SPRINT 1

Chick Counting Project

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01

Overview

OVERVIEW

02

Hardware

Cameras

RGBs:
Arducam 5mp
- 1080p
- 30 fps

CoolPix 900
- 1080p
- 30 fps

Thermal:
Long-wave IR Thermal Imaging
- 80x62
- 25 fps

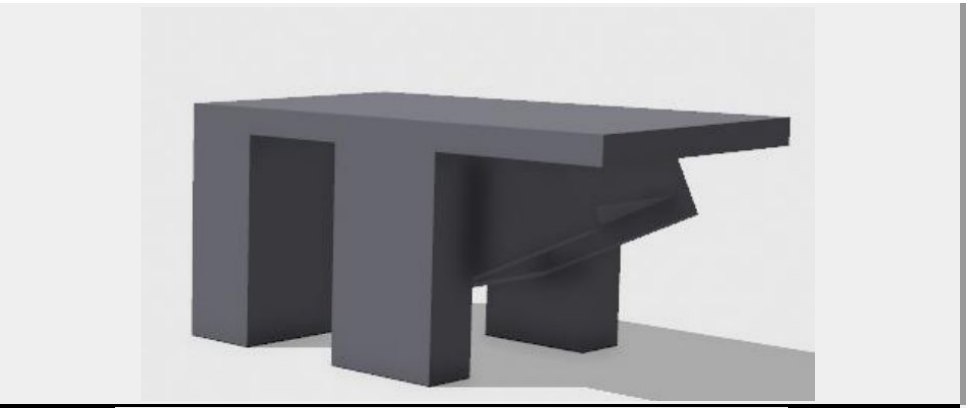
