Lehrstuhl für Connected Mobility
Fakultät für Informatik
Technische Universität München

TUM

Applications of Machine and Deep Learning in Mobile Networking

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Chair of Connected Mobility

Case for DL/ML in Mobile Networking Research

- Automatic high-level feature extraction
  - Suitable for data with complex structure and inner correlations ⇒ network data

- Handling large amounts of data
  - Mobile networks generate high volumes of different types of data at fast pace

- Insufficiently labeled data
  - Most current mobile systems generate unlabeled or semi-labeled data

- Training a single model for multiple objectives
  - Reduced computational and memory requirements of mobile systems when performing multi-task learning applications

- Handling geometric mobile data
  - Mobile data (user location, network connectivity) can be naturally represented by point clouds and graphs (i.e., have geometric properties)

Deep Learning Approaches

- Multilayer perceptron

- Boltzmann machine

- Auto-encoders

- Convolutional Neural Networks

- Recurrent Neural Networks

- Generative Adversarial Network

- Deep Reinforcement Learning

Topic areas

- **Network-level mobile data analysis**
  - Mobile big data mining (network prediction, traffic classification, CDRs)

- **App-level mobile data analysis**
  - Data analytics applied to edge devices

- **User mobility analysis**
  - Understanding movement patterns of mobile users

- **User localization**
  - Indoor/outdoor localization based on signals received from different mobile devices or wireless channels

Topic areas

- **Network control**
  - Deep reinforcement learning and deep imitation learning for network optimization, routing, scheduling, resource allocation, radio control

- **Network security**
  - Improving network security (infrastructure, software, privacy aspects)

- **Signal processing**
  - Physical-level aspects that benefit from DL

- **Mobile network applications**
  - Other relevant applications

Organization

Seminar Outline & Expectations

Topic selection   Topic assignment   Weekly presentations, submission of reviews, discussions
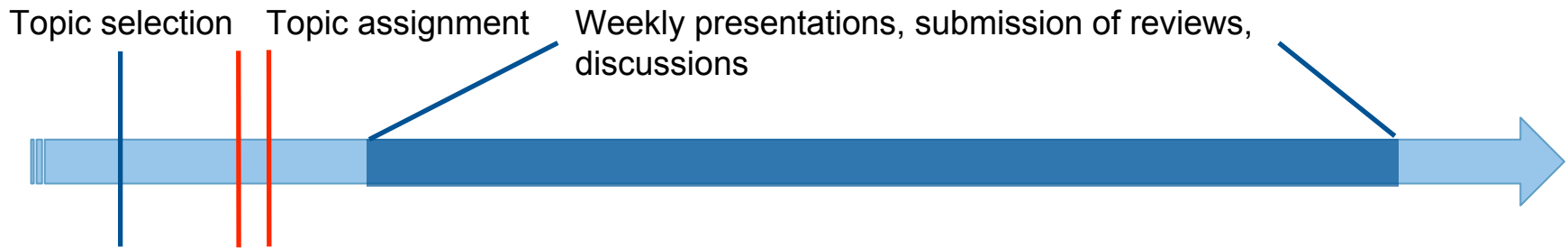
- **Choice**
  - Pick paper: 5 papers in order of preference email to course admins
  - Topic assignment: via mail and in Moodle
  - Everyone will present 2 papers and review others' papers

- **Preparation & requirements**
  - (Obv.) Read the paper
  - Understand the method, present both the method and the major findings
  - Presentation with slides: 20-30 min
  - Participation in the discussion
  - Attendance of weekly meetings