

Transportation

Economy

Health

Development

Sustainability

Transportation is vital to healthy development.
Global transport networks are failing under increased demand
with far-reaching and disastrous effects.

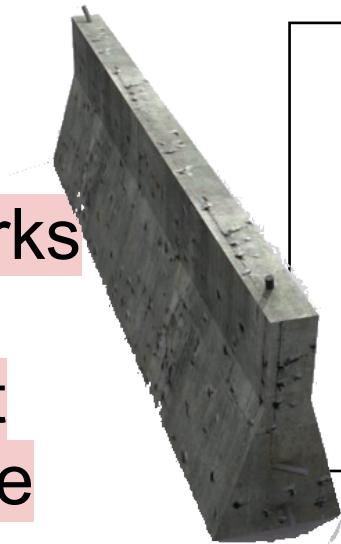


CCTV Monitoring

- Infrastructure
 - Personnel
 - Electricity
 - Data networks
- Cost
 - Deployment
 - Maintenance



...a rich-nation-only solution.



Development Systems

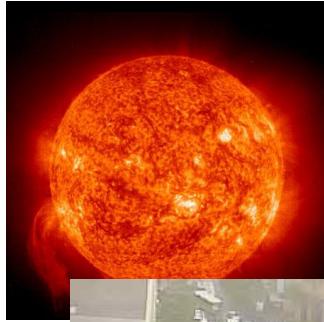
do **more** with **less**.



Introducing...

low-cost, low-power hardware
for real-time signal control.

Computer vision = pixel-based signal processing.



daytime



Color.
Cluttered feature space.
Global illumination effects.



nighttime



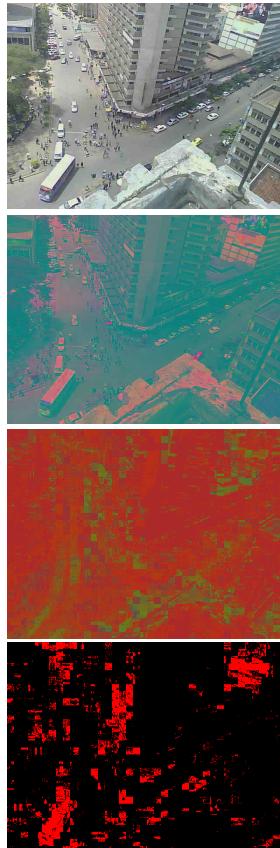
Loss of color.
Headlights.
Local illumination effects.

daytime

- Focus on segmentation of car pixels from background.
- Minimize parameters and training.

Gaussian mixture model:

Each pixel = mixture of colors generated by multiple surfaces.



R'G'B'

Y'CbCr

Learning

Mask



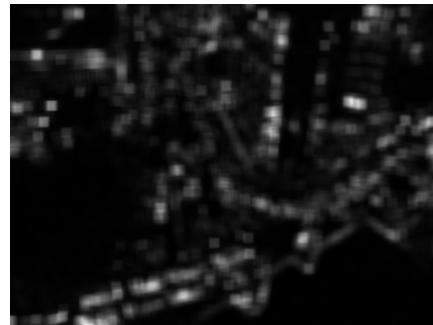
nighttime

- Focus on detection of headlights.
- Minimize parameters and training.

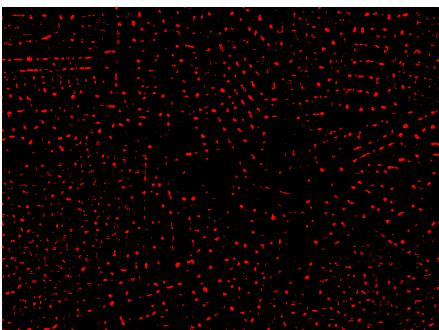
Adaptive bright object detection:
Find local bright objects and then perform global filter.



