

Problem Statement

AI for Humaneness: Can Image Classification tools available from AI help address some of the humanitarian challenges faced by us today? Such as hunger and poverty

IndulInstance - Microsoft Azure customvision.ai

Custom Vision: PovertyAssessment - Training Images

PovertyAssessment

Training Images Performance Predictions Train Quick Test

Filter Add images Delete Tag images Select all

Iteration

Workspace Tags +

Showing: all tagged images

Search For Tags:

Poor 5 ...
 Rich 8 ...

100%

The screenshot shows the Microsoft Custom Vision service interface for a "PovertyAssessment" model. The main area displays a grid of 16 training images used for model training. The images are arranged in four rows of four. The first row shows outdoor scenes: a muddy path through lush greenery, a destroyed area with debris and a car, a dirt road with a person in the distance, and a slum area with simple houses and a water canal. The second row shows residential areas: a dense cluster of small, colorful shacks, a modern two-story house with a large lawn, and a large, multi-story residence with multiple chimneys. The third row shows more residential scenes: a modern single-story house with a garage, a large ornate building with a clock tower, and a modern two-story house with a large lawn. The fourth row shows a modern single-story house with a garage and a modern two-story house with a large lawn. At the bottom right, a green progress bar indicates "100%". On the left sidebar, there are sections for "Iteration" (set to "Workspace"), "Tags" (with "Tagged" selected), and search/filter options. The top navigation bar includes tabs for "Training Images", "Performance", and "Predictions", along with buttons for "Train" and "Quick Test".

PovertyAssessment

Training Images Performance Predictions Train Quick Test

Iterations

Probability Threshold: 50% ⓘ

Iteration 1
Trained : moments ago with General [A2] domain

✓ Publish ⌂ Prediction URL ⚡ Delete ⏪ Export

Finished training on 12/5/2023, 6:25:54 PM using General [A2] domain
Iteration id: f22dd91b-e56a-450e-9d14-2a1fa9edfbc4
Classification type: Multiclass (Single tag per image)

