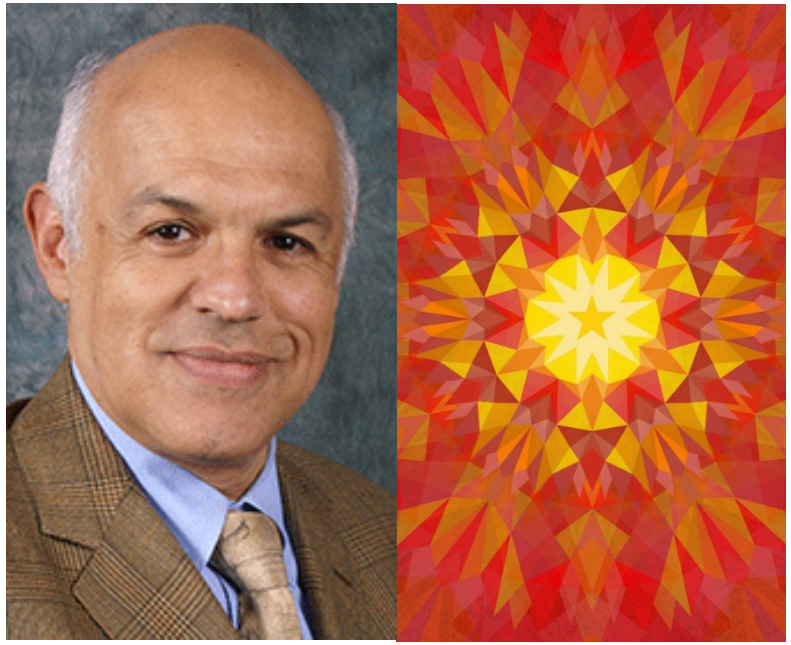
ITU KALEIDOSCOPE ONLINE2020

7-11 December 2020

WRAP-UP SESSION

Mostafa Hashem Sherif
Kaleidoscope Steering Committee Member
and TPC Chair



WRAP-UP SESSION

ITU KALEIDOSCOPE ONLINE2020

Session 1

The path towards digital transformation

S1.1 **Toward a typology of "going digital“**
***Cheng Gong**, Bangkok University, Thailand*

S1.2 **Analysis on the social and economic impacts of Internet platforms**
***Anqi Zheng**, China Academy of Information and Communications Technology (CAICT), China*

S1.3 **5G Healthcare applications in Covid-19 prevention and control**
Haiying Ren, China Academy of Information and Communications Technology (CAICT), China

Kai Jakobs
RWTH Aachen University, Germany

Highlights from Paper 1

Toward a typology of “going digital”

- Based on a systematic review of more than 100 papers, the authors have developed a classification for the “going digital” of organisations.
- Using a 2x2 (sources of fundamental changes x end result) typology matrix, the approaches for ‘going digital’ fall into four classes:
  - Digitalisation: exogenous sources, realignment.
  - Digital Mutation: exogenous sources, realignment.
  - Digital Metamorphosis: endogenous, transformation.
  - Digital Transformation: endogenous, transformation.
- The typology can guide organisations in managing their way towards “digital”.

Highlights from Paper 2

Analysis on the social and economic impacts of Internet platforms

- The paper discusses the impact of the Chinese Internet platform WeChat on the country's economy and its workforce.
- Numerous fields of consumption are driven by WeChat (education, information consumption, catering, etc.).
- WeChat's direct contribution to the GDP is calculated to CNY 920 bn, its indirect contribution to CNY 1130 bn.
- It is estimated that WeChat has created more than 26 Mio direct jobs and over 3.5 Mio indirect ones.
- I couldn't find any figures about how the situation would look like without WeChat and if or to what degree Covid-19 had an impact on the results.

Highlights from Paper 3

5G Healthcare applications in Covid-19 prevention and control

- The paper discusses the benefits of the deployment of 5G mobile networks for health care in the time of a pandemic.
- Using China as the example it provides a brief yet detailed overview of the various (pilot) health applications that benefitted from 5G connectivity.
- The paper also highlights the need for further standardisation in the e-health sector and for further research to move from “pilot” to “regular”.
- Finally, the authors recommend a potential way forward from standards to demos to promotional activities.

