# PREDICTING WEATHER VARIATIONS WITH MACHINE LEARNING

CLIMATEWINS FINAL PROPOSAL

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# CLIMATEWINS OBJECTIVES

Identify weather patterns outside regional norms

Determine if unusual weather patterns are increasing

Generate possible future weather scenarios (25–50 years)

Find the safest places to live in Europe under future conditions

# TRAINING & ALGORITHMS EXPLORED

Achievement 1: Supervised learning, optimization basics, ethics

Achievement 2: Unsupervised learning (clustering, PCA), Random Forest, SVM, CNN, RNN

Advanced ML: GANs & image-based ML, Hyperparameter tuning & evaluation

# BEYOND HISTORICAL WEATHER DATA

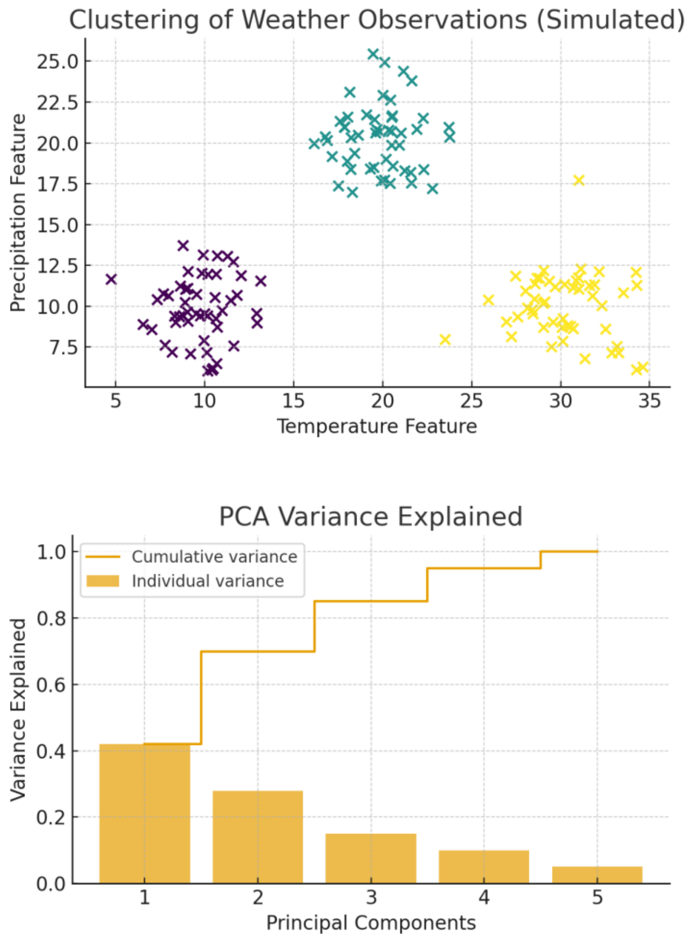
Population & migration trends

Infrastructure resilience (roads, housing, hospitals)

Climate risk maps (floods, wildfires, droughts)

Economic impact data (insurance claims, agricultural yields)

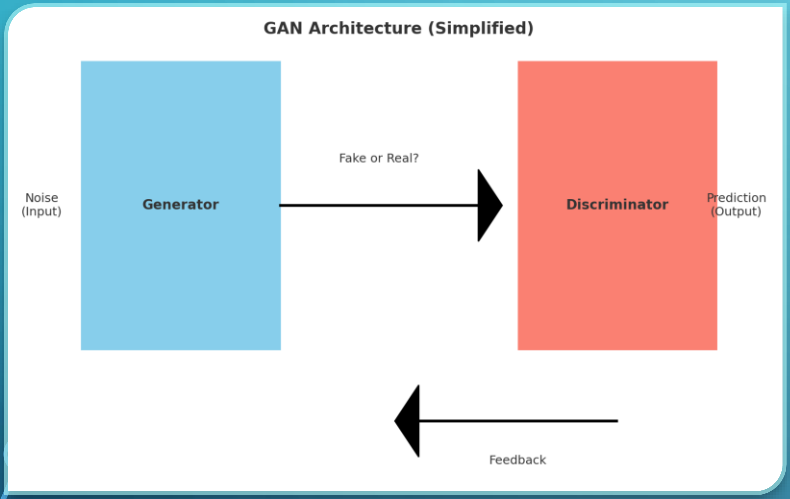
Satellite imagery & global climate projections




