poloclub.github.io/#cse6242

CSE6242 / CX4242

Data & Visual Analytics

Duen Horng (Polo) Chau

Associate Professor, College of Computing
Associate Director, MS Analytics
Director of Industry Relations, The Institute for Data Engineering and Science
Associate Director of Corporate Relations, The Center for Machine Learning
Georgia Tech

Course Registration

Classroom has capacity for 300 students. **We will raise the number of seats to 305.**

If you have decided not to take this course, **please free up your seat ASAP**, so other students can get in.

If you are on the waitlist, please wait for seats to open up.
Enrollment changes a lot during first week of class.

CSE 6242 A

212/215 seats filled

83 waitlist slots taken

CX 4242 A

65/65 seats filled

17 waitlist slots taken

Course TAs **Be very nice to them!**

Asmit Kumar Singh

Kanika Dhiman

Hoesu Chun

Ishan A Desai

Yiwei Kuang

Yuna Lee

Arya Mohan

Google “Polo Chau” (easy to find; should be first result)

Georgia Tech College of Computing

Polo Club of Data Science | Bio | CV | Students | Publications | Teaching | Funding | Press | Fun | Blog

Polo Chau

Legal name:
Duen Horng Chau

Associate Professor, School of Computational Science & Engineering
Associate Director, MS in Analytics
Director of Industry Relations, The Institute for Data Engineering and Science
Associate Director of Corporate Relations, The Center for Machine Learning
Georgia Tech

Linkedin | Twitter | Google Scholar | YouTube

Admi: Kevelyn Cormier Financial Managers: Holly Rush
pol atech.edu faculty.cc.gatech.edu/~dchau
4-385-7682 Campus mail code: 4011

ou are interested in joining my group.

Welcome to connect on Linkedin!

Jul 2021 - Adjunct Associate Professor

My research group website:

Polo Club of DATA SCIENCE

Scalable. Interactive. Interpretable.

Students (see all)

- Haekyu Park, CS PhD
- Zijie (Jay) Wang, ML PhD
- Austin Wright, ML PhD
- Seongmin Lee, CS PhD

How to address Polo?

Grammatically correct

Prof. Chau

Dr. Chau

Grammatically incorrect, but popular

Prof. Polo

Dr. Polo

The course focuses on working with large datasets.

(Also the focus of Polo's research group)

poloclub.github.io

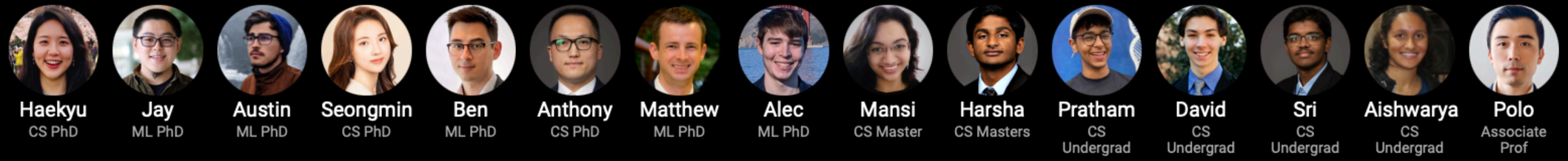
Polo Club of Data Science

AI + **HI**

ARTIFICIAL INTELLIGENCE

HUMAN INTELLIGENCE

Scalable interpretable and trustworthy tools to make sense of complex large-scale datasets and models