Conclusions/Recommendations

Conclusions

- The papers cover three different aspects of “The path towards digital transformation” – a corporate one, an economic one and one that is specific to a field of applications.
- They all agree that the digital transformation is here to stay, and that there will be tremendous opportunities. I tend to agree.
- The overall tone is very (overly?) enthusiastic; e.g. any (societal) risks to be associated with an all-embracing deployment of digital (smart) technologies are largely ignored.

Recommendation

- Don’t ignore the vast range of non-technical issues that relate to digital technologies (societal, legal, environmental, economic, etc.). But don’t over-emphasise them either.

ITU KALEIDOSCOPE ONLINE2020

Session 2
Design principles, architecture and protocols for the digital transformation

S2.1 **Lightweight and instant access technologies and protocols to boost digital transformations**
***Yihua Ma**, ZTE Corporation and State Key Laboratory of Mobile Network and Mobile Multimedia, China*

S2.2 **Automation of computational resource control of cyber-physical systems with machine learning***
***Ved P. Kafle,** National Institute of Information and Communications Technology (NICT), Japan*

Eva Ibarrola
University of the Basque Country, Spain

Highlights from Paper 1

Lightweight and instant access technologies and protocols to boost digital transformations

- There are problems in existing access protocols and some novel access technologies are provided to solve them:
  - Contention-based non-orthogonal multiple access (NOMA)
  - Reduce the pilot overheads by using information extracted from the data
  - Enhanced pilot design to support more users to reduce the allocation overhead
  - Joint use of diversity and successive interference cancellation (SIC)
- Based on these technologies, potential modifications of protocols are proposed to realize lightweight and instant access.
- Case studies of both massive and critical scenarios are considered to show the need for these novel access technologies to boost digital transformation.

Highlights from Paper 2

Automation of computational resource control of cyber-physical systems with machine learning

- A dynamic resource control scheme to adjust computational resources allocated to virtual network functions (VNFs) is proposed.
- The scheme employs machine learning (ML) techniques composed of multiple regression models that are continuously retrained online by using performance data collected from the running system.
- Experimental results demonstrated its effectiveness to meet QoS requirements with lesser amounts of resources.
- The proposed scheme is based on the ML-based network control and management methods that are currently being standardized in the ITU-T Study Group 13. The authors plan to bring the outcome of their research to ITU for standardisation.

Conclusions/Recommendations

- **Conclusions and recommendations for paper 1**: Despite of having some technical problems during the presentation of the paper (the pre-recorded video was needed), it is clear that this research work may be very useful for definition of novel access technologies for future networks. Therefore, I would recommend the authors to contribute to related ITU Study Groups (SG-11, SG-13, Focus Group on Technologies 2030…) with their proposal so new standards on these novel access technologies may be developed.
- **Conclusions and recommendations for paper 2:** Questions on this paper were about the standardisation activities that the authors were carrying out related to this research work, the deployment of the proposal in real scenarios and about the type of machine learning algorithms that they were using. Again, I would like to encourage the authors to keep contributing to ITU with their excellent research work results.

ITU KALEIDOSCOPE ONLINE2020

Session 3
Wireless infrastructure and digital transformation

S3.1 **Digital transformation via 5G: Deployment plans***
***Narges Gholipoor**, Tarbiat Modares University, Iran*

S3.2 **Flexible multiplexing mechanism for coexistence of URLLC and eMBB services in 5G networks***
***Kai Xiao**, ZTE Corporation and State Key Laboratory of Mobile Network and Mobile Multimedia, China*

S3.3 **Wireless technology and protocol for IIoT and digital twins**
***Jie Tan**, ZTE Corporation and State Key Laboratory of Mobile Network and Mobile Multimedia Technology, China*

Christoph Dosch
ITU-R Study Group 6 Vice-Chairman; IRT GmbH, Germany

Highlights from Paper 1

Digital transformation via 5G: Deployment plans

- The presentation dealt with the complex process to migrate from 4G (LTE) to 5G. The paper describes various avenues to achieve this goal.
- 5G is considered as a prime means for the digital transformation which is based on three pillars:
  - **People**
  - **Processes**
  - **Tools**
- The paper discusses the deployment challenges for the three substantial network components:
  - **5G Core** Network
  - **5G Transport** Network
  - **5G Radio Access** Network (RAN)
- Furthermore, the print paper is an excellent reference for understanding 5G.

