

Urban Insights

better choices for healthier cities, one pixel at a time

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Thank you!



TEXAS TECH
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TRANSPORTATION
COMMISSION

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IMAGINE



Urban Insights

Problem



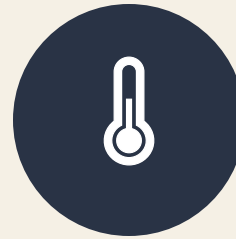
Worst Drought in
California in 1200 years!

Solution



Land Cover*
Detection &
Classification
Insights

Use Cases



Impact on
Microclimate and
Correlation with
Median Household

Deliverables



Research Paper,
API & Website

*land cover indicates the physical land type such as water, grass, trees, impervious surfaces, soil and turf

Welcome to Urban Insights

Better choices for healthier cities... One pixel at a time!

[Read More](#)

ABOUT

OUR MISSION



Contents

- 1 Data Sets
- 2 Model and Training
- 3 Results
- 4 Architecture
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Data Sets

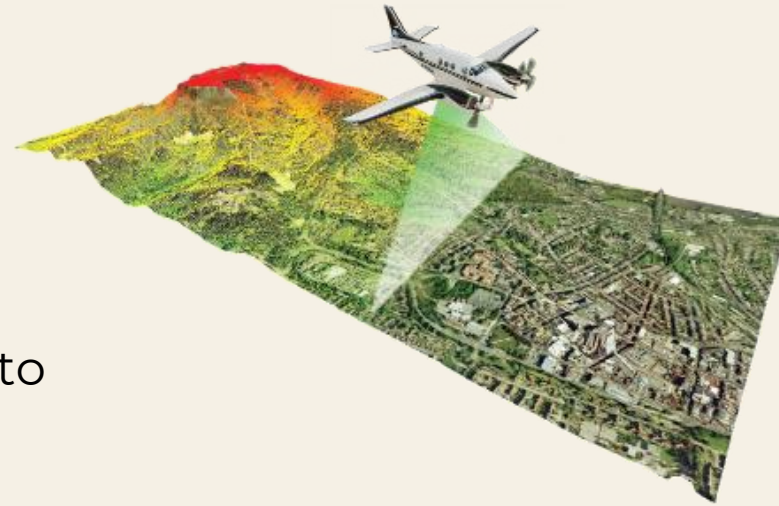
1. NAIP

Extract Aerial Images Containing 4 Channels:

- **Red**
- **Green**
- **Blue**
- **Near-Infrared**

Apply transformations to
extract insights, e.g.:

$$\text{NDVI} = \frac{\text{NIR} - \text{Red}}{\text{NIR} + \text{Red}}$$



2. CENSUS

3. Land Surface Temperature Data



$0 < \text{NDVI} < 0.33$



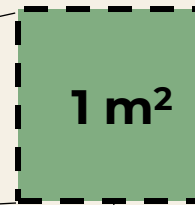
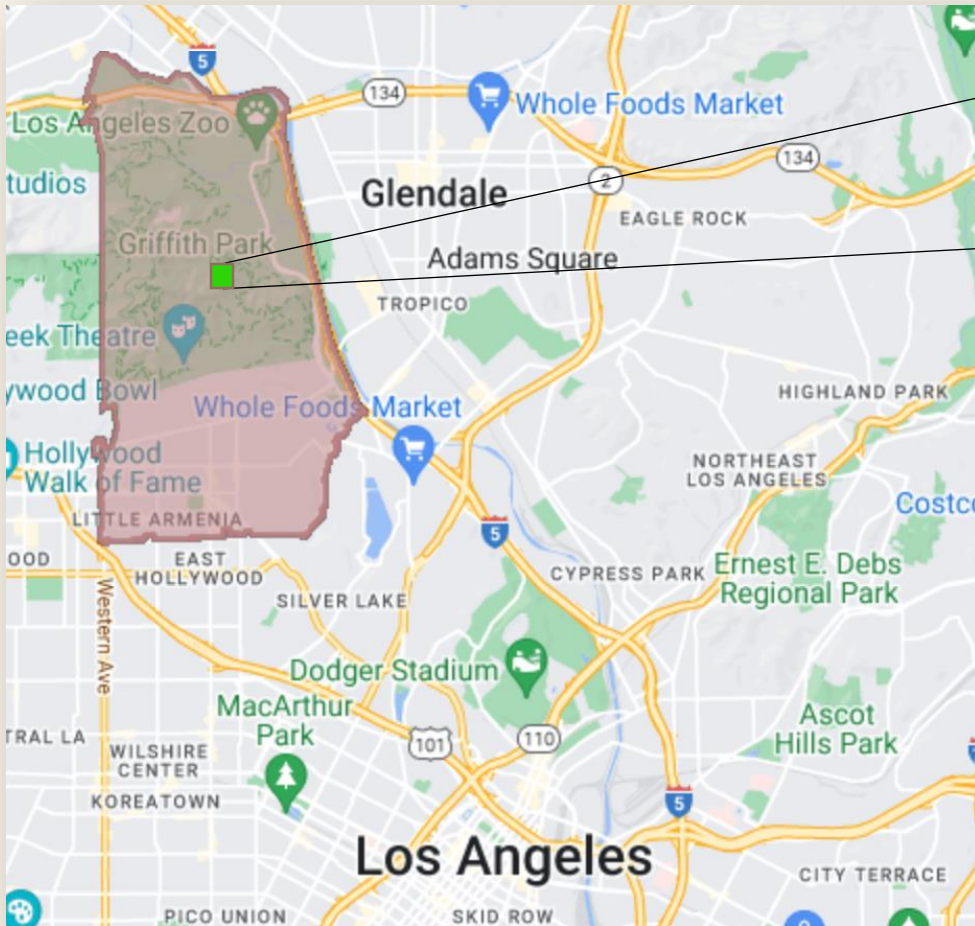
$0.33 < \text{NDVI} < 1$

***NAIP**: National Agriculture Imagery Program

***NDVI**: Normalized Difference Vegetation Index

Implementation

Google Earth Engine 

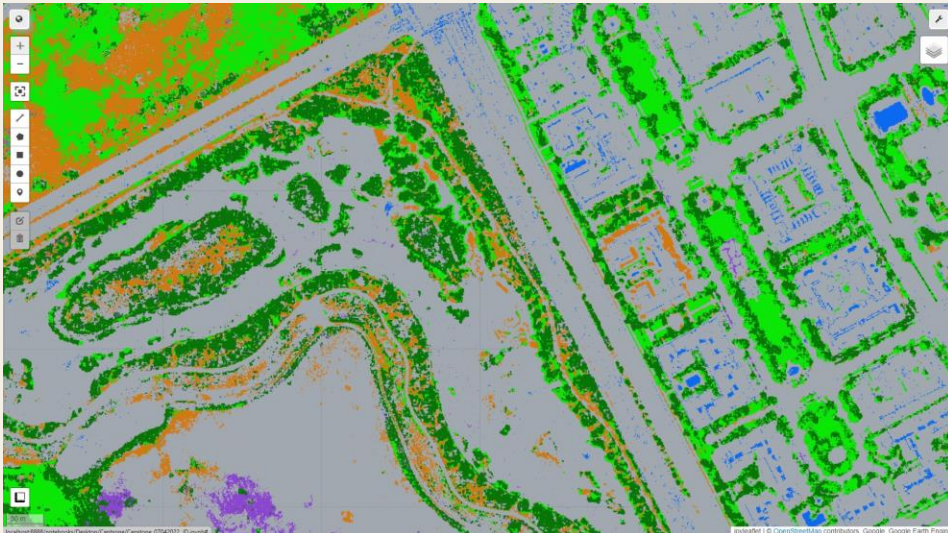


CLASS = GRASS

FEATURES = [
R,
G,
B,
NIR,
NDVI,
NIR_Entropy,
NIR_Contrast,
NIR_Gearys
]

