

Video analytics at scale for mobile Internet-of-things platform

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Aug 1, 2017

Video Cameras in IoT

Traffic monitoring,
surveillance
in smart cities



Industrial Internet

Connected cars



Edge Computing for video analytics



- Analytics:
 - objects relevant to queries, summaries, anomalies
- Motivation:
 - Efficient bandwidth use
 - Energy savings in transmission
 - Low latency response

Video analytics: Challenges

- **Bandwidth constraints:** detect relevant objects (MobiCom'15)
- **Energy tradeoffs:** save transmit energy by local processing (SECON'17)
- **Low-latency response:** adaptive streaming (HotWireless'17)
- **Querying video cameras at scale:** Optasia (SoCC'16)

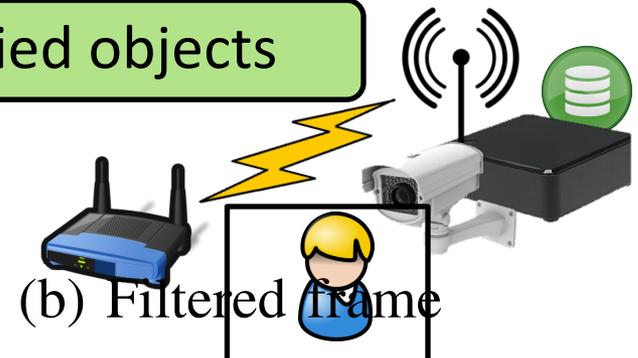
Prior work

- Content-delivery networks
- Adaptive video streaming
- Mobile app offloading to cloud

Video analytics: Challenges

- Bandwidth constraints: Vigil (MobiCom'15)

Edge Computing Node detects queried objects



(a) Input frame

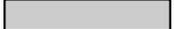
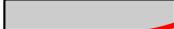
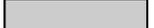
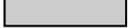


(b) Filtered frame



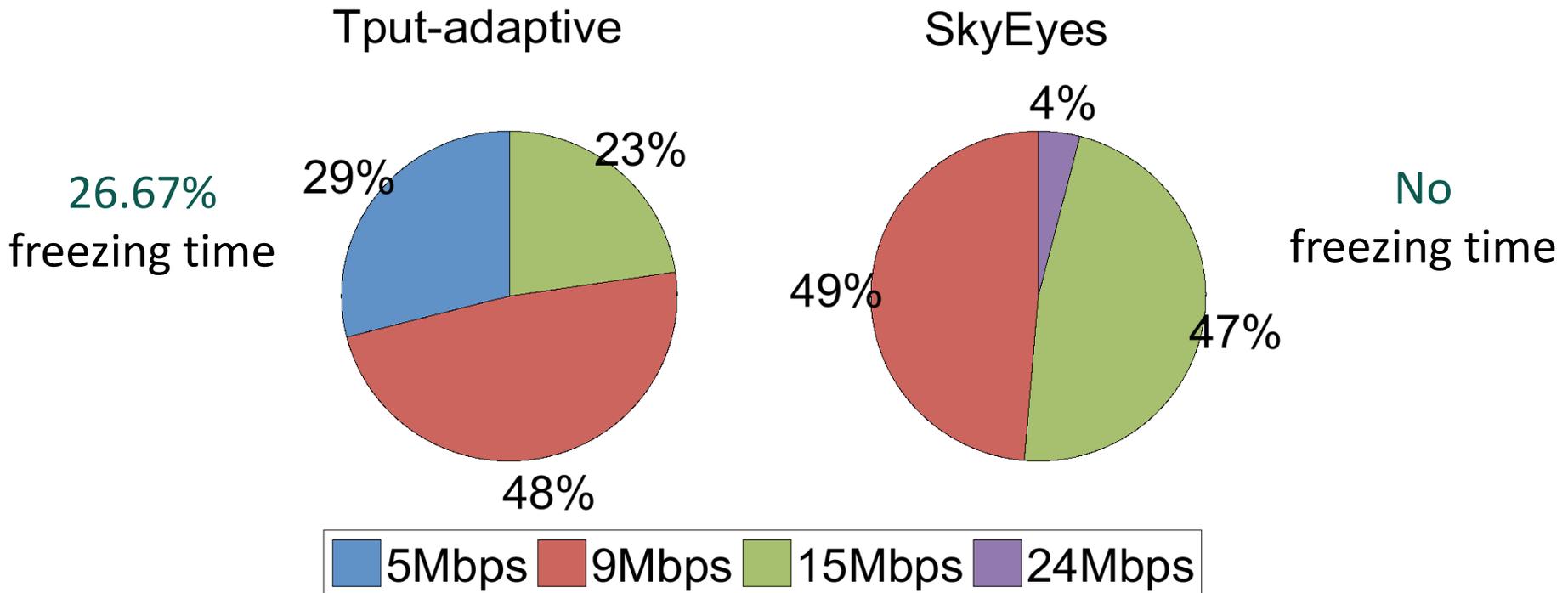
Video analytics: Challenges

- Energy tradeoffs: save transmit energy by local processing (SECON'17)

Filtering <i>Net. load</i>	Processing energy (mJ)		Streaming energy (mJ)	
	Classifier A	Classifier B	Classifier A	Classifier B
None				
<i>Low</i>	36 	41 	94 	97 
<i>Medium</i>	"	"	"	"
<i>High</i>	"	"	"	"
Adaptive				
<i>Low</i>	358 	99 	81 	76 
<i>Medium</i>	629 	158 	69 	60 
<i>High</i>	922 	210 	57 	46 
Full-time				
<i>Low</i>	1227 	268 	45 	28 
<i>Medium</i>	"	"	"	"
<i>High</i>	"	"	"	"

Video analytics: Challenges

- Low-latency response: adaptive streaming(HotWireless'17)



SkyEyes: higher video rate, no freezing screen

Conclusions

- Video analytics – inefficient to ship all streams to cloud
- Limited bandwidth constraints require content-aware compression.
- Edge processing needs to strike a tradeoff between energy spent on processing versus transmitting
 - Algorithms that adapt processing to video workloads strike better energy-bandwidth tradeoffs
- Low-latency response & mobility requires predictive analytics at the edge to meet the constraints