Networking and Machine Learning Breakout Session Summary

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Topics discussed

- Success, lessons, and future directions
  - ML for networking
  - Networking for ML/AI
  - ML for wireless networking
  - ML for network security, privacy, and forensic analysis

Much success

- Channel estimation; fingerprinting; wireless scheduling; spectrum sharing and access; localization; protocol design; routing; transfer capability among different settings;

- Predictive maintenance and failure management, power management, network measurement, anomaly/attack detection

Challenges

- Lack of labelled data
- Lack of data itself
- Lack of interpretability
- Not knowing when and under what situations ML works

Lessons learned

- ML is useful when we do not know a lot about the system
- Start with simple models
- A lot of nice optimization techniques to learn from ML community
- Statistical testing is important
- ML can help reduce the complexity in networking problems
  - How to convert a networking problem is important
- Federated learning/distributed learning is an area from networking can help ML

Future directions

- Theoretical guarantee
  - What theoretical guarantees do ML-based (especially DNN-based) solutions provide?
- Interpretability
  - Why does the ML-based solution achieve better performance than traditional solutions? When does it work, and when not?
- New techniques for noisy or unlabeled data
  - Unsupervised learning, semi-supervised learning, weak-supervised learning …
- Fail-safe robustness: extreme outliers, adversarial input
  - Switch to other techniques when a model does not work

Future directions (cont.)

- ML analysis for Physical Unclonable Functions (PUF) based security protocols
- Intent learning: how to learn intents from existing configurations
- Real-time training when packets arrive
- Federated and distributed learning
  - How can we improve the network performance for federated and distributed learning?
- Support for data sharing and data management