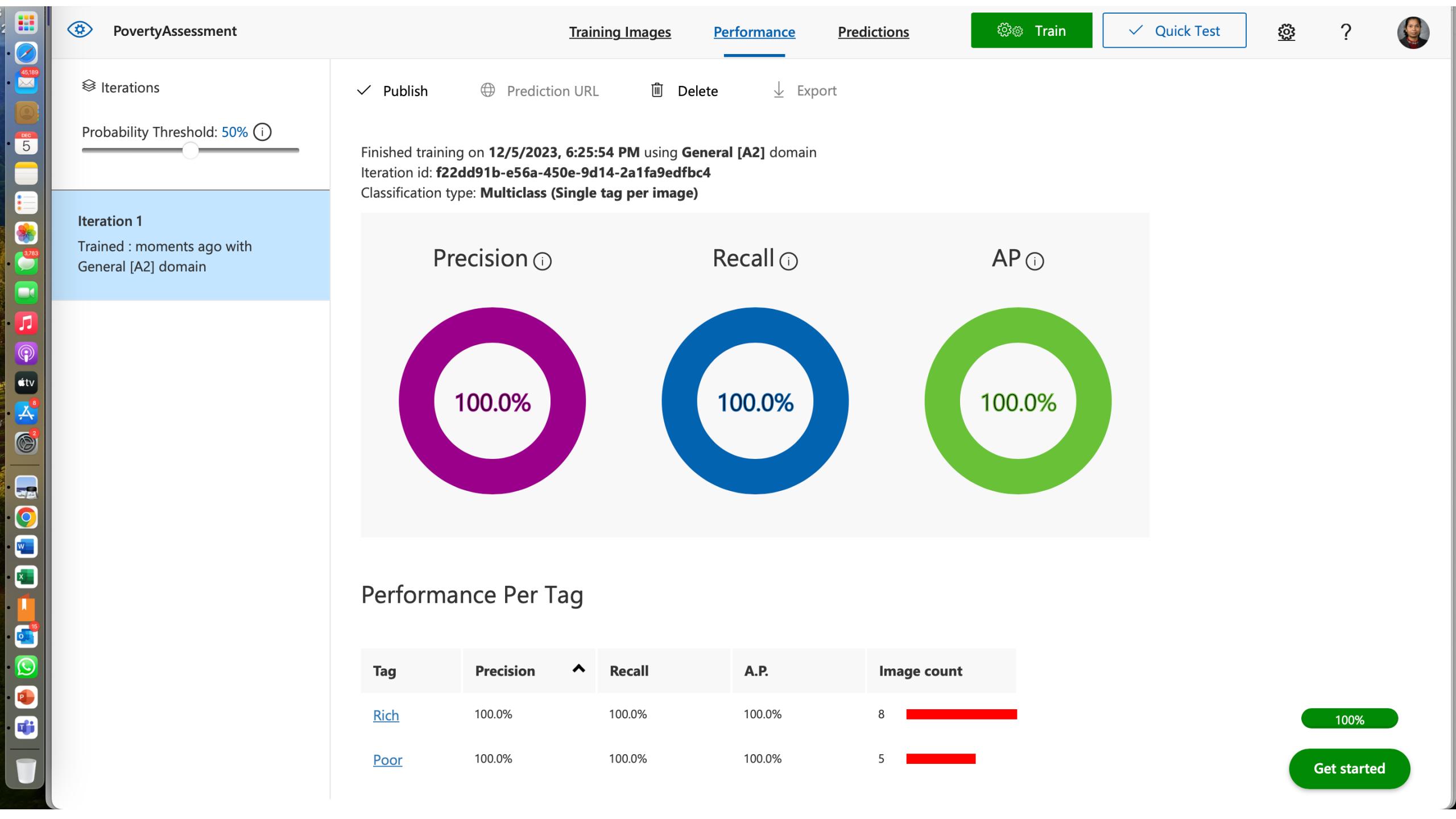
Precision ⓘ Recall ⓘ AP ⓘ

100.0% 100.0% 100.0%

Performance Per Tag

Tag	Precision	Recall	A.P.	Image count
Rich	100.0%	100.0%	100.0%	8  100%
Poor	100.0%	100.0%	100.0%	5 

