CS471 Graph Machine Learning and Mining

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Mondays & Wednesdays AM 10:30 ~ AM 11:45 at N1 #117

★ Course Description

Graphs are fundamental tools for modeling relationships between objects, enabling us to model diverse real-world problems and data. Graph machine learning and graph mining techniques are utilized in many modern AI and big data analytics domains. This course introduces various graph-based machine learning and mining techniques, including graph neural networks (applying deep learning ideas to graphs), knowledge graphs (representing human knowledge as graphs), graph representation learning (converting graphs into feature vectors), random walks and centrality measures on graphs, graph clustering, and graph anomaly detection. This course also introduces how these techniques are applied in information retrieval, natural language understanding, computer vision & graphics, robotics, and bioinformatics.

※ Expected Audience: upper-class undergraduate students (학부 3, 4학년); this course is not eligible for exchange students.

『그래프는 개체 간의 관계를 나타내는 도구로써, 실생활의 다양한 데이터 및 문제를 모델링 하는 데 사용된다. 그래프 기계학습과 그래프 마이닝 기술은 최신의 인공지능 및 빅데이터 분석 분야에서 다양하게 활용되고 있다. 딥러닝 기술을 그래프에 접목한 그래프 신경망, 사람의 지식을 그래프로 표현한 지식 그래프, 그래프를 특성 벡터 형태로 변환하는 그래프 표현학습, 그래프에서의 랜덤 워크 및 중심성 분석, 그래프 클러스터링과 그래프 이상점 탐지 등 그래프 기반의 다양한 기계학습 및 마이닝 기술을 소개한다. 또한, 이러한 기술들이 정보 검색, 자연어 이해, 컴퓨터 비전과 그래픽스, 로봇공학, 생물 정보학 등의 분야에서 어떻게 활용되는지 소개한다.』 #그래프 #기계학습 #마이닝 #그기마

★ Materials: The instructor will share her own lecture notes.

★ Prerequisites

Programming Skills, Linear Algebra, Data Structures, and CS376 Machine Learning

- Students should be familiar with basic computer science principles; they should be able to understand and write non-trivial computer programs.

- Students should be able to implement their ideas using some programming language for the project.

- Python-based programming assignments will be given during the semester.

- Students should have taken CS376 Machine Learning.

★ Evaluation (Grading: A-F)

- Attendance & Participation: 10%

- HW: 20%

- Quiz: 40%

- Project: 30%

★ Topics

1. Basic Concepts of Graphs

2. Centrality Measures

3. Random Walks & Closeness

4. Graph Clustering & Hypergraphs

5. Graph Representation Learning

6. Deep Learning with Graphs

7. Graph Neural Networks (GNN)

8. GNN Training & Applications

9. Graph Anomaly Detection

10. Knowledge Graph Embedding (KGE)

11. GNN-based KGE Methods

12. Graph Models in Web Search & Natural Language Understanding

13. Graph Models in Computer Vision & Graphics

14. Graph Models in Robotics & Bioinformatics