Analyzing Pedestrian Activity with Computer Vision

Jeesoo Kim, Morgan Hobson, Aidan Smith, Kavya Tumkur

Druid Hill Park: A Matter of Funding

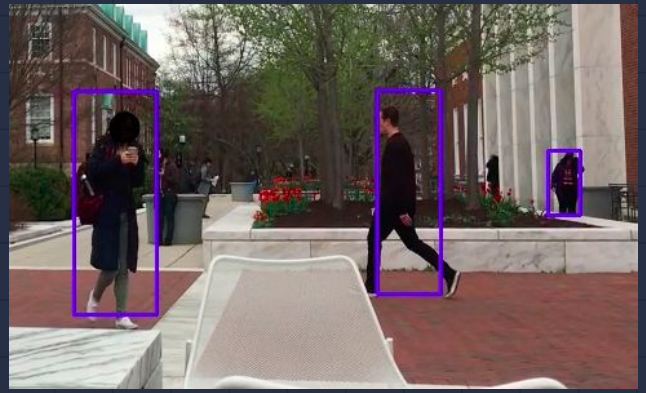
Objective:

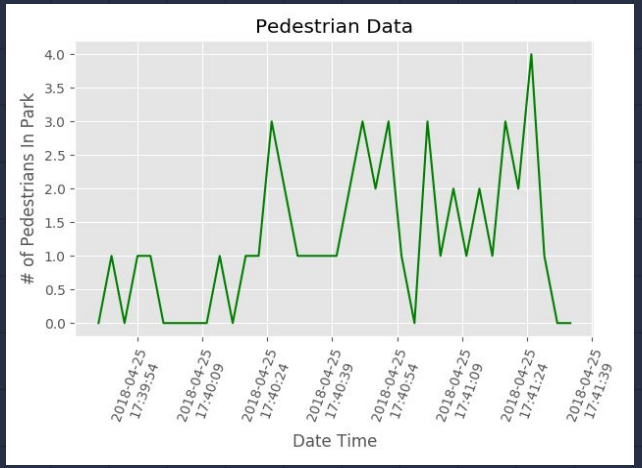
Develop software that analyzes video streams to provide park usage statistics

How?

1. Object Detection and Tracking Algorithms

2. Data Visualization

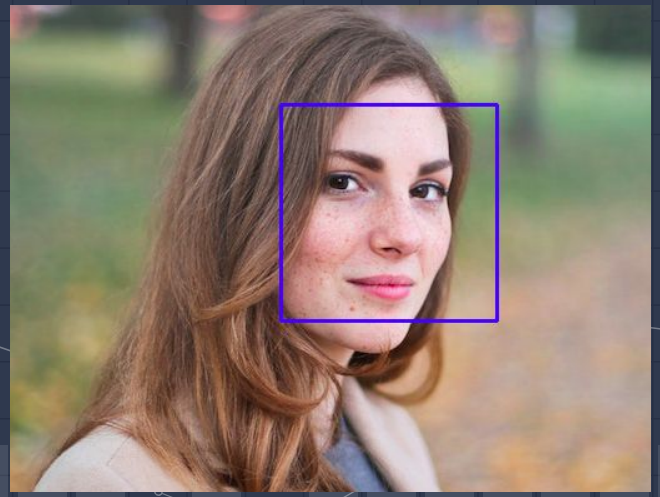




Development Process:
Object Detection and Tracking

Object Detection Algorithm

- Objects scored based on classified images
- Face detection: Haar cascades
- HOG Detector
- TensorFlow Single Shot Detection (SSD)