Get started





My Tags

Add a tag and press enter

Predictions

Tag	Probability
Poor	99.9%
Rich	0%

Save and close



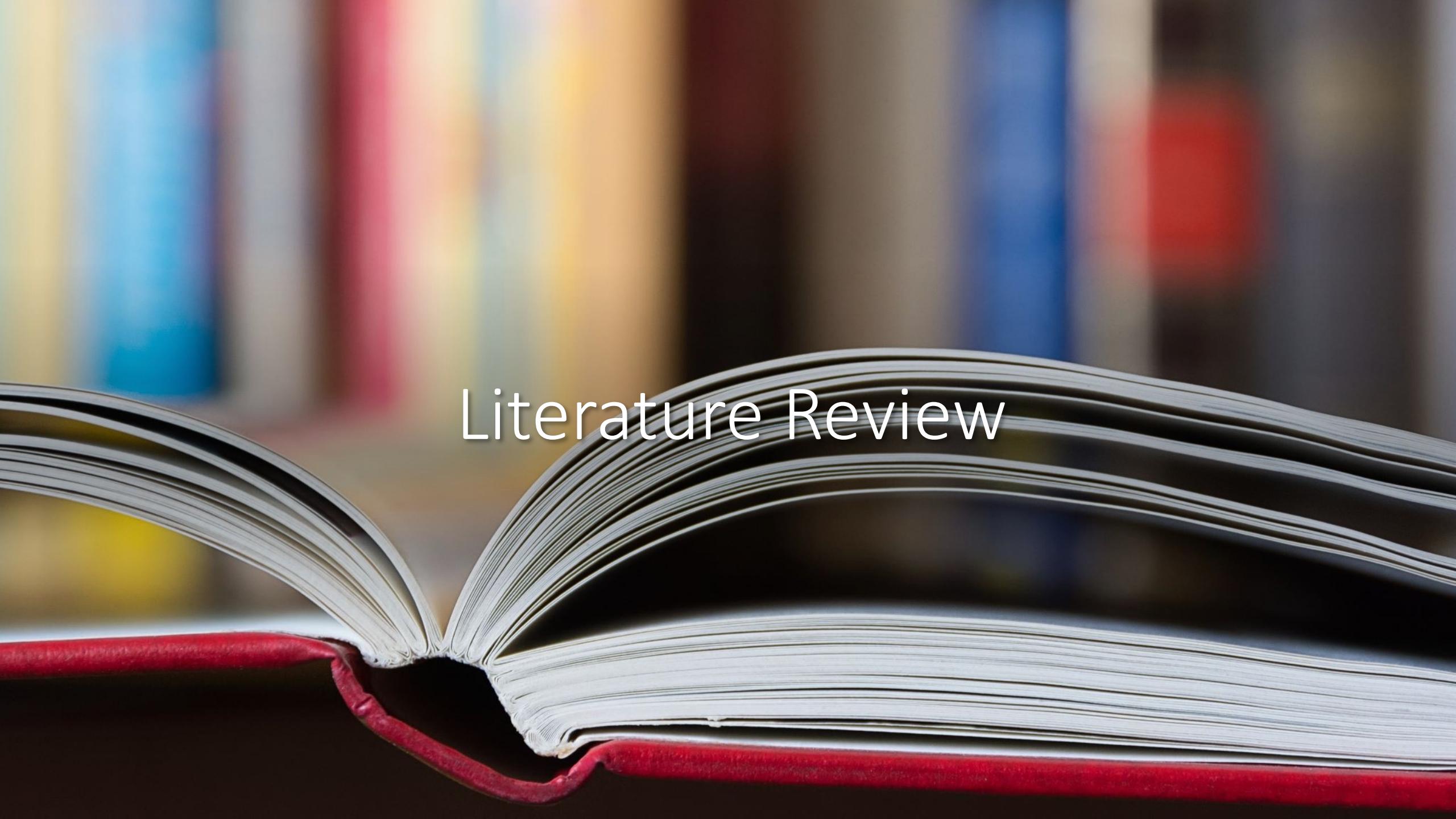
My Tags

Add a tag and press enter

Predictions

Tag	Probability
Rich	95.8%
Poor	4.1%

Save and close

A close-up photograph of an open book with red leather covers. The pages are white and slightly aged. In the background, a blurred stack of books in various colors (blue, red, yellow, green) is visible, creating a soft, academic atmosphere.

Literature Review

Nighttime Light Predictions from Satellite Imagery

Neal Jean, Rachel Luo

Department of Electrical Engineering

Stanford University

Jae Hyun Kim Department of
Computer Science Stanford University
jakekim@stanford.edu

Highlights of the research

- A good indicator of both economic development and population density is nighttime light intensity.
- The lack of reliable poverty data in developing countries poses a major challenge for making informed policy decisions and allocating resources effectively in those areas of the world.
- Predicting the nighttime light intensity distribution of a region given the corresponding daytime satellite image and
- fine-tuning a Convolutional Neural Network (CNN) pre-trained on ImageNet, and then test the classifier's performance in predicting values of nighttime light intensity
- Experiments show that we can achieve up to 70% accuracy on a three-class (low, medium, high nightlights intensity) classification task

A review of explainable AI in the satellite data, deep machine learning, and human poverty domain

Ola Hall , Mattias Ohlsson , Thorsteinn Rögnvaldsson

Department of Human Geography,

Lund University, Lund

Sweden Center for Applied Intelligent Systems Research,

Halmstad University, Halmstad

Sweden Division of Computational Biology and Biological Physics

Department of Astronomy and Theoretical Physics

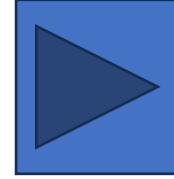
Lund University, Lund, Sweden

14 October 2022

Highlights of the research

- The combination of satellite imagery and deep machine learning now has the capability to estimate some types of poverty at a level close to what is achieved with traditional household surveys.
- Research has shown that certain aspects of human poverty and welfare can be measured with deep machine learning in combination with satellite imagery.
- Future directions would be to develop methods to understand which features in an image that triggers a certain response and relate that to domain knowledge