Current Camera-pi Configuration

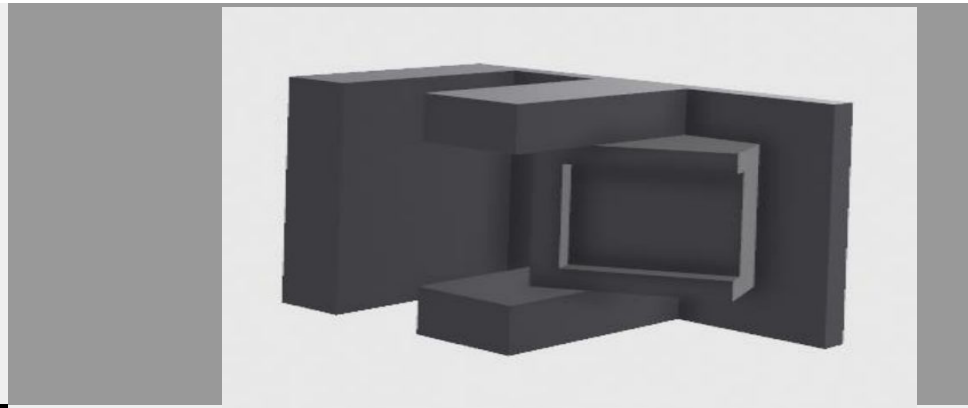
2.1

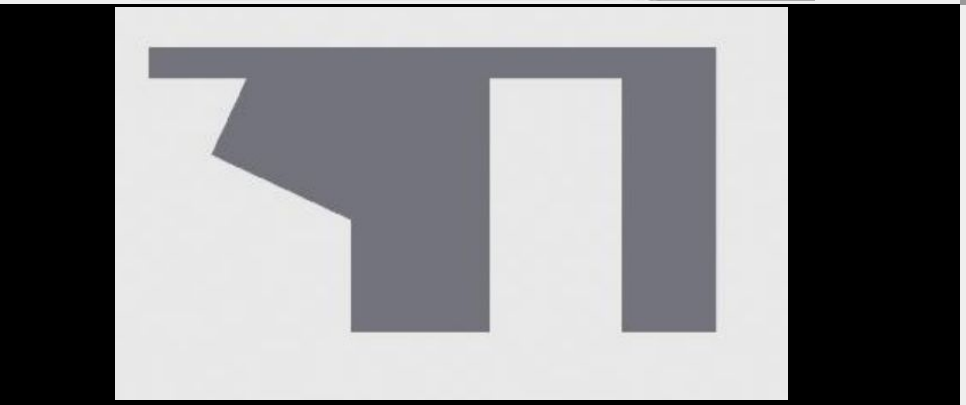
Hardware Configuration

Hardware Configuration

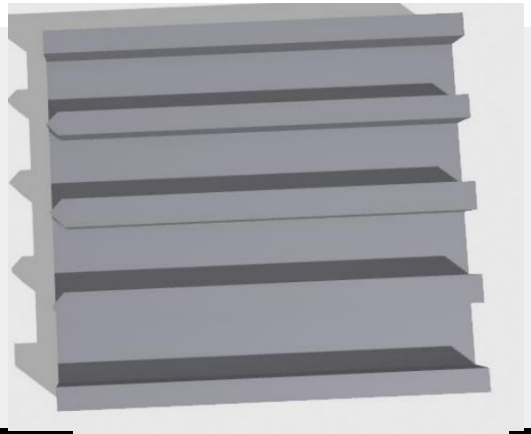
Pi RGB Camera Holder

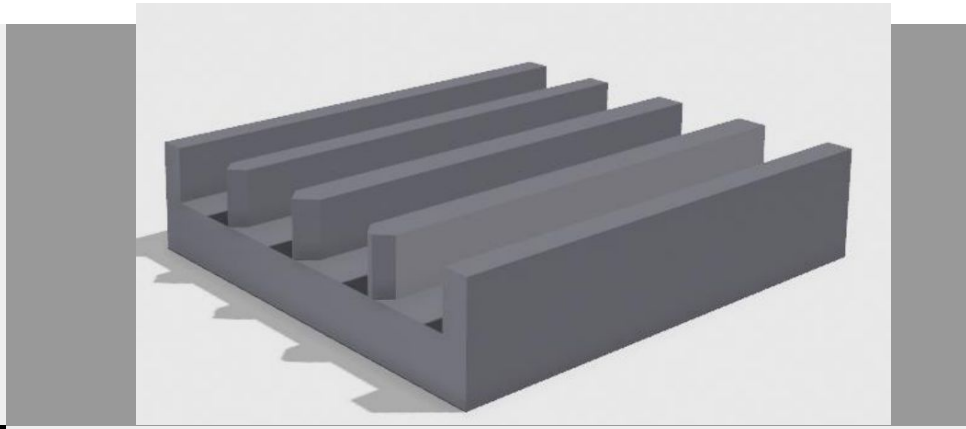


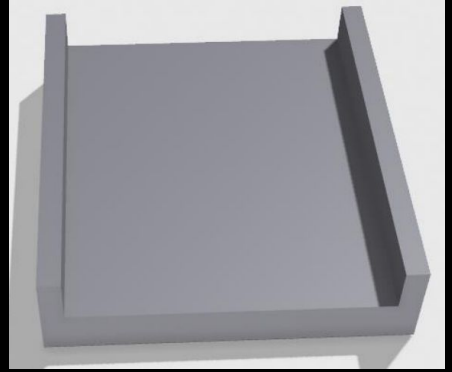