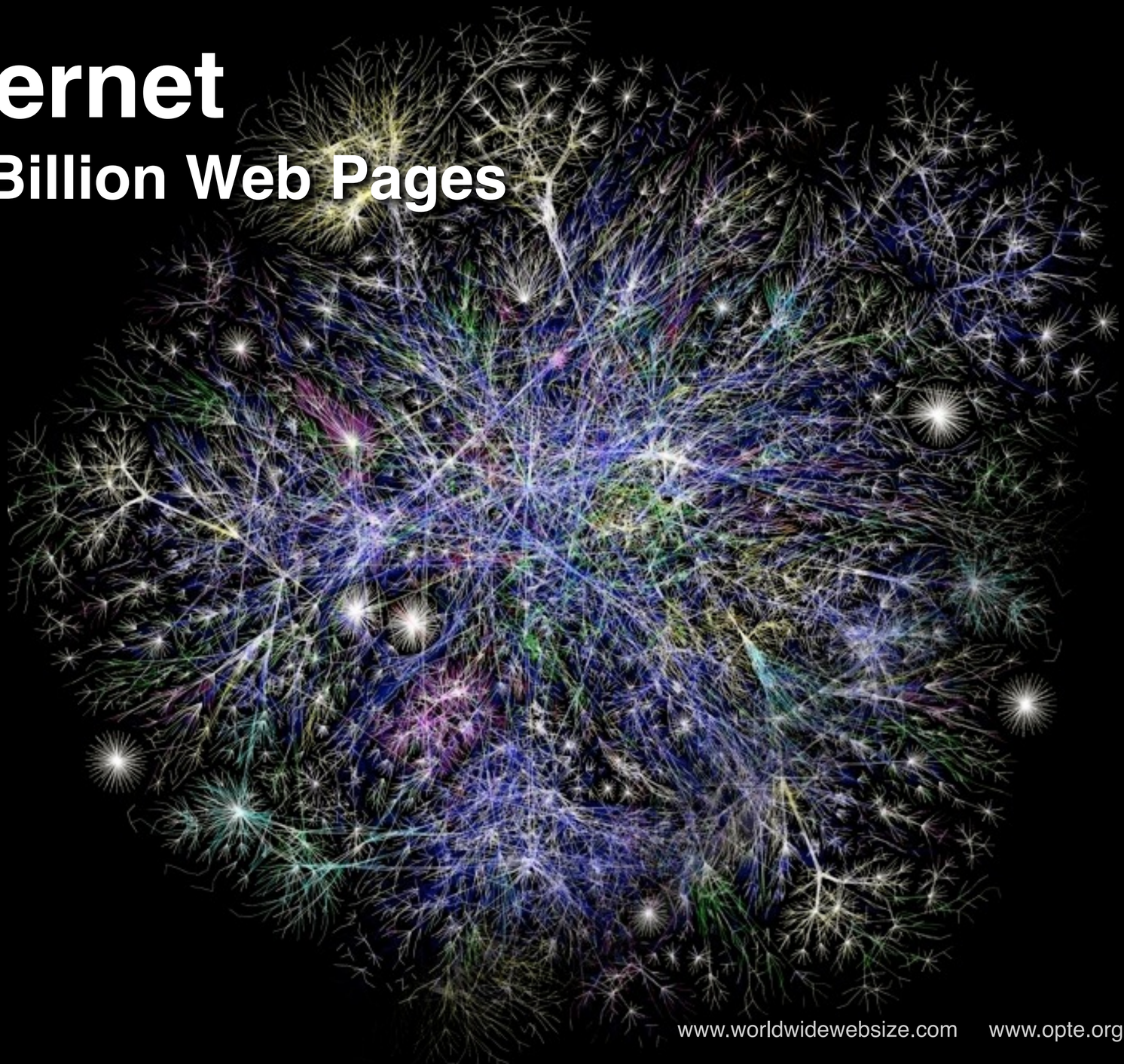


Haekyu — CS PhD
Jay — ML PhD
Austin — ML PhD
Seongmin — CS PhD
Ben — ML PhD
Anthony — CS PhD
Matthew — ML PhD
Alec — ML PhD
Mansi — CS Master
Harsha — CS Masters
Pratham — CS Undergrad
David — CS Undergrad
Sri — CS Undergrad
Aishwarya — CS Undergrad
Polo — Associate Prof

Fred — Research Scientist, Apple
Nilaksh — Applied Scientist, Amazon AWS AI
Scott — Senior Applied Scientist, Microsoft
Rahul — Applied Scientist, AWS AI Computer Vision
Sivapriya — AI Research, JPMorgan Chase
Chakri
Omar — CS PhD, Stanford
Megan
Alex — Software Engineer, Goldman Sachs
Kevin

