



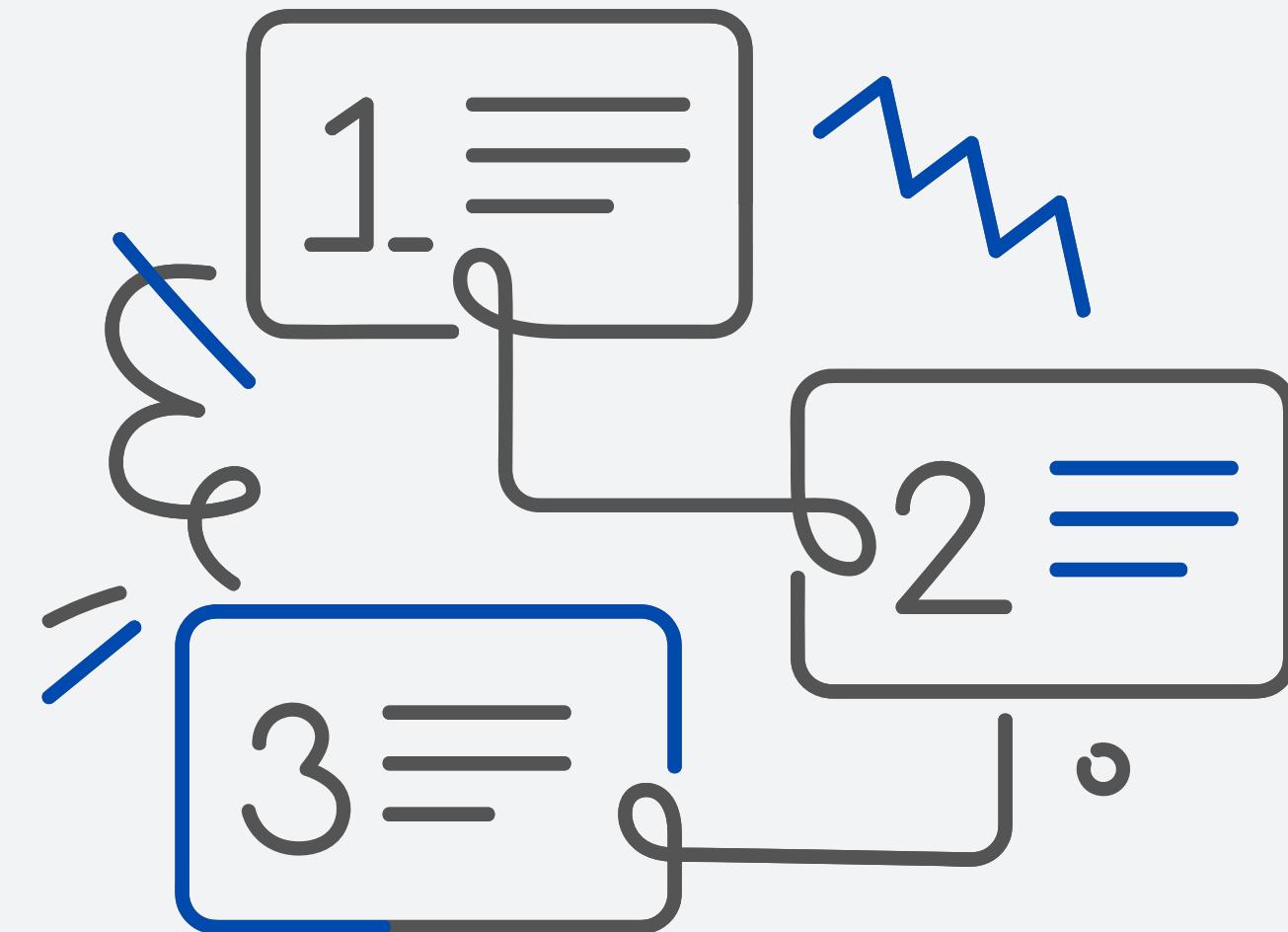
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# Accelerating Urban Analysis with CNN and Satellite Imagery

Erdal Erdas

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- 2. Data Loading and Preparation
- 3. Data Visualization
- 4. Model Building and Training
- 5. Evaluation of Training Results
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# Introduction

What is the problem?

# Introduction

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**Problem:** Urban planners and landscape architects conduct field studies to analyze cities and regions, which causes the process to take longer. How can we make this process shorter and more efficient?



**Goal:** Develop a CNN model using satellite images and optimize the analysis time by accelerating the detection process thanks to the developed model.



# Dataset Overview



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**Name:** SkyCity Aerial City Landscape Dataset

## Categories:

1. Bridge
2. Commercial
3. Industrial
4. Intersection
5. Landmark
6. Park
7. Parking
8. Playground
9. Residential
10. Stadium



# Dataset Overview

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**Image Resolution:** 256x256 pixels

**Number of Images per Category:** 800

**Total Images:** 8,000

**Description:** SkyCity is a meticulously curated dataset, bringing together urban landscapes from the publicly available AID and NWPU-Resisc45 datasets. Featuring **10** distinct city **categories** with **800 images each**, all at a resolution of 256x256 pixels, this dataset serves as a valuable resource for researchers and developers delving into the realm of **urban landscape analysis**. Proper credits to the original contributors of the AID and NWPU-Resisc45 datasets are duly acknowledged.

**Source:** <https://www.kaggle.com/datasets/yessicatuteja/skycity-the-city-landscape-dataset/data>



# Data Loading and Preparation

Are we ready?

# Data Loading and Preparation

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$f(x)$

This section has 3 functions.

- The `data\_load` function **loads** class names and **creates** a dictionary mapping class names to **labels**.
- The `data\_prep` function **prepares** data generators for **training and validation**.
- The `split\_data` function **splits** data into **features (X)** and **labels (y)**.



The background of the slide is a dark blue-tinted aerial photograph of a rugged mountainous terrain. A winding asphalt road cuts through the dense green forests, leading from the foreground towards the horizon. In the middle ground, there's a small cluster of buildings and a bridge crossing a valley. The overall scene conveys a sense of natural beauty and engineering.

# Data Visualization

What we have?

# Data Visualization

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$f(x)$

This section has a function.

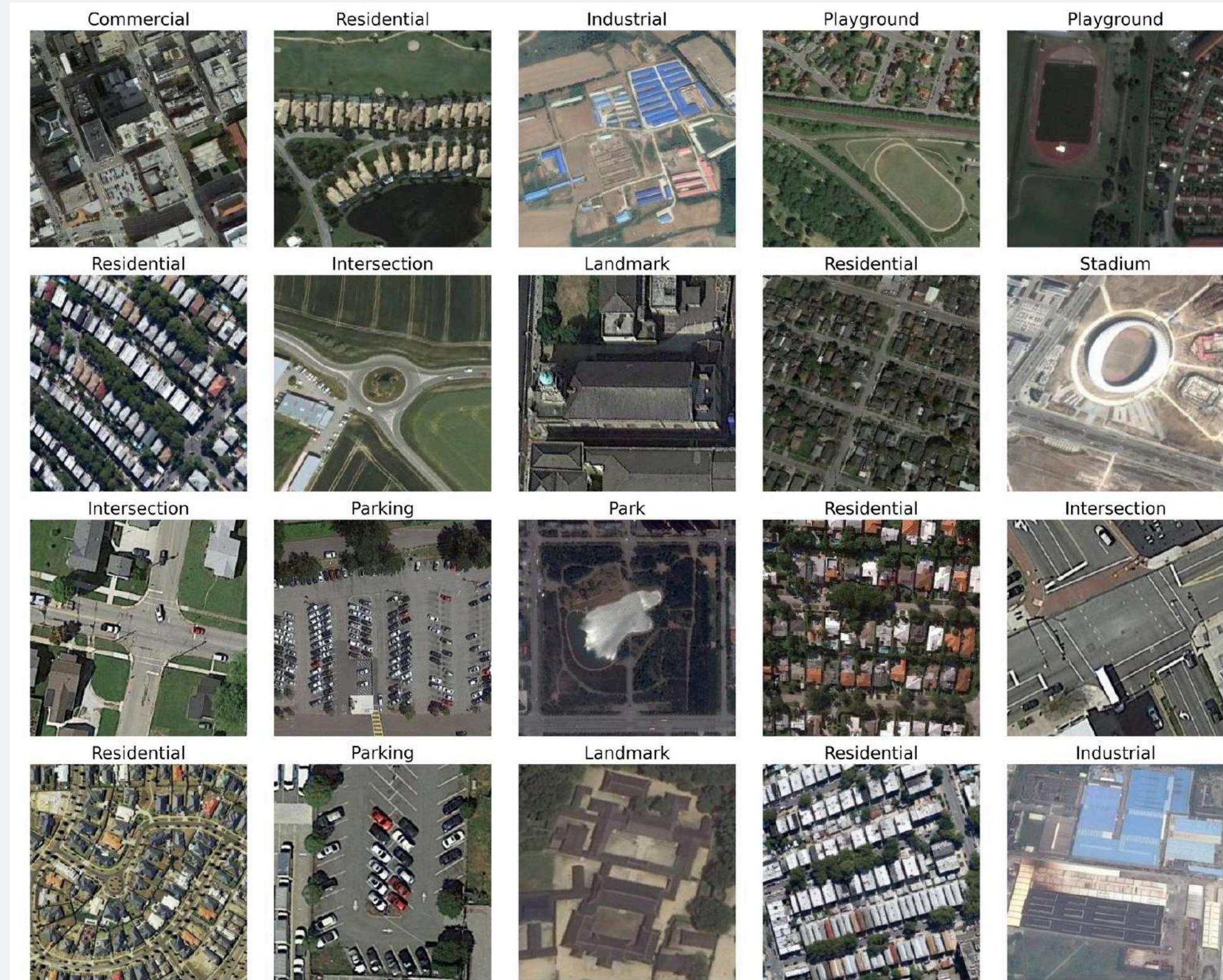
- The `visualize\_images\_with\_labels` function visualizes random images with their labels.



`visualize_images_with_labels`

# Data Visualization

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# Data Visualization

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# Model Building and Training

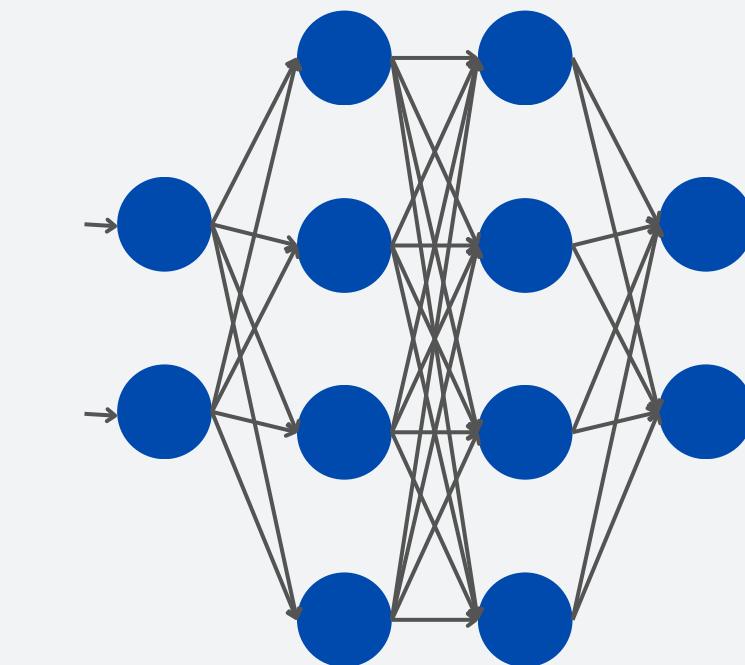
How we can solve the problem?