1 m² : 1 square meter

GEE Baseline Model



- 80/20 split on pixels → 80/20 split on polygons
- GEE* provided ML toolkit (Random Forest)
- Macro F_1

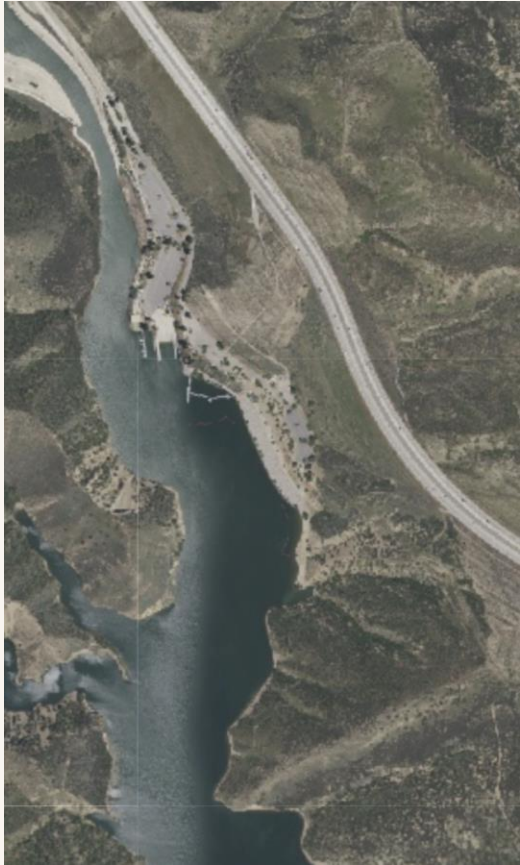
Classes Classified by the Model

- Water
- Trees
- Grass
- Turf
- Impervious
- Soil

*Google Earth Engine

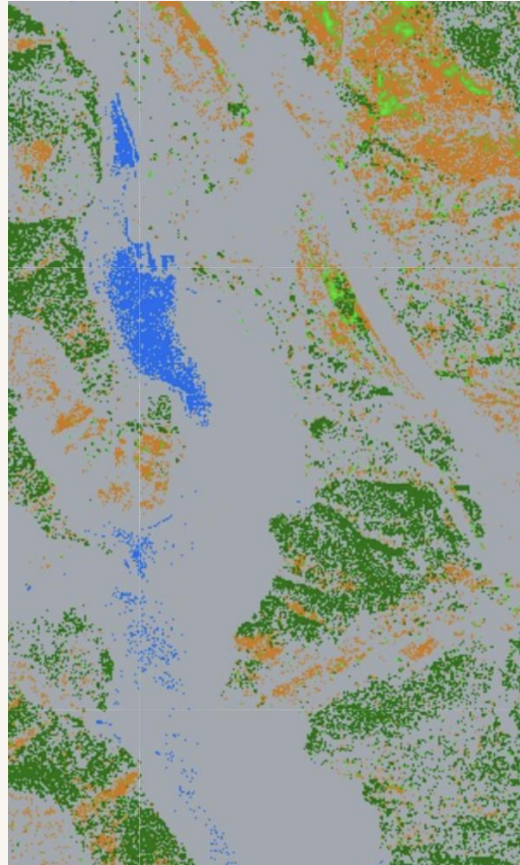
Model Iterations

Satellite Image



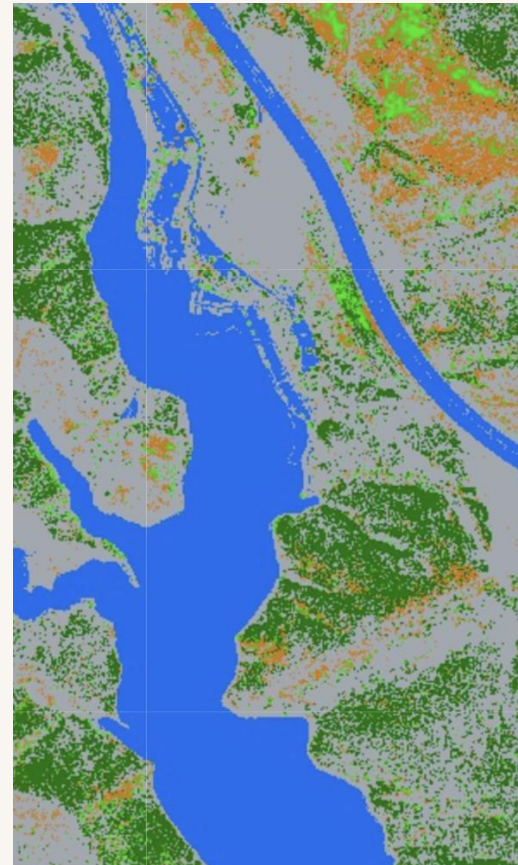
