ECE 590/COMPSI 590 Special Topics: Edge Computing

Video Analytics on the Edge

Monday November 12th, 2018

Video Analytics: Lecture Outline

- Video analytics on the edge
 Video analytics recap
 Current and emerging use cases
 OpenFog vision
 - ≻Microsoft Research vision

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Video Analytics on the Edge

Seen by some as the "killer app" for edge computing



IEEE Computer, 2017

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Video vs. Video Analytics (1/2)

- Video streaming: older research domain
 - E.g., adaptive video resolution
 - Netflix as we know it now may not have become possible without it



Video vs. Video Analytics (2/2)

• New: Video + Al



AWS Rekognition Demo

Available since 2017

New Edge-specific Angle: Video Analytics for Privacy

- ePrivateEye
- Video denaturing



Lecture Outline

Video analytics on the edge
 Video analytics recap

Current and emerging use cases

- ≻OpenFog vision
- Microsoft Research vision

Video Deployments: Current

- One camera installed for every 29 people on the planet
 - One for every 8 people in mature markets
- Wide range of applications
 - Traffic control
 - Surveillance in public and private spaces





Emerging Video Deployments: Drones

- Possible abstraction: controllable flying camera
- May need additional advanced video processing techniques due to shaking



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Emerging Video Deployments: Wearable Cameras (1/2)

 "In an effort to increase police accountability, the Durham City Council has approved a plan to spend \$1.4 million dollars to outfit police officers with body cameras for the next five years"



November 2016

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Emerging Video Deployments: Wearable Cameras (2/2)

 From spy movies to consumer market



Energy Harvesting Wearable Cameras

- Several lines of work
- "Solar cells convert light to electricity. Image sensors also convert light to electricity. If you could do them both at the same time in the same chip, you'd have the makings of a selfpowered camera"



Images: University of Michigan Images from a University of Michigan's self-powered sensor were captured at 7.5 frames per second [left] and 15 frames per second [right].

Self-Powered Image Sensor Could Watch You Forever, S. K. Moore, IEEE Spectrum, Apr. 2018

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Intelligent Wearable Cameras

- Several to appear at CES this year
 >Usually mobile phone-assisted
- Interesting vision for the future

Emerging Video Deployments: Augmented Reality

- AR is multi-sensory
- Image recognition element to it





Lecture Outline

- Invited speakers: recap and discussion
- Video analytics on the edge
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 - ≻OpenFog vision
 - ➢ Microsoft Research vision

Edge Support For Video Analytics

 Access to substantial computing resources with low latency

OpenFog Consortium Reference Architecture Example

• Securing air travel

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Cameras are all already in place



Securing Air Travel

- Airport terminal provisioned with a hierarchy of fog nodes
- Track travelers throughout the journey
- · Applications deployed: risk scoring, vehicle capture, baggage capture, ...



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Microsoft Research Vision



Real-Time Video Analytics: The Killer App for Edge Computing, IEEE Computer, 2017 20

Ongoing Deployment in Bellevue (1/3)

- Since December 2016
- Traffic video analytics: help the city understand and track volumes of cars, pedestrians, and bikes
 - Directional counts at monitored intersections
- Technology deployed:
 - Wide-angle cameras to cover the whole intersection with one camera
 - NVIDIA GTX 1080 GPU to run DNNs
- Will feed actuation systems that control light duration

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Ongoing Deployment in Bellevue (2/3)



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Summary: Edge for Video Analytics

- Promising due to the ubiquity of camera deployments
- Appears in multiple lines of work
- Necessary for emerging use cases
 Drones, augmented reality, wearable cameras