# Model Building and Training

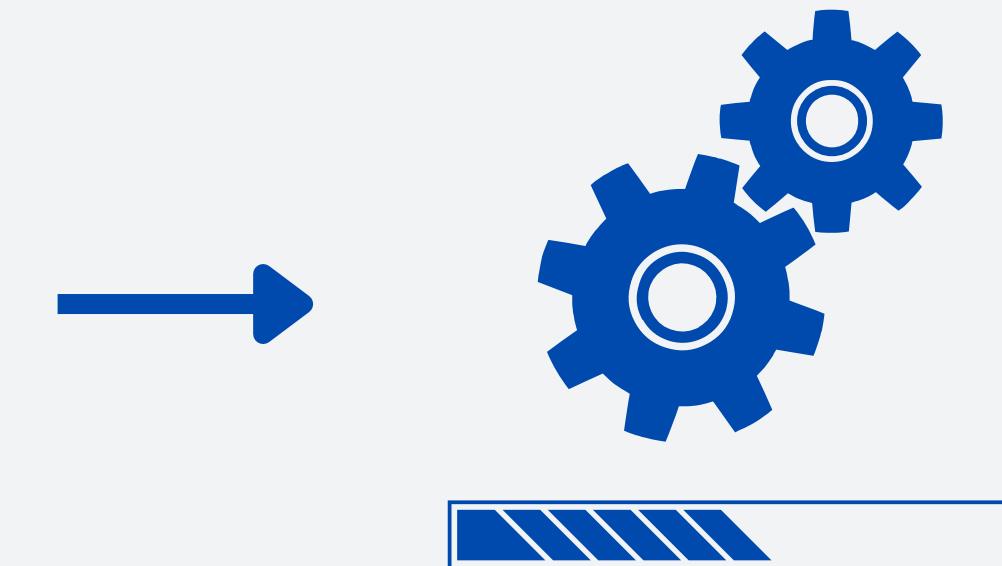
$f(x)$

This section has **2 functions**.

- The `build\_model` function builds a **CNN model** based on the input shape and number of classes.
- The `train\_model` function **trains the model** with **early stopping** and returns training history.



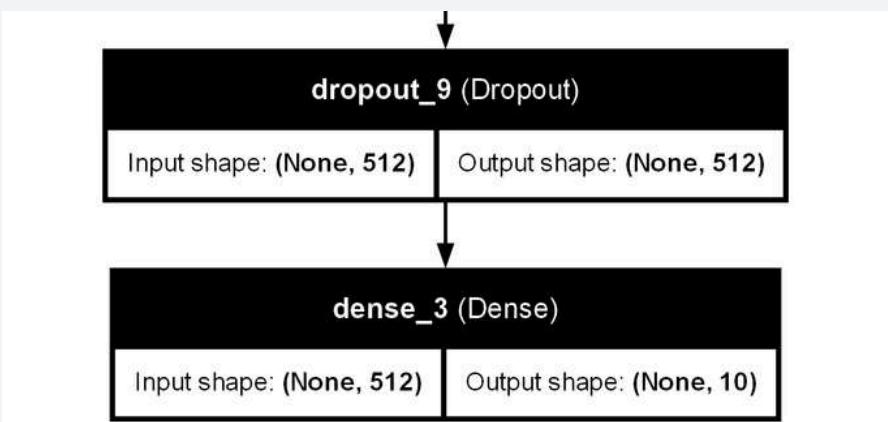
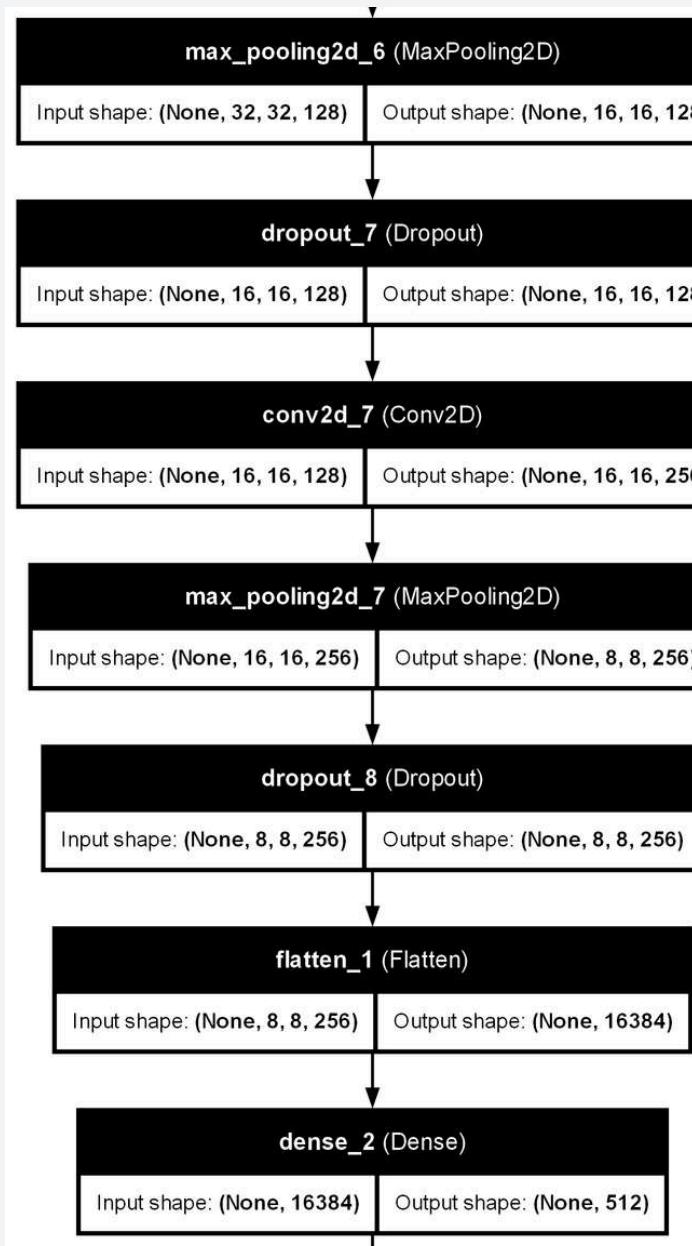
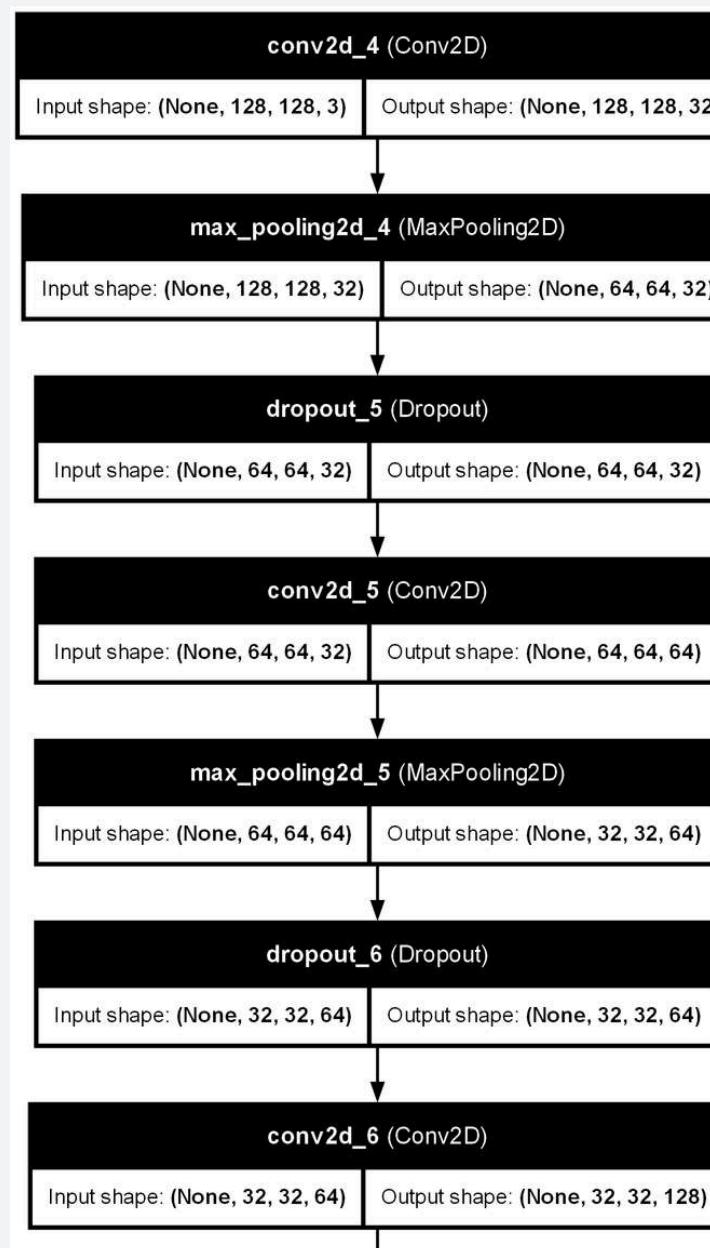
`build_model`



`train_model`

# Model Building and Training

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## SALE REPORT



# Evaluation of Training Results

Did we overfit or did we learn?



# Evaluation of Training Results

$f(x)$

This section has **2 functions**.

