CSE 703:
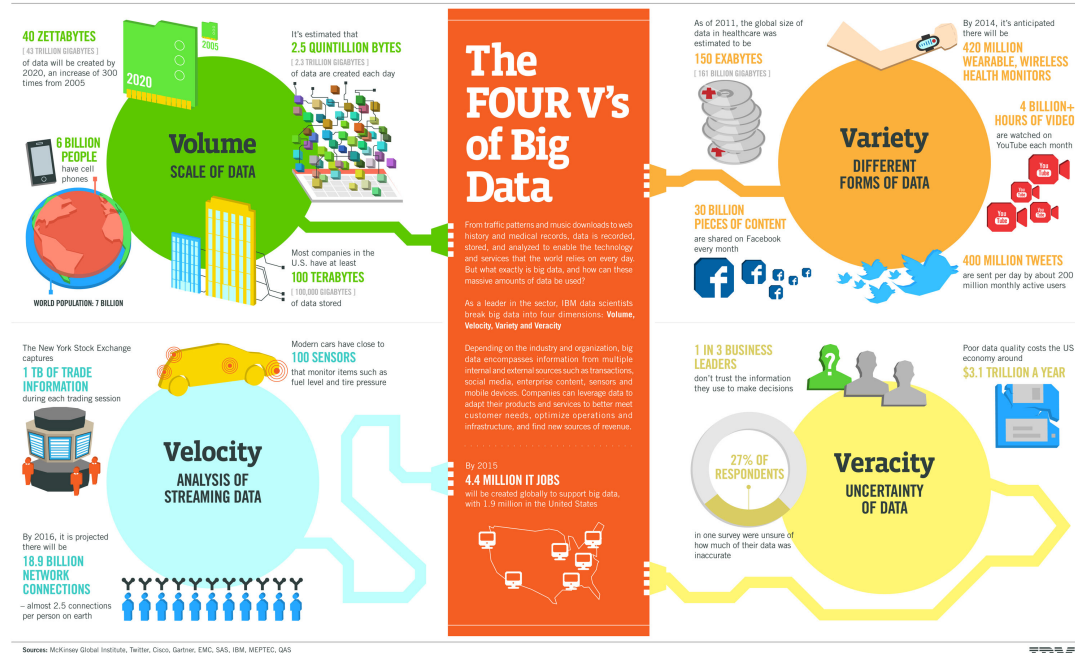# Deep Learning on Graphs

A. Erdem Sariyuce

Who am I?

- My name is A. Erdem Sariyuce
    - I go by Erdem
    - My pronouns are he/him/his

- Research on graph (network) mining, management, and learning
    - Practical algorithms
        - Streaming, distributed, parallel
    - Leverage the characteristics of real-world data
    - Fast graph analytics

Graphs are everywhere

Social

Information

Routers

Protein-interaction

Heard About Big-Data?

- Yes, I do that, but for graphs

- Not only big, but also
  - Dynamic
  - Incomplete
  - Noisy
  - Distributed

What's this class about?

- Machine learning on graphs
  - How to handle graph data?

- Traditional ML techniques are helpless for graphs
  - Graphs are dimensionless!
  - Not like the fixed-size feature vectors

- Our focus is on Deep Learning
  - Unprecedented success in audio/image/video/text processing
  - Paradigm shift from feature engineering
  - Challenging when data is a graph
  - Hot research topic

What's this class about?

- We will cover a range of topics about
  - Graph embeddings
    - Factorization-based
    - Random-walk based
    - …

  - Graph neural networks
    - Graph convolutional networks
    - Graph attention networks
    - Homophily
    - …

Logistics

- Course website: https://sariyuce.com/F23-703.html

- Class hours: Wed 5:00-7:00 @ Davis 113A
  - Lectures will NOT be recorded

- Office hours: Thu 10-12 @ Davis 323

- I prefer to do all communications over Piazza
  - Including private messages

- For private/urgent matter: erdem@buffalo.edu

Course Structure

1. Questions before class

2. Presentations

3. Discussion in class

The class structure each week

- One paper each week: Paper list is available at the course website
- Everyone reads the paper and comes to class
- Before class:
  - **<u>Listeners (All the other students):</u>**
    - Ask questions about the paper on Piazza <u>until Monday night</u>
  - **<u>Explainers (1 or 2 students):</u>**
    - Each explainer prepares a presentation independently
    - Explainers collectively answer the questions on Piazza <u>until Wed noon</u>
    - Each explainer chooses top 5 most interesting questions for in-class discussion
- In class:
  - **<u>Explainers (1 or 2 students):</u>**
    - I'll randomly choose one of the explainers as the presenter.
    - The other explainer, if any, <u>can</u> chip in during the presentation AND <u>will</u> lead the discussion of the Piazza questions AND <u>will</u> discuss the weaknesses of the paper
      - <u>For some papers, the reviews and rebuttal are available</u>

