1]$ prevalence of poor/borderline consumption
 - 12 Expert-labelled crisis periods in 6 countries
- Synthetic Data:
 - Empirically-calibrated
 - Signal model: AR(1), 6 scenarios, 50 seeds for hyperparameters tuning

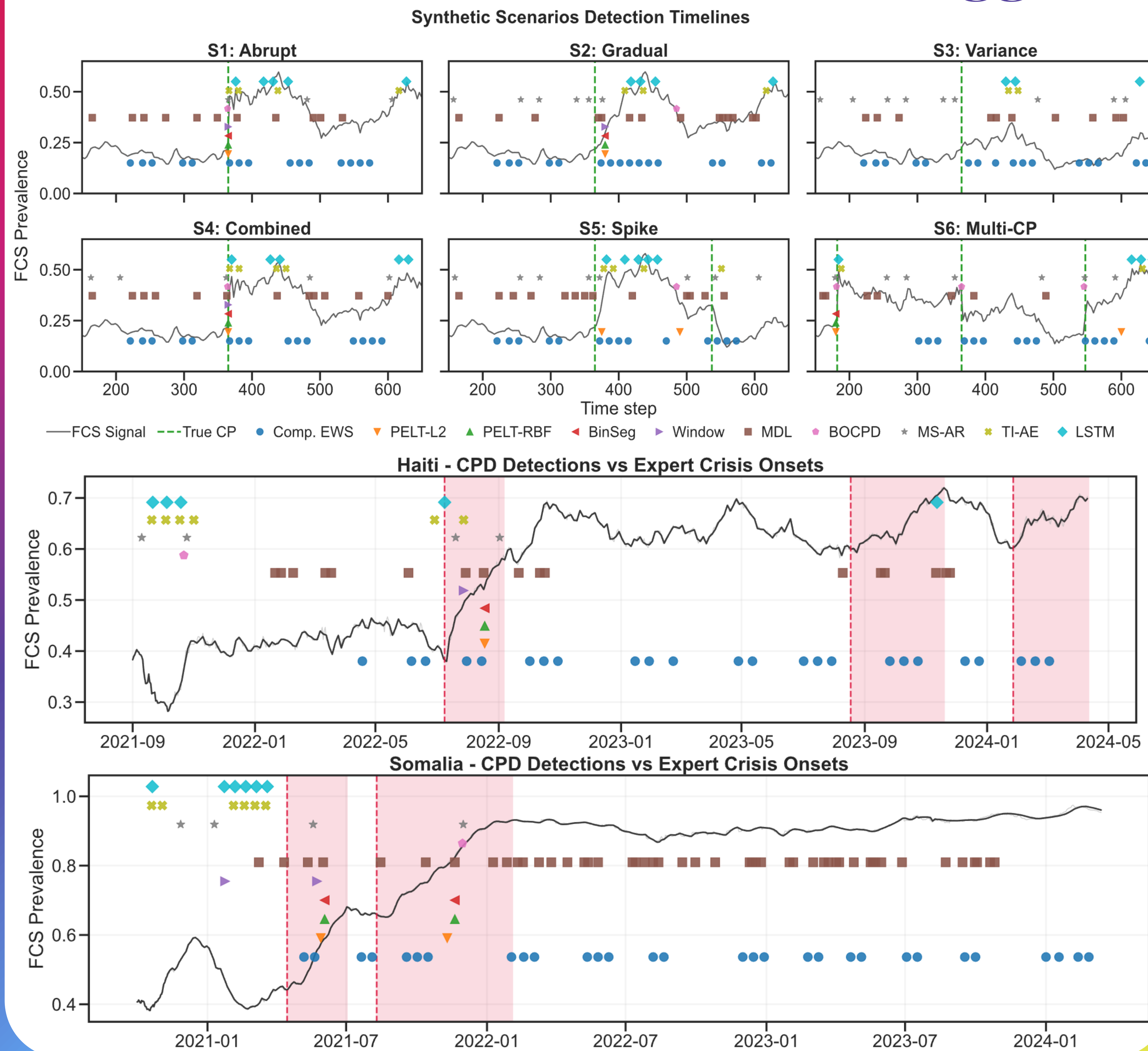
10 Methods

Family	Methods
Early Warning Signals	Composite (Variance, AR1, ...)
Offline Statistical	PELT-L2/RBF, BinSeg, Window, Minimum Description Length
Dynamical Systems	Bayesian Online CPD, Markov Switching-AR
Deep Learning	LSTM, Time Invariant-AutoEnc.