Some other interesting reads



- ❖ Combining nighttime lights in prediction of poverty incidence at the county level
- ❖ Are night-time lights a good proxy of economic activity in rural areas in middle and low-income countries? Examining the empirical evidence from Colombia
- ❖ Predicting poverty and wealth from mobile phone metadata
- ❖ Using Nighttime Satellite Imagery as a Proxy Measure of Human Well-Being
- ❖ Poverty Estimation with Satellite Imagery at Neighborhood Levels
- ❖ Night-time light remote sensing for sustainable development goals

GDP Per Capita

Ireland -
\$104,000

Switzerland
- \$92,000

Qatar -
\$88,000

Afghanistan
- \$363

Somalia -
\$462

Niger -
\$533

100+ Poverty Pictures | Download Free... Home - OneDrive preparation for final project presentati... IndulInstance-Prediction - Microsoft Az... Custom Vision: NightLight - Performan...

NightLight Training Images Performance Predictions Train Quick Test ?

Iterations Probability Threshold: 50% (i)

Iteration 1 Trained : moments ago with General [A2] domain

✓ Publish ⌂ Prediction URL Delete ↓ Export

Finished training on 12/5/2023, 7:01:18 PM using General [A2] domain
Iteration id: a58e068d-4b04-4adc-a237-77112ebc4347
Classification type: Multiclass (Single tag per image)

Precision (i) Recall (i) AP (i)

100.0% 100.0% 100.0%

Performance Per Tag

Tag	Precision	Recall	A.P.	Image count
Well_Lit	100.0%	100.0%	100.0%	6 100%
LowLight	100.0%	100.0%	100.0%	5 100%