Object Detection: Challenges

False positives and negatives

Object Detection

Detecting people with TensorFlow
< Livestream >

Isolating objects using
background subtraction

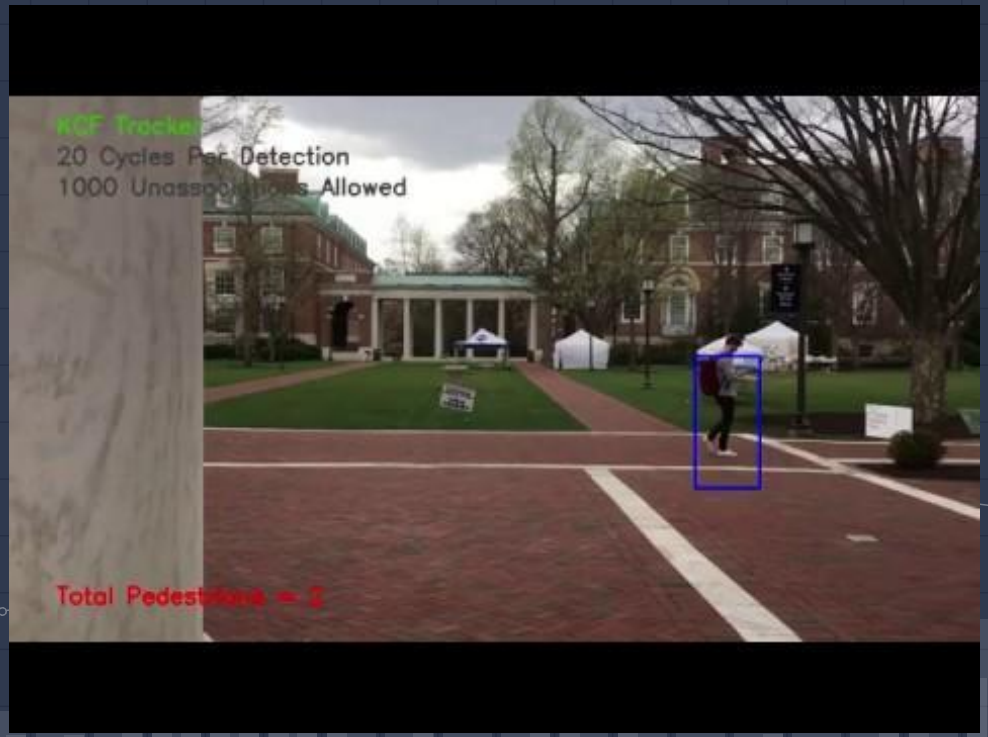
Tracking Algorithm: Early Stages

- Context used rather than from scratch
- Faster speeds with tracking
- Works by providing bounding box