Hardware Configuration Testing Track





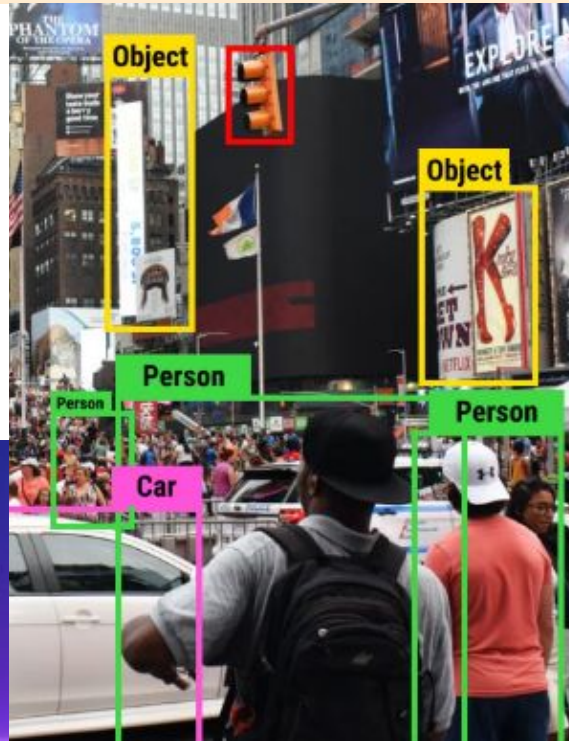


03

Backend

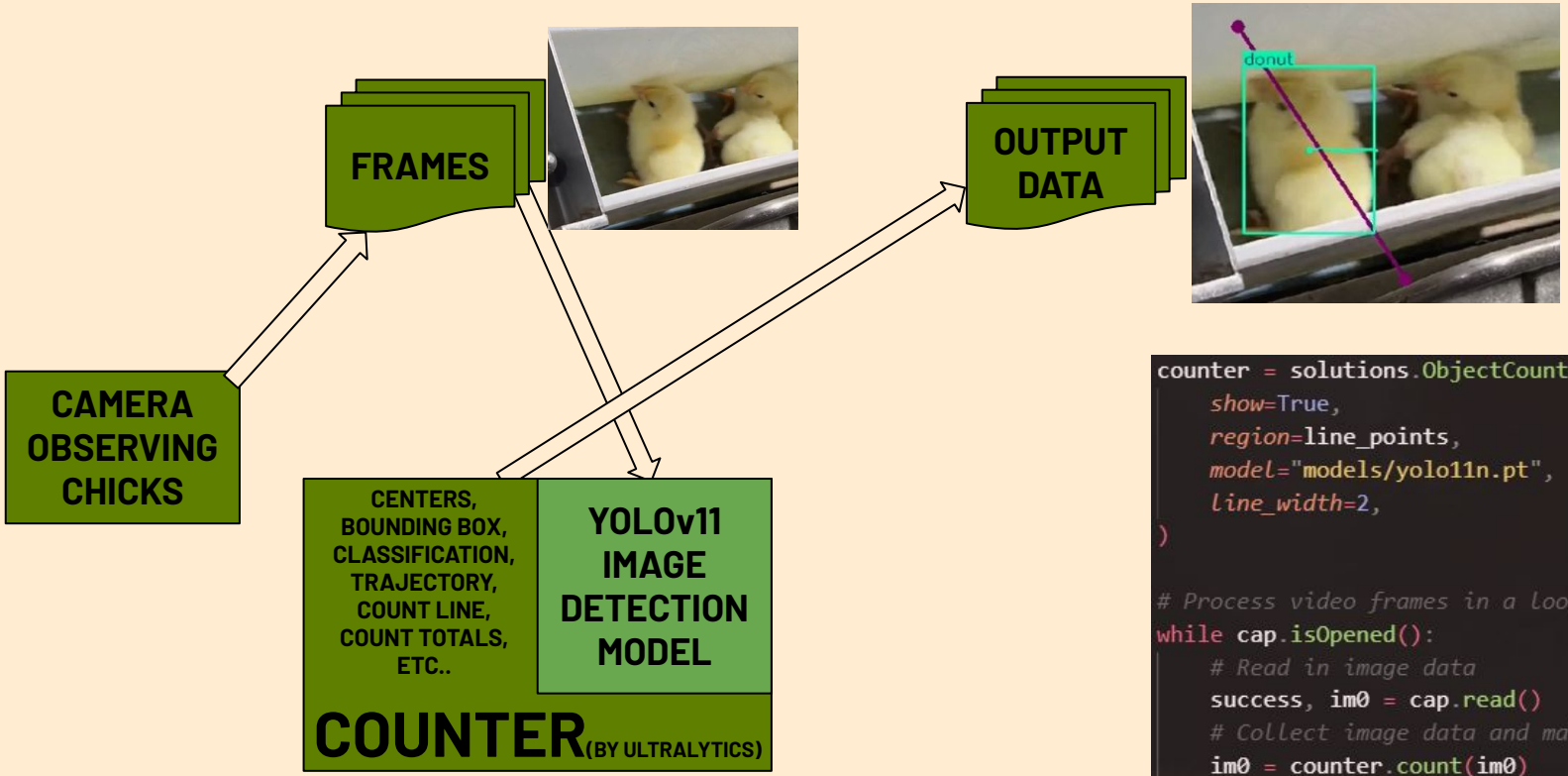
Client's Desired Path

Implementation of the pre-trained image classification model, "YOLOv11", by Ultralytics to identify and count chicks.



