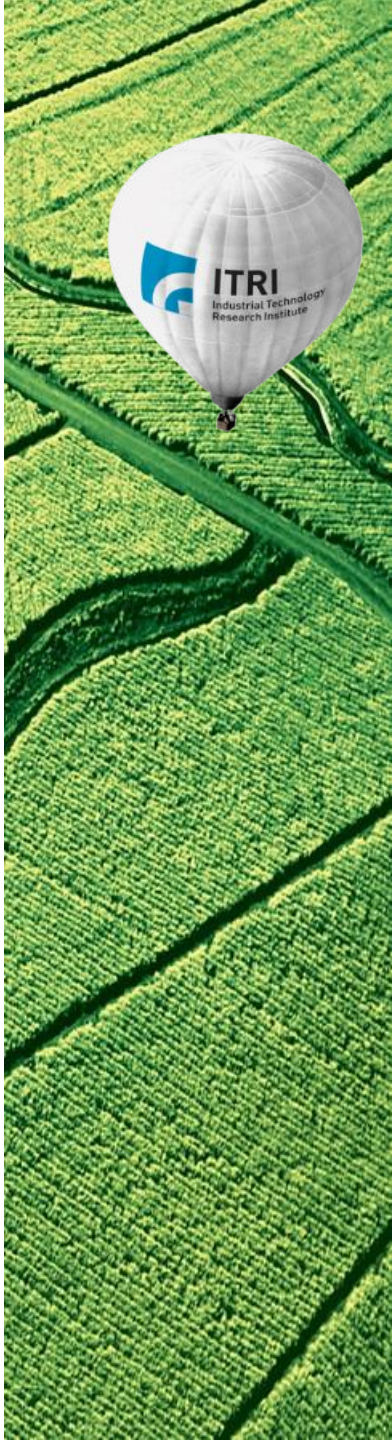
DNN Video Analysis OS

George Chen(陳澤世)
Division for AI Computing Platform(X000)
ICL/ITRI



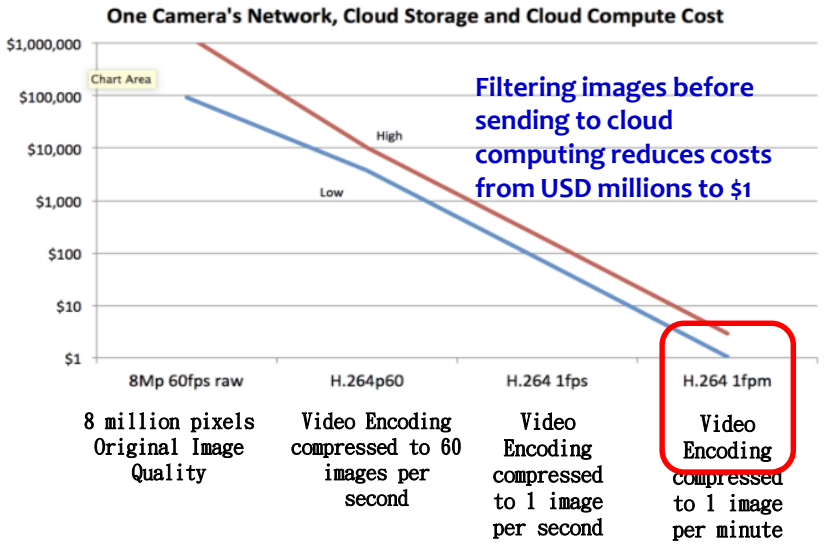
Cost of Image Streaming to Cloud Computing

- Connecting Camera to Internet
  - Optical Fiber：USD$0.10/TB
  - Broadband：USD$8-20/TB
  - T1 dedicated line：USD$100/TB
- Cloud Storage for Images
  - Standard：USD$12.50/TB per month
  - Long-term：USD$2.5/TB per month
- Image Analysis Cloud Computing
  - YOLO on AWS GPU costs approx. USD$0.58 per million images (equivalent to one day with 10 images per second)