Highlights from Paper 2

Flexible multiplexing mechanism for coexistence of URLLC and eMBB services in 5G networks*

- The presentation describes novel ways for uplink management and power control for eMBB (enhanced mobile broadband): DPCI and ROPC.
- DPCI (Dynamic Pattern Cancelation Indication) reduces the amount of falsely cancelled data of eMMB in case of request for URLLC (Ultra-reliable Low-latency Communication) and thus improves the amount of transmitted eMBB data.
- ROPC (Resource Occupancy based Power Control) improves the throughput for both eMMB and URLLC by setting different power control parameters for different groups of time-frequency resources. The power values are determined for each group time-frequency resource according to the index in the time-frequency resource indication field (UE).

Highlights from Paper 3

Wireless technology and protocol for IIoT and digital twins

- Based on the requirements for Industrial Internet of Things (IIoT), the presentation introduces the developments in 3GPP for URLLC (Ultra reliable low latency communication) with respect:
  - **Low latency**
  - **High reliability**
  - **Little jitter, and**
  - **High transmission efficiency**
- Further, the paper analyzes the enhanced key technologies required in the IIoT.
- With respect to digital twins, the paper dwells on the integration of various elements of information technology (IT) and operation technology (OT).
- Finally, the application of IIoT in digital twins is analyzed according to the actual situation.

Conclusions/Recommendations

- The three papers of Session 3 discuss key issues with respect to the introduction and usage of 5G.
- Much effort is given to realize and optimize the operation of 5G for the various usages anticipated such as (relatively) low data-rate exchange with ultra-reliable and low-latency transmissions or eMMB (Enhanced mobile broadband service) for (relatively) high data-rate video streaming or exchange.
- Further research is certainly needed to consolidate the achieved results and, importantly, to introduce them to the ongoing standardization activities of 3GPP and ITU.

ITU KALEIDOSCOPE ONLINE2020

Session 4
Digital transformation in daily life

S4.1 **A Technique for extracting the intention of messengers in social media**
Balakrishnan Nalin Prashanth, *University of Moratuwa, Sri Lanka*

S4.2 **Towards a digital process platform for future construction sites**
Hans Aoyang Zhou, *RWTH Aachen University, Germany*

Andy Chen
Catatronic Enterprise & REDDS Capital, Canada and IEEE TEMS

Highlights from Paper 1

A Technique for extracting the intention of messengers in social media

- In this paper, the authors propose a technique that can extract the intention of users from their online chatting by converting the non-textual information along with misspellings and abbreviations into a meaningful text and analyzing it to understand the true motives of the author.
- The purpose is to detect anonymous predators or users with malicious intent who are using Instant Messaging (IM) for fraudulent purposes.
- The focus of this research is on sexual predators. Hence, the binary classification of the messages as appropriate and inappropriate at of this stage.

Highlights from Paper 2

Towards a digital process platform for future construction sites

- In this paper, the authors propose a data-driven approach to the management of construction sites, in which they extract data from machines, send them to a central data storage with scalable computational resources for analysis to improve the management of the construction.
- The communication infrastructure developed is modular and manufacturer-independent to accommodate the existing heterogenous communication interfaces in construction sites,
- The mix of technologies in the common communication infrastructure consists of edge computing, cloud computing, mobile communication, as well as Big Data technology in one common communication infrastructure to be deployed in future construction sites.

Conclusions/Recommendations

- There is a need to develop better connectivity in remote rural areas. Without connectivity, no digital transformation will be possible in the development of remote communities and their related development projects.
- Online sexual predators and human trafficking are major threats to the humanity. More research projects are needed to assist law enforcement in the detection and criminal prosecutions of these predators. Governments and corporations should be encourage such projects including funding.