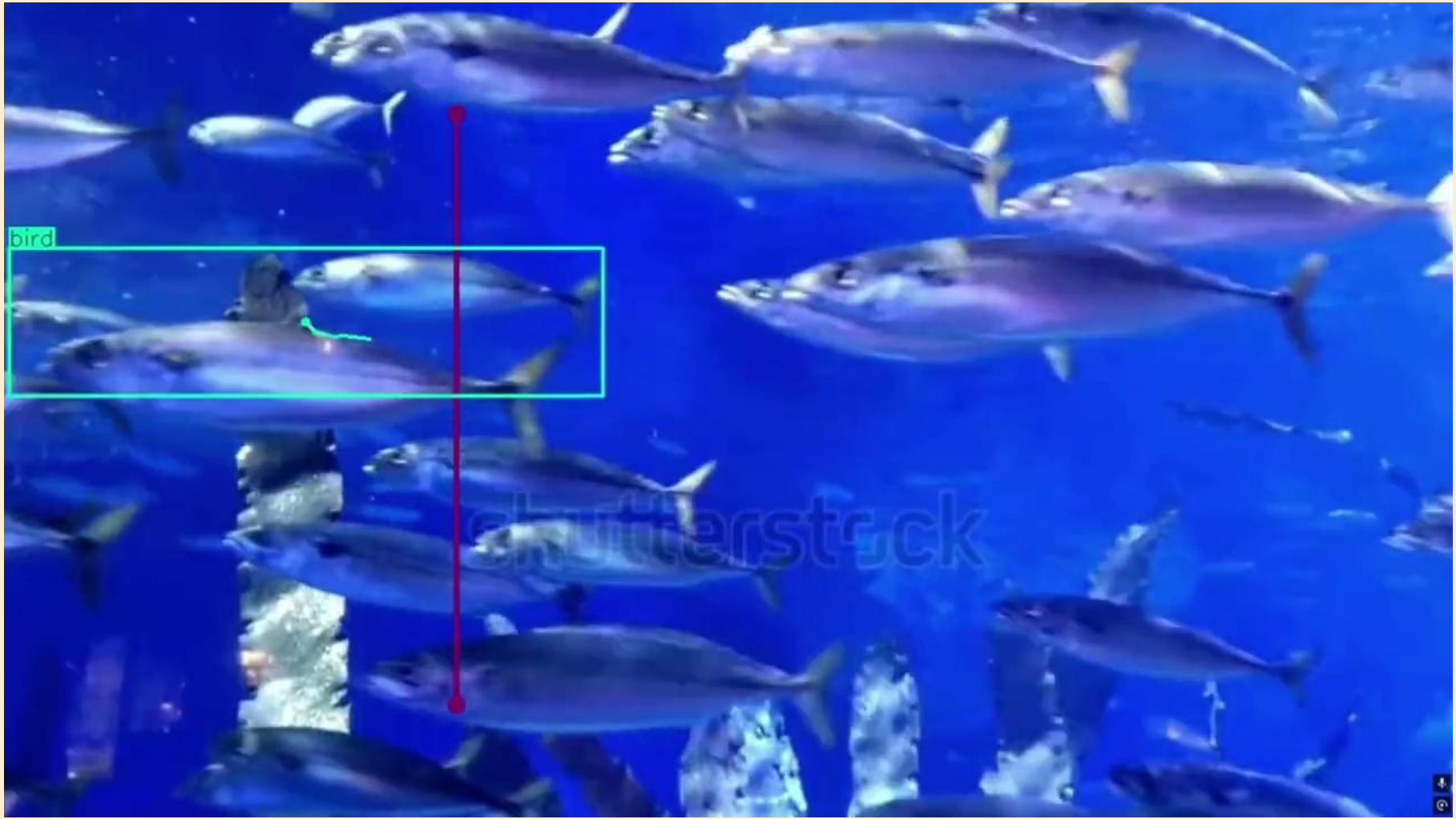
```python
# Open the video file
cap = cv2.VideoCapture("data/fishies.mp4")
assert cap.isOpened(), "Error reading video file"

# Get video properties: width, height, and frames per second (fps)
w, h, fps = (int(cap.get(x)) for x in (cv2.CAP_PROP_FRAME_WIDTH, cv2.CAP_PROP_FRAME_HEIGHT, cv2.CAP_PROP_FPS))

# Define points for a line or region of interest in the video frame
line_points = [(400, 100), (400, 620)]  # Line coordinates

# Initialize the video writer to save the output video
video_writer = cv2.VideoWriter("object_counting_output.avi", cv2.VideoWriter_fourcc(*"mp4v"), fps, (w, h))

model = "models/yolo11n.pt"

# Initialize the Object Counter with visualization options and other parameters
counter = solutions.ObjectCounter(
    show=True,                          # Display the image during processing
    region=line_points,                 # Region of interest points
    model="models/yolo11n.pt",          # Ultralytics YOLO11 model file
    line_width=2,                       # Thickness of the lines and bounding boxes
)

# Process video frames in a loop
while cap.isOpened():
    success, im0 = cap.read()
    if not success:
        print("Video frame is empty or video processing has been successfully completed.")
        break

    # Use the Object Counter to count objects in the frame and get the annotated image
    im0 = counter.count(im0)

    # Write the annotated frame to the output video
    video_writer.write(im0)
```

