CSCE 6933: Advanced Topic in Computer Science
(Learning with Graphs)

1. **Timing and Access**

Class Hours: Monday 1:00-3:50
In Person Class: Discovery Park; B217

2. **Course Content.** Course will focus on modeling data with using graphs and algorithms to learn from the graphs, with a focus on graph neural networks.

3. **Prerequisites.** It is expected that the students have taken graduate courses in algorithms, data structures and know basics of set theory and combinatorics.

4. **Class Structure**

   Lecture by instructor 45-50 minutes
   Break for 10 minutes
   Presentation of paper/ project/Tutorial (1) 45 minutes
   Break for 10
   Presentation of paper/project/Tutorial (2) 45 minutes

   Every student should present at least one paper. The project can be done independently or in a group of two. The project submission will include (i) a 6 page (excluding references) paper in IEEE double column format and (ii) link to datasets, code and results.

5. **Evaluation**

   We will apply a peer review system, where other students can anonymously grade and comment on the presentations and the final paper. The final grade for each item will be 50% of the grades given by peers and 50% of the grade given by instructor.

   The grade distribution is as follows 30% on paper presentation; 10% on reviews (please put in well commented reviews); 5% on class participation. 55% on project—this will be divided into 20% on a midterm report, 20% on the final paper and 15% on the quality of code and other artifacts.

Plagiarism Policy. Academic Integrity Standards in this course are consistent with UNT policy: STUDENT STANDARDS OF ACADEMIC INTEGRITY (18.1.16), or other related/existing UNT polices. The work that you turn in to be graded, must be your own work. Usage of unauthorized material and sources, or depending on any unauthorized assistance, to answer homework problems, tests questions, writing reports, or carrying any type of assignment, etc., without the permission of the instructor, or without complete and accurate and complete attribution/citation of the source, when applicable, is viewed as an academic misconduct.

6. **Textbook**

There are no official textbooks. The materials in the lectures and associated links should be sufficient. You can also use materials available online.
Suggested books on Graphs/Networks
Network Science. Barabasi
(http://networksciencebook.com/)
Networks: An Introduction
(https://math.bme.hu/~gabor/oktatas/SztoM/Newman_Networks.pdf)

7. **Instructor and TAs**

Yuede Ji
Email: yuede.ji@unt.edu
Sanjukta Bhowmick
Email: Sanjukta.bhowmick@unt.edu

8. **Office Hours:** By appointment. If you have any questions or clarifications send email to the instructors. We will respond with 24 hours. If you want to discuss the material outside the regular office hours, send us an email and we can schedule an ad hoc meeting.

All information about the class, any changes in schedule, etc. will be posted on the announcements via CANVAS. Please check the announcements regularly.

Topics Covered

1. Overview of graph algorithms and their applications
2. Sparse matrix computations and application as graph algorithms
3. Unsupervised learning on graph (community detection, link prediction, recommendation systems)
4. Embedding nodes into feature vectors
5. Graph neural networks
6. Interpretable graph neural networks
7. Applications of GNN in different domains

Useful tools

- NetworkX (Python-based CPU) https://github.com/networkx/networkx
- PyG (GNN) https://github.com/pyg-team/pytorch_geometric
- Deep Graph Library (GNN) https://github.com/dmlc/dgl
- Dive into Graphs (GNN & GNN Explanation) https://github.com/divelab/DIG

Course Structure (Tentative schedule)

	Topic	Details	Note
Jan. 23	Overview of Graph and Graph Algorithms	Graph, graph traversal, graph connectivity, etc.	
Jan. 30	Community Detection	Clustering, link prediction, etc.	Tutorial on NetworkX by Dr. Ji Projects discussed
Feb. 6	Sparse Matrix Computation	SpMV, Laplacian, etc.	Project abstract due. Paper presentation (2 students)
Feb. 13	Graph Embedding I	Node2vec, others, and applications.	Paper presentation (2 students)
Feb. 20	Graph Embedding II	Computation (Invite Santosh)	Paper presentation (2 students)

Feb. 27	Graph Neural Network I	GCN, GAT, others, computation systems, and applications of GNNs.	Paper presentation (2 students)
Mar. 6	Graph Neural Network II	Computation. (Invite Qiang)	Paper presentation (2 students)
Mar. 13	Graph Neural Network III	Applications.	Paper presentation (2 students)
Mar. 20	No class (Spring break)		
Mar. 27	Interpretable Graph Neural Network	GNN explanation basics, GNNExplainer, Illuminati, etc. (Invite Haoyu)	Mid-term report due. Paper presentation (2 students)
Apr. 3	Makeup Class		
Apr. 10	Guest lectures	Bibek, Yang, Wei Han	
Apr. 17	Guest lectures		
Apr. 24	Project presentation		25 minutes per student
May 1	Project presentation		Final report due