Internet

50 Billion Web Pages

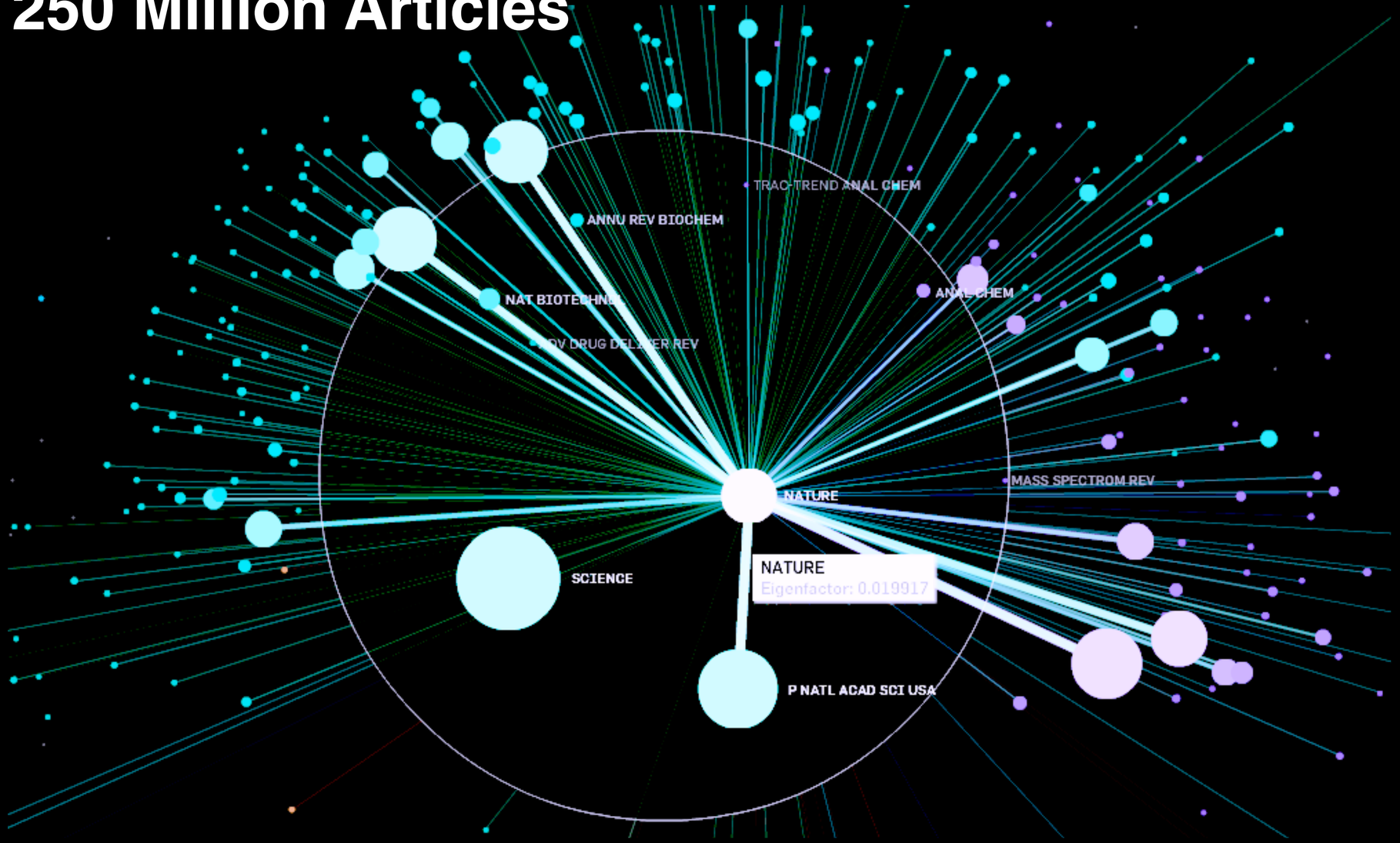


Facebook

2 Billion Users

Citation Network

250 Million Articles



www.scirus.com/press/html/feb_2006.html#2 Modified from well-formed.eigenfactor.org

Many More

twitter

Who-follows-whom (500 million users)

amazon

Who-buys-what (120 million users)

at&t **cellphone network**

Who-calls-whom (100 million users)

