Lucy Cherkasova, ARM Research

The Good, The Bad and The Ugly of AI for IoT and Sensor Networks

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- Lucy's research interests include the analysis, design, and performance management of concurrent and distributed systems with the the latest focus on emerging IoT systems and Big Data processing.

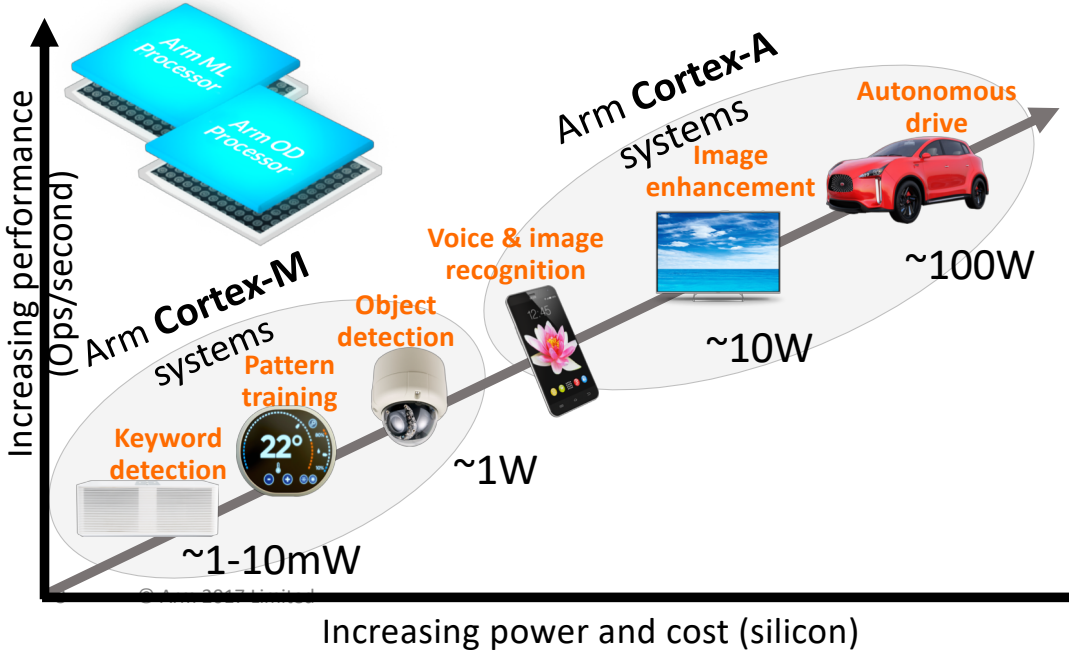
- Before joining Arm, Lucy worked for 20+ years at HP Labs, where she has authored over 100 referred publications and 78 patents.

- Over the years she has mentored and co-advised more than 20 PhD students/interns.

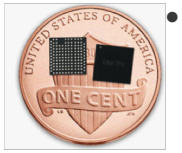
- She is an ACM Distinguished Scientist and recognized by multiple Certificates of Appreciation from the IEEE Computer Society.

AI/the Good

- Today, over 95% of AI-enabled devices are in mobile, smart home and IoT (90% are based in ARM arch)
- Could there be a trillion connected things/sensors? 150 billion embedded processors, 20% growth….
- How do we get useful insights from data and automate these findings?
- Smart environments, personal assistants, self-driving cars – require an efficient ML/AI processing
- *AI applications are pushing compute to the Edge:* design of new hw and programming frameworks
  - Google: Tensor Processing Unit (TPU) for inference (Cloud)



- ***TinyML*** *(ARM)*: deep learning in ultra-low power systems (Arm Helium™ technology)
  - Improves: *ML* (15 times) and *DSP* (5 times)
- ***Edge TPU:*** Google's purpose-built ASIC designed to run AI at the edge



  - ***TensorFlow Light*** *(Google)* for mobile and microcontrollers: 25KB of flash, 30KB of RAM to operate
- ***Federated ML*** *(CMU, Google)*
- ***AutoML:*** selects the best model for the task

arm

AI/the Bad

- **Adversarial Machine Learning & Data Poisoning Attacks**

Suppose that the sign is

Add small adversarial noise…

and the ML in your self-driving car thinks it's

- Black box analysis. Lack of "explainability"...
  - Rich Caruana "Friends Don't Let Friends Deploy Black-Box Models: The Importance of Intelligibility in Machine Learning"
- Ethics, morals, and decision making issues
  - Google announces AI ethics panel (March, 2019) on how to use emerging technologies.
- No security standards… *Mirai Botnets of Things* earned an unfortunate distinction of being on the *Breakthrough Technologies of 2017* according to the MIT Technology Review
  - A flood of cheap webcams, video recorders, and IoT gadgets have little or no security
  - This makes it easier than ever to build huge botnets for DDoS attacks