ITU KALEIDOSCOPE ONLINE2020

Session 5
Augmented reality and tourism

S5.1 **An immersive mobile application for improved learning and virtual tour experience: A nature reserve perspective**
Ruchen Wyngaard *and* ***Lebogang Nkabinde****, University of the Western Cape, South Africa*

S5.2 **Self-guided virtual tour using augmented reality**
Aphile Kondlo*, University of the Western Cape, South Africa*

Roberto Minerva
Télécom SudParis, France

Highlights from Paper 1

An immersive mobile application for improved learning and virtual tour experience: A nature reserve perspective

- The paper pointed to out a nice approach for enabling Virtual Guided Tours within a natural reserve.
- The focus was on modelling and present relevant information about different and engaging objects.
- The development was facilitated by the usage of existing “engines”. This gave the opportunity to focus on the modelling, but it also limited the application because not all the desired functionalities were present.

Highlights from Paper 2

Self-guided virtual tour using augmented reality

- The paper presented different mechanisms for ‘Marking” (identifying and classifying) the objects under consideration. However, the development focused on marker-based tags in order to speed up the developments.
- The applications is developed and tailored to the specific natural reserve, but it could also be made more general in order to reuse its capabilities.
- The development was rapid with contributions from users that provided useful and important feedback for the improvement of the app.

Conclusions/Recommendations

- This field (Virtual and Augmented Reality applications for Tourism) seems to be interesting for the general public and the technical propositions were well received from the audience.
- A specific suggestion from the audience concerned gamification to encourage user involvement which could be extremely important for the success of this kind of applications.
- There are also many enabling basic engines that can be integrated in order to build a viable platform.
- The development times and the methodologies used (Agile / scrum) showed that the development of these applications could be rapid and very much tailored to the needs of users.

ITU KALEIDOSCOPE ONLINE2020

Session 6
Immersive technologies in farming

S6.1 **Immersive technologies for development: An analysis of agriculture**
Ofentse Mabiletsa, *University of the Western Cape, South Africa*

S6.2 **Immersive interactive technology: A case study of a wine farm**
Ofentse Mabiletsa, *University of the Western Cape, South Africa*

Simão Ferraz de Campos Neto,
Telecommunication Standardization Bureau,
ITU

Highlights from Paper 1

Immersive technologies for development: An analysis of agriculture

- This paper reviews a number of studies that applied immersive technologies to agriculture and identifies commonalities
  - Education and training; tourism and virtual tours; health and safety; diseases and pest management; livestock and crop tracking; farm marketing.
- AR (Augmented Reality) and VR (Virtual Reality) are the most used technologies.
- Of the 17 papers reviewed, only one has seen real-life deployment, indicating low level of use in Africa
  - Mixed reality was the least exploration application.
- Immersive technologies have potential but the best way to apply to e-agriculture merits further exploration. A solid analysis can inform and guide future research in the applications of immersive technology to agriculture.

Highlights from Paper 2

Immersive interactive technology: A case study of a wine farm

- The study concerns e-visits to a wine farm and its wine production process
  - 3D 360-degree rendering: virtual walk-through of vineyards, lodge, community garden, conference facilities & cellar
  - The relevance has been elevated in the context of the COVID-19 pandemic.
- The application was developed with the client using the SCRUM (fast prototyping) methodology.
- The results and feedback confirm that the farm marketing application shows promise in advertising the wine farm offerings and in promoting its various products.
- Future research should leverage lightweight applications with other integrative technologies such as IoT, blockchain, and machine-learning for sustainable agriculture and marketing of farm product.

Conclusions/Recommendation

- Immersive technologies are still in the early stages of exploration and development
  - They can play an important role in food security and in improving the economic outlook in local communities while increasing sustainability
  - So far, little deployment in Africa.
- Methodologies on the application of VR/AR/MR to agriculture need to be better understood / experimented.
- Showcase of a wine farm visiting app has shown the great potential for promoting winemaking, the farm and its products
  - Virtual / immersive experiences can increase sales when physical access is difficult, e.g. overseas customers and COVID-19 pandemic restrictions.