# CLIMATE PATTERN SHIFT DETECTION

- Goal link: Identify abnormal patterns & track increase in extremes
- ML Method: Clustering (k-means, hierarchical), PCA, anomaly detection
- Data Needed: Daily weather, regional baselines, satellite anomaly maps

# FUTURE CLIMATE PROJECTION GAN




- The second experiment explores whether we can simulate future weather conditions using GANs.
- Synthetic sequences of temperature and precipitation will be fed into RNN forecasting models and used to augment rare-event datasets for anomaly detection.
- We will assess the quality of generated data using statistical similarity predictive utility, and domain realism checks. Recent literature on GAN-based climate downscaling supports this approach, and implementation could begin with Conditional GANs to control for region and season.

# EVALUATION CRITERIA FOR SYNTHETIC DATA

To ensure GAN-generated climate data is reliable, we will evaluate using:

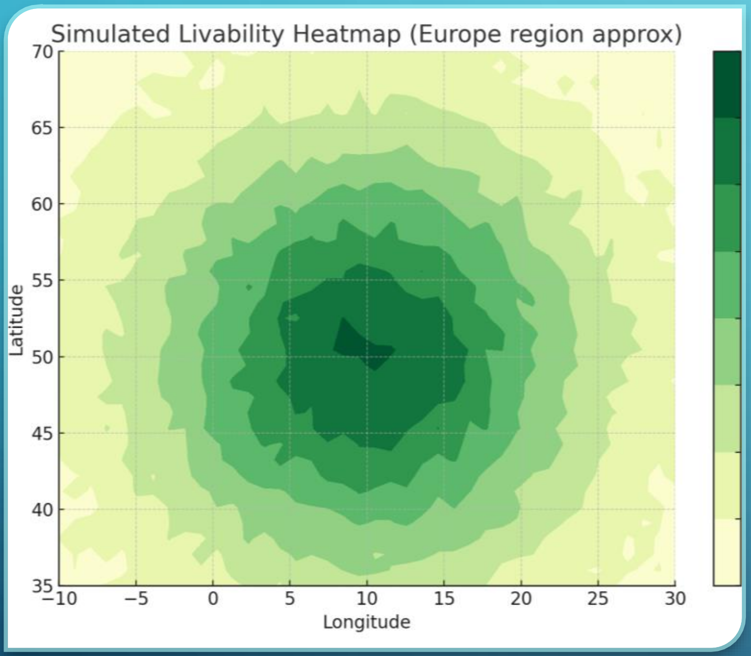
Statistical Similarity – KL-divergence, Earth Mover's Distance (EMD)

Predictive Utility – Does synthetic data improve RNN forecasting accuracy?

Domain Realism – Expert checks to confirm outputs stay within physical climate limits

These criteria ensure that synthetic data meaningfully strengthens ClimateWins' predictive pipeline.

# SAFE ZONES FOR CLIMATE REFUGEES




- Goal link: Identify safest regions to live in future Europe
- ML Method: Ensemble models (Random Forest + CNN with geospatial data)
- Data Needed: Weather, flood/fire maps, infrastructure, population density

# SUMMARY & RECOMMENDATIONS

Most promising experiment: Safe Zones for Climate Refugees

Why: Directly supports human safety & stakeholder impact; Also leverages GAN + RNN forecasts for future scenarios and anomaly detection for short-term risk.

Next steps: Gather datasets

Pilot clustering & GAN experiments; integrate with RNN forecasts

Evaluate models with accuracy, anomaly detection rates, and livability indices

THANK YOU FOR YOUR TIME

QUESTIONS WELCOMED

GITHUB: GITHUB - RODEESHA1/MACHINE-LEARNING-WITH-PYTHON-BASICS: MACHINE LEARNING TO HELP PREDICT THE CONSEQUENCES OF CLIMATE CHANGE FOR EUROPEAN NONPROFIT ORGANIZATION, CLIMATEWINS

# THANK YOU