Quick Test

X

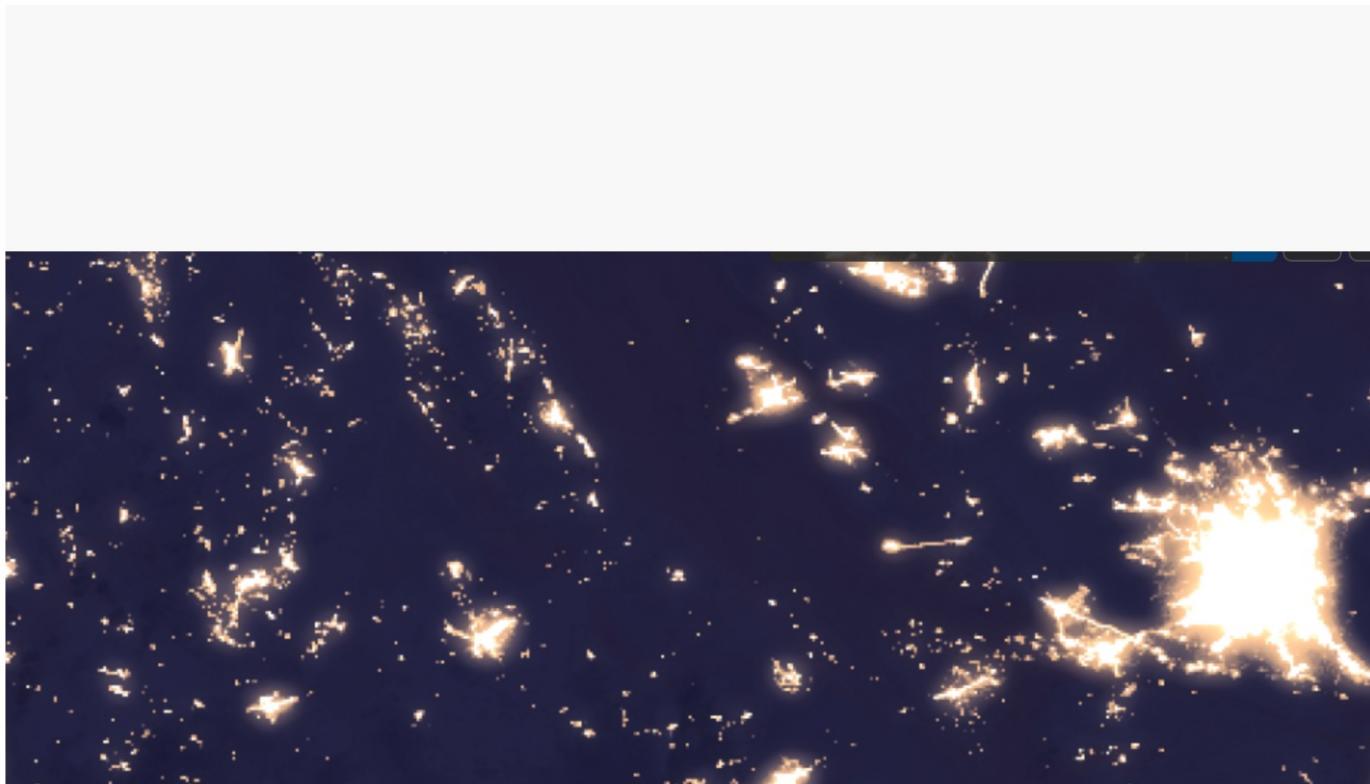


Image URL

Enter Image URL



or

Browse local files

File formats accepted: [jpg](#), [png](#),
[bmp](#)

File size should not exceed: [4mb](#)