Experience We learned

- Video filtering on edge servers or front end devices greatly reduces the cost of network transmission/Storage/Computing Analysis

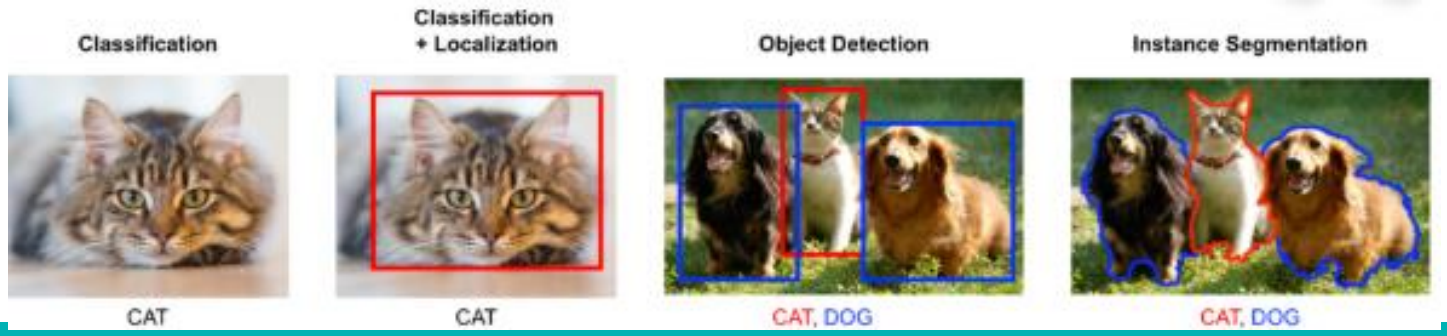
Data Streaming	Network Costs		Storage Costs		Sub. Cost	3 yrs Costs
	OF	BB	Day	Month		
8Mp raw	9,500	950,000	79,000	476,000	3,300	92,000-1,430,000
H.264 p60	47	4,700	400	2,400	3,300	3,700-10,000
H.264 @ 1 fps	1	79	7	39	55	62-173
H.264 @ 1 fpm	0	1.30	0.11	0.66	0.91	1-3



