Roke

Part of the
Chemring Group

UDRC WAMI Challenge

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Problem

Problem

Detecting vehicles and pedestrians (targets) in urban areas using an airborne camera, from anything other than a vertical viewpoint, is difficult as much of the road network is occluded by:

- Buildings;
- Trees;
- Shadows.

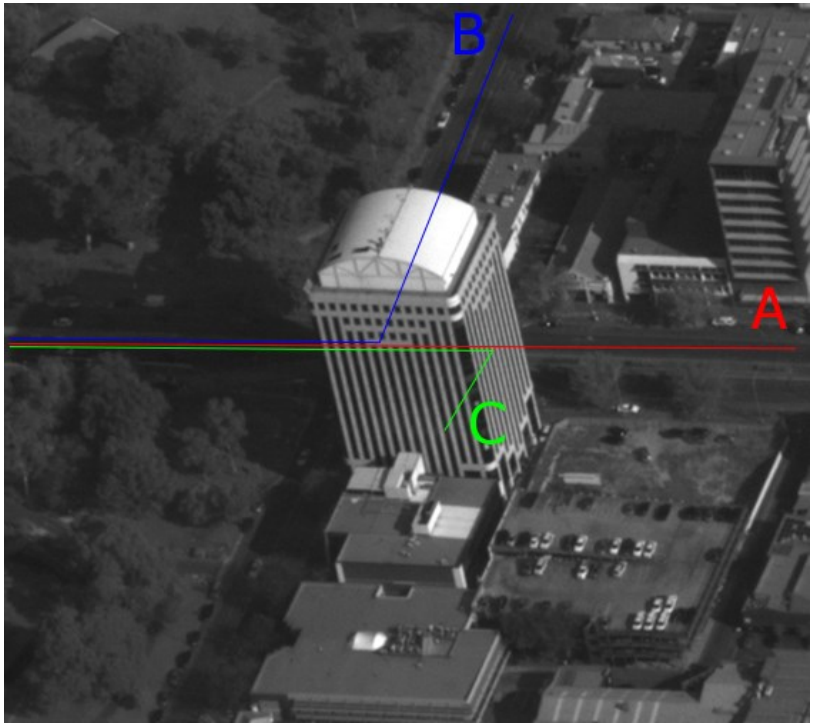
Problem

Determining tracks of a target's movement through such an area is then also difficult, as there is a need to distinguish between:

a) temporary occlusion;

b) change in velocity;

c) permanent occlusion where targets are no longer visible in the state space (having entered a building, for example).

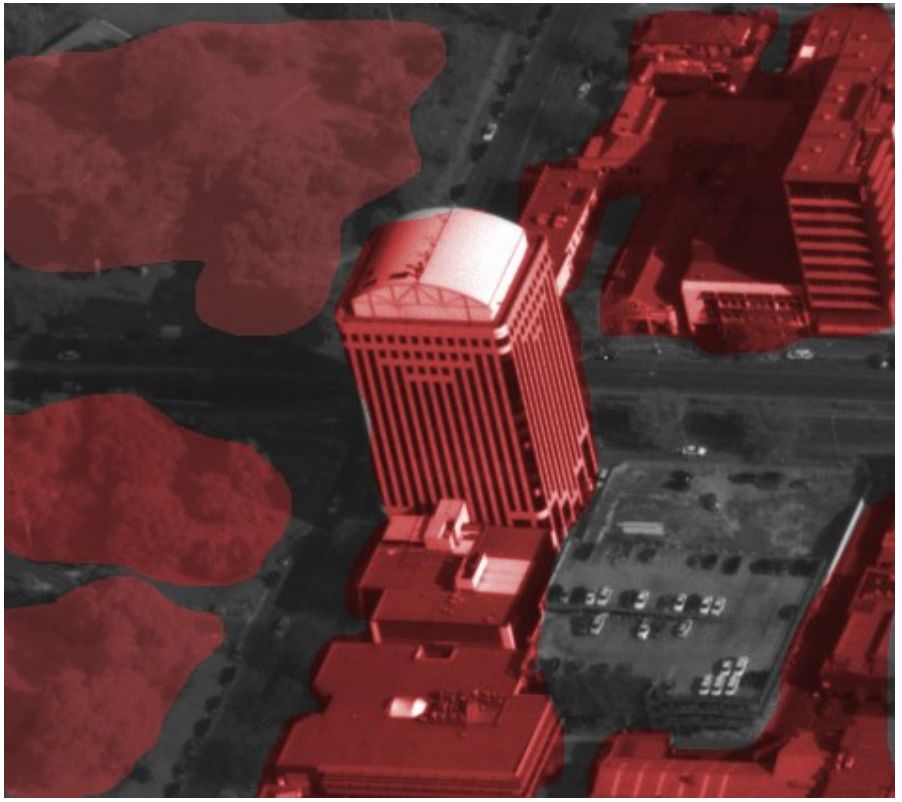


Problem

- Some Bayesian trackers contain models of the detection likelihood of a target;
- They require a high level of uncertainty in that model if there is a variable amount of occlusion;
- This high level of uncertainty in the detection likelihood propagates a larger proportion of candidate tracks;
- This is undesirable in regions with low levels of occlusion such as extra-urban areas.