NAIP Image

Neural Net V1



Biased towards
impervious

Neural Net V2



Biased towards water

Neural Net Ensemble

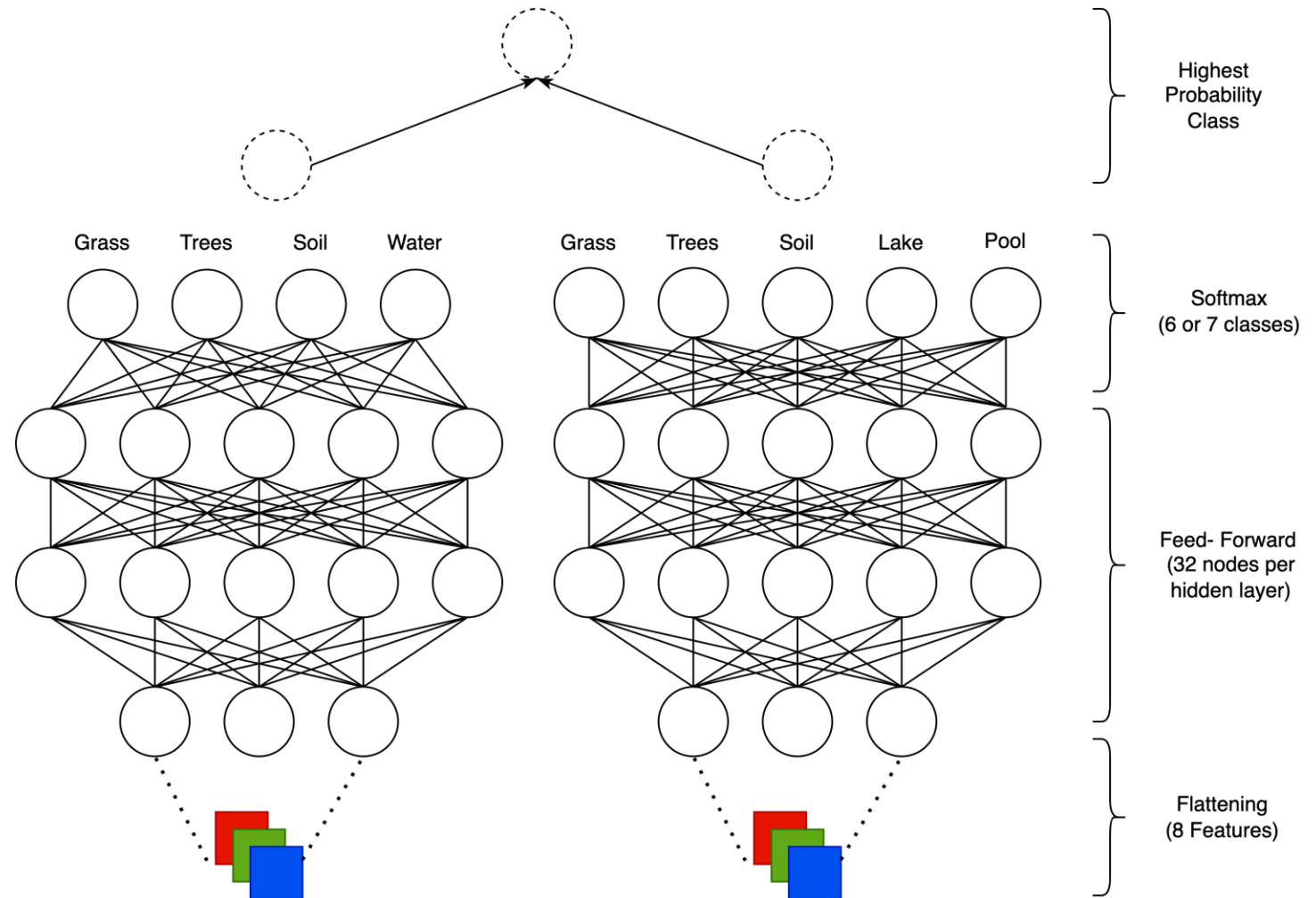


Max probability class
from both models

Neural Network Ensemble Model

Hyperparameters

Layers	3
Nodes	32
Dropout	0.05
Learning Rate (Adam)	0.01
Activation	ReLU
Batch Size	120



Model Performance Comparison

F ₁ Score	Baseline (RF)	Neural Net V1	Neural Net V2	Ensemble