Protein-protein interactions

200 million possible interactions in human genome

Sources: www.selectscience.net www.phonedog.com www.mediabistro.com www.practicalecommerce.com/

“Big Data” Analyzed

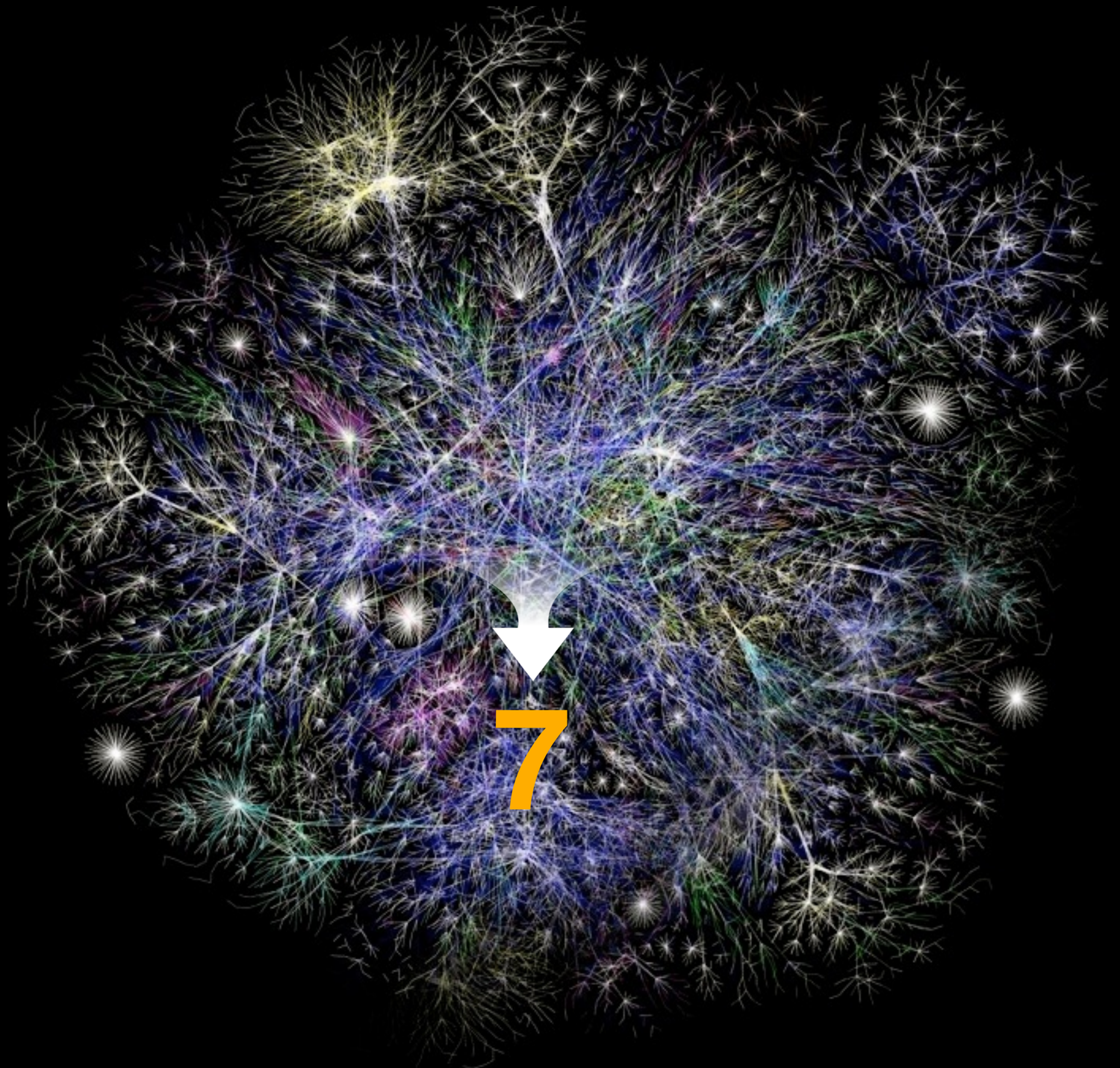
Graph	Nodes	Edges
YahooWeb	1.4 Billion	6 Billion
Symantec Machine-File Graph	1 Billion	**37 Billion**
Twitter	104 Million	3.7 Billion
Phone call network	30 Million	260 Million