Before class: Presentation

- Questions on Piazza before each class (by **<u>listeners</u>**)
  - Everyone will read the papers!
  - I'll post some guides on how to read a paper

- Questions are due Monday night 11.59pm
  - Open-ended, thought-provoking
  - Seed for class discussions
  - Unique (i.e., check the already posted questions and do not ask the same question)
  - 'What does Fig. 4 tell?' is NOT a question

- **<u>Explainers</u>** will collectively read and answer the questions on Piazza between <u>Mon night and Wed noon</u>
  - Can coordinate among themselves (or not)

In class: Presentation

- For each paper;
  - 45 minutes presentation, excluding citation analysis
  - It will be highly interactive; by me and others
  - You may find slides online
    - But don't rely on those too much!
    - Usually, the author slides are prepared for conference presentations and conference presentations are only for 15-20 mins

  - Citation analysis for at least 10 mins
  - References: Which papers are cited in this paper?
  - Cited by: Which papers have cited this paper?
    - Google Scholar, Microsoft Academic Search

- You can get feedback on slides/talk before the class!
  - Ask timely
  - Don't wait until the last day

In class: Citation Analysis

- References: Which papers are cited in this paper?
  - Briefly explain 5 references that form basis for the paper

- Cited by: Which papers have cited this paper?
  - Google scholar
    - `https://scholar.google.com/`
  - Check the ones at top venues
    - NeurIPS, ICML, ICLR, SIGKDD, WWW, WSDM, Nature, Science …
  - Check the ones that got most citations
  - Briefly explain 5 of those; what's new there?

In Class: Discussion

- Each **explainer** will choose top 5 most interesting questions for in class discussion
  - Discuss those questions after the presentation; give her/his opinion, others should chip in as well

Grading is S/U

- Same grading for 1, 2, or 3 credits

- Serving as an **explainer** (one time): 34 pts
  - Regardless of being the presenter or not
- Serving as a **listener** (asking Piazza q, 11 times): 11*6: 66 pts

- 100 pts in total
- 80 pts is needed for an S

- I'll be strict on this; I don't care if you cannot graduate or your visa status is impacted or whatnot

Deciding paper assignments

- I posted the paper list on the website

- I will randomly assign **explainers** to papers after the add drop deadline (9/5, Tue)
  - No changes or no exchanges (among yourselves)
  - Will announce the assignments on Piazza

Next week

- Jason will present this survey paper:
  - [**Machine Learning on Graphs: A Model and Comprehensive Taxonomy**](#) **Journal of Machine Learning Research 23 (2022) 1-64**
  - Available on the course website.
  - Jason is a PhD student in my group.

- I'll start a question thread for this paper.
  - Just to show you how you'll be doing it in the following weeks.
  - For this paper, you do NOT need to ask a question on Piazza; but you can if you want (won't be graded)

Accessibility Resources

- If you have a diagnosed disability (physical, learning, or psychological) that will make it difficult for you to carry out the course work as outlined, or that requires accommodations such as recruiting note-takers, readers, or extended time on exams or assignments, you must consult with [Accessibility Resources](#) (60 Capen Hall: 716-645-2608).

- You must advise me during the first two weeks of the course so that we may review possible arrangements for reasonable accommodations.

- (Also available in the course webpage)

Critical Campus Resources

- Sexual Violence
  - UB is committed to providing a safe learning environment free of all forms of discrimination and sexual harassment, including sexual assault, domestic and dating violence and stalking.
  - If you have experienced gender-based violence (intimate partner violence, attempted or completed sexual assault, harassment, coercion, stalking, etc.), UB has resources to help.
  - This includes academic accommodations, health and counseling services, housing accommodations, helping with legal protective orders, and assistance with reporting the incident to police or other UB officials if you so choose. Please contact UB's Title IX Coordinator at 716-645-2266 for more information. For confidential assistance, you may also contact a Crisis Services Campus Advocate at 716-796-4399.

- Mental Health
  - Counseling Services
    - 120 Richmond Quad (North Campus), 716-645-2720
    - 202 Michael Hall (South Campus), 716-829-5800
  - Health Services
    - Michael Hall (South Campus), 716-829-3316
  - Health Promotion
  - 114 Student Union (North Campus), 716-645-2837

Preferred Name

- If you would like to be addressed by a name that is different from the one in UB records, please let me know and we will use your preferred name in our communications with you. Further, you will be able to use your preferred name in all documents.

Questions?