grass	0.88	0.88	0.89	0.90
trees	0.85	0.80	0.86	0.85
turf	0.84	0.94	0.91	0.93
soil	0.92	0.92	0.94	0.94
impervious	0.86	0.87	0.89	0.89
natural water	---	---	0.77	---
pool water	---	---	0.99	---
all water	0.67	0.84	---	0.99
Macro F ₁ Average	0.84	0.88	0.89	0.92

Correlation with Median Household Income

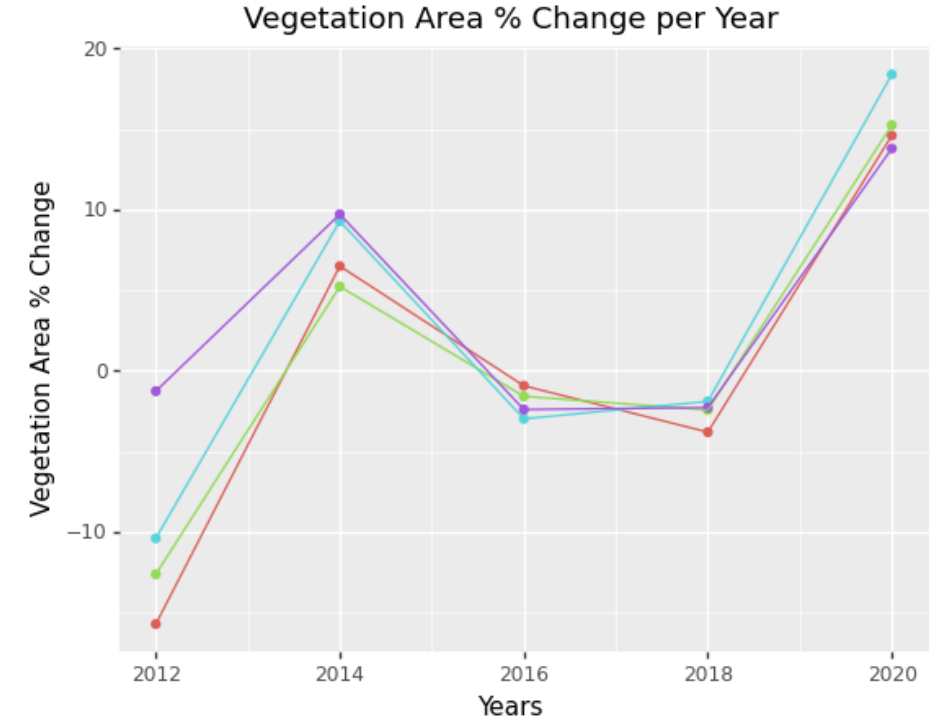
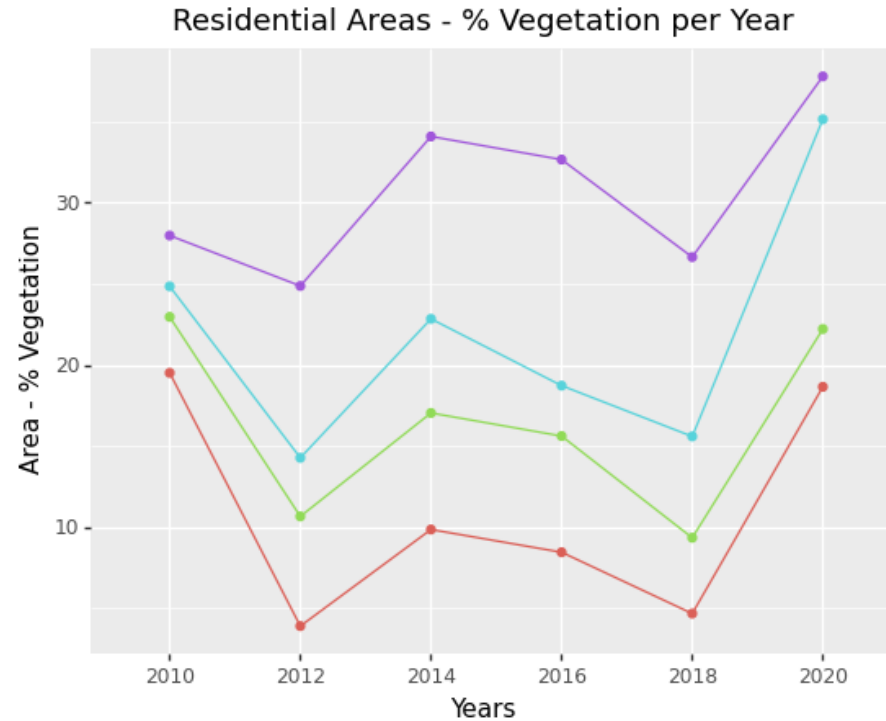