Main Takeaways

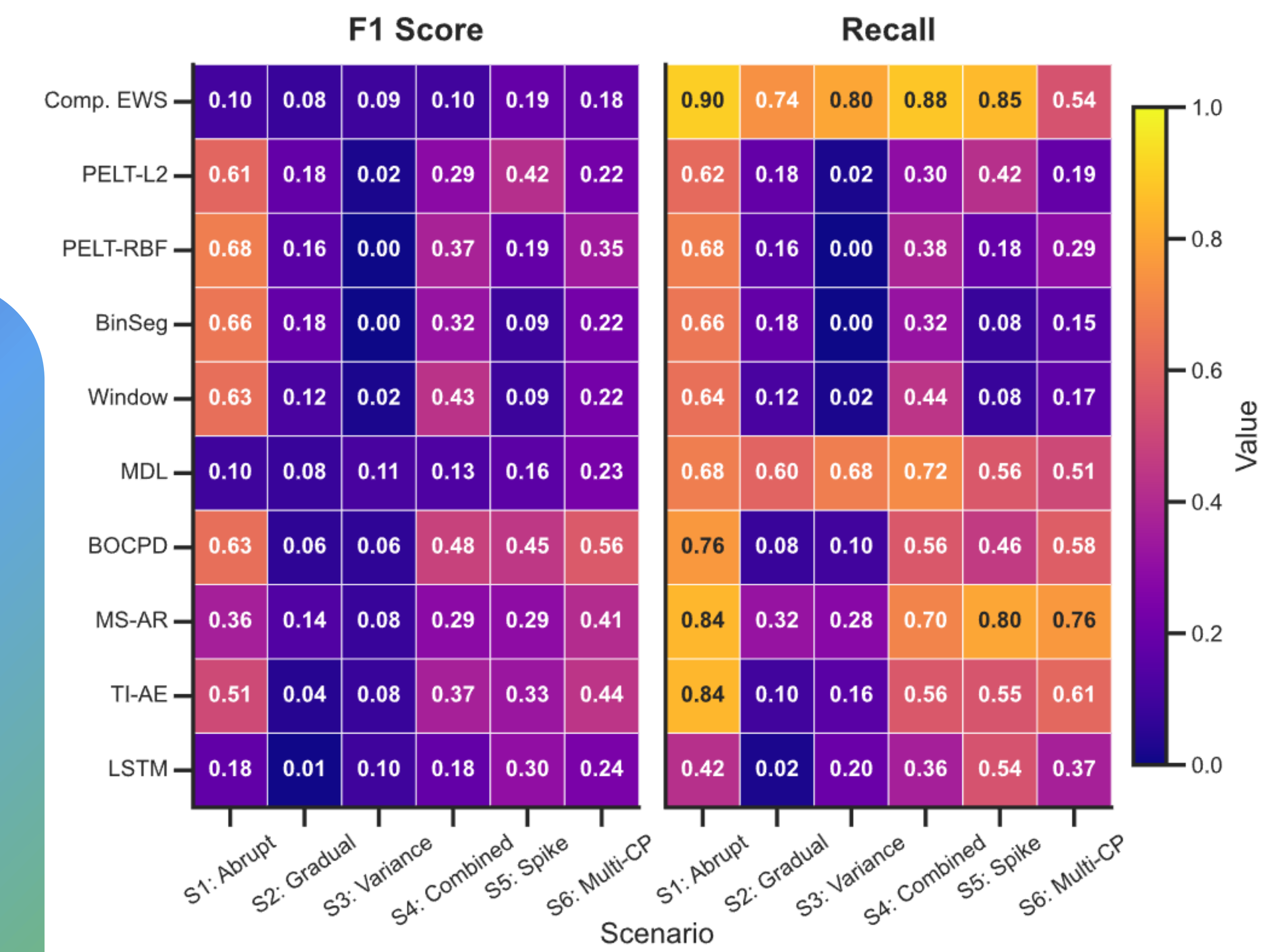
- **CPD methods** can be applied to food security data, **recovering the few true positives**
- No single algorithm solution, holistic approach
- Next: incorporating spatial dynamics, exogenous drivers, and multivariate representations
- These methods already add value as **early screening tools** that direct analysts' attention to potentially critical situations