Using model trained in

Iteration

Iteration 1 ▾

Predictions

Tag	Probability
-----	-------------

Well Lit	70.4%
----------	-------

Low Light	29.5%
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Quick Test

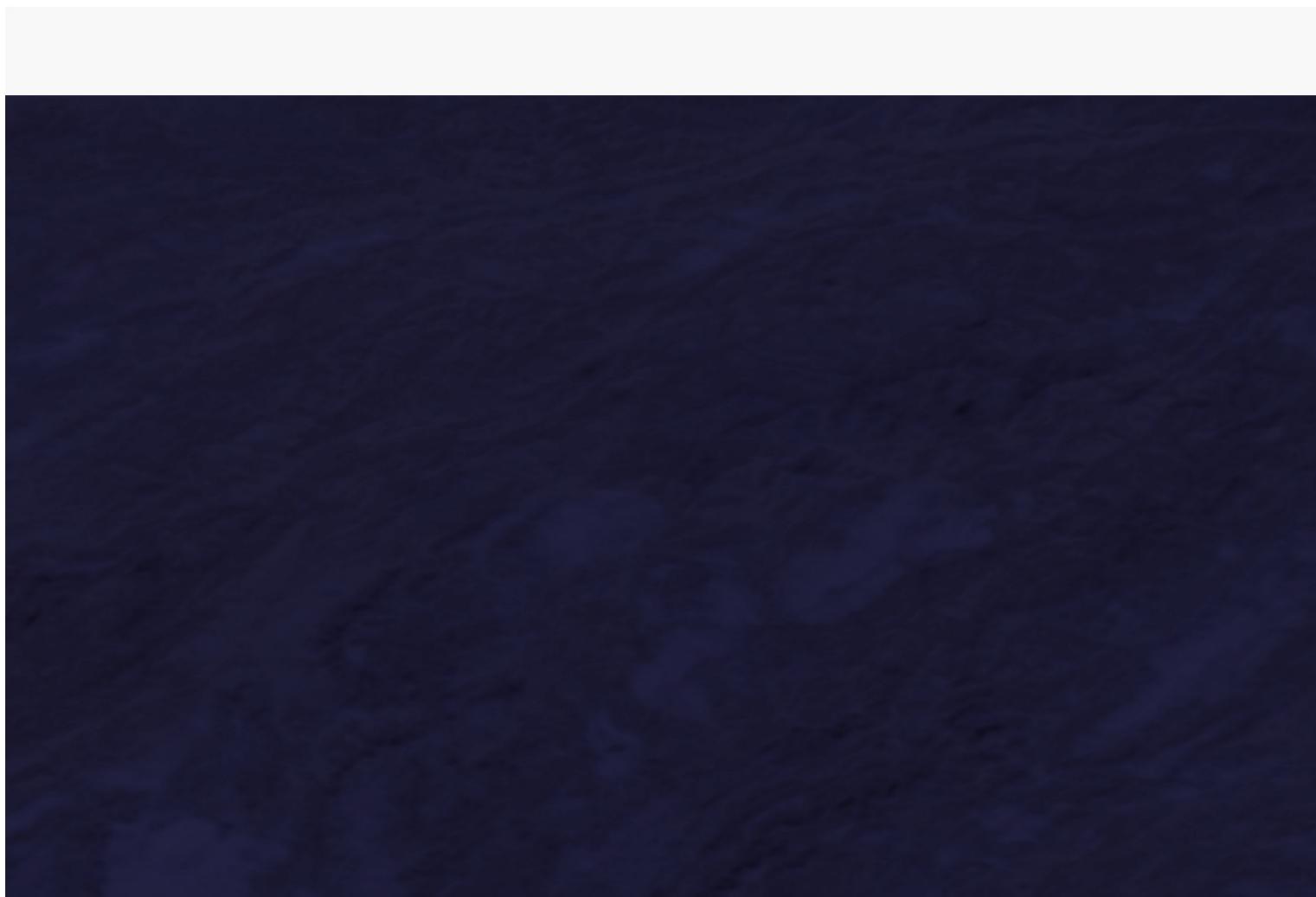


Image URL

Enter Image URL



or

Browse local files

File formats accepted: [jpg](#), [png](#),
[bmp](#)

File size should not exceed: [4mb](#)