2.97%

Area Increase for every
10K USD in Median
Household Income

0.5%

Rate of Change Positive
Increase for every 30K USD
in Median House Income



Income Group

- Less than 47K
- Less than 63K
- Less than 83K
- More than 83K

Impact on Microclimate



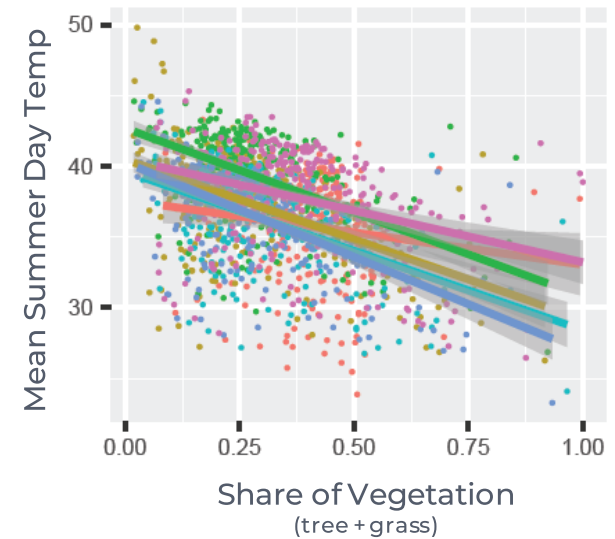
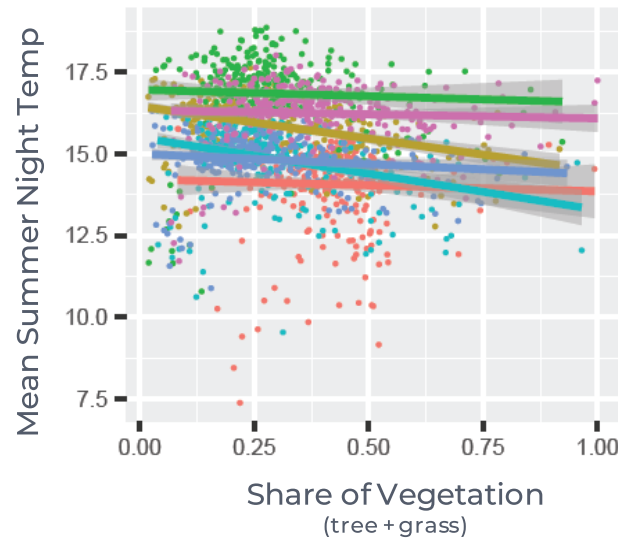
-2.25° C