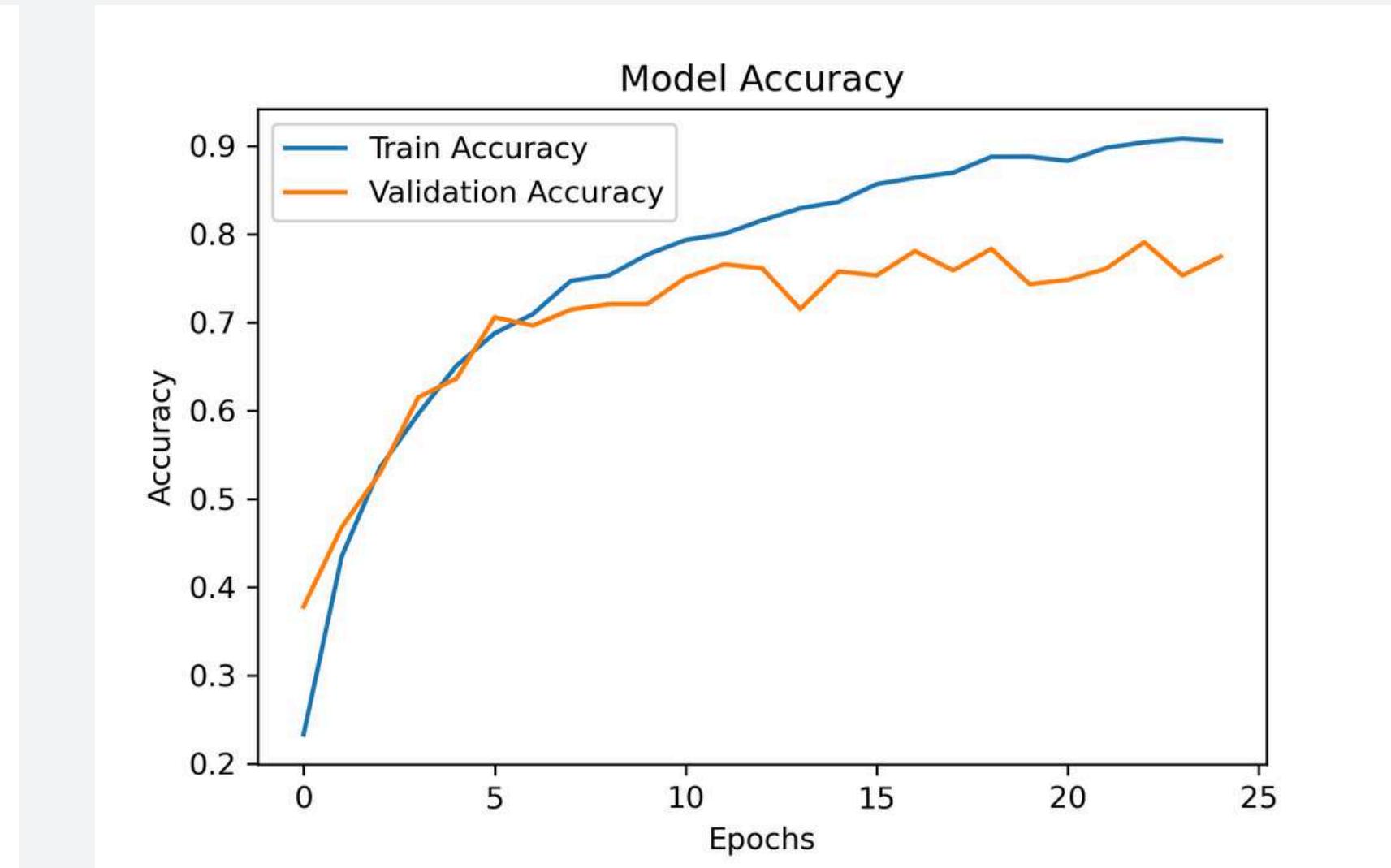
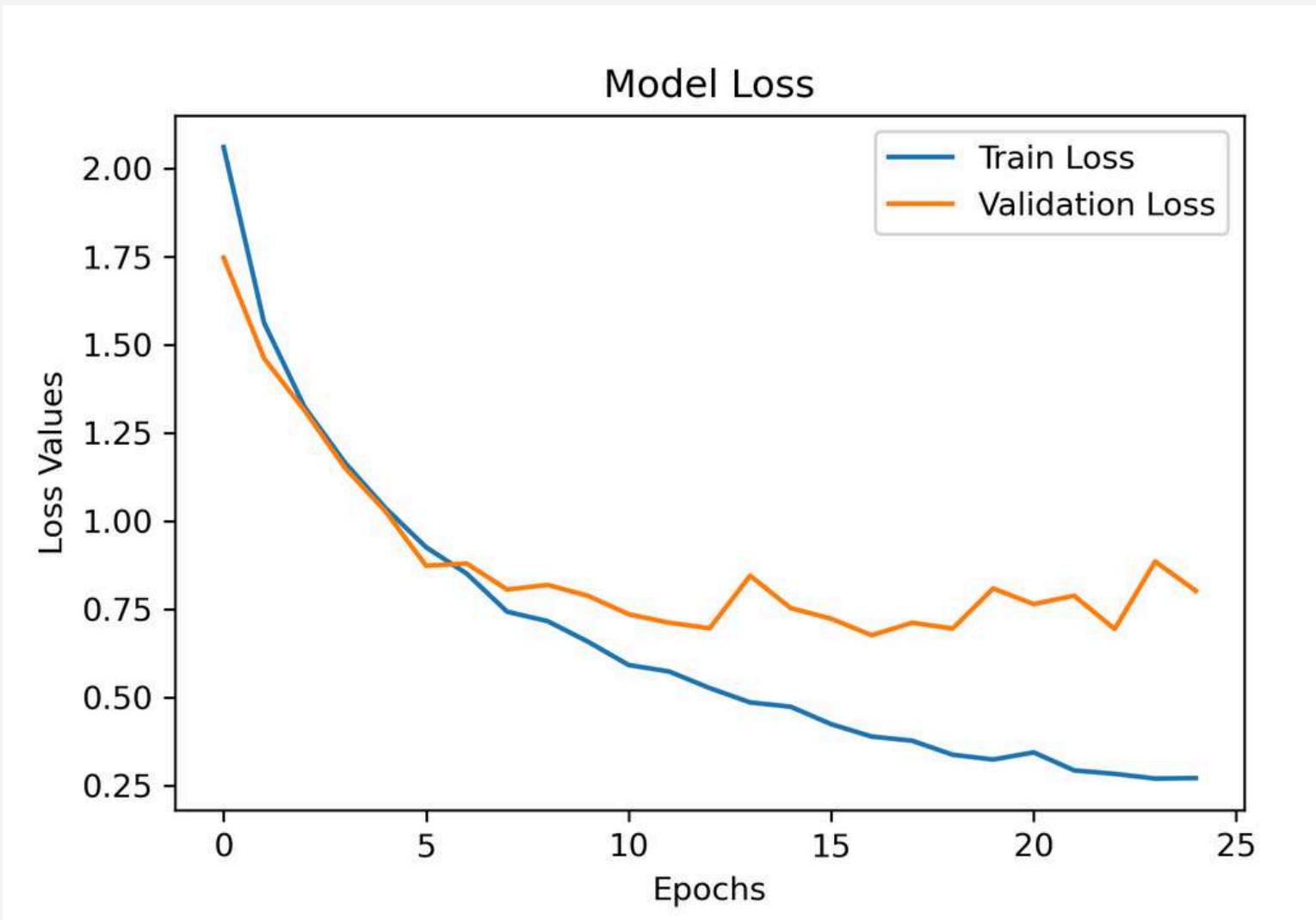
- The `plot\_accuracy` function plots **training and validation accuracy** over epochs.
- The `plot\_loss` function plots **training and validation loss** over epochs



**plot\_accuracy**  
**plot\_loss**

# Evaluation of Training Results

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- With the `EarlyStopping` command we **save the model at its most successful state**, so we do **not lose validation accuracy**.

**Validation Accuracy: 80%**

**Note:** It needs to be trained with more data to increase the success rate.

## SALE REPORT



# Model Performance and Predictions

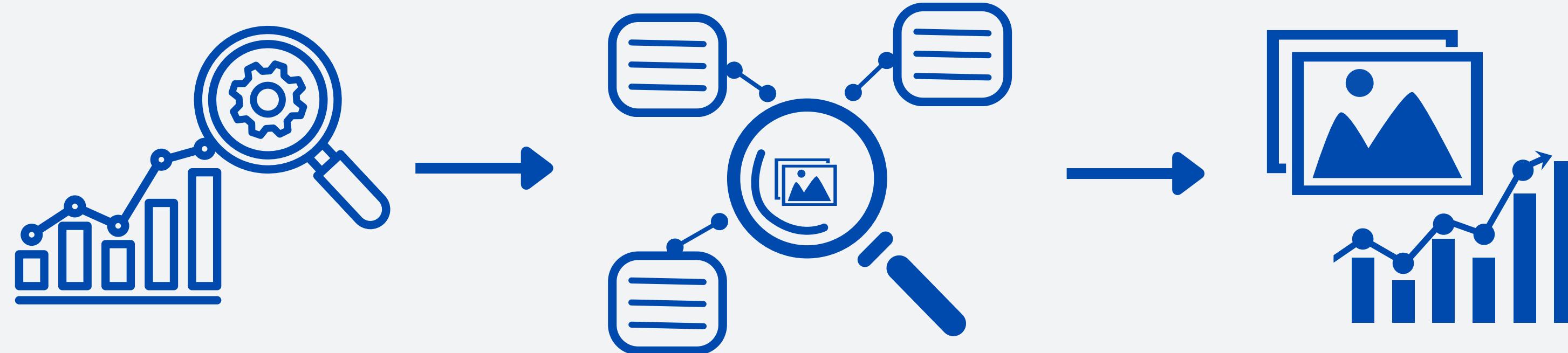
How successful we are?

# Model Performance and Predictions

$f(x)$

This section has **2 functions**.

- The `get\_best\_validation\_metrics` function extracts and **prints the best values for validation accuracy and loss** from the training history.
- The `predict\_random\_image` function **predicts the class and probabilities** for a random image.

