Full Domino Detection & Dominos in the World Map

Kacper Gasior & Kesia Ann Vino

Model Information

Architecture

Roboflow RF-DETR Instance Segmentation (2X Large)

Dataset Composition

High-quality training data focused on accuracy.

~640 Hand-annotated base images

746 Total images in training set (with augmentations)

125 / 123 Validation / Test set split

Note: Reduced from ~1300+ in previous iterations to prioritize quality over quantity.

Preprocessing & Augs

Preprocessing:

- Resize: Fit (black edges) in 768x768
- Grayscale Applied
- Filter Null: Require annotations

Augmentations:

- Rotation: -15° to +15°
- Shear: ±10° Horiz & Vert
- Blur: Up to 1px

Model Statistics and Predictions

Validation Set Performance

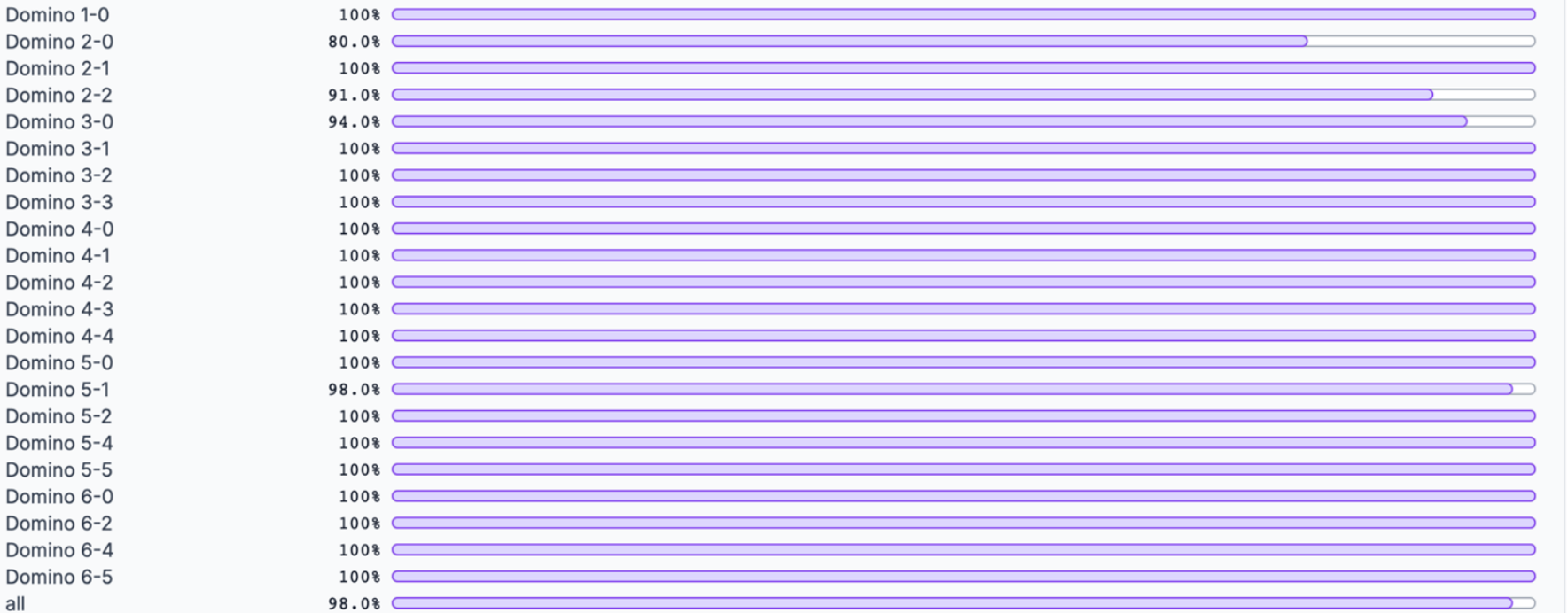
mAP@50	Precision	Recall	F1 Score
98.3%	97.4%	93.3%	95.3% (External)

** Metrics represent overall model performance across all detected domino classes on the held-out validation set.*

Average Precision by Class (mAP50)

These metrics are reported by the model provider and may not follow industry-standard evaluation techniques. Learn more about model evaluation best practices and important caveats here.

Validation Set | Test Set



Average Precision by Class (mAP50)

These metrics are reported by the model provider and may not follow industry-standard evaluation techniques. Learn more about model evaluation best practices and important caveats here.

Validation Set | Test Set

FSM Pipeline

STEP 01

Start Connection to RoboFlow Model

STEP 02

Type ". domino" to call the DominoDetector FSM

STEP 03

Run current frame through 2 Models: Domino Counting + Segmenting & Depth Inferencing

