Large-Scale Detailed Mapping of Dengue Vector Breeding Sites Using Street View Images

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Dengue Prevention and Control

- No curative treatment
- Vaccine: CYC-TDV or Dengvaxia
  - 60% effectiveness
  - Not approved for use in children under 9 years old
  - Not a viable single line of defense
- Targeted environmental and ecosystem management still crucial to control

Mosquito Vector

- Aedes aegypti
- Breeding Sites – very small
  - Artificial water containers: jars, flower pots, pails, old tires
  - Natural water containers: coconuts
- Relatively immobile: travels less than 400m from breeding site
- Combination results in highly localized sites of disease transmission
- If we can detect breeding sites, we can map risk and focus intervention

Breeding Site Mapping: Current Approaches

- Manual surveys
  - Larval surveys
  - Teams survey areas and sample containers
  - Breteau Index (BI), House Index (HI), Container Index (CI)
  - Does not scale to large areas
- Remote Sensing
  - Use proxies such as land cover
  - Resolution too low to detect breeding sites
- Proxies
  - Socio-economic status
  - Access to running water
  - Indirect, low resolution

Objective

- Create highly detailed maps of vector breeding sites at the scale of cities and provinces.

- Approach – Automatically detect breeding sites in street view images.
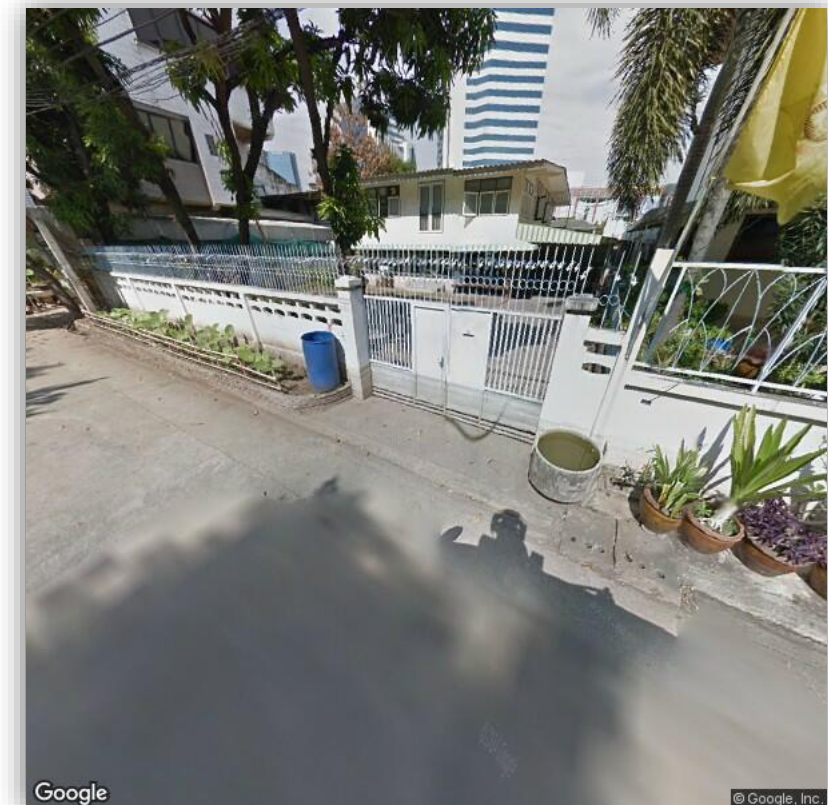   - Can also be applied to drone images