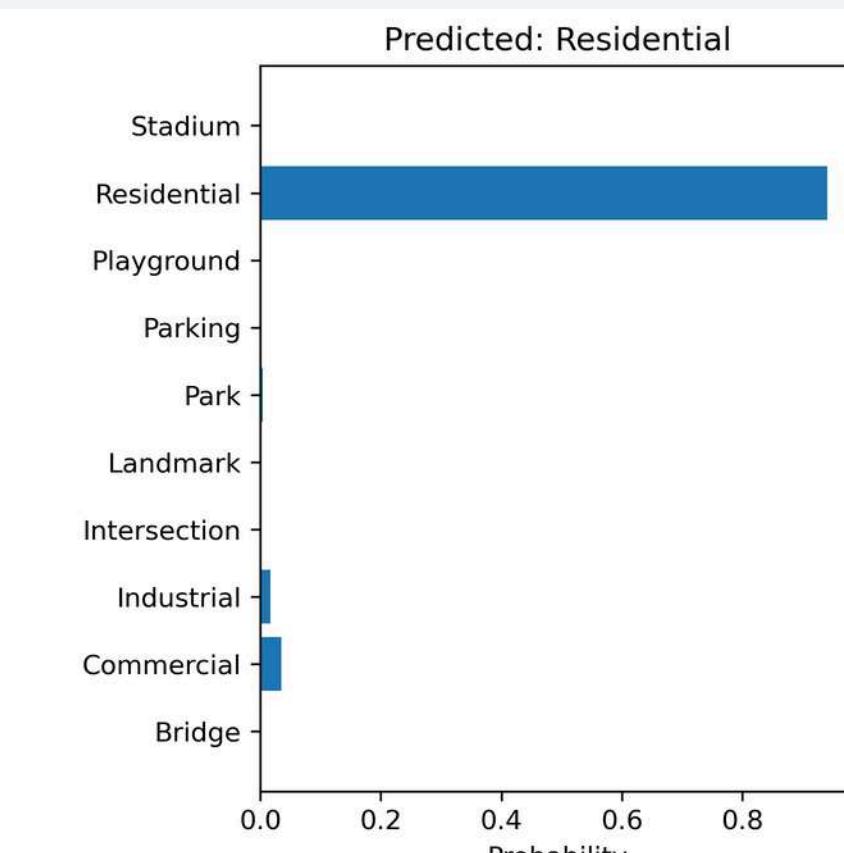
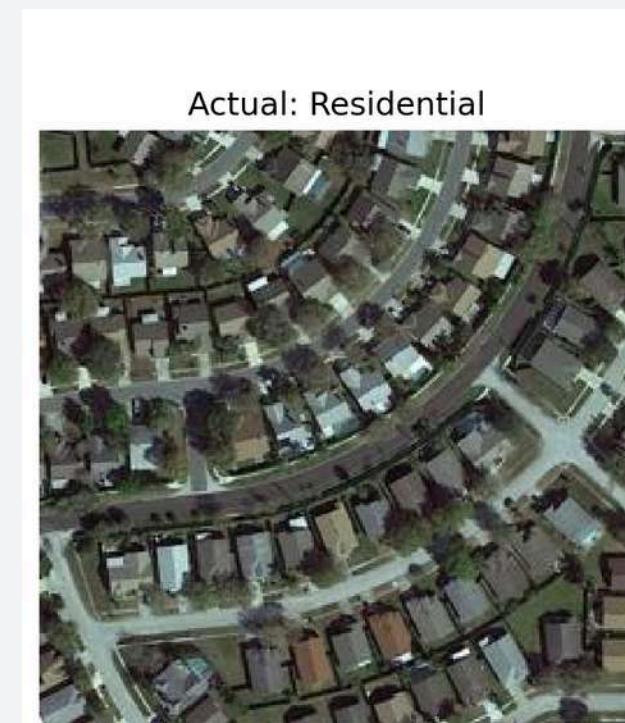
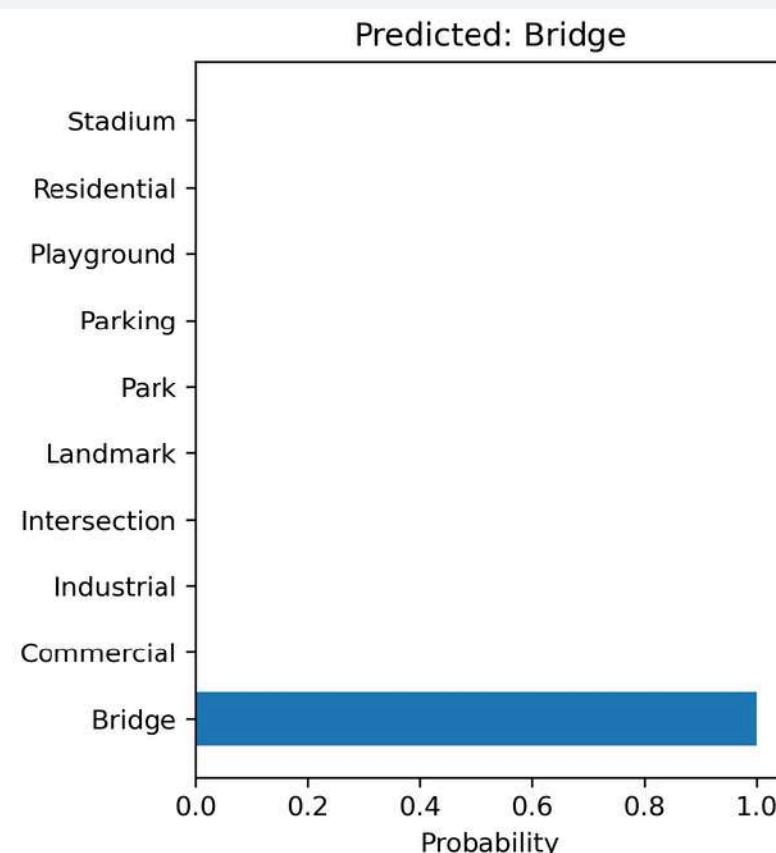
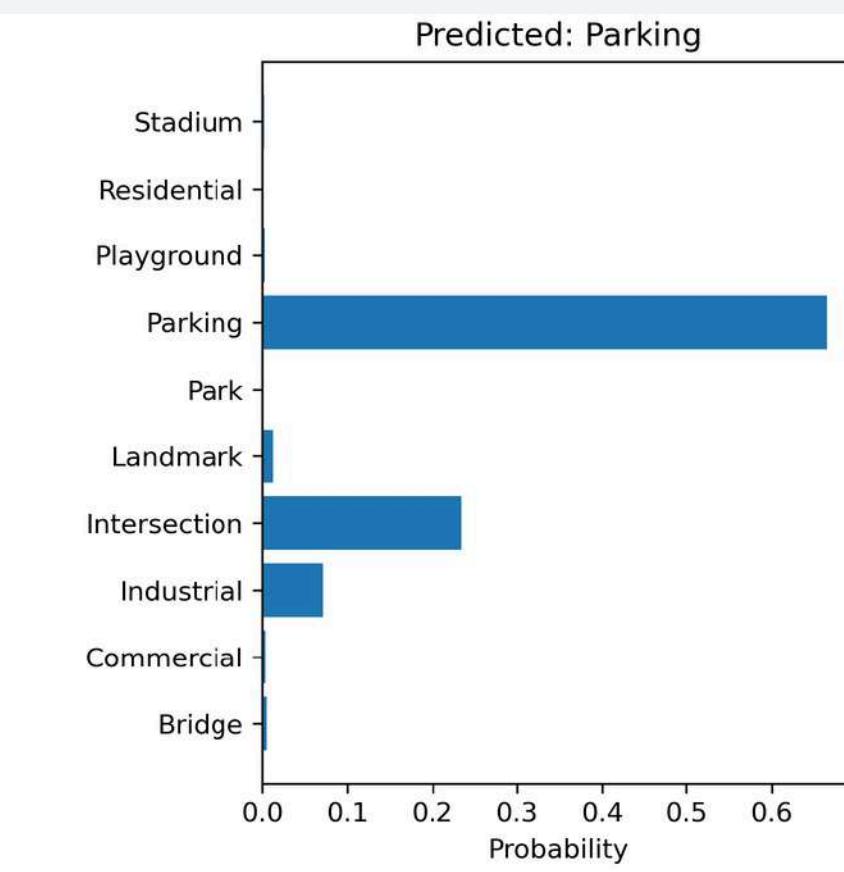
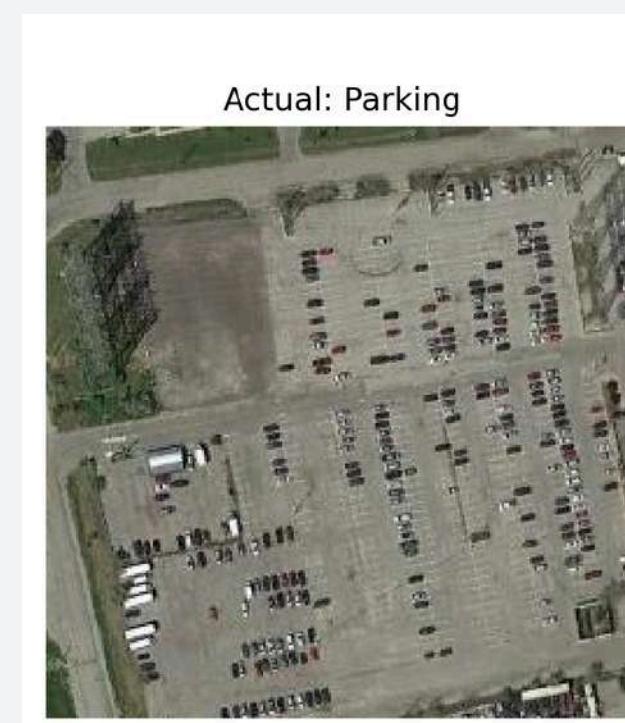
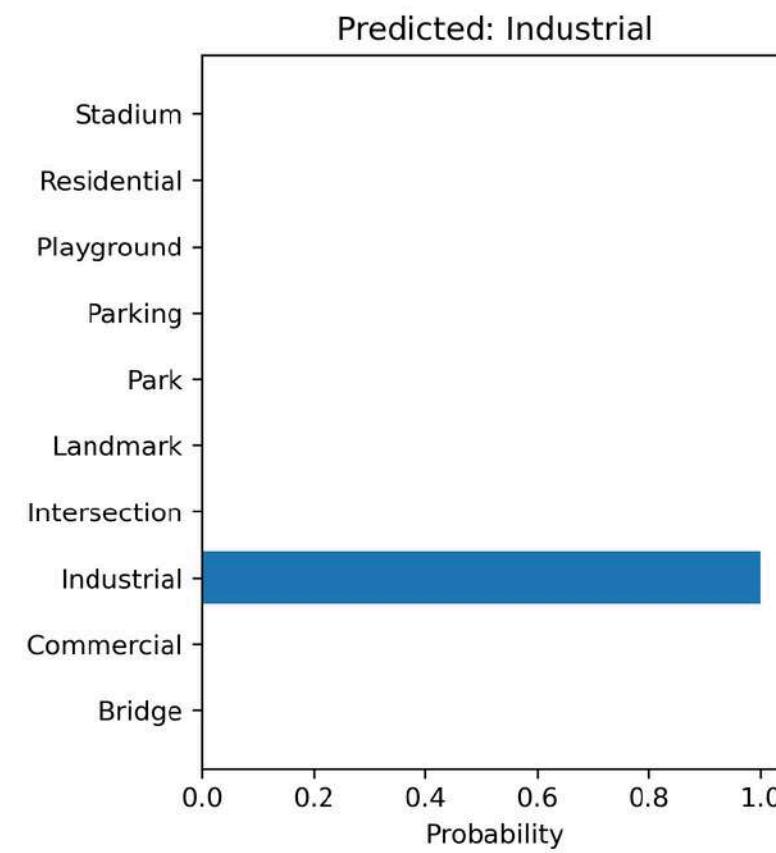