Reference：http://www.cogniteventures.com/2017/10/07/what-does-a-5-camera-cost/

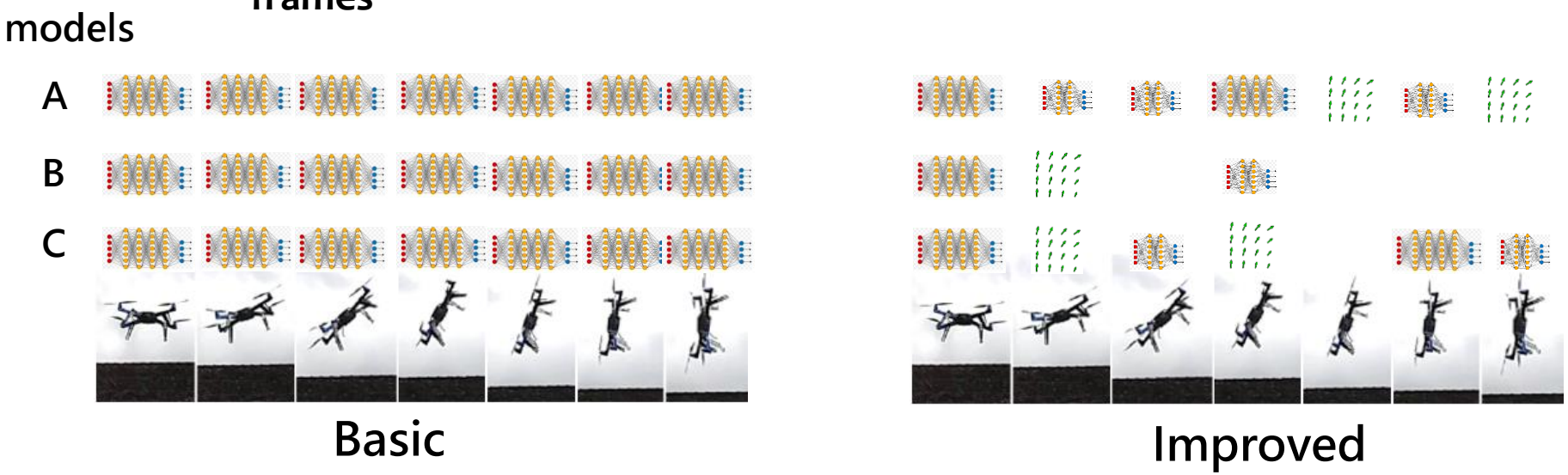
Video Recognition Speedup

- **AI inferences for real-time video:**
  - **Inference video frames as independent images**
  - **Using open-source YOLO, one GPU card can inference 30 images per second**
  - **Thus, each 30 FPS camera costs one GPU card**
    - **Very expensive**
- **Our video recognition improvement**
  - **Using the similarity of neighboring frames to speedup AI**
  - **Current version can be applied for 1. DNN Object Detection 2. Classification + Localization**
    - **We are not developing for 1. DNN Object Classification and 2. Object Segmentation**



Video AI Recognition PaaS Platform

- **DNN video recognition system**
  - **As a PaaS platform, integrating large number of cameras and scheduling AI jobs on multiple GPU hardware**
  - **Basic version**
    - **Run M full-version AI model on every frames**
  - **Improved version:**
    - **Run full-version, partial version AI model, and/or speedup version, on every frames**