ITU KALEIDOSCOPE ONLINE2020

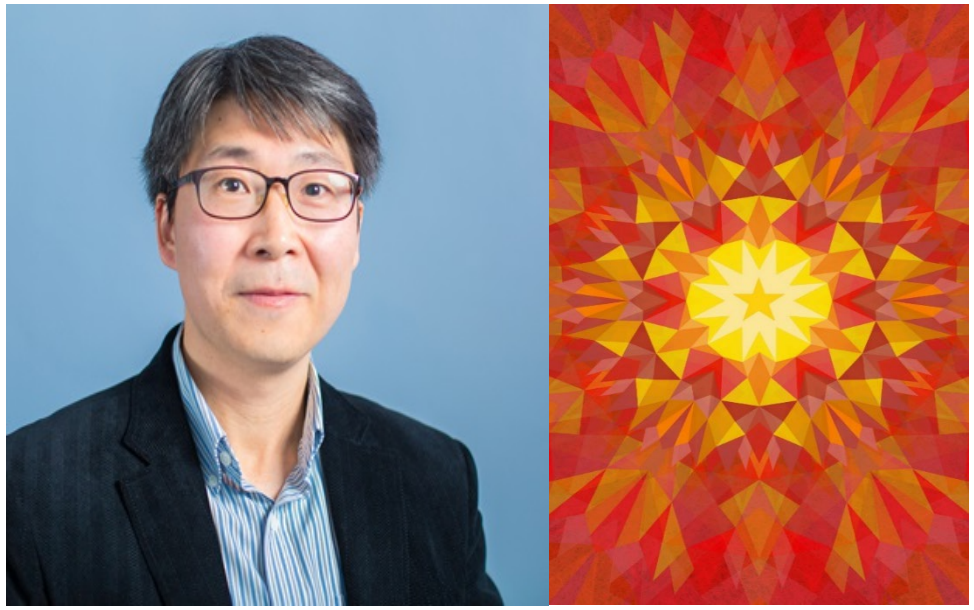
Session 7
AI, machine learning and digital transformation

S7.1 **AI-based W-band suspicious object detection system for moving persons using GAN: Solutions, performance evaluation and standardization activities***
***Keping Yu**, Waseda University, Japan*

S7.2 **An AI-based optimization on handover strategy in non-terrestrial network***
***Chenchen Zhang**, ZTE Corporation and State Key Laboratory of Mobile Network and Mobile Multimedia Technology, China*

S7.3 **BSR: A balanced framework for single image super resolution**
***Dehui Kong**, State Key Laboratory of Mobile Network and Mobile Multimedia Technology and ZTE Microelectronics Research Institute, China*

Gyu Myoung Lee
Liverpool John Moores University, UK



Highlights from Paper 1

AI-based W-band suspicious object detection system for moving persons using GAN: solutions, performance evaluation and standardization activities

- Aim: Develop sensing / imaging with AI-based W band (75-110GHz) technologies to recognize suspicious objects on moving persons automatically and efficiently
  - Use Convolutional Neural Network (CNN) technology based on suspicious object database
  - Primary screening with W-band radars and secondary screening with W-band hybrid imagers
- Generative adversarial network (GAN)
  - Generate a large number of millimetre-wave images by GAN based on the original images to be used for CNN training
  - The experiment for four types of suspicious objects for the training and evaluation of the CNN
- Standardization activities on AI
  - ISO/IEC JTC1 (AI, big data), IEC (wearable devices) ISO (industrial robots, smart finance and smart driving)
  - ITU-T (Y.AI4SC on AI and IoT, Y.qos-ml on machine learning based QoS assurance)
- Q&A discussions
  - How do W-band technologies work for a suspicious object detection system for moving persons?
  - How standardization activities promote the development of AI?

Highlights from Paper 2

An AI-based optimization on handover strategy in non-terrestrial network

- Aim: Predict the handover decision to compensate the time lag in satellite links and avoid the handover caused by noise
  - Periodically measure the strength of reference signals of different cells to always access a strong cell
  - Historical reference signal received power (RSRP) with the information to avoid unnecessary handover
- A supervised learning based on convolutional neural network
  - Proposes a novel directed graph model for the handover process to find the best handover strategy
  - Perform suboptimal handover based on UE's historical RSRP using the trained CNN
- Simulation results
  - In the AI-based method, the handover number of more than 70% of the UEs are reduced by more than ¼
  - The number of handovers is significantly reduced while the average RSRP is only reduced by 3%.
- Q&A discussions
  - What is the next step for future research?
  - Performance trade off when AI technique is applied

Highlights from Paper 3

BSR: A balanced framework for single image super resolution

- The imbalance phenomenon of super resolution (SR) task and the difference between SR and other computer vision tasks are analyzed.
  - Three imbalance effects: sample imbalance, feature imbalance, and object function imbalance.
- A Balanced Super Resolution (BSR) framework based on Random Filter Sampling (RFS).
  - Framework architecture with the working process of batch acquisition
  - RFS to form balanced training sets during batch training and light spatial attention mechanism to improve the effectiveness of residual features.
- Experiments on testing sets show that this method is superior to the SOTA methods.
- Q&A discussions
  - Have these techniques ben used in processing medical images?
  - Is there any plan to commercialize this technique?, what are the applications planned for commercialization?