`get_best_validation_metrics`

`predict_random_image`

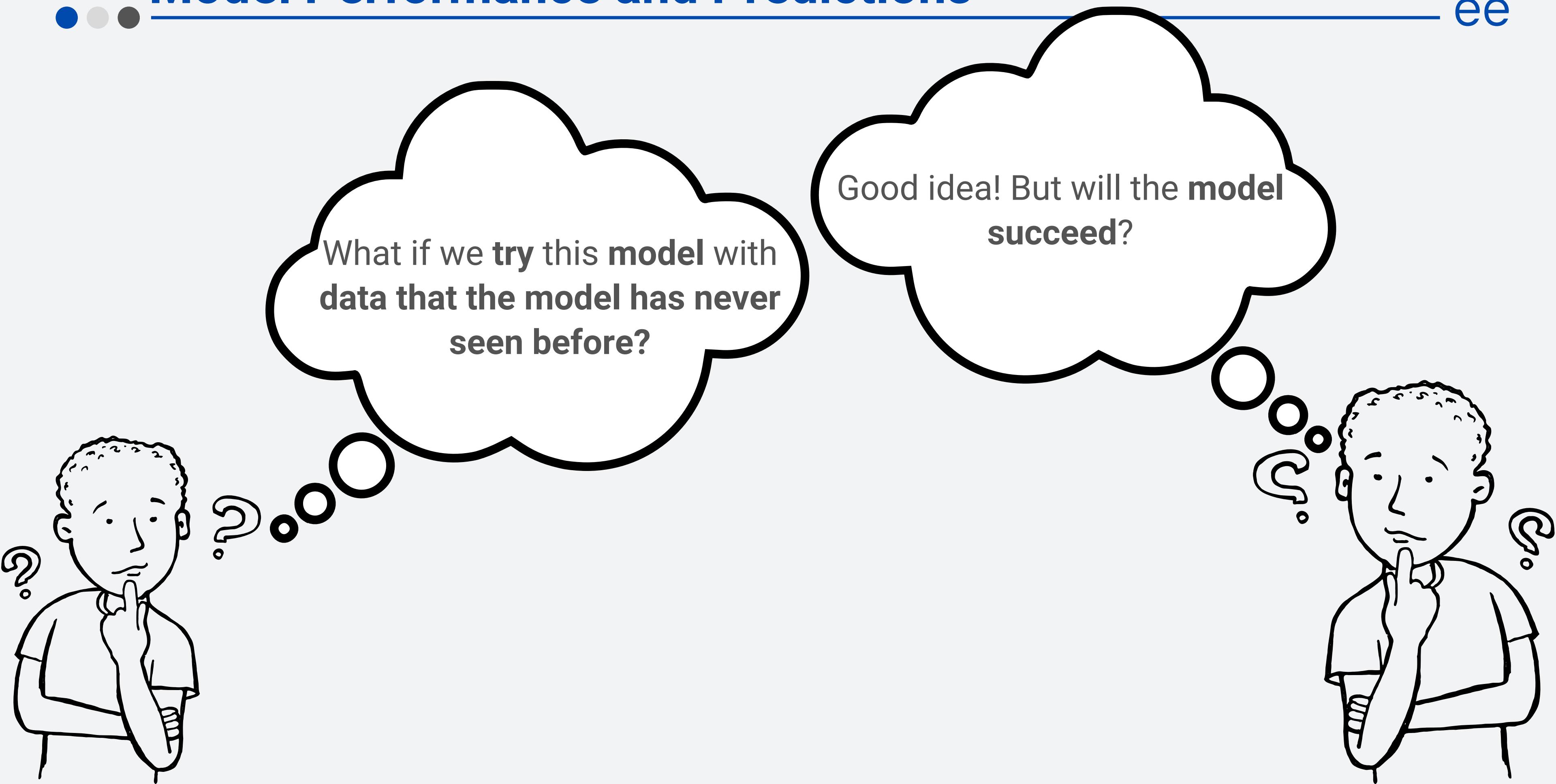
# Model Performance and Predictions

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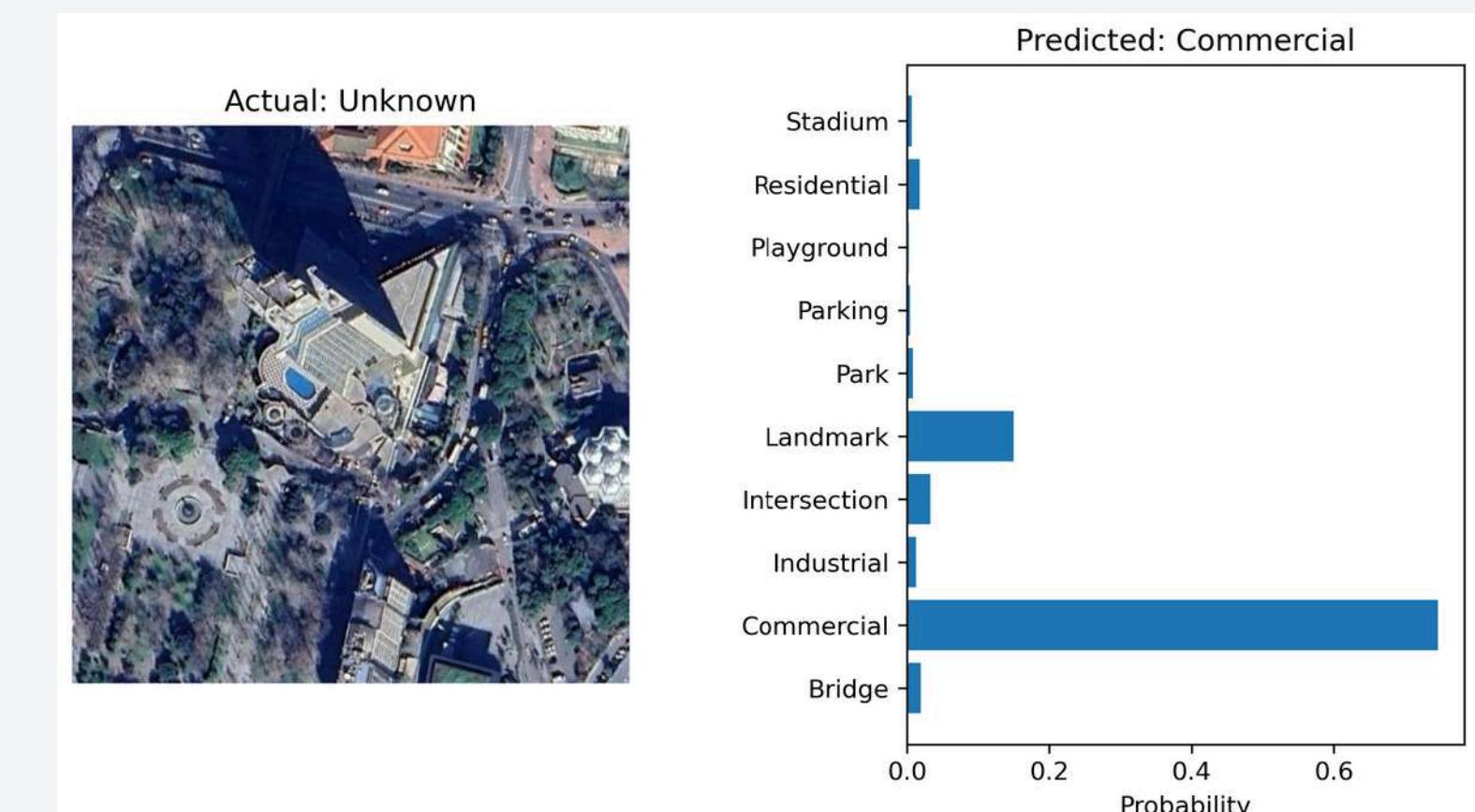
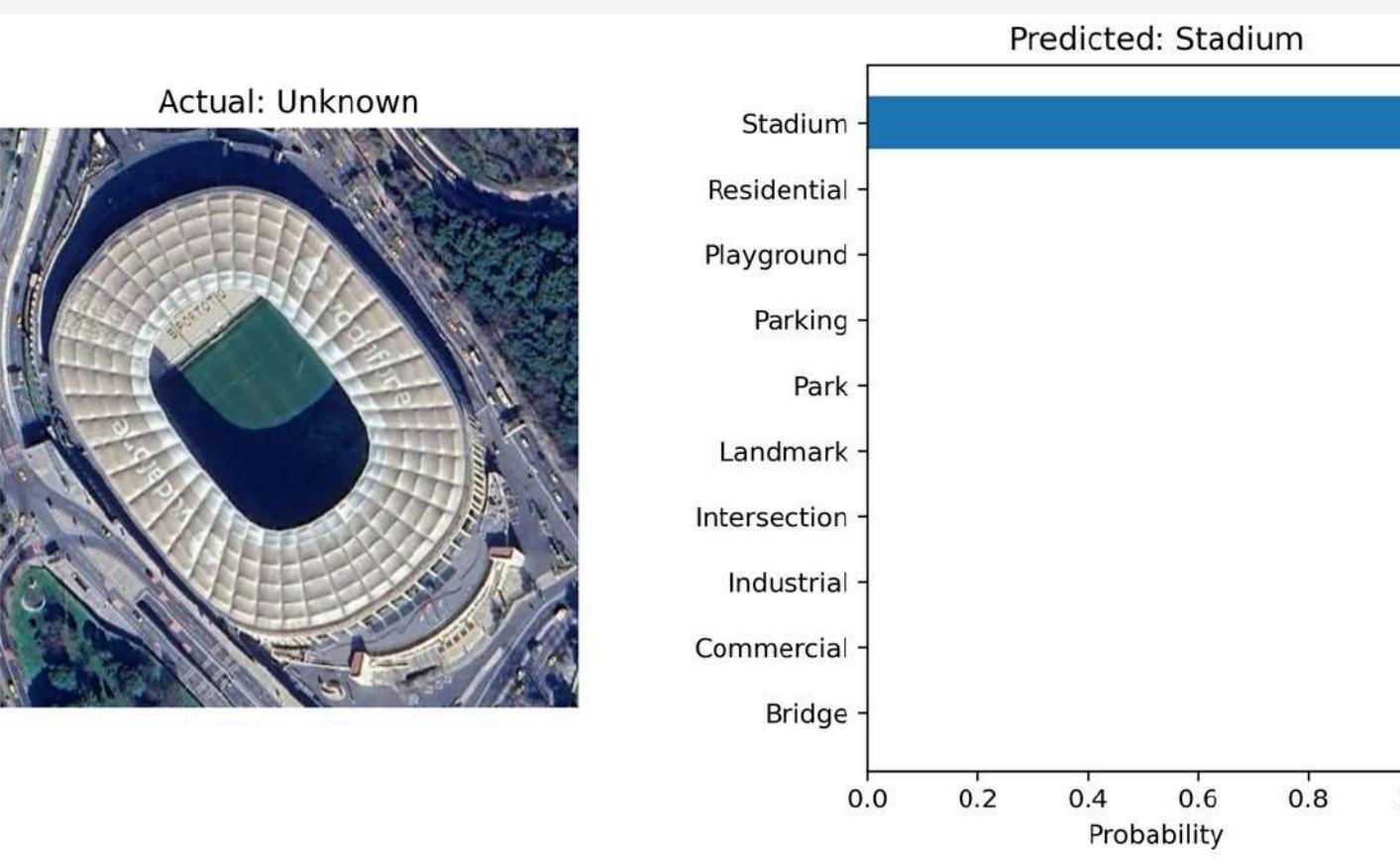
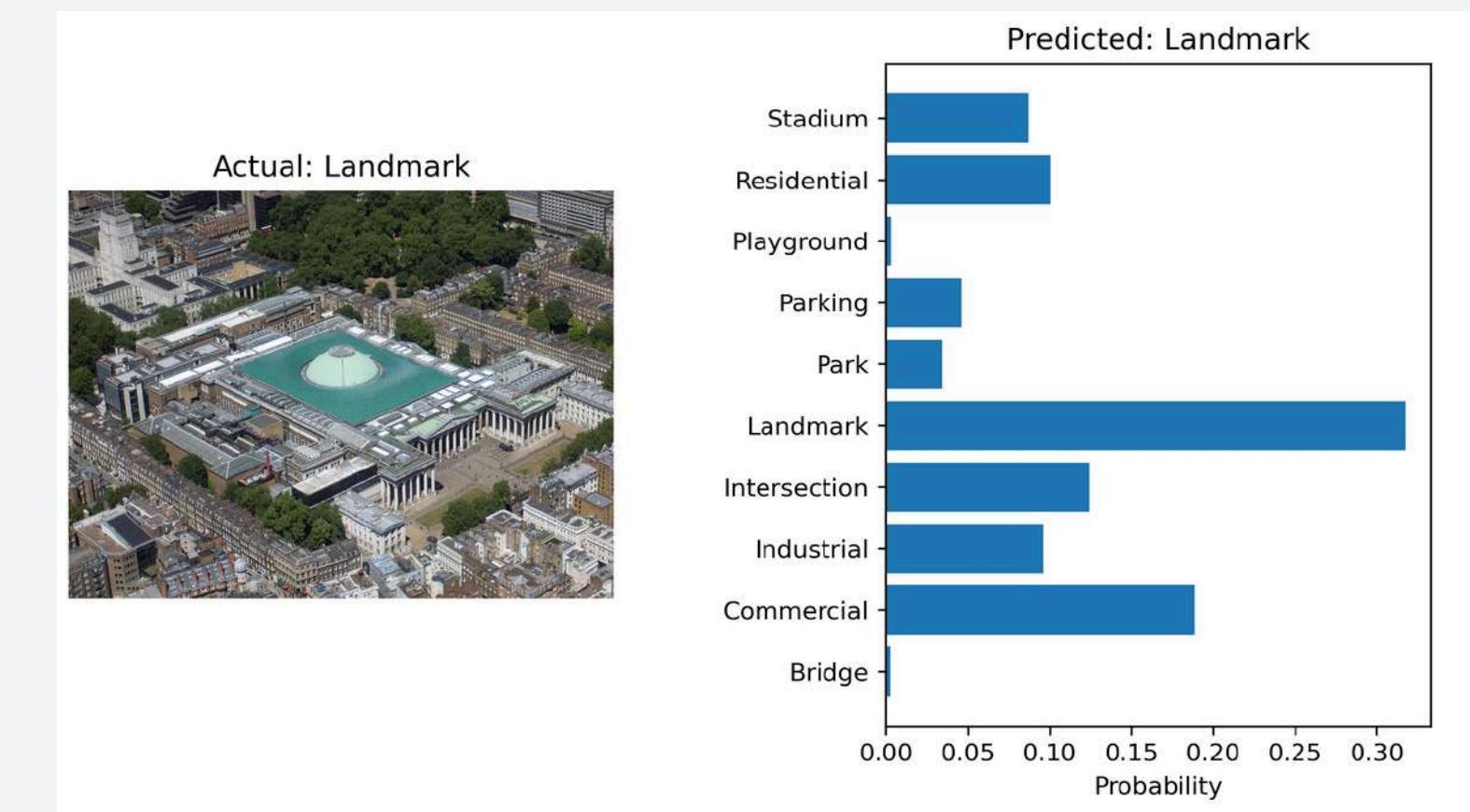
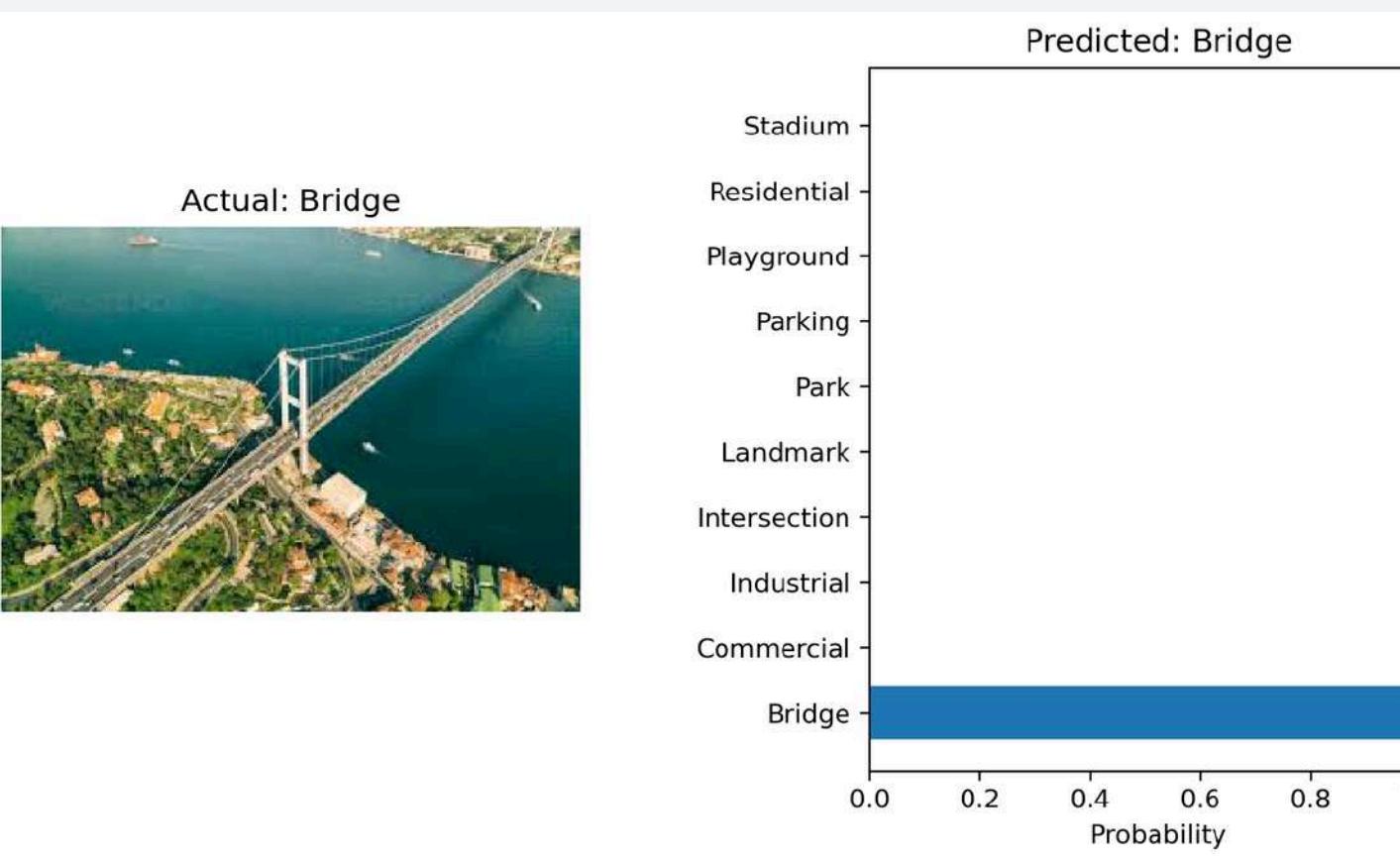
# Model Performance and Predictions