Ultralytics Live Object Counting

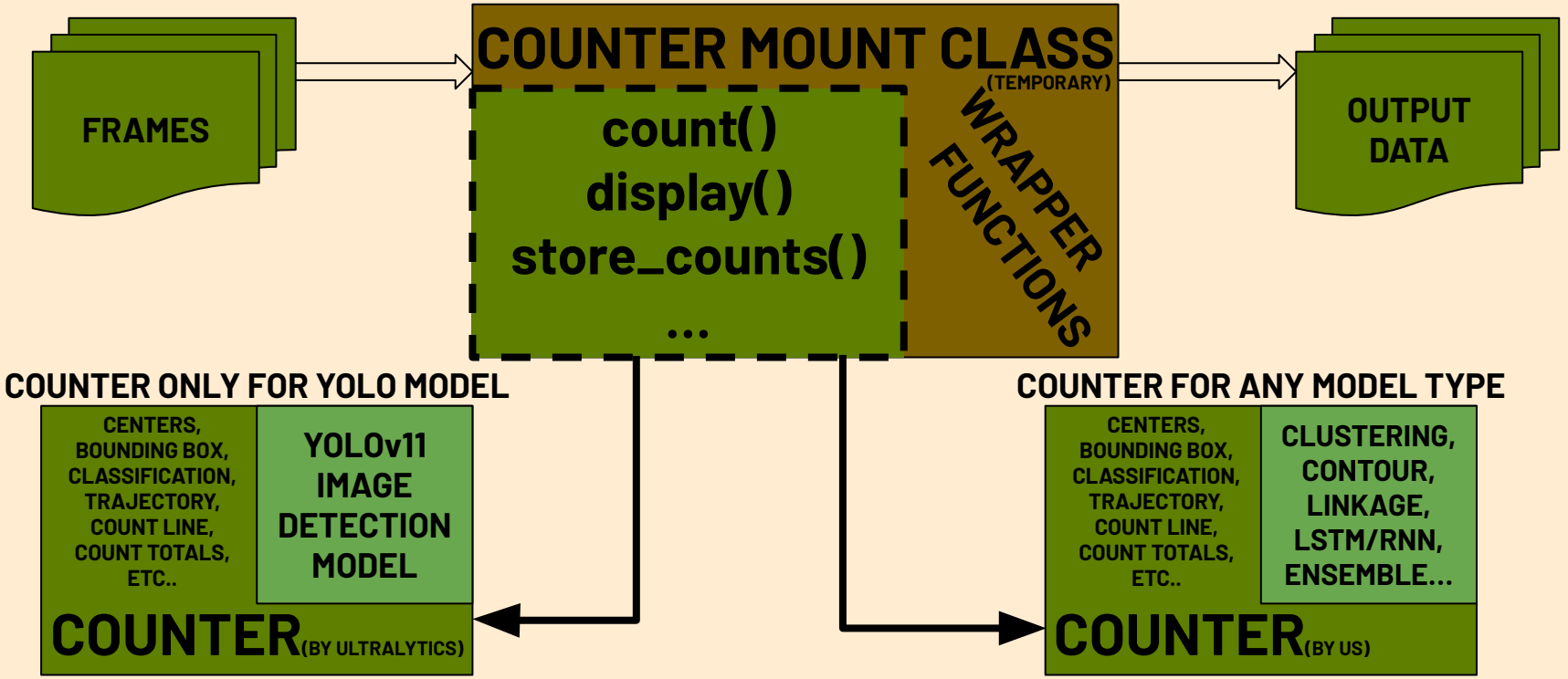



```python
counter = solutions.ObjectCounter(
    show=True,                                  # D
    region=line_points,                         # R
    model="models/yolo11n.pt",                  # U
    line_width=2,                               # T
)

# Process video frames in a loop
while cap.isOpened():
    # Read in image data
    success, im0 = cap.read()
    # Collect image data and make computations
    im0 = counter.count(im0)
```