Grass areas are on average cooler than impervious

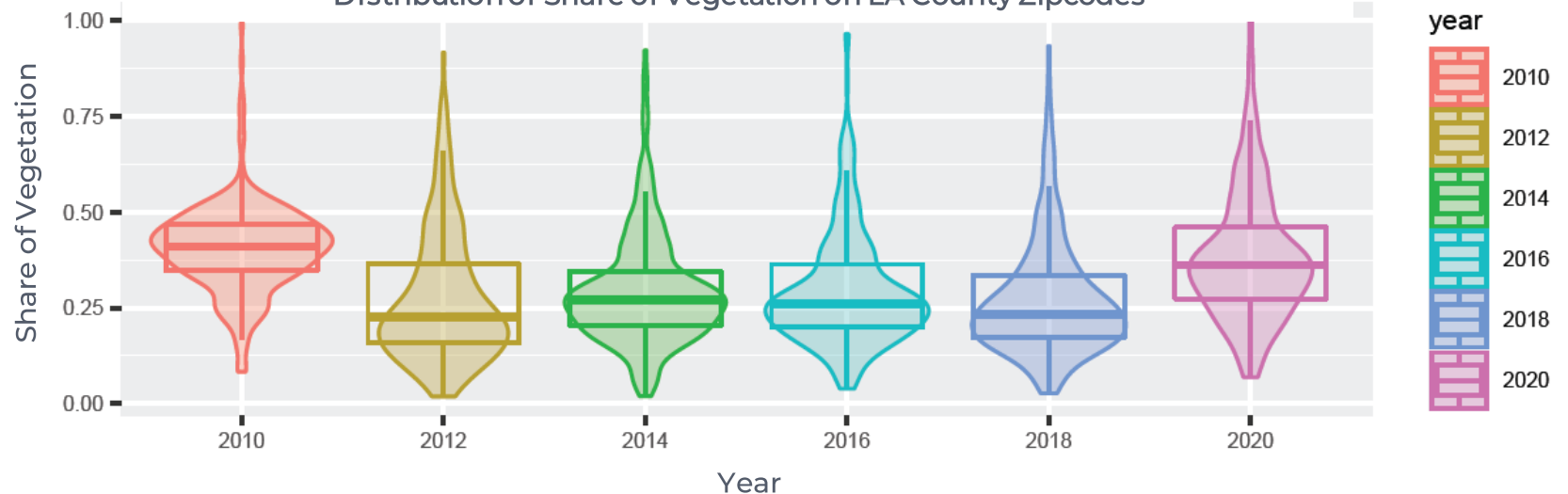
-2.16° C

Tree areas are on average cooler than impervious

Mean Temp vs Share of Vegetation on LA County Zipcodes



Distribution of Share of Vegetation on LA County Zipcodes



Layered Architecture

Input



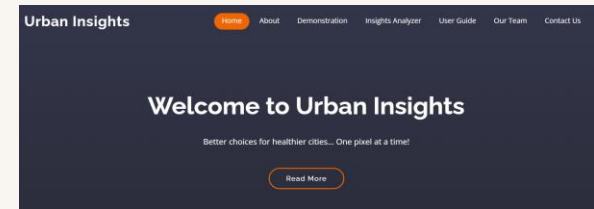
Modeling



Integration



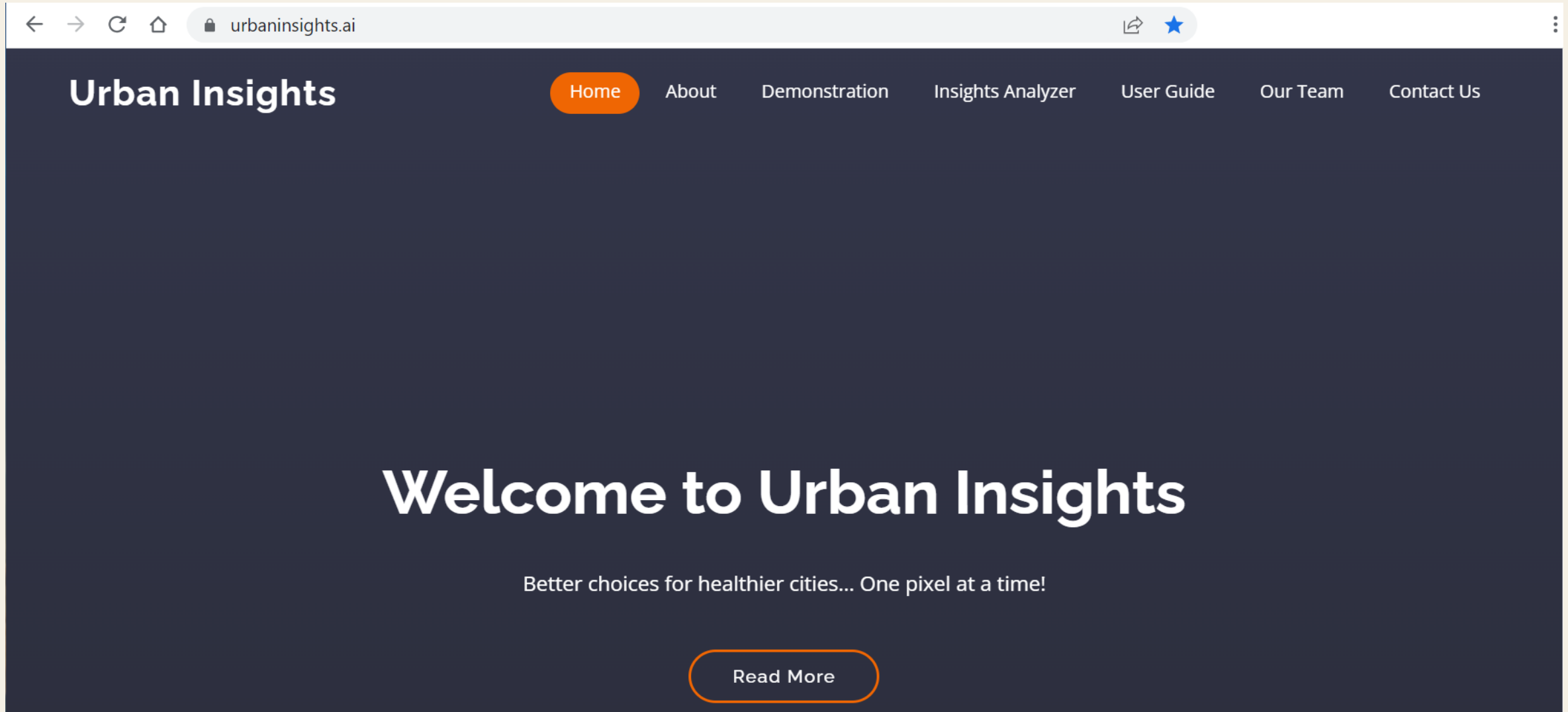
Output



urbaninsights.ai



Live Demonstration



Summary



Worst climate crisis
of generations



Urban Insights
provides eco-friendly
insights



Policy makers can
use this to design
incentives to curb
outdoor residential
water usage



Urban planners
can use this to
plan and
redevelop cities



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Thank you!

~ from team Urban Insights



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<https://bit.ly/3SCnZoB>



GitHub

<https://github.com/urbaninsights>