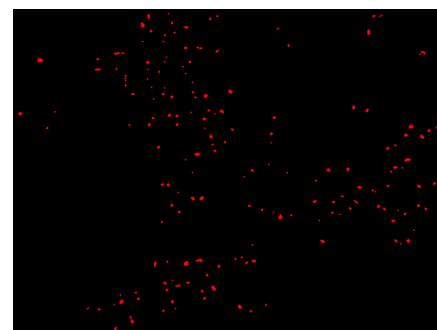
Denoise



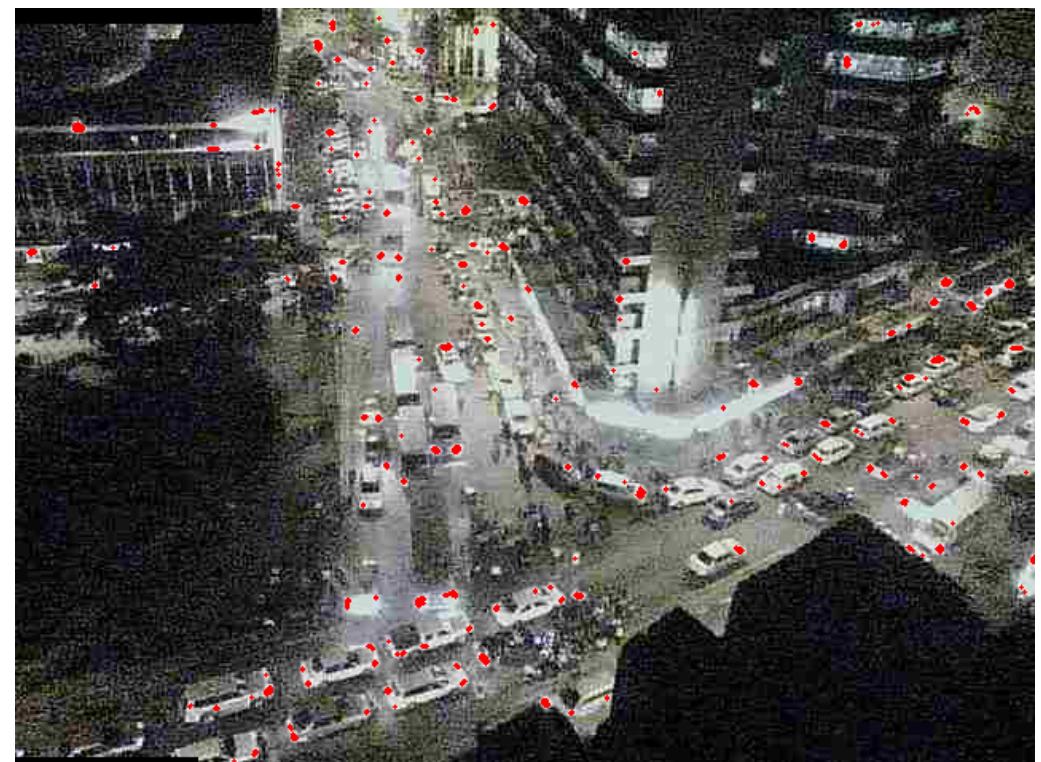
Variance



Local

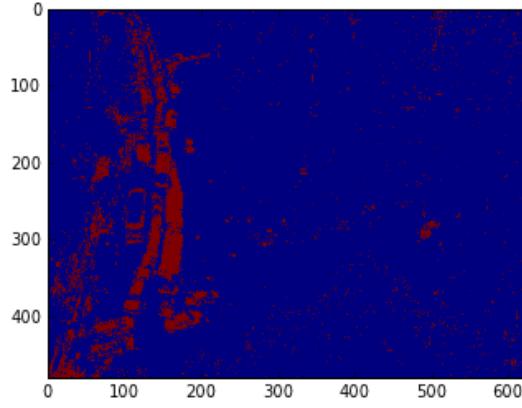
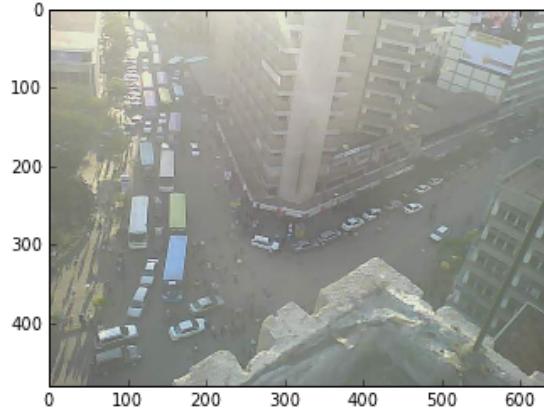


Global

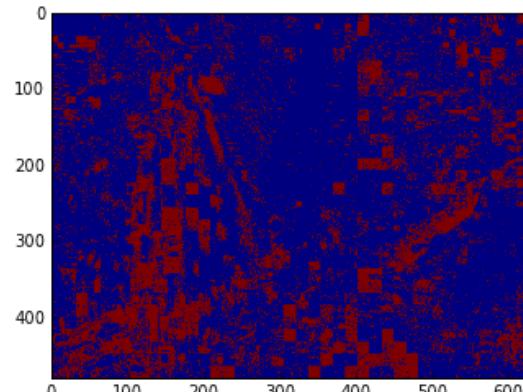


results - daytime

Good segmentation under limited illumination conditions.