CPD Methods Are Valuable Triggers

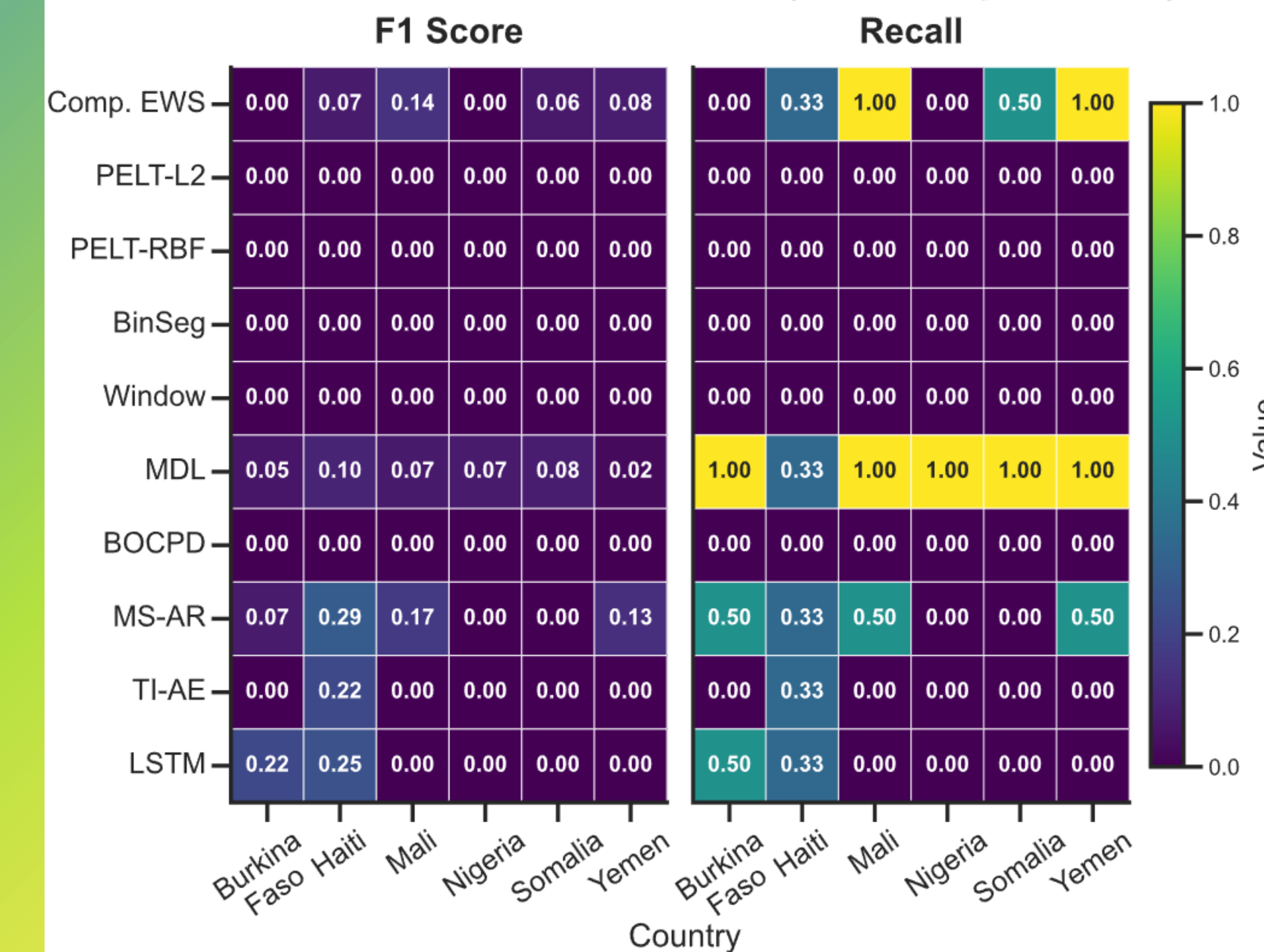


Results

CPD Performance on Synthetic FCS Scenarios



Real-World Detection Performance (FCS, 14-day tolerance)

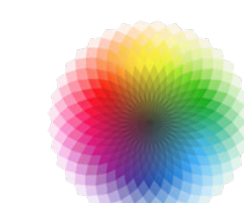


References & Acknowledgments

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