Conclusions/Recommendations

- AI/ML based solutions for intelligence
  - A broad range of applications areas: suspicious object detection, optimization of handover strategy and image resolution
  - Various approaches: Convolutional Neural Network
- Performance trade off – complexity vs. accuracy
- Realization and commercialization of AI/ML based solutions
- Significant efforts for standardization on AI/ML and related applications
  - ITU-T Focus Groups (5GML, AI4AD, AI4EE, AI4H and a new FG on Autonomous Networks)
  - Gaps between research and standardization.

ITU KALEIDOSCOPE ONLINE2020

Session 8
Security in industrial applications

S8.1 **PERT: Payload encoding representation from transformer for encrypted traffic classification**
Hong Ye He, *ZTE Corporation, China*

S8.2 **Visual action recognition using deep learning in video surveillance systems**
Dhananjay Kumar, *Anna University, India*

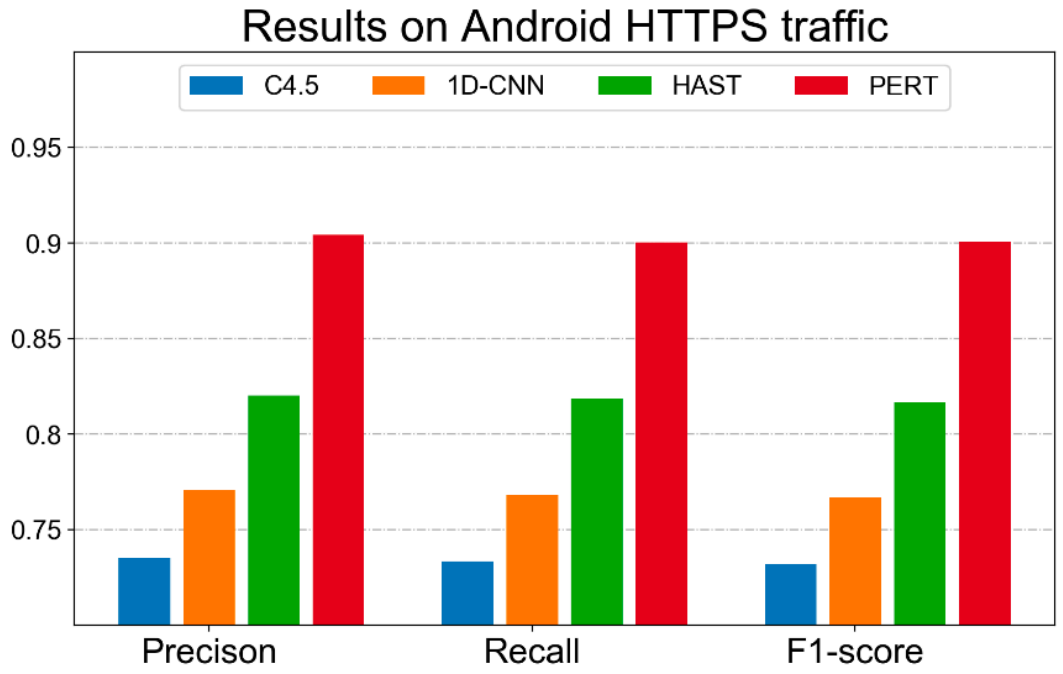
S8.3 **STCCS: Segmented time controlled count-min sketch**
Ismail Khram, *Beirut Arab University, Lebanon*

Duncan Sparrell
CISSP, CSSLP, CCSK, Senior Member IEEE;
sFractal Consulting, USA

Highlights from Paper 1

PERT: Payload encoding representation from transformer for encrypted traffic classification