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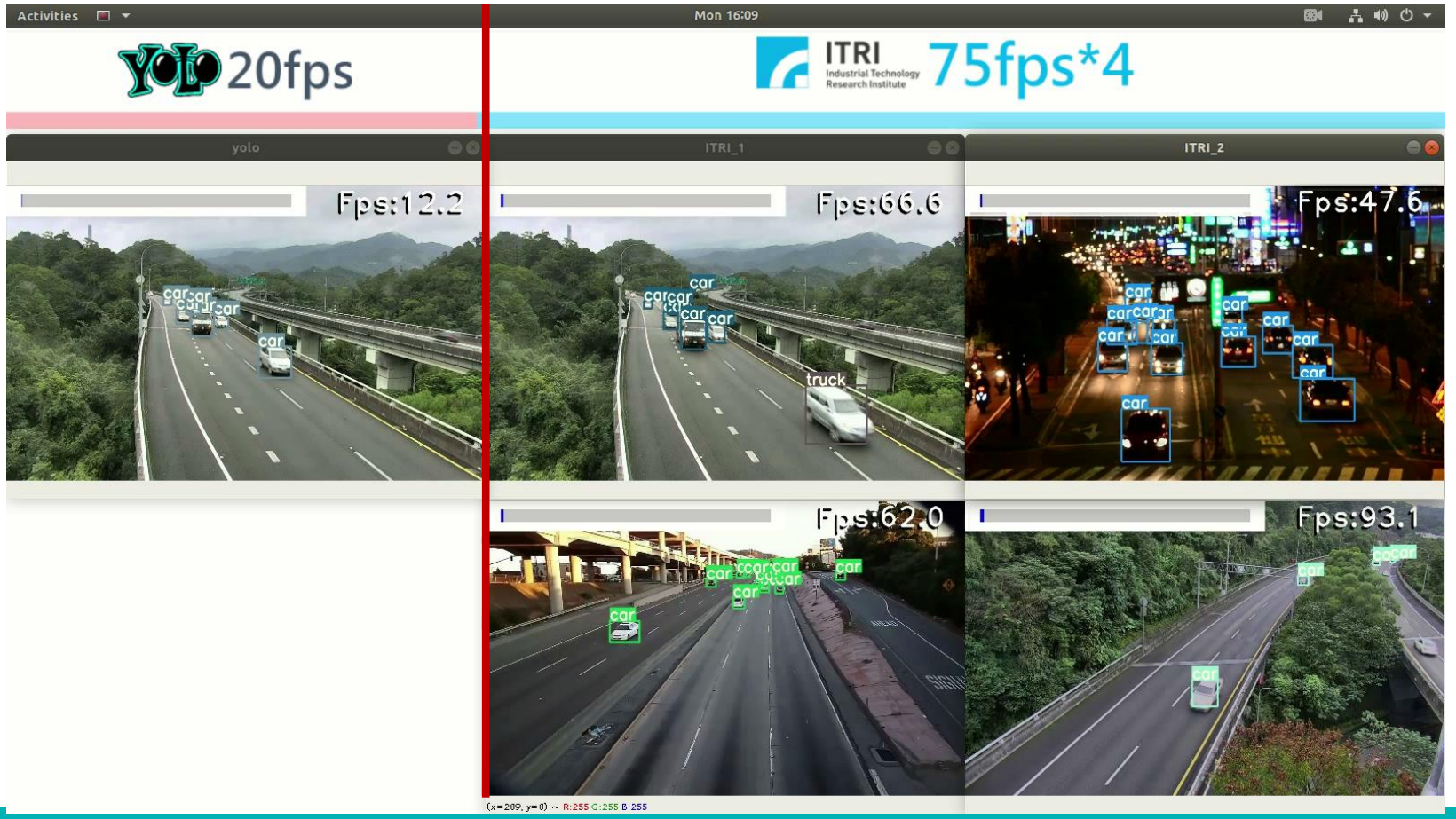
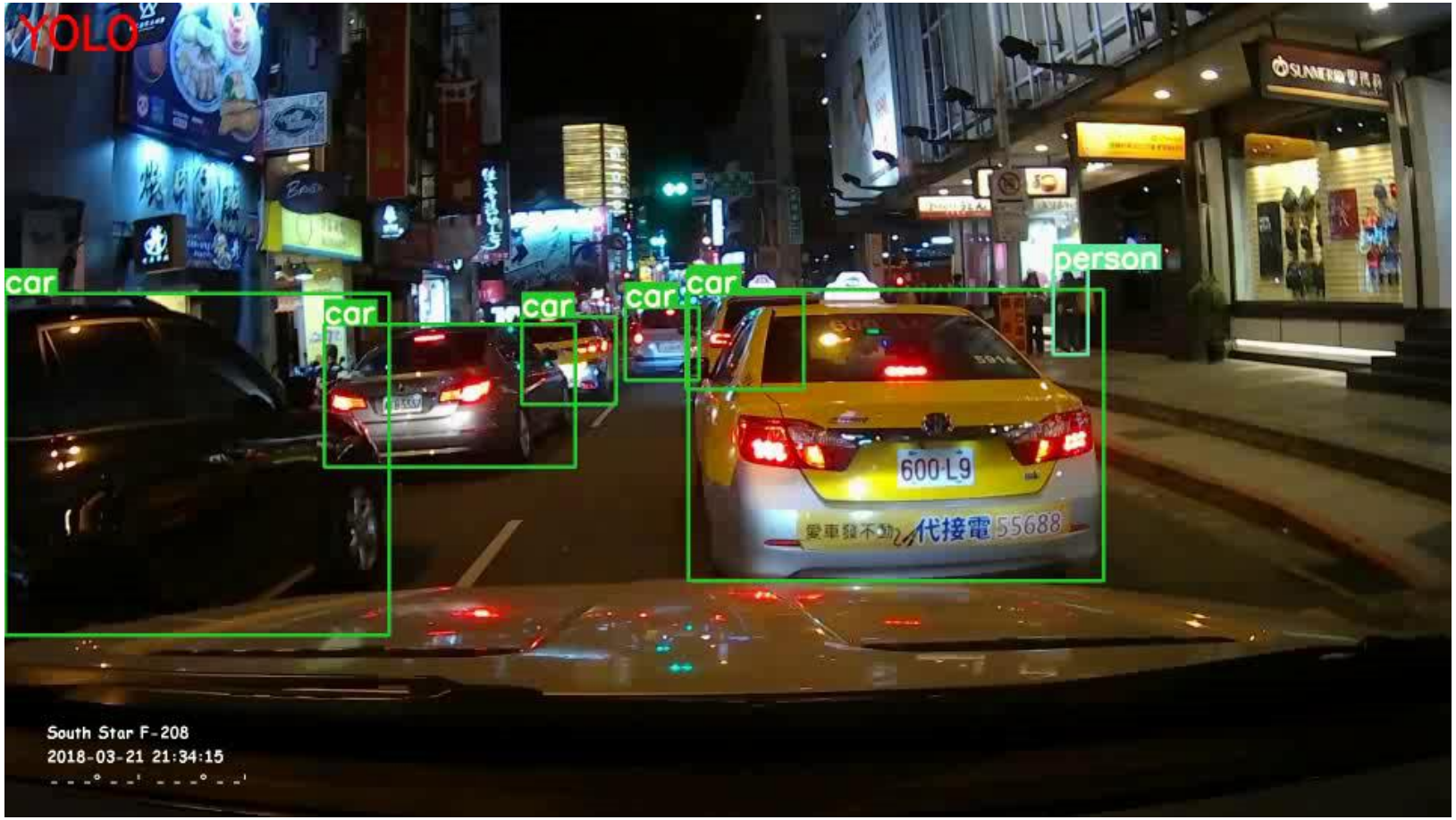
Performance Improvements