We also work with small data.
Small data also needs love.

7±2

Number of items an average human holds in working memory

George Miller, 1956


7


Data
Insights

How to do that?

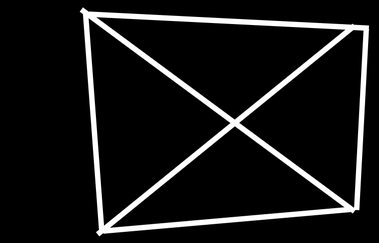
COMPUTATION
+
HUMAN INTUITION

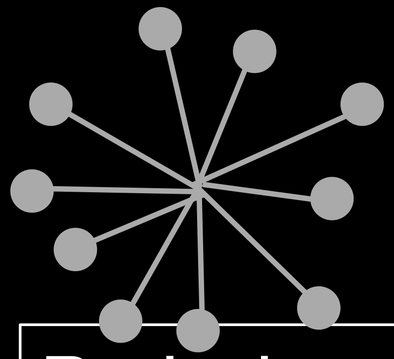
Or, to ride the AI wave…

ARTIFICIAL INTELLIGENCE
+
HUMAN INTELLIGENCE

How to do that?

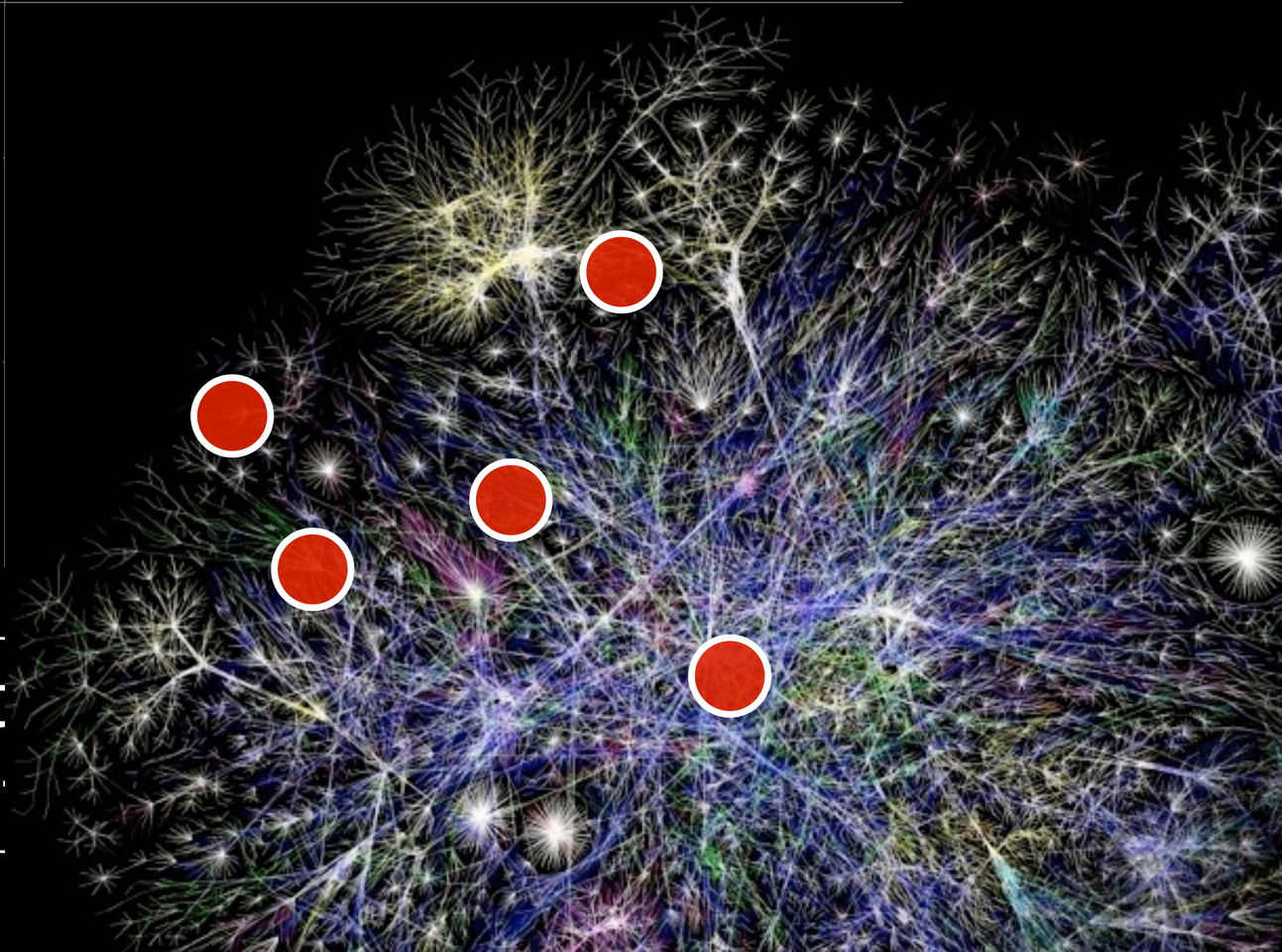
Computation





Both develop met
sense of ne

Interactive Vis



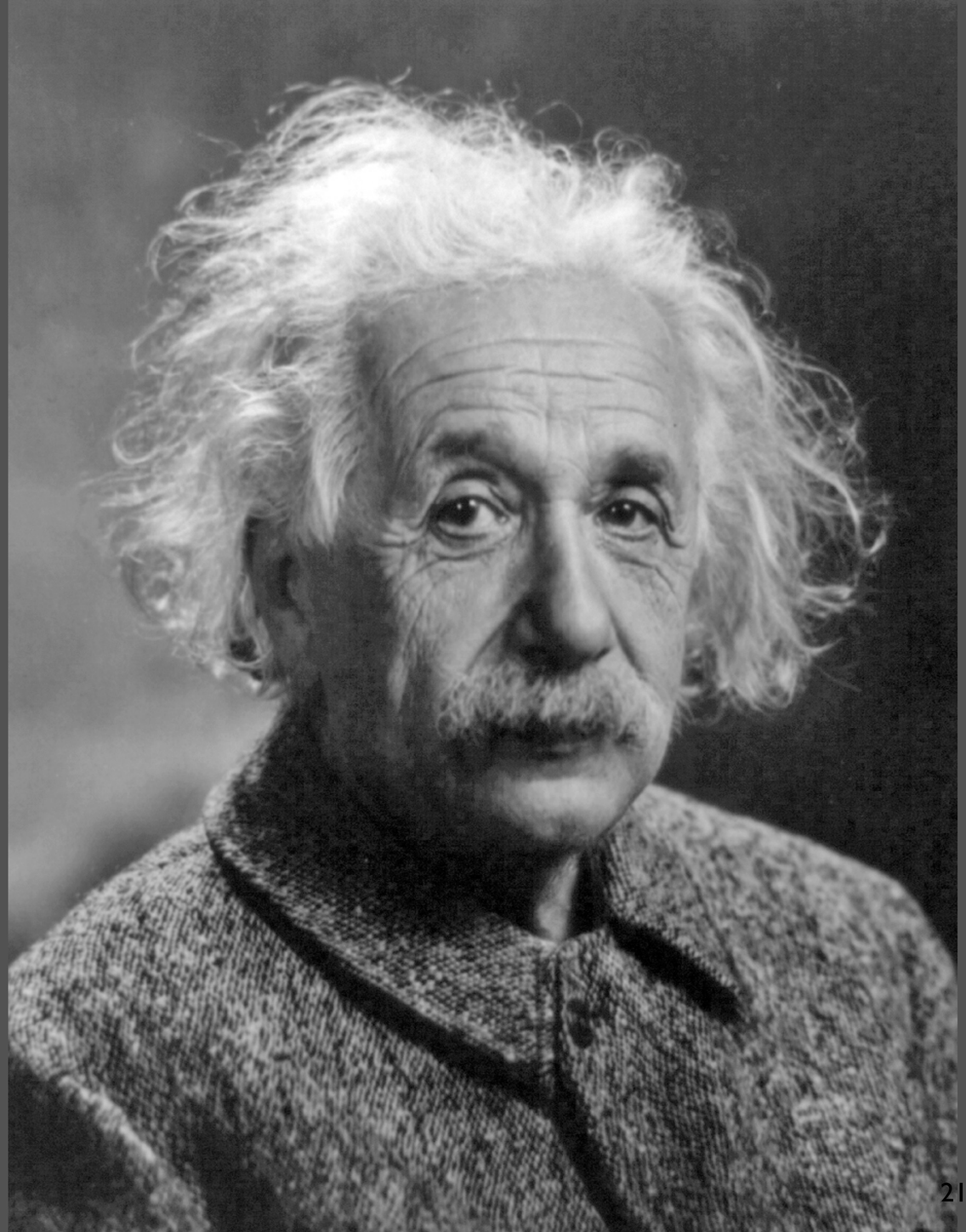
Our Approach for Big Data Analytics

MACHINE LEARNING	HCI Human-Computer Interaction
Automatic	User-driven; iterative
Summarization, clustering, classification	Interaction, visualization
>Millions of items	Thousands of items

Our research combines the
Best of Both Worlds