STEP 04

Report rank, distance, and orientation for each detected Domino

STEP 05

Create a Domino in the world map based on reported statistics

Domino in the World Map

PHYSICAL REPRESENTATION

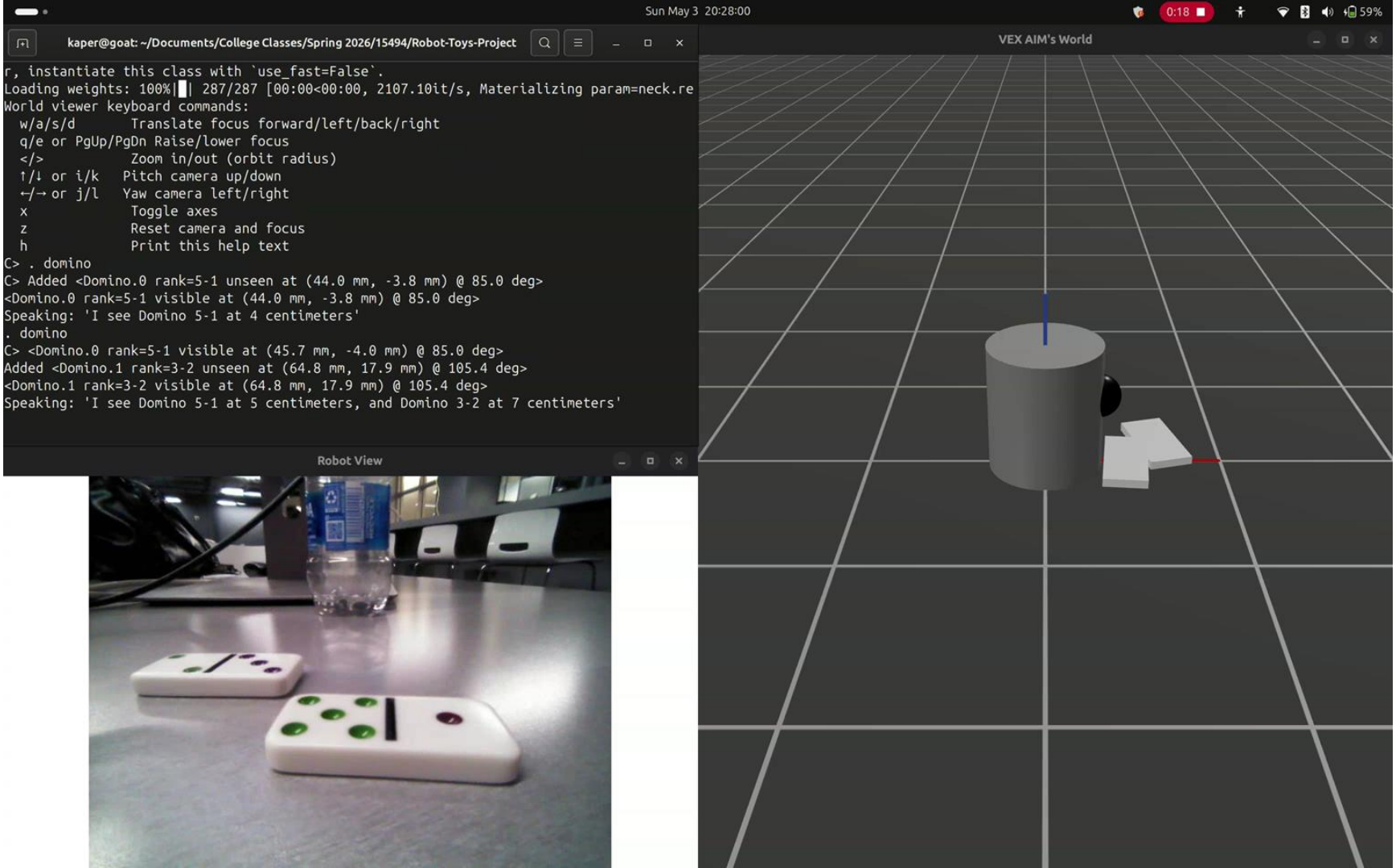
Fixed Dimension Box Models

Dominoes are represented as 25mm x 50mm x 5mm boxes. Their orientation is determined by the model's reported data.

WORLD MAP INTEGRATION

Object Access & Identification

Every detected Domino is instantiated as a unique model, accessible via the `Domino.{i}` identifier within the world map object set.


Sun May 3 20:28:00
0:18
59%
kaper@goat: ~/Documents/College Classes/Spring 2026/15494/Robot-Toys-Project
r, instantiate this class with `use_fast=False`.
Loading weights: 100%|| 287/287 [00:00<00:00, 2107.10it/s, Materializing param=neck.re
World viewer keyboard commands:
w/a/s/d Translate focus forward/left/back/right
q/e or PgUp/PgDn Raise/lower focus
</> Zoom in/out (orbit radius)
↑/↓ or i/k Pitch camera up/down
←/→ or j/l Yaw camera left/right
x Toggle axes
z Reset camera and focus
h Print this help text
C> . domino
C> Added <Domino.0 rank=5-1 unseen at (44.0 mm, -3.8 mm) @ 85.0 deg>
<Domino.0 rank=5-1 visible at (44.0 mm, -3.8 mm) @ 85.0 deg>
Speaking: 'I see Domino 5-1 at 4 centimeters'
. domino
C> <Domino.0 rank=5-1 visible at (45.7 mm, -4.0 mm) @ 85.0 deg>
Added <Domino.1 rank=3-2 unseen at (64.8 mm, 17.9 mm) @ 105.4 deg>
<Domino.1 rank=3-2 visible at (64.8 mm, 17.9 mm) @ 105.4 deg>
Speaking: 'I see Domino 5-1 at 5 centimeters, and Domino 3-2 at 7 centimeters'
Robot View
VEX AIM's World

Future Improvements

SPATIAL LOGIC

Orientation Precision

Compute the correct orientation of the dominos in the world map environment.

VISUALIZATION

Metadata Display

Display the pips/rank of the domino in the world map for easier identification.

MODEL ACCURACY

Multi-Domino Case Handling

Improve performance on multi-domino frames by including more multi-domino images in training data.

DATA PIPELINE

Dataset Stratification

Refine Train / Validation / Test data splitting to address current model inaccuracies.