Using model trained in

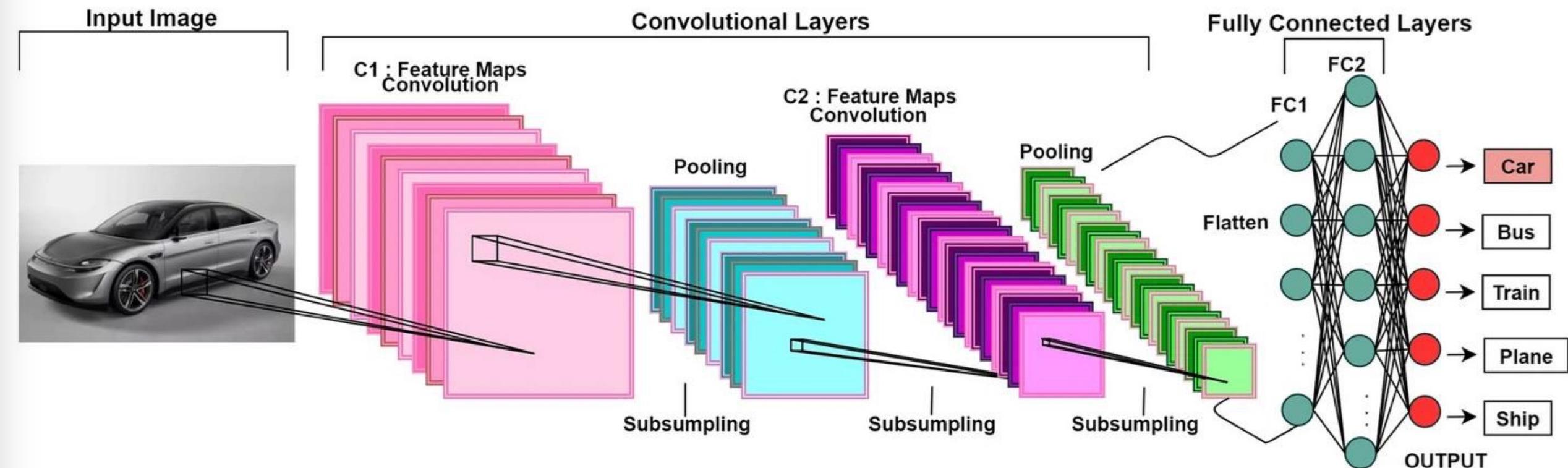
Iteration

Iteration 1 ▾

Predictions

Tag	Probability
Low Light	77.6%
Well Lit	22.3%

CONVOLUTIONAL NEURAL NETWORKS



Deep learning architecture used to recognize features on objects (e.g. pictures, satellite images, etc.) to be classified into certain labels.

METHODOLOGY

Input image

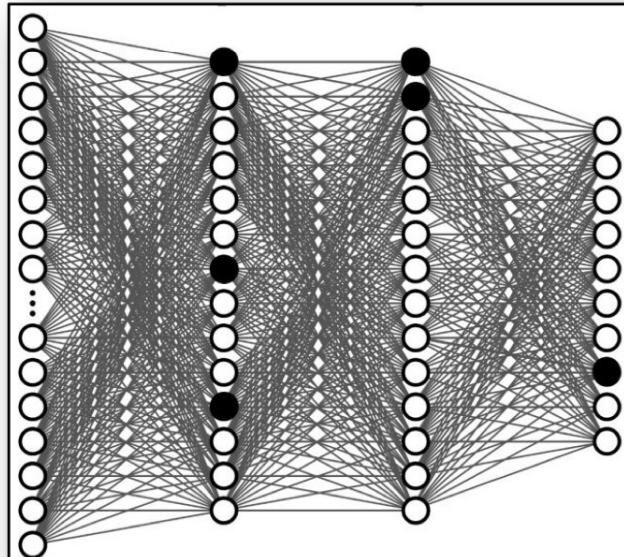


Day time
satellite images



Night time light
intensities

Extract features using trained
machine learning algorithm

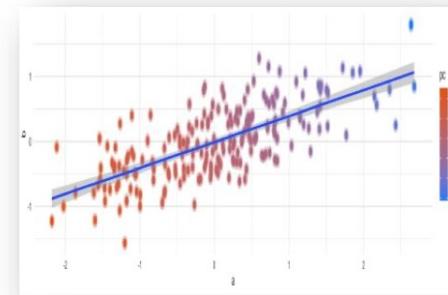


Convolutional Neural
Networks
(ResNet34)