Our mission & vision:

Scalable, interactive, usable tools for big data analytics



“Computers are incredibly fast, accurate, and stupid.

Human beings are incredibly slow, inaccurate, and brilliant.

Together they are powerful beyond imagination.”

(Einstein might or might not have said this.)

Logistics

Course website
(policies, syllabus, schedule, etc.)

https://poloclub.github.io/cse6242-2024spring-campus/
(link also available on Canvas)

Discussion, Q&A, find teammates

Ed Discussion
(link available on Canvas)

Make sure you're in the right Ed Discussion! (CSE-6242-O01, CSE-6242-OAN have their Ed Discussion forums too)

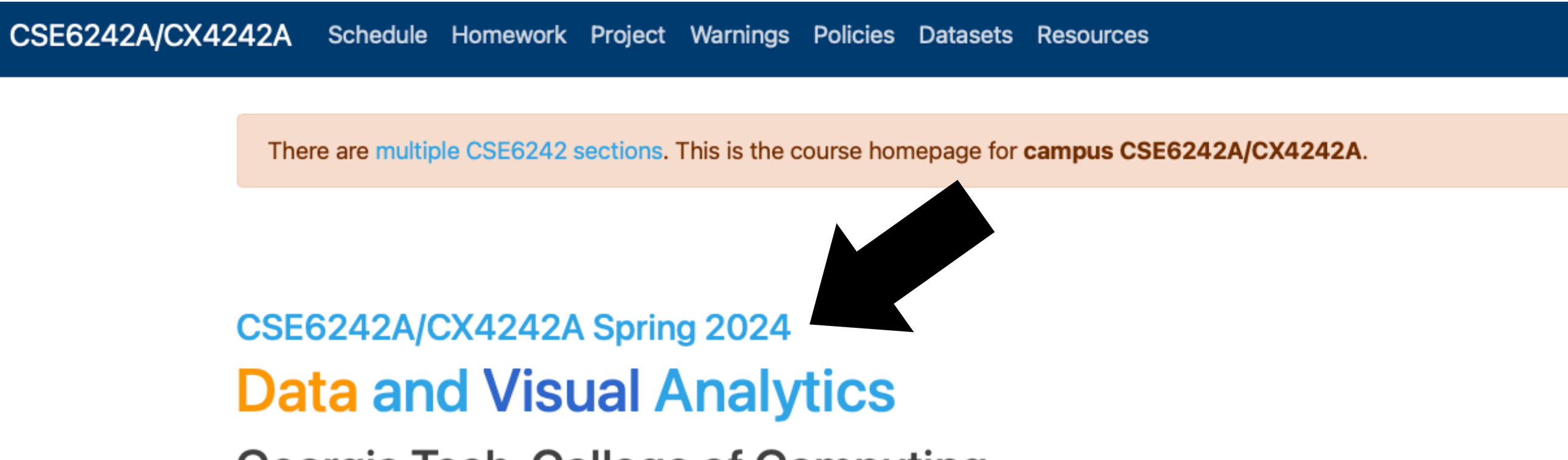
Assignment Submission

Canvas/Gradescope

Course Homepage

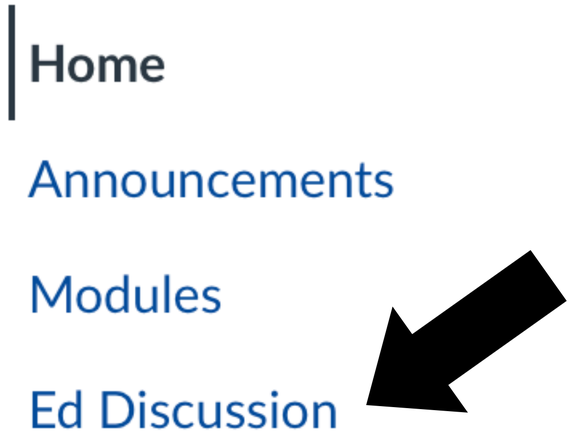
For syllabus, schedule, projects, datasets, etc.