shutterstock

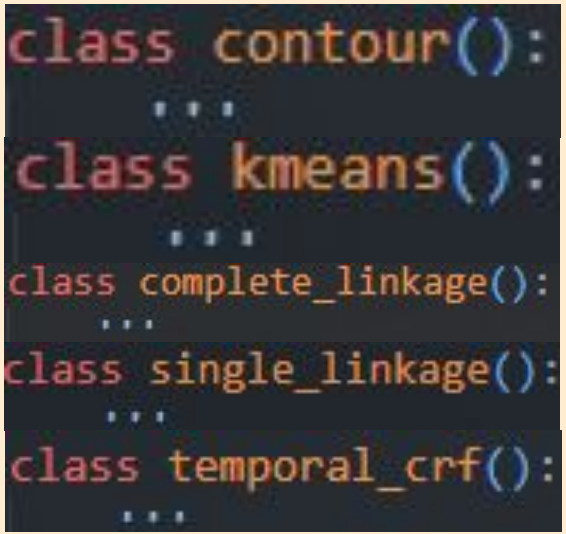

bird

Expanding Capacity of Counter

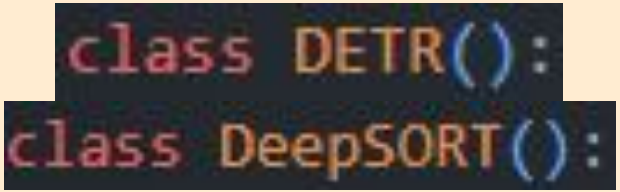


```python
#counter class, acts as a mount for yolo or custom models
class Counter():
    '''
    ### info: ###
    This class will load and mount a desired counter method.
    ### params: ###
    -   counter-type:
    -   -   Type of clustering model that will be used.
    -   counter-kwargs:
    -   -   Dict variable containing all parameters and values for the counter.
    '''
    def __init__(
        self,
        counter_type    :   Literal['YOLO','Clustering']    =   None,
        counter_kwargs  :   dict                            =   {}
    ):
        assert (counter_type != None), "Counter_type not defined for class 'Counter'. Please select a valid option."

        #define the counter type based off of counter method used
        match(counter_type):

            #if we are working with a YOLO based counter, make this class act as a mount
            case 'YOLO':
                self._counter = yolo_implementation.YOLO_ObjectCounter(**counter_kwargs)

            #if we are working with a custom clustering model, NOTE DEV HERE END#NOTE
            case 'Clustering':
                raise NotImplementedError(f'Counter type {counter_type} has not yet been implemented.')

        #this variable keeps the string variable of the type of counter, ex: YOLO
        self._counter_type = counter_type

        #this variable is a list of tuples, with each tuple being a coordinate of a center
        self._detected_object_centers = []

        #this variable is NOTE POSSIBLY TEMPORARY NOTE for tracking projection of centers
        #this variable will be a tuple of projected X, Y offset for next frame
        self._detected_object_vectors = []

        #this variable will be a dictionary (str:int) of detection classifications and totals over time
        self._detected_totals = {}
```