How a Tracker Works

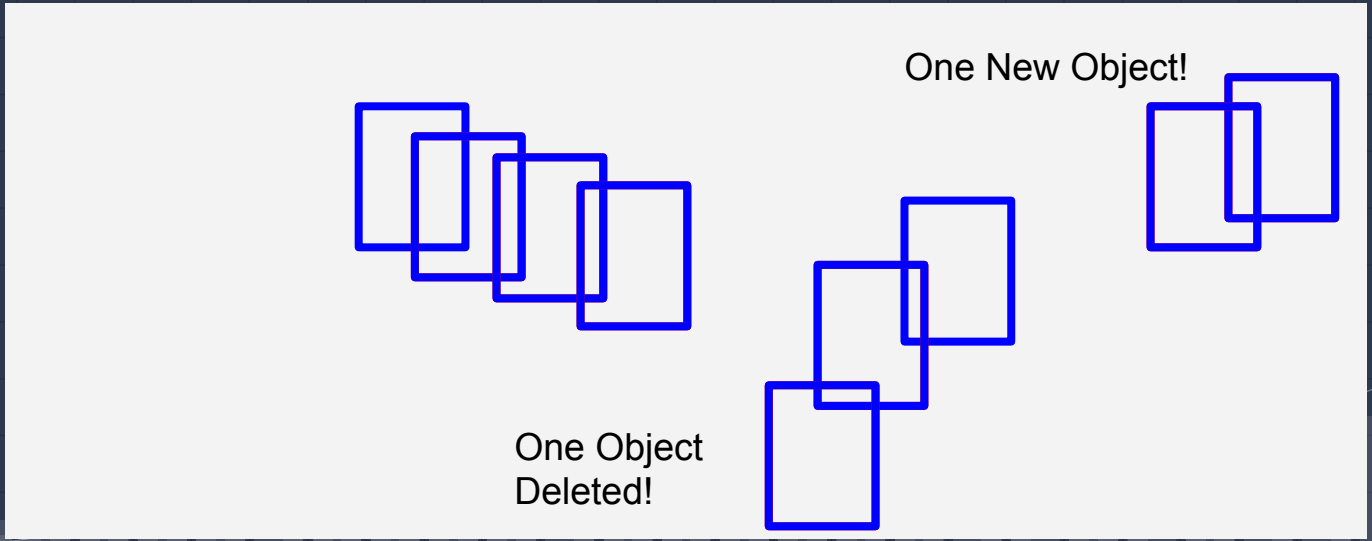
Tracking Algorithm

- Hanging trackers
- Accumulation
- Tracking failures



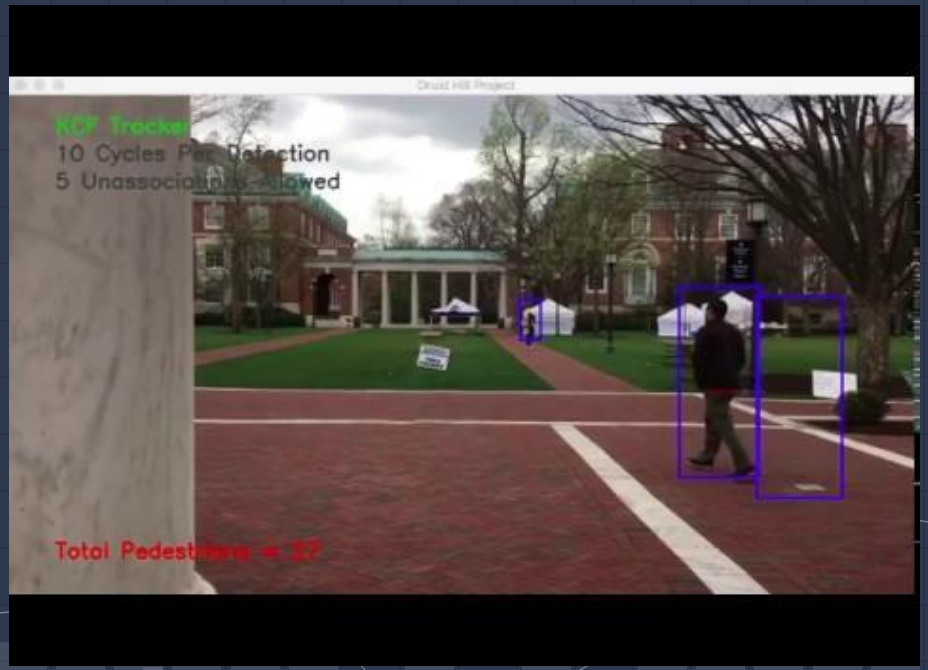
Solution: Hungarian Algorithm

- Allows for the assignment of old objects to new objects using the context of previous frames