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# Model Performance and Predictions

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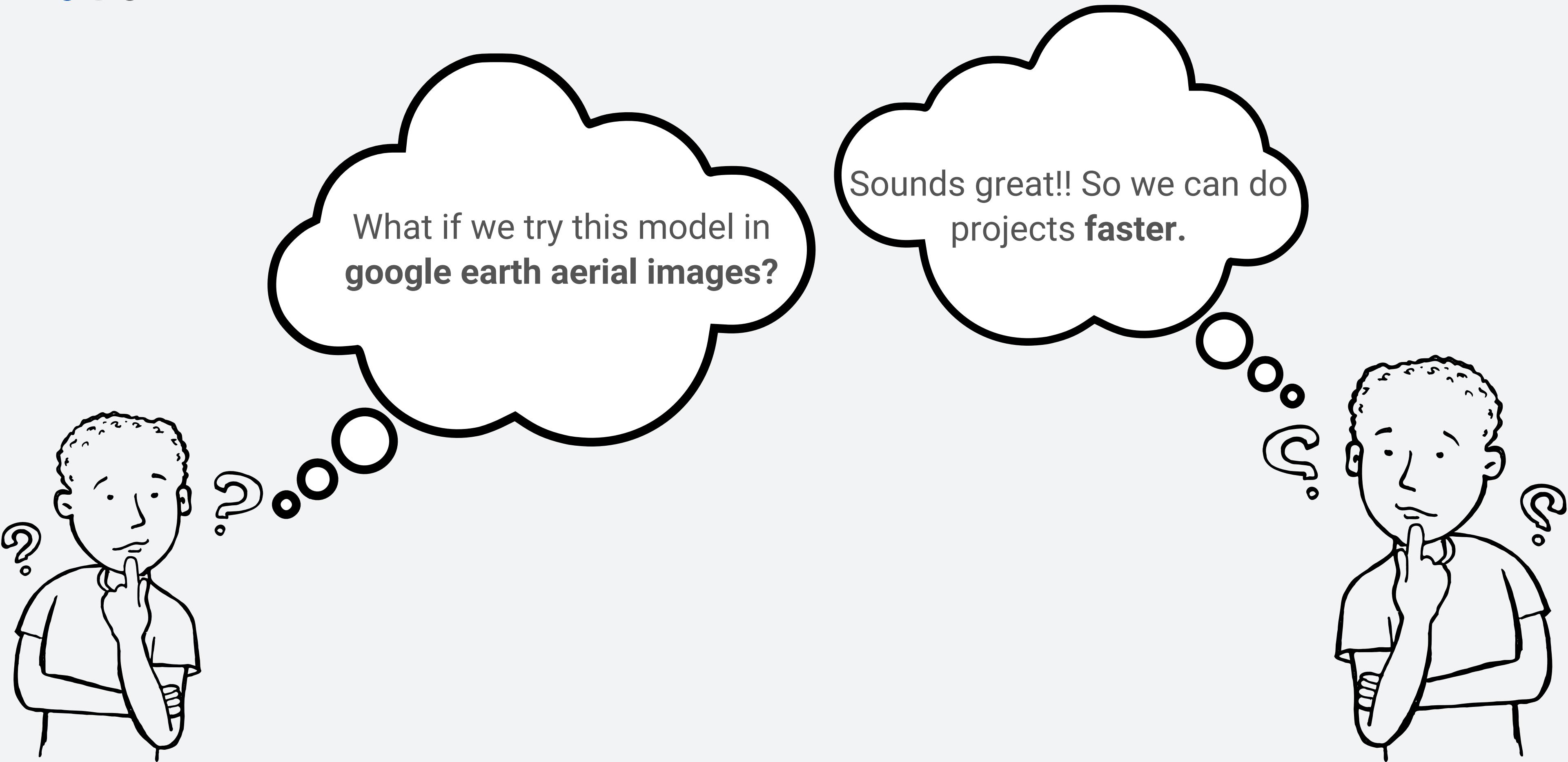


# Conclusion and Future Work

What are the potential future improvements?

## Conclusion and Future Work

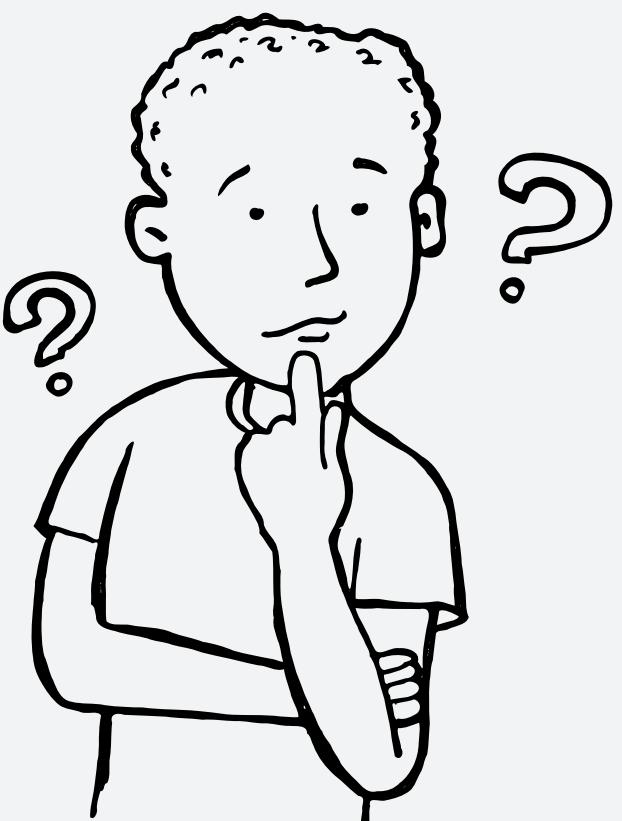
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# Conclusion and Future Work

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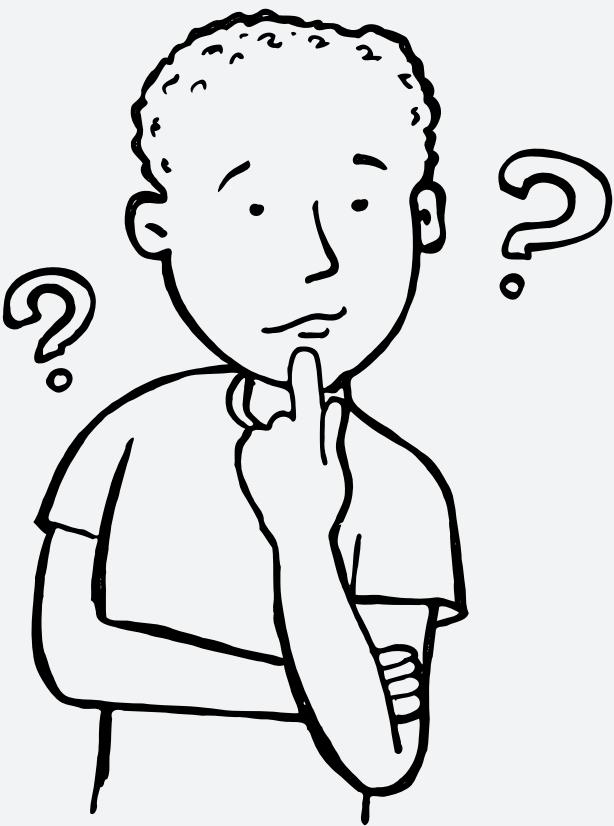
- Imagine a photo taken from Google Earth.