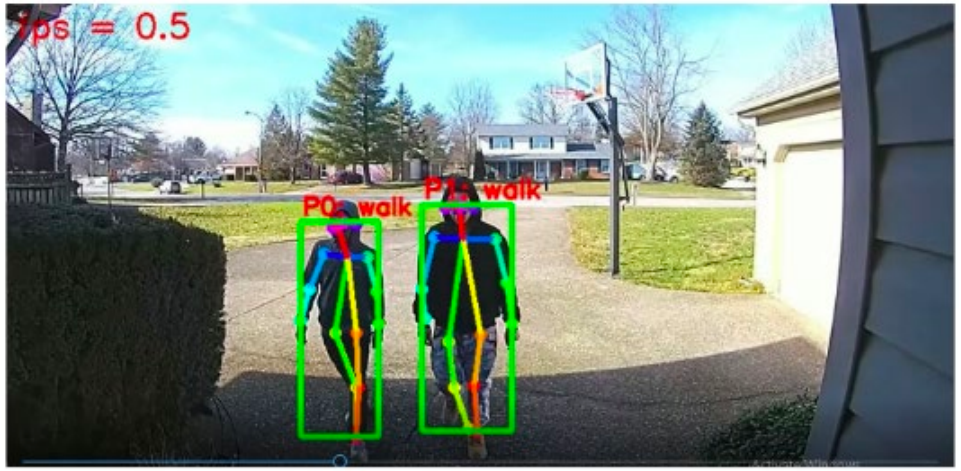
- PERT has significantly improved performance for classifying encrypted traffic



Highlights from Paper 2

Visual action recognition using deep learning in video surveillance systems

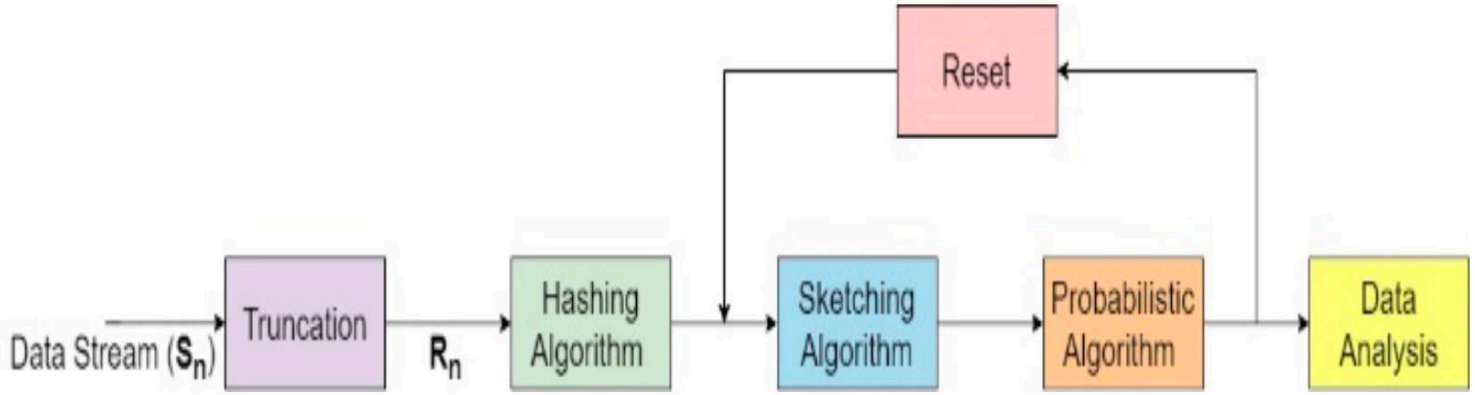
- Combines two models, HGN/DNN, to capture human actions
- 95.6% accuracy against 2 different standard datasets
  - Meets the requirements for video surveillance in Recommendation ITU-T F.743



Highlights from Paper 3

STCCS: Segmented time controlled count-min sketch

- SCTTS is new way of analyzing data of particular interest to IoT
- Improves on traditional count-min sketch algorithm using time/frequency



Conclusion/Recommendation

- **Conclusion**: Security is of growing importance in Industrial Applications
  - there is a exciting work going on in research, in standards, and in the intersection of the two.
- **Recommendation**: Extend H.626.5
  - based on “Visual action recognition using deep learning in video surveillance systems”.