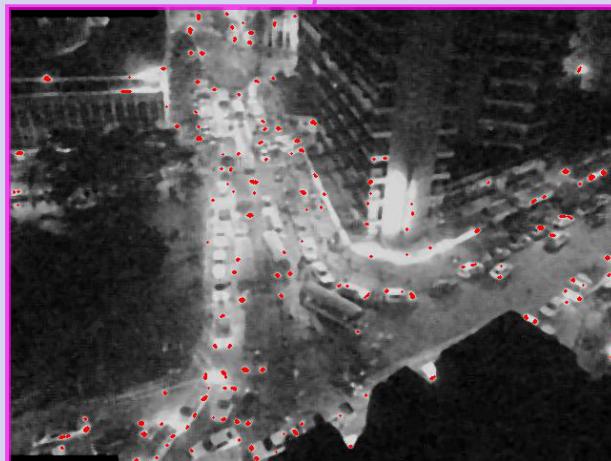
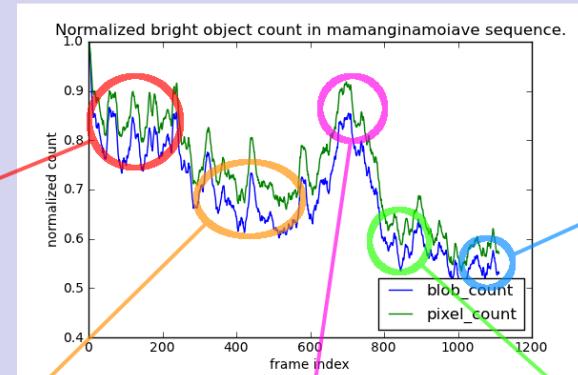
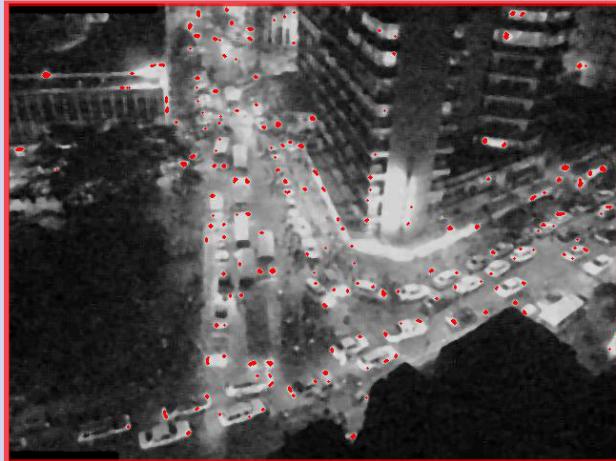
Extremely sensitive to proper image exposure.
Severe artifacts from JPEG image compression.
Try mean-shift clustering to identify vehicles.



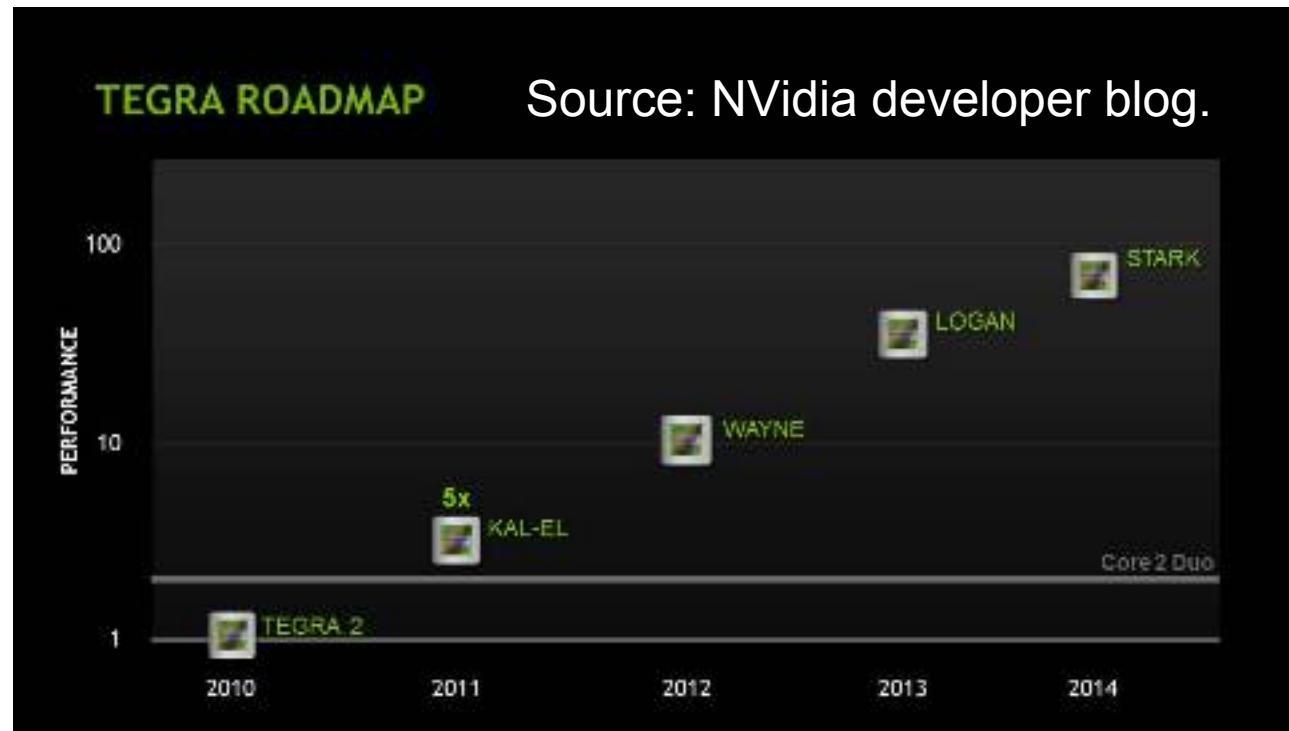
results - nighttime

Satisfactory performance correlated with visual inspection.

Background modeling to eliminate static/flashng features.



Welcome to the age of inexpensive and highly capable embedded platforms.



GPU + mobile devices = innovative development systems