# Conclusion and Future Work

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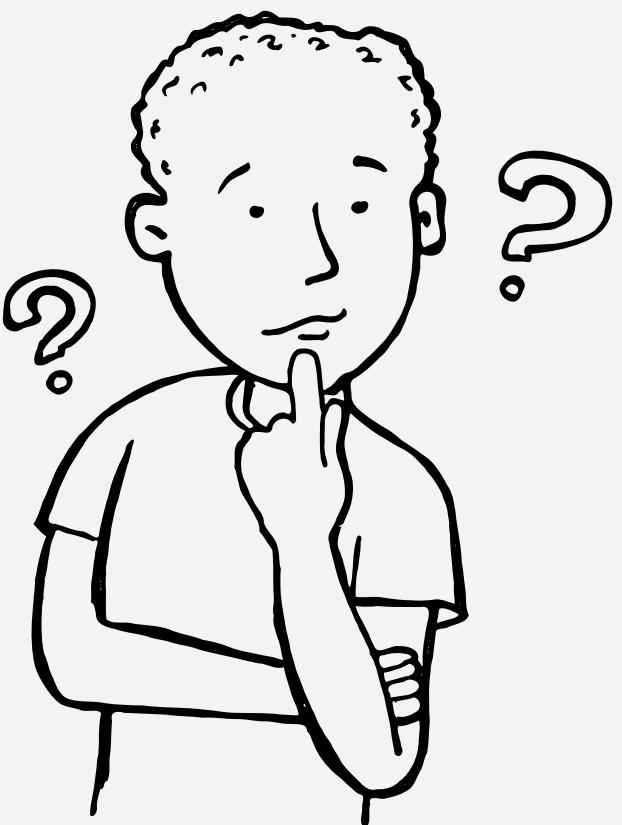
- If we split the photo into small pieces the model can predict.



# Conclusion and Future Work

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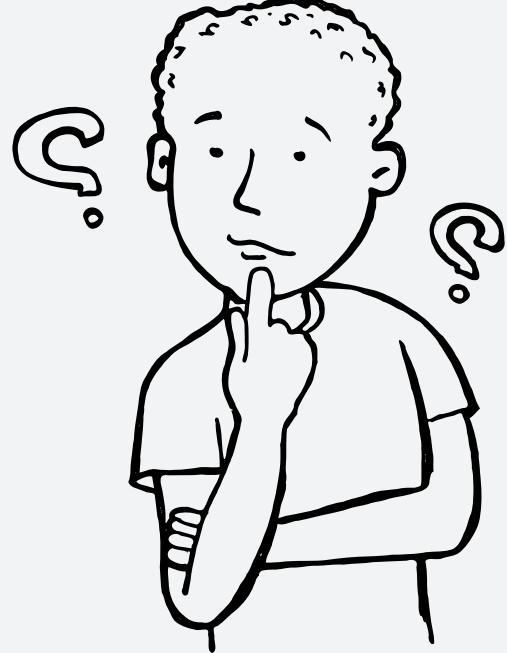
- Imagine a photo taken from Google Earth.



# Conclusion and Future Work

ee

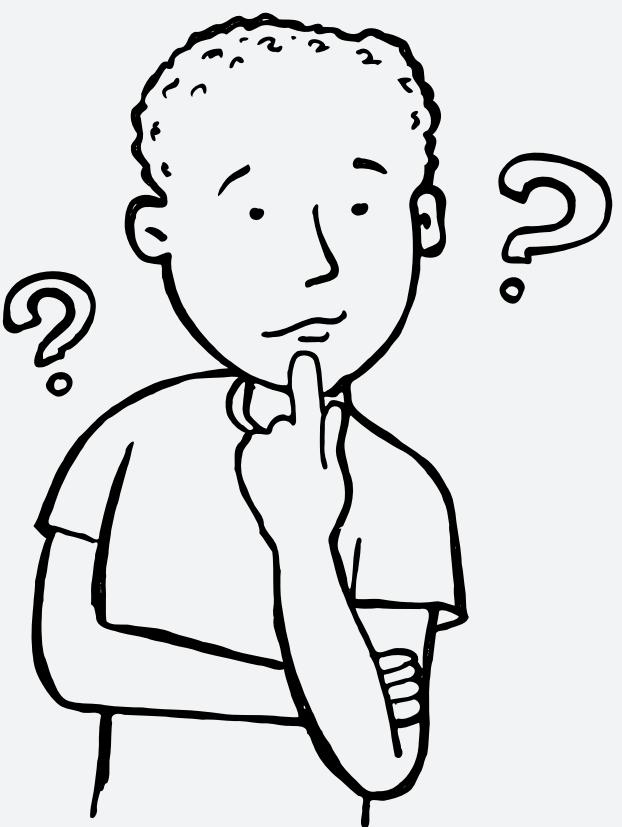
- If we split the photo into small pieces the model can predict.



# Conclusion and Future Work

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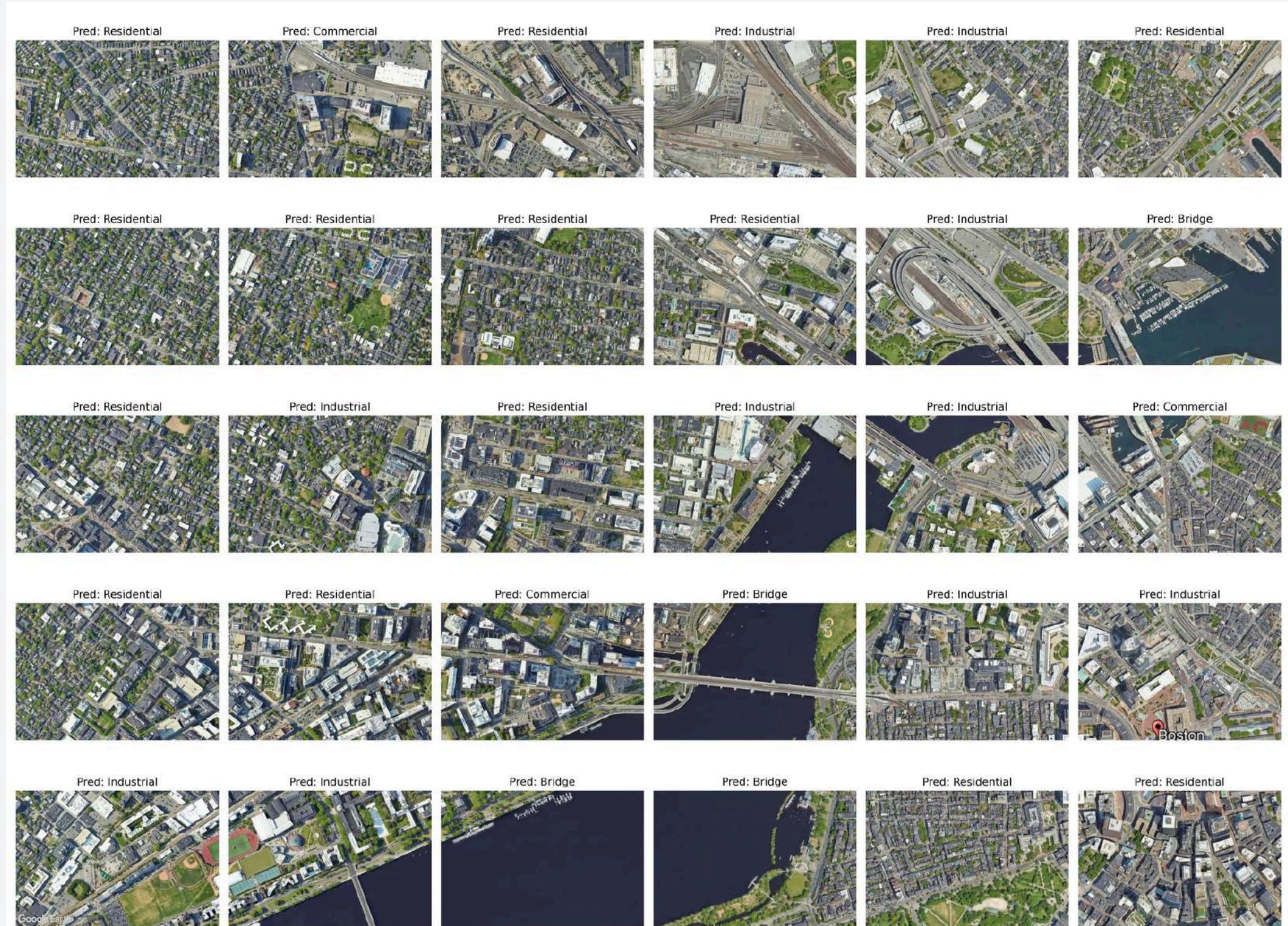
- Imagine a photo taken from Google Earth.



