

AI for Smart Consumer Electronics: at the Edge or in the Cloud?

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I welcome the readers to the September 2019 issue of the IEEE Consumer Electronics magazine. This becomes our first issue after Consumer Electronic Society decided to move from the previous editorial service to new one called “Common Design Service” for its production. I am thankful to the previous Managing Editor Craig Causer and his production team for the wonderful job for CE magazine for last 7 years since its inception in 2012. I am hopeful that we will maintain same quality and standards with the new production team.

The cover theme of this issue is dedicated to “Artificial Intelligence at the Edge” (Edge-AI) of the Internet-of-Things (IoT). IoT makes physical components smart or intelligent in the form of cyber-physical systems (CPS) which in turn make system of systems like smart cities possible. For example, healthcare with IoT makes smart healthcare, and transportation with IoT becomes smart transportation, and so on. Data analytics play a major role in these smart components. In a smart city estimated that sensors, social networks, web pages, image and video applications, and mobile devices generate more than 2.5 quintillion bytes (1 Exabyte or EB = 1 one quintillion bytes = 1000^6 bytes = 10^{18} bytes = 1000000000000000000 B = 1000 petabytes = 1 millionterabytes = 1 billiongigabytes) data per day. It is rightly said that data is the new gold, not oil. The data analytics makes it possible to retrieve information from data which then enables stake holders to make decisions (responses) based on it. As I have stated in my “Smart Electronics” keynote at IEEE International Symposium on Smart Electronic System (iSES) 2018 and an IEEE Potentials Magazine January 2019 Special Issue on this topic, “smart” while used loosely to describe many feature, ESR-Smart is overall summary of usage. ESR-Smart refers to Energy-Smart, Security-Smart, and Response-Smart of a device, system, or a system-of-systems at the different levels of granularity. Response-Smart is data and subsequently AI based information retrieved from the data.

Questions arise: Is the data always big? Is AI always needed. The short answer for both is “No”. While at the higher level, for example, in a smart city, or in a smart healthcare domain, the aggregated data (at the cloud/datacenter), is big data, the data is not big all the time. For example, the data at the individual sensors or Things, may not be bigdata. What is difference between AI at the cloud (datacenters) and AI at the edge (close to the sensors)? It is a good question. At the cloud (in datacenter) bigdata exists and AI analytics (or machine learning or ML models) can be derived for these. Cloud AI based on bigdata can be slow and energy consuming due to vast amount of data. But, Cloud-AI is expected to have highly accurate models and developed over global and large chunk of data. On the other hand, the data at the sensor/Thing end can be smaller and easier to train the ML models. The data at the edge/fog in the edgedatacenters/microdatacenters can be medium data. But, training is possible in a reasonable time to build ML models. Edge-AI can be of reasonable accuracy and fast which is possible to obtain and execute with minimal computational resources and energy. However, one has to be careful Edge-AI may not capture global features which can only happen when global data at the cloud/datacenter is available. So, a hierarchical training to have Edge-AI and further fine tuning with at the cloud/datacenter is a very good trade-off.

FEATURE ARTICLES

Deep Learning for Consumer Devices & Services 2 - AI gets Embedded at the Edge: This cover article presents integration of artificial intelligence at the edge of IoT, in contrary to standard practice of AI at the cloud or datacenter.

Rise of Anonymous Cryptocurrencies - Brief Introduction: This article examines many available cryptocurrencies in terms of their anonymity characteristics.

Smart Healthcare in the Era of Internet-of-Things: This article discussed broad perspective of IoT based smart healthcare with introduction of 7P (Personalized, Persuasive, Predictive, Participatory, Preventative, Perpetual, and Programmable) features.

A Hybrid Framework to Evaluate Breast Abnormality using Infrared Thermal Images: This article presents an Infrared Thermal Imaging based non-invasive method for the inspection of breast malignancy.

Medical Information Security for Wearable Body Sensor Networks in Smart Healthcare: This article presents secure and safe wireless body sensor networks (WBSNs) based communications in smart healthcare.

A Device-to-Device System for Safety and Emergency Services of Mobile Users: This article presents a location based system to provide safety and emergency services to mobile users.

Efficient Data Transfer in a Heterogeneous Multi-Core based CE Systems: This article presents a cache optimization scheme to reduce performance penalty in shared cache of CPU-GPU multicore based CE systems.

SPECIAL SECTION

This special section titled “Human Centric AR&VR Display and Human Interface Technologies for Automobile” presents selected articles which discuss various advances in research related IoT which can have impact on the automobiles including cars and motorcycles. I would like to thank the Guest Editor Haruhiko Okumura for all the hard work for this strong special section which will be a good reading for CE community.

COLUMNS

Bits Vs. Electrons -- Bits vs. Things: This article titled “Bits versus Things” Bob Frankston presents a philosophical perspective of transmitting a physical object in a communication channel.

Storage -- Data Center Disaggregation Using NVMe: This article discusses the prospects of disaggregation of storage using Non-Volatile Memory Express (NVMe) for its efficient utilization in bigdata environment.

Professional Development Corner -- Giraffic’s Founder and CEO, Yoel Zanger: This article presents interview of Giraffic’s Founder and CEO Yoel Zanger by our CEM Executive Editor Tom Wilson.

LOOKING FORWARD

I hope this issue dedicated to edge AI helps a wider set of CE community to advance their knowledge. I also hope more and more themes will be covered in future in this CE magazine on the latest hot topics with the help of editorial board and authors around the globe. I hope to continue excellent quality CE magazine for our readers with the production team.

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