

WEEKLY UPDATE 2

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1. Weekly Progress

1.1. Literature Review

- **STUDY:** *Stochastic Delay Forecasts for Edge Traffic Engineering via Bayesian Networks* (Hogan, Esposito)

Latency The time it takes for a packet of data to get from one designated point to another.

Edge computing Node processing and traffic steering takes place in a process or among paths at the edge of the network as opposed to the core of the network (like Cloud Computing paradigm)

Computer Network Physically, a network is a hierarchical system that is organized by geographical proximity

- Bayesian network approach has the best latency predictor, low error
 - * Probabilistic graphical model that contains random variables and their conditional dependencies (acyclic graph)
 - * Each node in the network represents the latency at a point in time relative to time t with the aim of predicting the latency
 - * Lower density in the Bayesian network means lower prediction accuracy

- **STUDY:** *Knowledge-Defined Networking* (Mestres, et. al)

Software-Defined Networking (SDN) Provides a logically centralized control plane. Ex: A logical single point in the network with knowledge of the whole

Network Analytics (NA) A centralized platform that provides real-time packet, flow-granularity information, configuration, and monitoring

Knowledge Plane (KP) Uses machine-learning and cognitive techniques to operate the network

Machine Learning (ML) Allows machines to self-learn using a database of history without being explicitly programmed

Deep Learning (DL) A machine learning method based on learning data representations, instead of task-specific algorithms

- Use Artificial Intelligence, Software-Defined Networking, and Network Analytics to create a new paradigm: Knowledge-Defined Networking
- Goal: Have the KP use ML and DL to gather knowledge about the network and exploit that knowledge to control the network using logically centralized control capabilities provided by SDN
 - * Operated by a control loop to provide automation, recommendation, optimization, validation, and estimation
 - * Applications: routing in an overlay network, resource management in an NFV scenario, knowledge extraction from network logs, short and long-term network planning
 - * Challenges: ML models only work well when data is representative enough, which is hard to determine; requires a new set of skills; availability of standardized datasets; may need other ML techniques for this
- STUDY: *Energy-Efficient and Distributed Network Management Cost Minimization in Opportunistic Wireless Body Area Networks* (Samanta, et. al)

Wireless Body Area Networks (WBAM) Provides real-time electronic healthcare services to medically emergent patients in a cost-effective manner. Several body sensors are implanted on/in the human body to sense the physiological signals of patients. After sensing the signals, the sensor nodes send the sense data to the Local Processing Unit (LPU). The LPU sends the data to the LAs which then send the data to medical servers.

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1.2. Networking and Medicine/Personal Research

- AWS */lambda* store in central location in cloud, distribute the data from cloud, Amazon S3 for images (can have multiple versions), can

push images in the background; AWS has a webpage for Biotech and Pharma in the Cloud;

- <<https://techcrunch.com/2017/08/03/edge-computing-could-push-the-cloud-to-the-f>>
- WBANs are being used for Joint Sleep Scheduling and Opportunistic Transmission, Modeling Mobility and Psychological Stress Based Human Postural Changes (Samanta)
- Networking and Biotech intersect for the need of data security for patient records
- STUDY: *Nanowire FET Based Neural Element for Robotic Tactile Sensing Skin* (Navaraj, et. al); hardware implementable neural network for data-processing in e-skin
- STUDY: *Network embedding-based representation learning for single cell RNA-seq data* (Li, et. al); Single Cell Representation Learning method to implement data-driven non-linear projection and incorporate prior biological knowledge to learn more meaningful representations for both cells and genes
- Pubmed Search: network computing

Deep Neural Learning Networks that are made of several layers, which are made of nodes. Here, the nodes are patterned on a neuron in the human brain, simulation the action potential

Computer-Aided Drug Delivery (CADD) Models all formulations of a drug and eliminates those that are not worth testing in clinical trials; good for small-molecule drug discovery

2. Meeting

- New algorithm to identify communities - Uses biological data
- Finding a maximum click - network where all the nodes are connected

3. To-Do

- ☐ Read paper (Bera, Esposito)
- ☐ Find data sets to use (Ask Dr. Ahn)