Tracking + Hungarian Algorithm

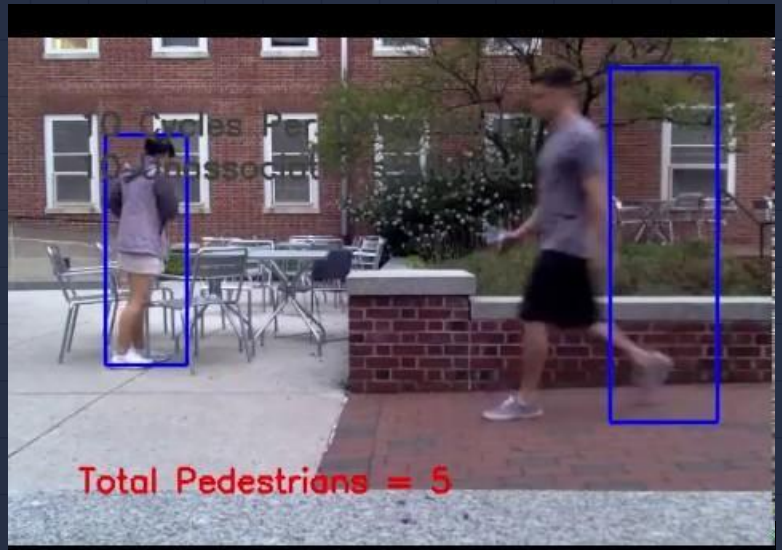
Tracker Accumulation

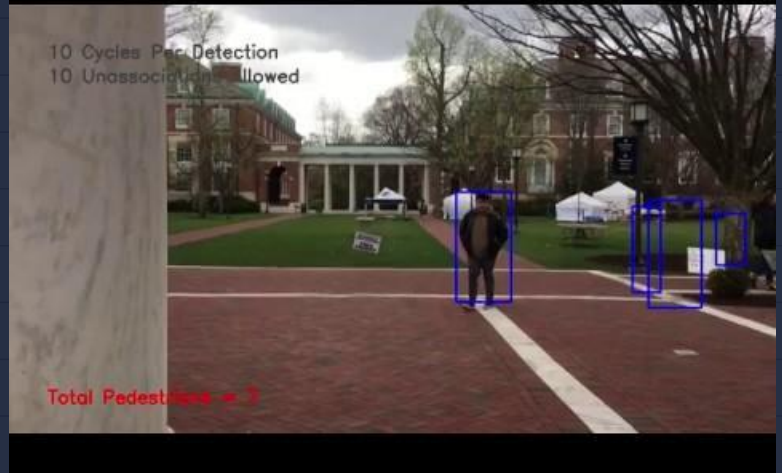


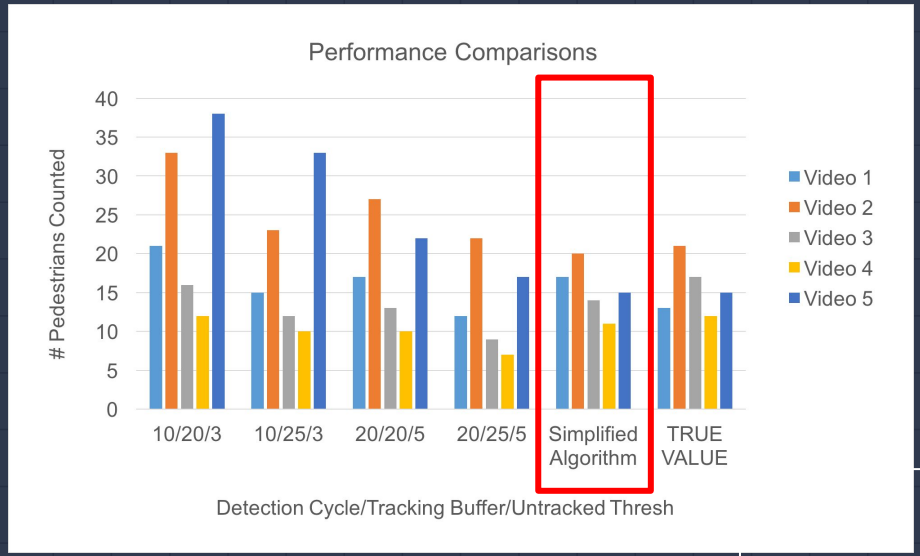
Improved Performance

Simplified "Radical" Algorithm

- Hungarian Algorithm applied to current and previous frame
- No tracking component







Performance Evaluation

	Video 1	Video 2	Video`3	Video 4	Video 5	Avg. Error
20/20/5	17	27	13	10	22	23%
20/25/5	12	22	9	7	17	22%
Simplified	17	20	14	11	15	12%
Expected	13	21	17	12	15	-

Final Verdict

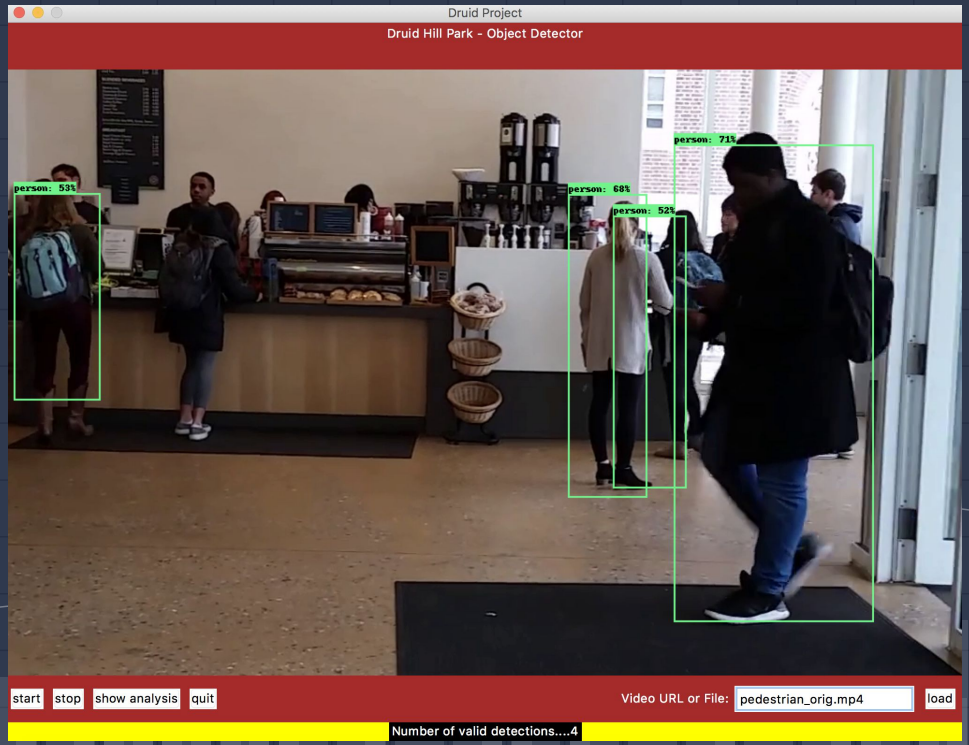
- Tracking implementation *currently* unsatisfactory
- Simplified Algorithm provides best performance
- Accurate pedestrian tracking = feasible!