CLUSTERING APPROACHES



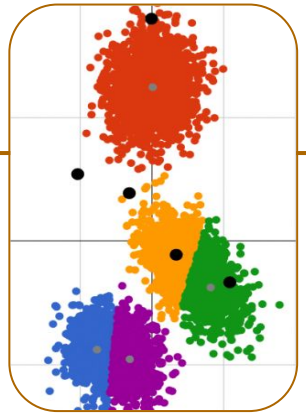
TRACKING APPROACHES



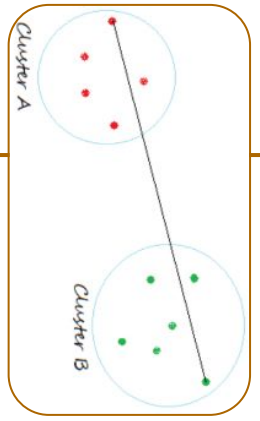
TEMPORAL / TIME-SERIES NEURAL NETWORK (LSTM-RNN)

Clustering / Tracking Methods

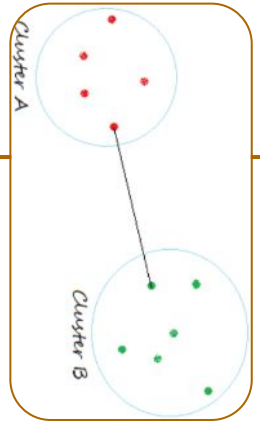
CONTOUR DETECTION
O(n) < t < O(n log n)
COMPLEXITY



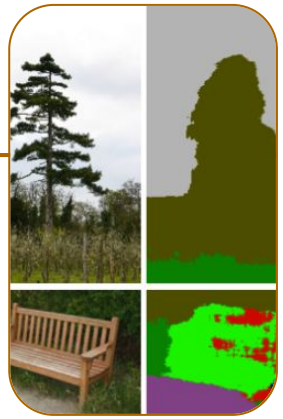
K-MEANS CLUSTERING
O(n*p*q*r)
COMPLEXITY



COMPLETE LINKAGE
O(n^2) < t < O(n^3)
COMPLEXITY

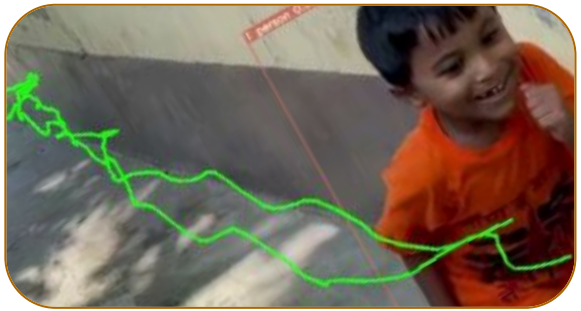


SINGLE LINKAGE
O(n^2) < t < O(n^3)
COMPLEXITY



CONDITIONAL RANDOM FIELD
O(n*k^2)
COMPLEXITY

RT-DETR **O(n) < t < O(n^2*k^2) COMPLEXITY**



DEEPSORT **O(n) < t < O(n log n) COMPLEXITY**

Tracking Loophole / Other Counting Approach

LSTM-RNN

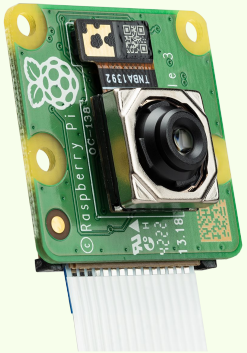
```python
def build_LSTM_model():
    model = tf.keras.Sequential([
        tf.keras.layers.Input(shape=(X_train.shape[1],X_train.shape[2])),
        tf.keras.layers.LSTM(256, activation='tanh', recurrent_dropout=0.0, return_sequences=True),
        tf.keras.layers.Dropout(0.25),
        tf.keras.layers.LSTM(128, activation='tanh', recurrent_dropout=0.0, return_sequences=False),
        tf.keras.layers.Dropout(0.25),
        tf.keras.layers.BatchNormalization(),
        tf.keras.layers.Dense(64),# kernel_regularizer=tf.keras.regularizers.l2(0.01)),
        tf.keras.layers.BatchNormalization(),
        tf.keras.layers.Activation('relu'),
        tf.keras.layers.Dropout(0.25),
        tf.keras.layers.Dense(params.target_neurons, activation=params.target_activation)
    ])
    model.compile(optimizer=opt6,
                  loss=params.loss_function
                  ,metrics=params.performance_metrics)
    return model
```