Problem

- Terrain models can provide some information about an urban area by providing building heights, but they cannot cope with real-time changes in the environment (for example due to building work);
- Knowledge of occlusion using real-time information would aid our filter design, as we can:
  - reduce the detection likelihood in occluded areas;
  - propagate candidate targets;
  - improve re-identification quality as the search space for detection is reduced.



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Challenge

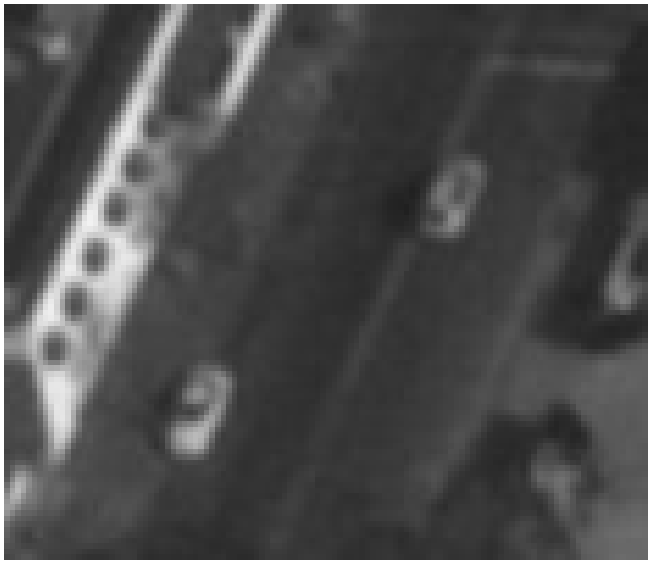
Challenge

Determine and label parts of each image that are occluded due to buildings.

- The dataset is a set of frames recorded over Adelaide's business district;
- Given a sequence of images and camera metadata, produce a binary mask for each image where pixels are given a value of occluded (0) or visible (1);
- The binary mask should treat the building footprint as equivalent to occluded ground;
- Novel approaches that can detect occlusions due to trees or areas in deep shadow are also welcomed, however such features won't form part of the scoring metric.

Dataset: Target Level

Resolution of a single target:



Dataset: Street Level

Resolution of a building:

Dataset: Single Camera

Resolution of a single camera:

Dataset: Whole Scene

Resolution of all six cameras:

Dataset format

Series of 48 RAW frames each with 6 cameras:

- Labelling format: date–frame_number–camera_number-VIS;
  - Example: 20140521042753-03032396-05-VIS
- Each camera image is 3248x4872 pixels;
- The framerate is approximately 3Hz;
- There is a small percentage of overlap between each camera;
- The pointing angle of the camera is approximately 45° from horizontal, but can be calculated with the accompanying metadata.

Dataset format

- Image rotation is camera dependent:
  - Even numbers are rotated clockwise and flipped
  - Odd numbers are rotated anticlockwise and flipped
- Each camera is laid out in the frame as follows:

3	**1**	**5**
2	0	4

POS Files

- Each frame comes with a POS file to specify the camera metadata:

	Camera								IMU Velocity					
Sensor name	**Yaw**	**Pitch**	**Roll**	**Latitude**	**Longitude**	**Altitude (ft)**	**IMU time (s)**	**GPS week**	**North**	**East**	**Up**	**IMU status**	**Offset from UTC**	**DST Flag**
$LAIR2	109.857426	1.803828	29.014919	39.753101	-84.130597	16843.046851	332717.087305	1554	-33.635874	83.931935	0.340803	3	-4	1

Reading the RAW files

```
#!/usr/bin/python

import numpy as np


file_path = /path/to/file

Even=True

height = 3248

width = 4872

img = np.fromfile(file_path,dtype="B")
img.shape = (height, width)
img = np.rot90(img)


if even:
    img = np.flipud(img)
else:
    img = np.fliplr(img)
```

Scoring

- Each image will be compared with our ground-truth data to determine how many buildings are causing occlusion;
- A score will be calculated based on the similarity to our ground-truth using the Jaccard index:

$$J(A,B) = \frac{|A \cap B|}{|A \cup B|} = \frac{|A \cap B|}{|A| + |B| - |A \cap B|}, \qquad 0 \leq J(A,B) \leq 1$$

Submission

- Submission date will be in October;
- submission portal details will be distributed at a later date;
- data can be submitted as a zipped set of binary masks in png format, labelled using the same format as the input:
  - 20140521042753-03032396-00-MASK
  - (Date – frame – camera – MASK)