- **Our technology speedup video inferencing, by interleaves using GPU and CPU, and supports multiple video streaming processes in parallel.**
  - **Left: Open-source YOLO (20 FPS)** **Right: Our method (Total 300 FPS)**



Accelerated Results of Image Recognition and Tracking

- **Processing Speed of Videos is 4.1 times faster than original Yolov4**
- **Accuracy improves from 61.27% to 61.02%**



Remarks：DEMO video played with 30 FPS

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Human Body Joint Point Test

- **Table tennis competition as example, processing speed from 31 FPS increased to 168 FPS which is 5.4 faster.**
  - **Accuracy increased from 54.8% to 56.3%**

- **AI Body Joint Points**

OpenPose (31FPS)

- **AI Body Joint Point +Tracking**

OpenPose-MV Tracking (168FPS)

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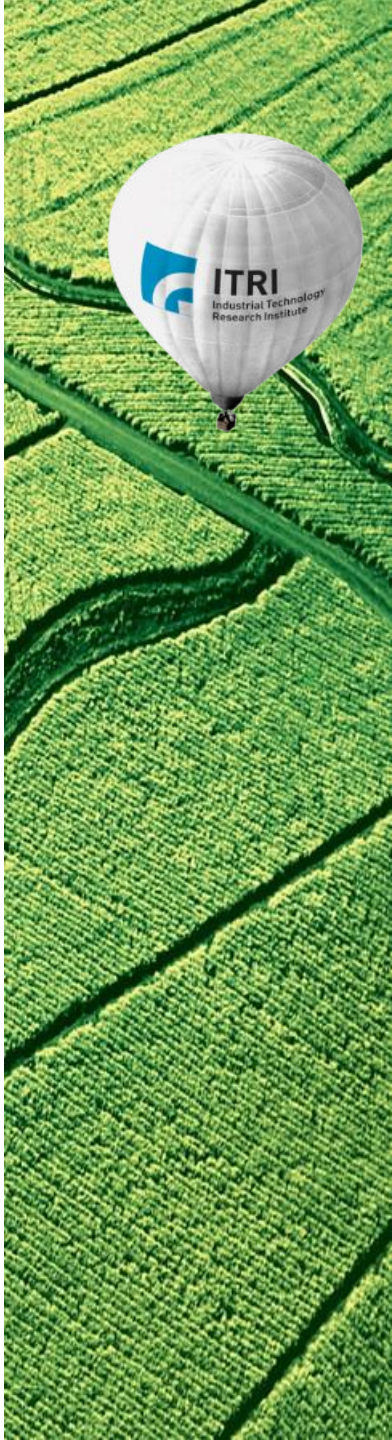
ITRI DNN Farm



George Chen
Tschen@itri.org.tw