04

Sprint Goals

Sprint 2 Goals

Configure All Cameras

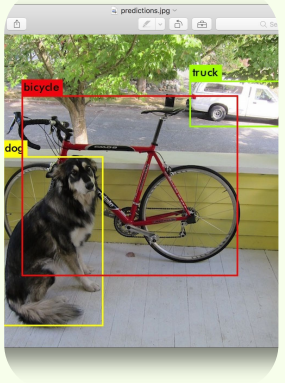


Attach, Write Scripts for
RGB & Thermal Cameras, testing on live environments and translating video to model-usable format

Perform Tests using Mock Environment

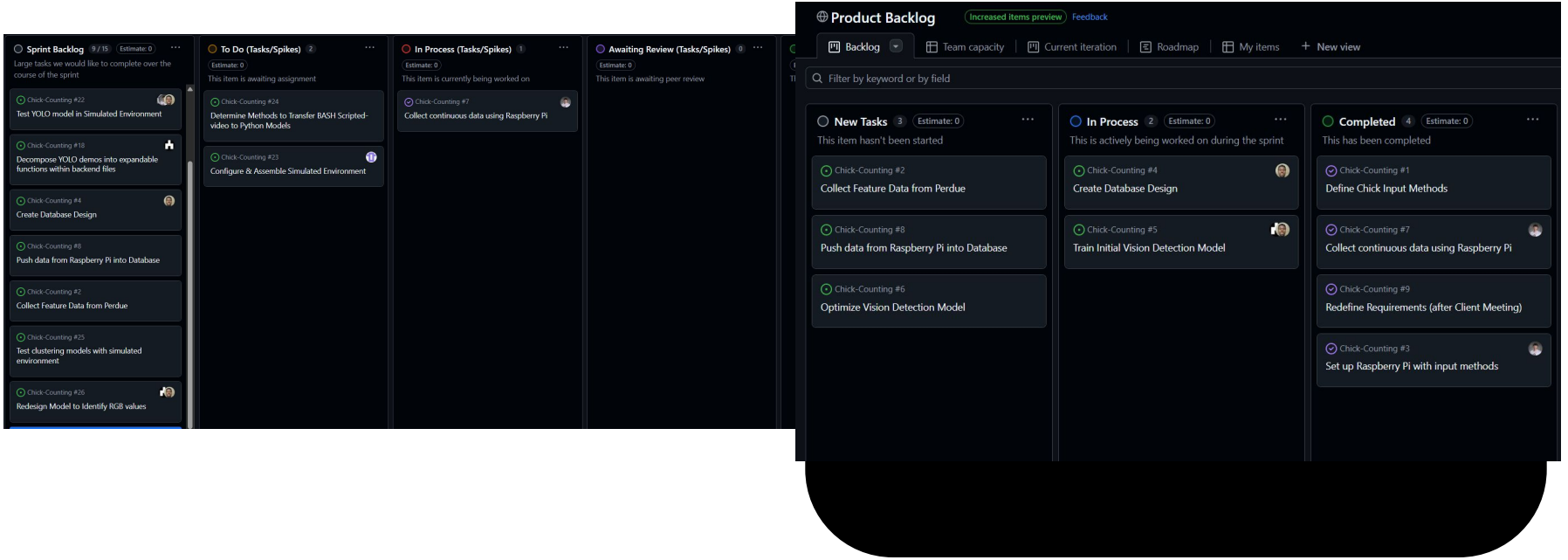
Utilize the Cameras & YOLO Models
To run tests in the simulated environment

Optimize YOLO & Custom Models



Using simulated environments
Test and optimize YOLO & Custom models to determine the best approach looking forward

Updated Product/Sprint 2 Backlog



Questions?

THANK YOU

Chick Counting