If you Google “cse6242”, you will see many matches.
Make sure you click the correct site!



Join Ed Discussion Right Away

via canvas.gatech.edu



Announcements and Discussion

We use Edstem for all announcements and discussion. Everyone must join this class's Ed Discussion through Canvas. Double check that you are joining the correct Edstem!
There are multiple concurrent course sections with the same name and course number taking place, e.g., online for OMSA and OMSCS, and campus for Atlanta-based students. Students must always use **Ed Discussion** to communicate with course staff or for any class-related questions. Ed Discussion will be used for general posts, including private and public posts, threads, mega threads, Q&A, and announcements.
If course staff needs to communicate with specific students (i.e. members of a project team), the **Ed Chat** feature of Ed Discussion will be used. Students can benefit from this feature to communicate with other students. e.g., to discuss forming a project.

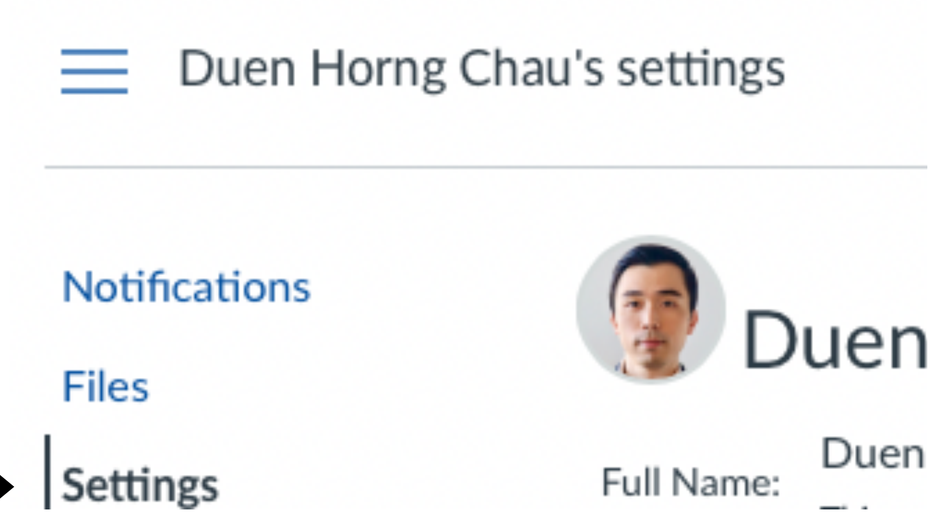
IMPORTANT: Everyone must ensure that the notification setting is on for both Ed Discussion and its Ed Chat feature to stay up to date with the class requirements and prevent losing points because of missing updates and announcements on Ed Discussion.

Important to join Ed Discussion because…

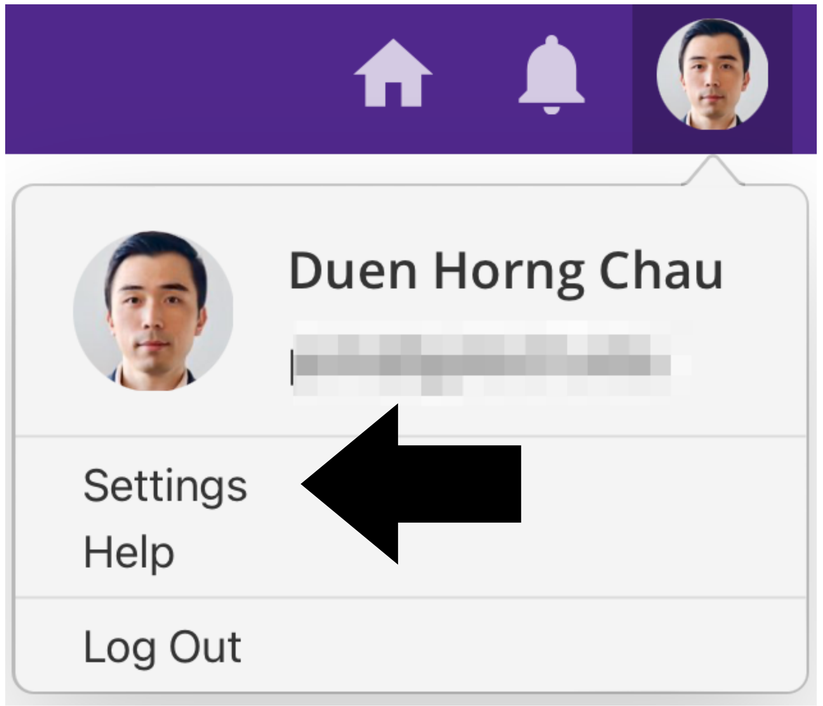
- We will announce events related to this class and data science in general
  - Distinguished lectures, seminars
  - Hackathons
  - Company recruitment events (with free food, swags!)