Live Stream Demo

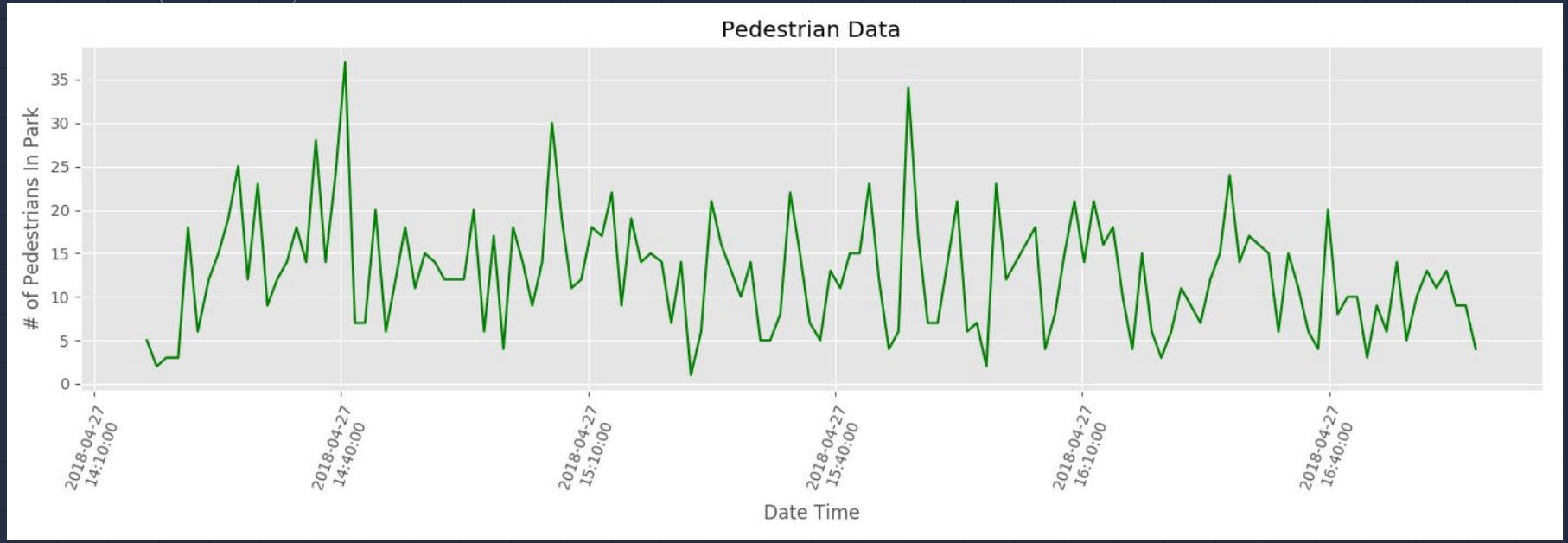
Usability
+
Data Visualization

Graphical User Interface

- Displays people count with boxes and percentages
- Text field allows user to input video file names and/or livestream URLs



Live Data Collection



< Alumni Weekend: Hopkins Livestream >

Future Steps

- Improve detection by training our own neural net
- Combine techniques to reduce tracking failures
- Extend detection to vehicles
- Additional GUI functionality i.e. graph toggling, data manipulation, etc.

Special Thanks!

Yair, Amy, Jacob

Questions?