Project Ideas for ECE209AS

Mani Srivastava

Use Available Datasets for Projects

- UCLA NESL's Model-Dataset-Platform Zoo
  - http://bit.ly/39HZrVs
- UCI ML repository
  - Many different types
  - https://archive.ics.uci.edu/ml/index.php
- Physionet
  - Complex Physiologic Signals
  - https://physionet.org
- MIMIC-III,
  - critical care database
  - https://mimic.physionet.org
- mORAL
  - https://mhealth.md2k.org/resources/datasets.html

Collect Your Own Sensor Data

- Apps for iOS
  - SensorLog app for iPad, iPhone, and Apple Watch (paid)
    - https://apps.apple.com/us/app/sensorlog/id388014573
    - Allows deployment of trained models too
- Apps for Android
  - Sensorstream IMU+GPS app for Android
    - https://play.google.com/store/apps/details?id=de.lorenz_fenster.sensorstreamgps
  - HyperIMU
    - https://ianovir.com/works/mobile/hyperimu/
- Edge Impulse
  - https://www.edgeimpulse.com
  - Mobile phones and many embedded boards

Synthetic Datasets

- Use physics-based simulators, probabilistic simulators, GANs etc. to generate temporal or spatiotemporal data
- Examples:
  - Microsoft's AirSim (https://github.com/microsoft/AirSim)
  - CARLA Simulator (https://carla.org)
  - LGSVL Simulator (https://www.lgsvlsimulator.com)
  - MIT's VIrtual Home (http://virtual-home.org)
  - OpenSHS (https://openshs.github.io/openshs/)
  - Facebook's AI Habitat (https://aihabitat.org)
  - OpenAIGym (https://gym.openai.com)
  - PyBullet (https://pybullet.org/wordpress/)
  - And many more...

Project Ideas

1. Comparison of alternative deep temporal models
2. Mitigating missing data in time series
3. Mitigating missing sensor in sensor network
4. Coping with irregular sampling in time
5. Spatial inference with moving sensors
6. Bad timestamps on sensor samples
7. Virtual or synthetic sensor (different modality, different location, different view)
8. Superresolution in time

Project Ideas (contd.)

9. Super resolution in space
10. Deep networks with compressively sampled inputs
11. Domain shifts (weather, sensor modality, …)
12. Variable execution time and its impact on control
13. Detecting complex events (patterns)
14. Adversarial input for multimodal timeseries
15. Explanation generation for multimodal timeseries

Transient Missing Sensor Data

- Sensor data often have gaps due to network outage, sensor failures etc.
- Two main approaches: *Repair gaps* vs *Be robust to gaps*
- Repair gaps
  - Impute using past samples, past and future samples, and samples from correlated sensors
  - Classical approaches (ARMA), RNNs, GANs
- Learn robustness to gaps
  - Use windowing
  - Augment input with mask
- Project: Select representative methods of different type, implement, and compare on