Low-cost, low-latency video analytics platform: System challenges

Peter Bodik
Microsoft Research
Cameras are everywhere!

Seattle Police Receive $600,000 Federal Grant For Body Cameras

You’re being watched: there’s one CCTV camera for every 32 people in UK

China’s 100 Million Surveillance Cameras

NYPD expands surveillance net to fight crime as well as terrorism
Vision Zero

Goal: eliminate traffic deaths and serious injuries

HIT BY A VEHICLE TRAVELING AT:

- 20 MPH
  - 9 out of 10 pedestrians survive

- 30 MPH
  - 5 out of 10 pedestrians survive

- 40 MPH
  - Only 1 out of 10 pedestrians survives

30 CRASHES A DAY
MORE THAN 10,000 A YEAR
NEARLY 35,000 TOTAL CRASHES IN THE LAST THREE YEARS

VISION ZERO WILL SAVE LIVES

150 PEOPLE SUSTAIN LIFE-CHANGING INJURIES EVERY YEAR
APPROXIMATELY 20 PEOPLE DIE ON OUR STREETS EACH YEAR

Speed is especially lethal for vulnerable users like pedestrians and people biking. The risk of injury and death increases as speed increases.
Traffic analytics: Collaboration with City of Bellevue

Use widely deployed traffic cameras
- Count cars/bikes/peds, detect near-collisions, anomalies

Next-generation traffic control

Bellevue
Pedestrian & Bicycle Implementation Initiative

Making Bellevue a great place to walk and bike.

Microsoft Research
Faculty Summit 2016
Challenges of video analytics platform

Processing
  • Query optimization
  • Declarative language

Storage
  • Flexible, geo-distributed storage
  • Secure sharing

Network
  • Live video, low latency, high bandwidth
Processing
Computer vision can be expensive

Best tracker from VOT 2015 = 1fps @ 8-cores + GPU

- compute cost in Azure = $1.7M/camera/year
Declarative language for video processing

Today: “execute this DLL”
- Cannot optimize automatically

Instead: “track and count cars and pedestrians”
- Enables optimization of video processing modules
Storage
Video storage today: inflexible and expensive

Today, storage provided by the customer
  • Abstracted away, not managed

Expensive
  • Storing 1 year of 2Mbps video in Azure = $19k/year
Many options for storing video

- Hot/cold storage
- Store based on detected events
- Secure sharing
Network
Networking at the core of video processing

Need high bandwidth

Some scenarios need low latency

Cameras connected over wireless/LTE/white spaces

Cost
  - Free upload to Azure, pay for download

Coupled with storage and compute placement
Orchestrating compute, storage, and transfer

move compute to data or data to compute?
Summary

High resource demand: CPU/GPU, storage, network

- Need to optimize and orchestrate resource usage

Bellevue Traffic Analytics Demo

- Thursday 12 – 2:30