Extracted
features

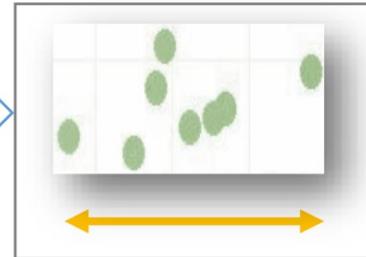


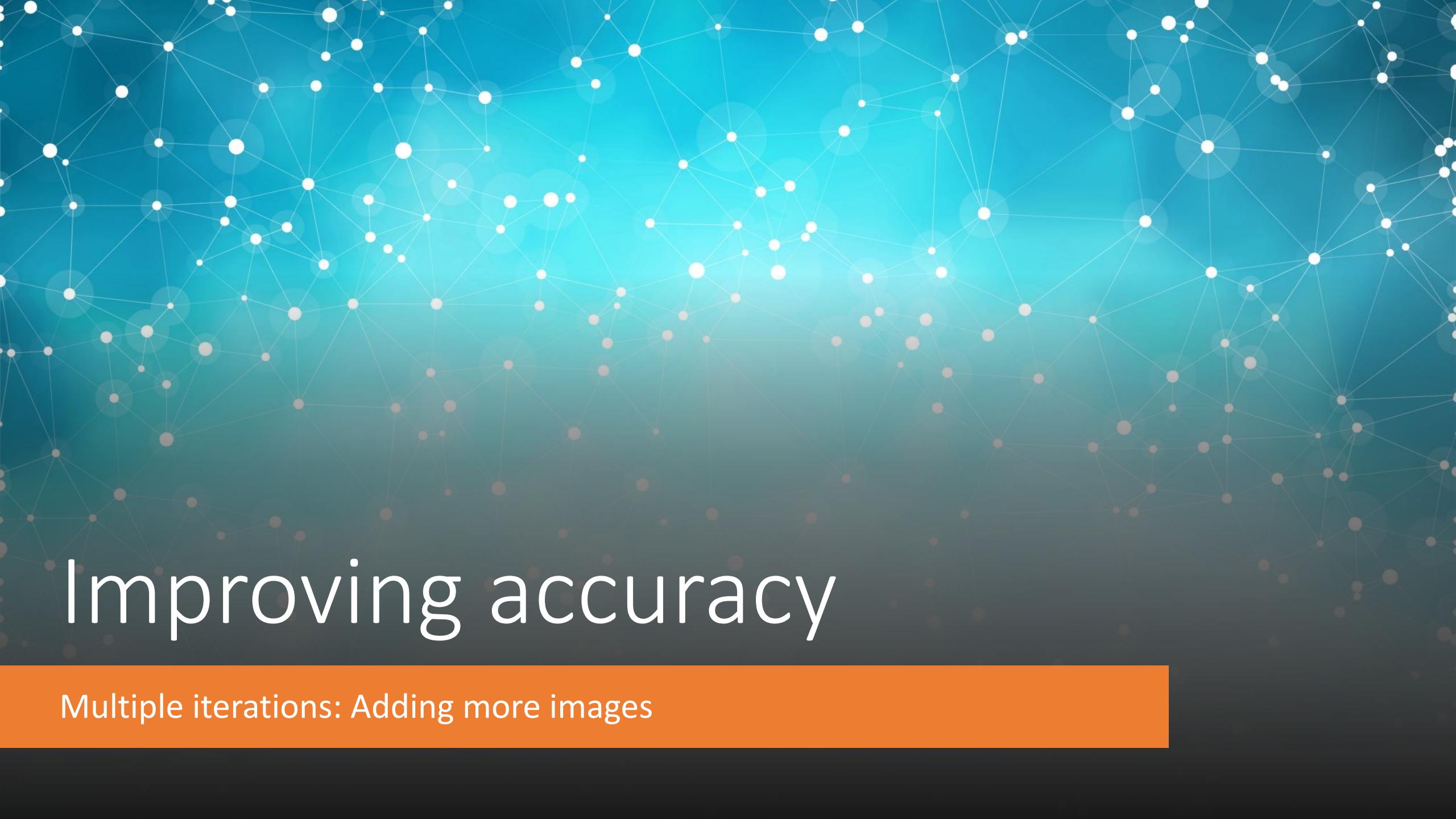
Trained regression
model



Ridge Regression
Support Vector Regression

Poverty statistics
indicators





Improving accuracy

Multiple iterations: Adding more images



Use Cases: How is this understanding helpful?

Use of proxies

Target Audience

- Humanitarian Aid Agencies such as Bill Gates Foundation, UN agencies, the World Bank, IMF, USAID etc.



Can these tools help address the challenges of refugees worldwide? Especially in the context of Water, Sanitation and Hygiene (WASH) – Satellite Imagery
Use the CNN features learned from the nightlights classification task to predict indicators of interest such as poverty, wealth, or health outcomes.

Our Hypothesis

Refugee data

- By the end of 2022, 108.4 million people were forcibly displaced worldwide as a result of persecution, conflict, violence or human rights violations. This includes:
 - 35.3 million refugees
 - 62.5 million internally displaced people
 - 5.4 million asylum seekers
 - 5.2 million people in need of international protection, a majority from Venezuela
- They live in crammed and sometimes unhygienic conditions with little infrastructure



Living Conditions in Refugee Camps



Hunger in the 4 Largest Refugee Camps in the World



© UNHCR/Jordi Matas



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The UN Refugee Agency



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UNHCR
The UN Refugee Agency



Thank you