- Images are automatically gathered from Google street view by following all roads in a region.
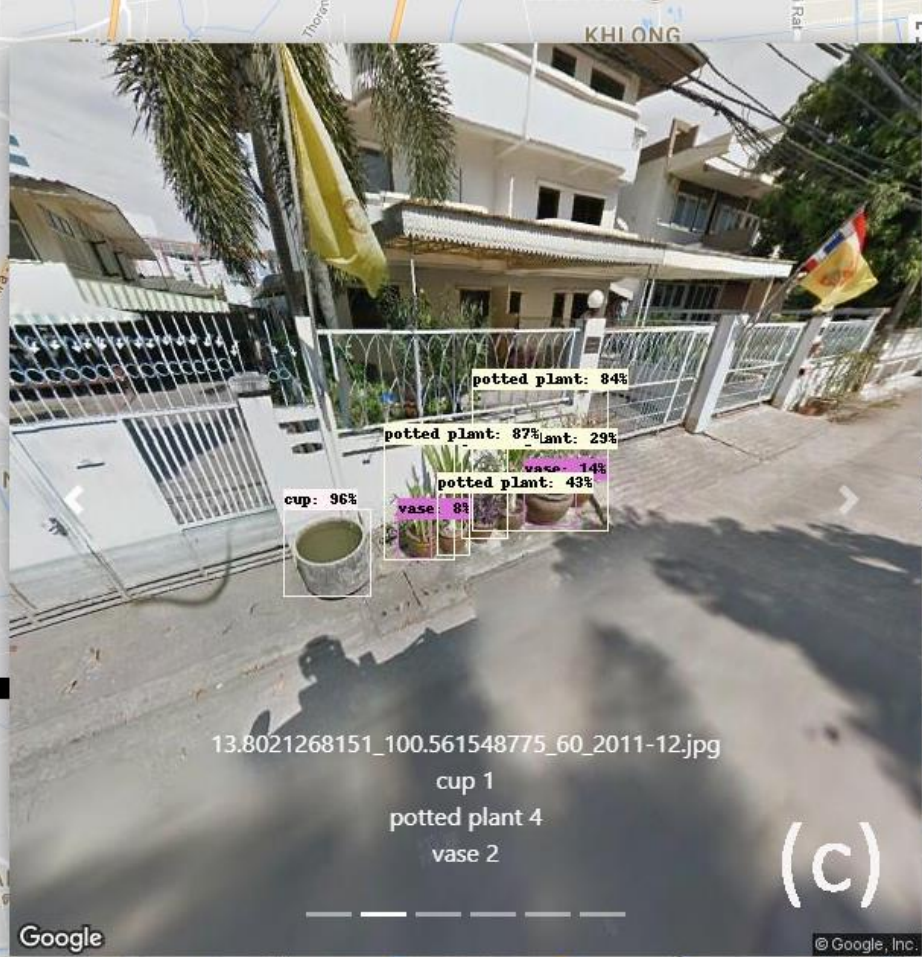- Follow each road and collect six images (panning in a circle) every 50 meters.
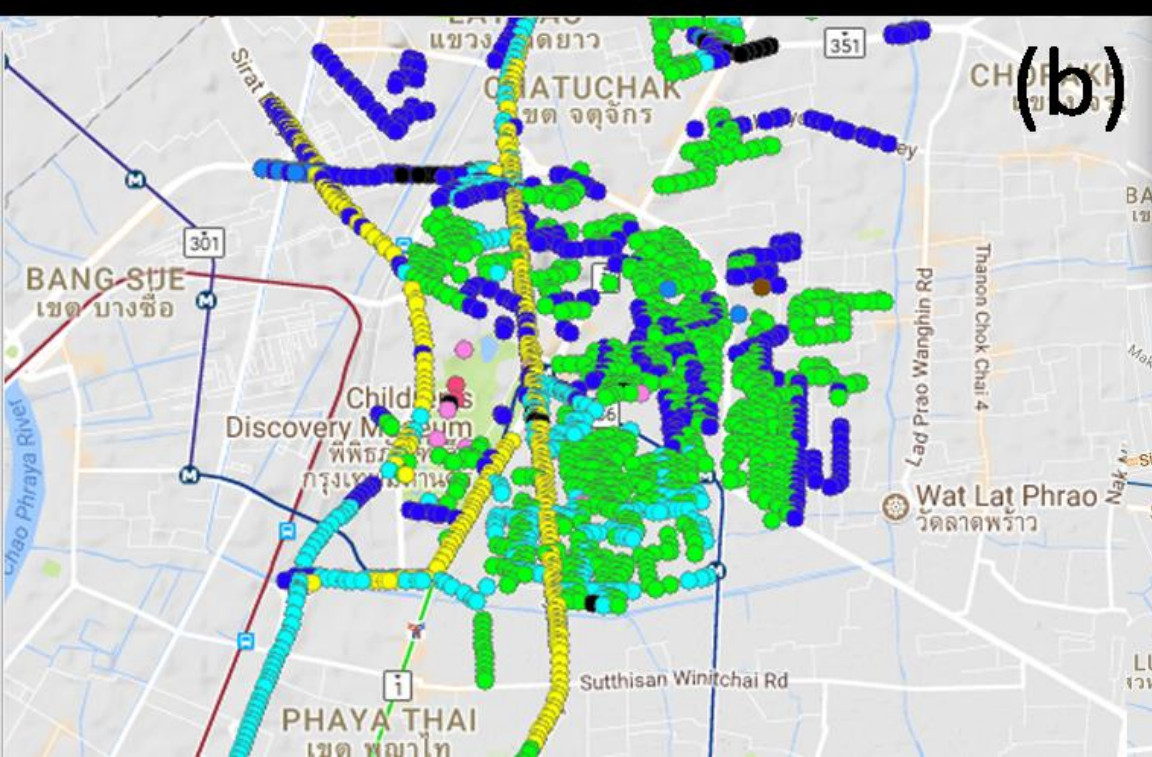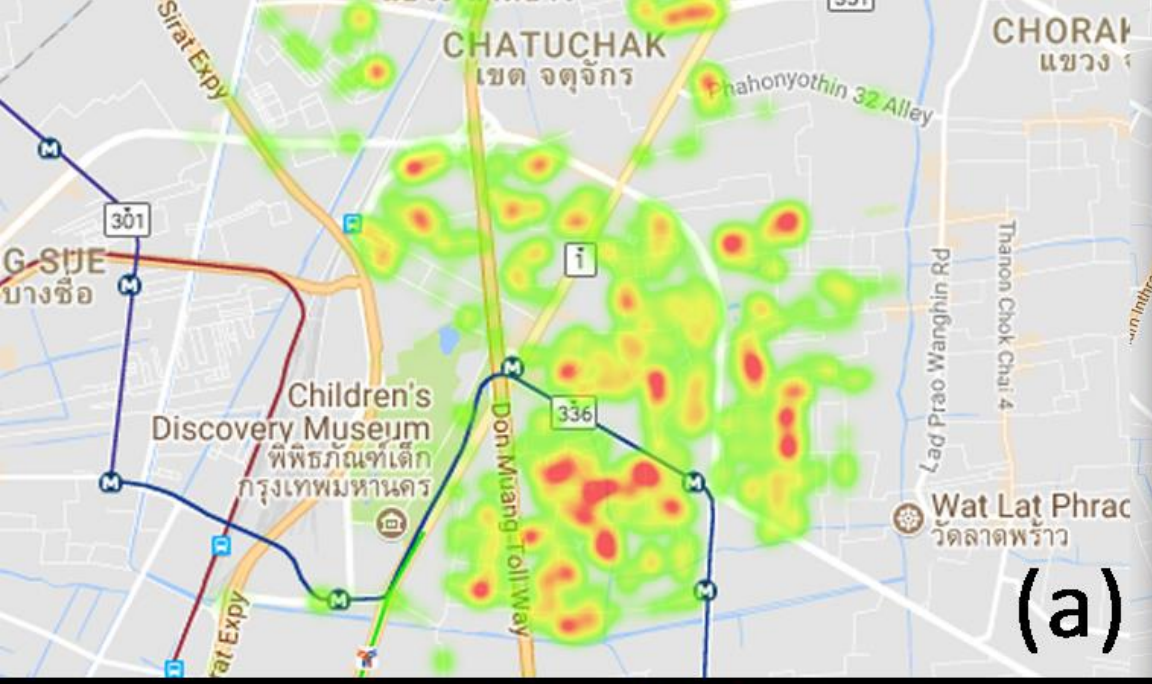
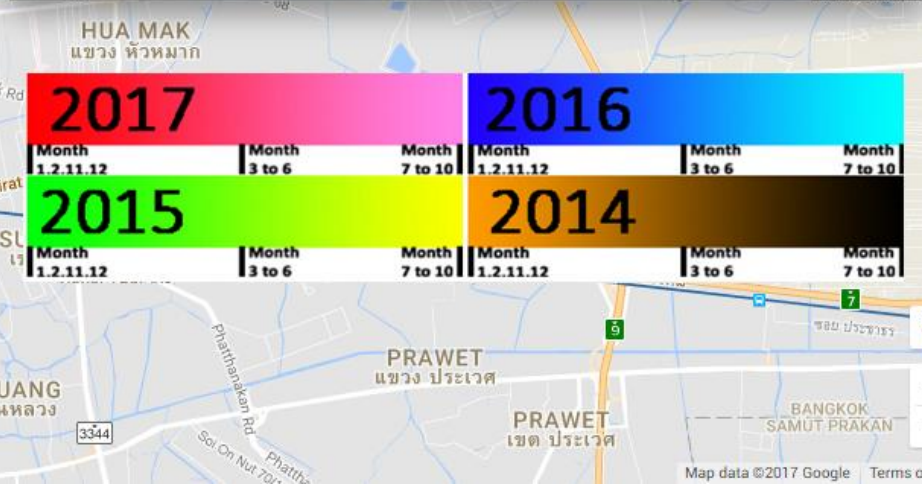

Road map

Sample points

Google street view image

- We use the existing **Faster R-CNN** object detection network we to recognize mosquito breeding sites.   Running time is on the order of 5 frames per second.

- (a) Heat map
- (b) Age map
- (c) Drill down to image with breeding sites

- Chatuchak district of Bangkok.

Ongoing Work

- Improve accuracy of breeding site recognition
  - Transfer learning
- Use breeding site information to create Breeding Site Index (BSI)
- Determine relation between BSI and
  - Larval indices: Breteau Index, House Index, Container Index
  - Mature mosquito vector counts
  - Dengue cases
- Evaluate added value of BSI in predictive modeling
- Create decision support tool
- Incorporation of drone and mobile phone image data