# Conclusion and Future Work

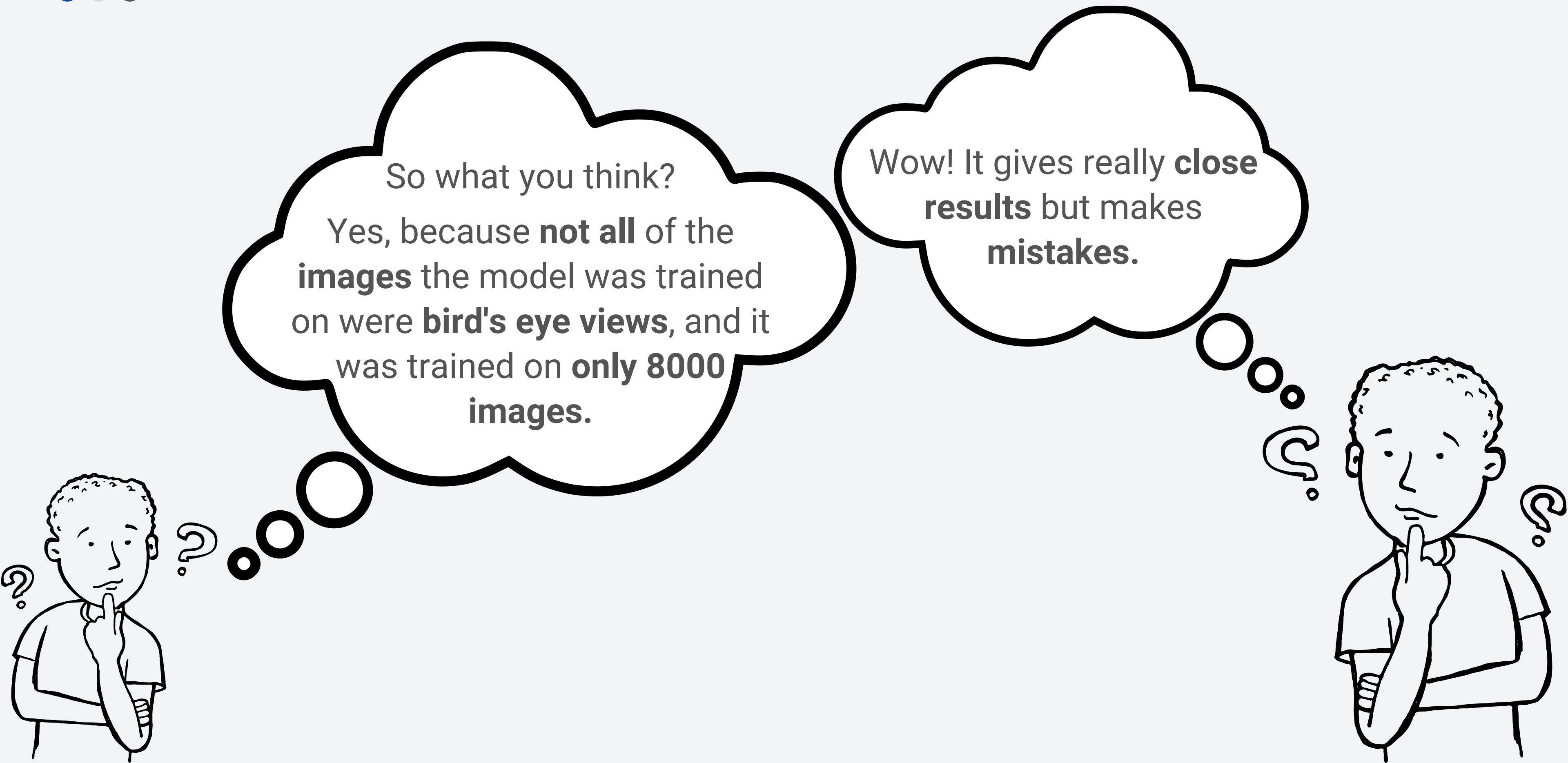
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- If we split the photo into small pieces the model can predict.



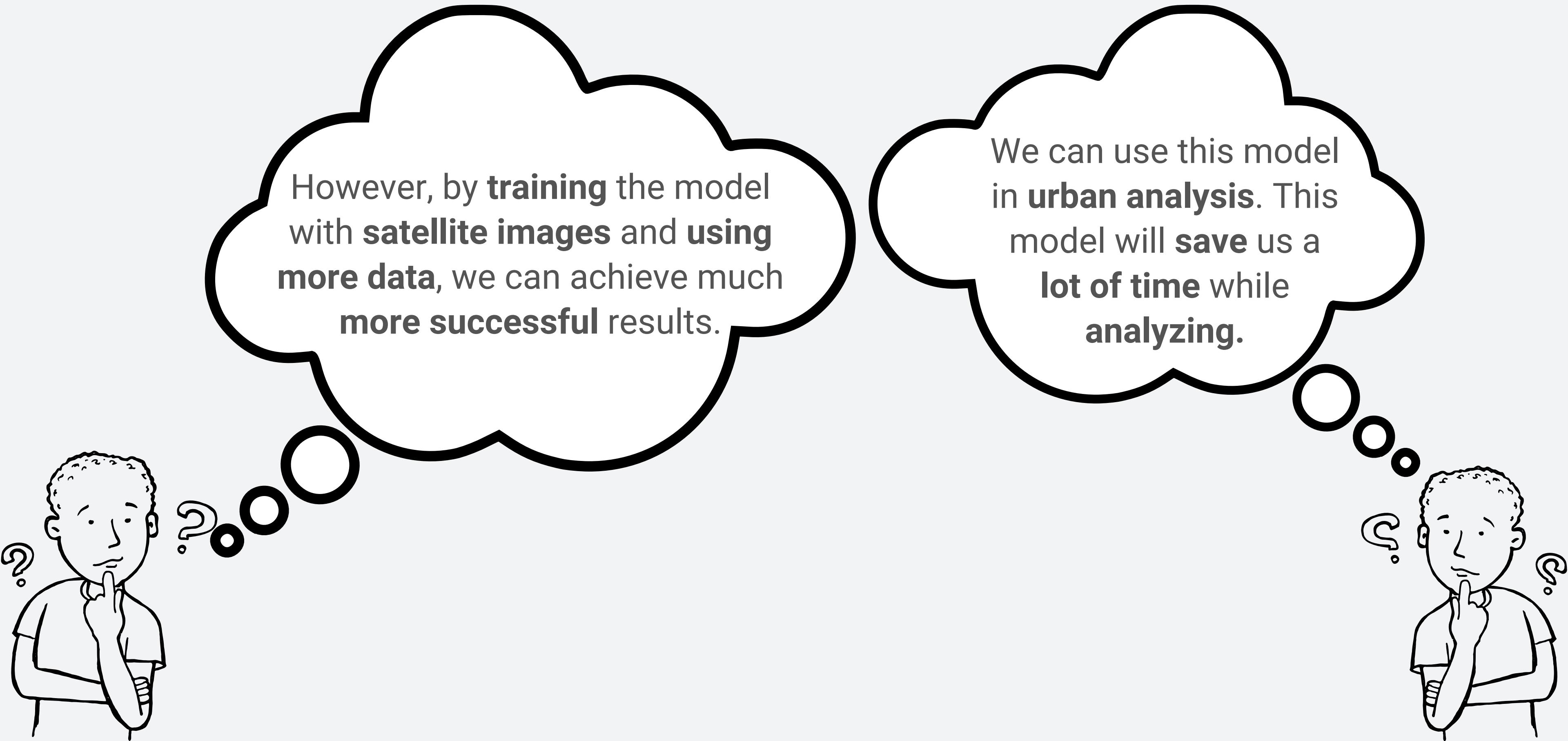
# Conclusion and Future Work

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## Conclusion and Future Work

ee



However, by **training** the model with **satellite images** and using **more data**, we can achieve much **more successful** results.

We can use this model in **urban analysis**. This model will **save** us a **lot of time** while **analyzing**.





# **Recommendations**

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## **Sectors where the model can be used:**

1. Construction
2. Municipality
3. Industry

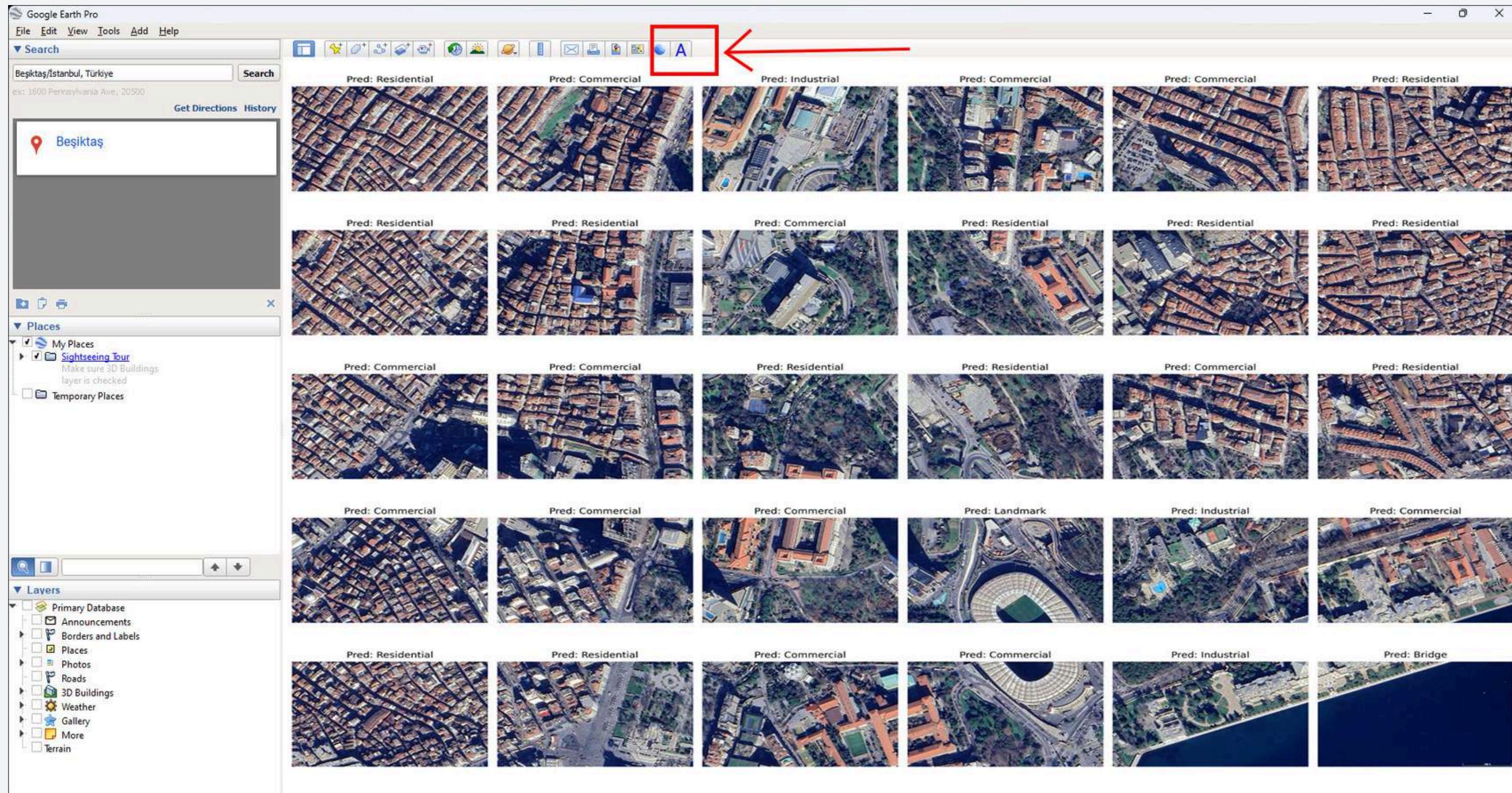
## **Fields of study where the model can be used:**

1. Urban Planning: Analysis of area and land use maps.
2. Landscape Architecture: Site analysis
3. Open Source: Google Earth extension

# Recommendations

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- Using the "Site Analysis" tool, you can perform analyses very quickly.



A blue-tinted photograph showing four hands, two belonging to a man in a suit and two to a woman in a dress, all giving a thumbs-up gesture. The background is a solid blue.

# thank you!

Erdal Erdaş