**Group Assignments**

**Group 1**. Rongfei Zheng, Jingcheng Wang, Junxi Wu - **Topic 1**

**Group 2.** Jiayue Jin, Chao Yuan, Junjie Zhang - **Topic 1**

**Group 3.** Weiran Zeng, Qinqi Song, and Anqi Wei - **Topic 2**

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# **Topic 1. Mobility AI with urban imagery, networks, and natural language**

**Introduction**: This topic uses unstructured data for mobility modeling, leveraging the generative and discriminative models of language, imagery, and graphs to develop multi-modal understanding of cities. Here we will be using the unstructured data and methods to understand the two US states, including its demographic makeup, socioeconomic status, and mobility patterns.

**Example papers**:

1. [Using deep learning and Google Street View to estimate the demographic makeup of neighborhoods across the United States](https://www.pnas.org/doi/abs/10.1073/pnas.1700035114)
2. [Combining satellite imagery and machine learning to predict poverty](https://pubmed.ncbi.nlm.nih.gov/27540167/)
3. [Deep hybrid models with urban imagery](https://arxiv.org/pdf/2303.04204.pdf)
4. [Learning representations of satellite imagery by leveraging point of interests](https://dl.acm.org/doi/pdf/10.1145/3485447.3512149)

**Resources**:

1. Data and coding tutorials are attached in Google Drive.

**Task Design for Group 1&2**

Group 1 focuses on Florida and Group 2 focuses on California.

1. First, read the example papers and the resources in Google Drive
2. Understand the socio-demographics data from census (California\_ct and Florida\_ct). Visualize the census tracts using shapefiles (tl\_2020\_12\_tract, Florida; tl\_2020\_06\_tract, California).
3. Download street-view and satellite images. Document the longitude and latitude of the images.
4. Use the street-view and/or satellite images to predict socio-demographics.
5. Design modeling innovations to improve the predictive performance.

**Topic 2. Spatiotemporal mobility data mining with deep learning**

### Introduction: This topic is designed to delve into the immense potential of utilizing advanced deep learning technology (particularly, graph neural networks) in the realm of variable spatiotemporal mobility tasks. Our focus includes a wide spectrum of applications such as forecasting, inference, extrapolation, and representation learning, among others. We encourage you to comprehend the foundational elements of advanced deep learning architecture, while also applying them to innovatively designed spatiotemporal mobility tasks.

**Example papers**:

1. [Uncertainty Quantification of Sparse Travel Demand Prediction with Spatial-Temporal Graph Neural Networks](https://dl.acm.org/doi/pdf/10.1145/3534678.3539093)
2. [Uncertainty Quantification of Spatiotemporal Travel Demand with Probabilistic Graph Neural Networks](https://arxiv.org/pdf/2303.04040)
3. [Fairness-enhancing deep learning for ride-hailing demand prediction](https://arxiv.org/pdf/2303.05698)
4. [Spatio-Temporal Graph Convolutional Networks: A Deep Learning Framework for Traffic Forecasting](https://arxiv.org/abs/1709.04875)
5. [Spatial-Temporal Transformer Networks for Traffic Flow Forecasting](https://arxiv.org/abs/2001.02908)

**Spatiotemporal Data Resources**

1. PEMS Data<https://dot.ca.gov/programs/traffic-operations/mpr/pems-source>
2. METR-LA Data<https://zenodo.org/record/5146275>
3. Crime prediction data (Classification Problem)<https://github.com/Rafa-zy/HAGEN>
4. Traffic datasets<https://github.com/liuxu77/LargeST>
5. Chicago Divvy Bike usage dataset<https://data.cityofchicago.org/Transportation/Divvy-Bicycle-Stations-All-Map/bk89-9dk7> (Stations)

<https://data.cityofchicago.org/Transportation/Divvy-Trips-Dashboard/u94x-unre> (Trips)

**Coding Resources**:

1. STGCN GitHub
   1. <https://github.com/FelixOpolka/STGCN-PyTorch>
   2. <https://github.com/hazdzz/STGCN>
2. [DCRNN github](https://github.com/liyaguang/DCRNN)
3. [GraphWave Net github](https://github.com/nnzhan/Graph-WaveNet)
4. [Spatial-Temporal Transformer Network Github](https://github.com/xumingxingsjtu/STTN)
5. [Pytorch-geometric-temporal](https://github.com/benedekrozemberczki/pytorch_geometric_temporal/tree/master)

**Task Design for Group 3**

1. First, please read through the example papers, data and coding resources.
2. Choose one or two spatiotemporal data sources. Clean the data and visualize the spatial pattern and temporal trends.
3. Create a baseline spatiotemporal graph neural network for prediction.
4. Design model innovation to improve the predictive performance.