Add your photo to help us and your classmates recognize you!

Canvas



Ed Discussion



If you need help cropping headshot photo into square shape, use **Magic Crop** (https://poloclub.github.io/magic-crop/)

Course Goals

What is Data & Visual Analytics?

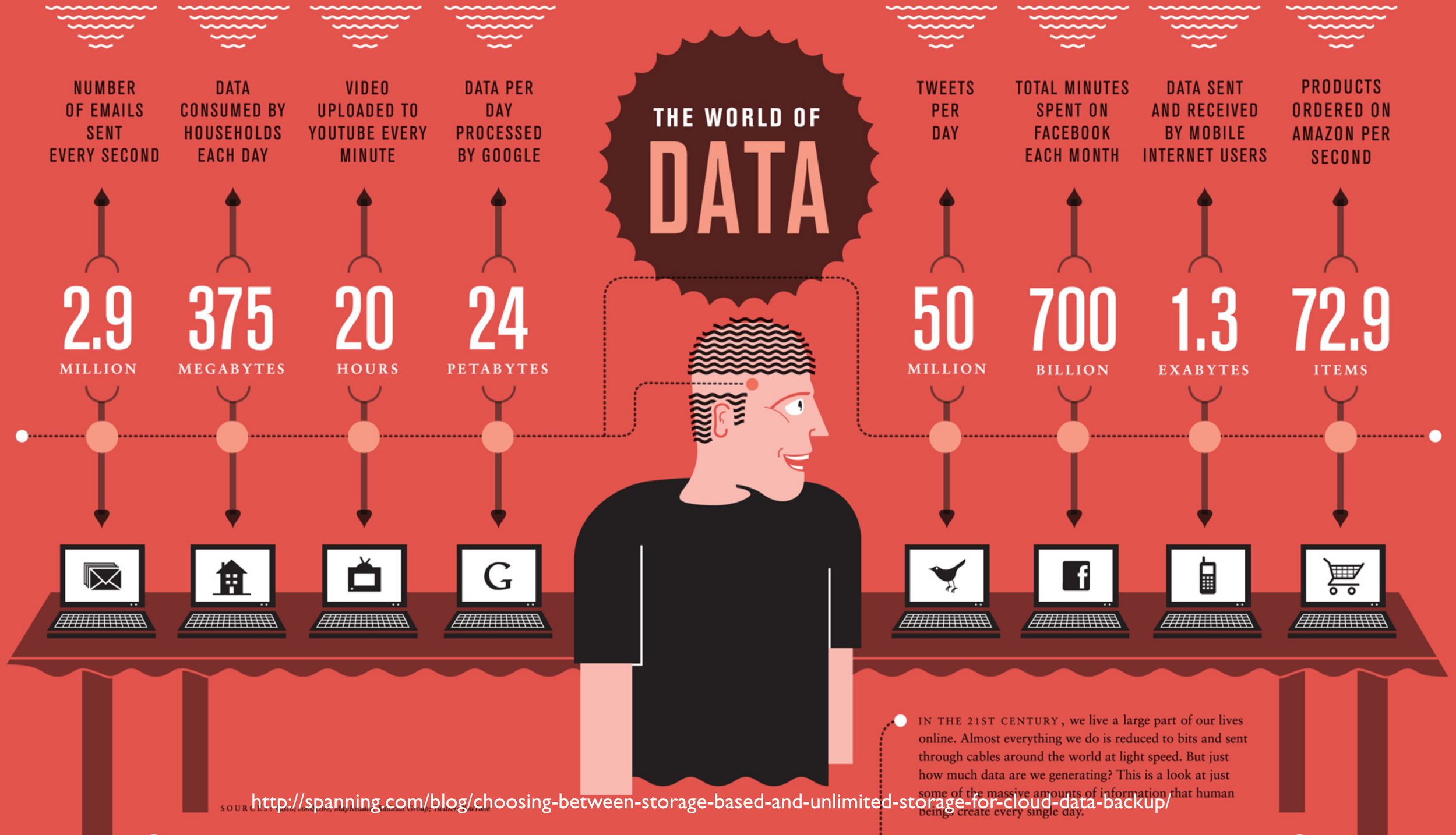
No formal definition!

Polo's definition:
the *interdisciplinary* science of combining
computation techniques and
interactive visualization
to transform and model data to aid
discovery, decision making, etc.

What are the “ingredients”?

Need to worry (a lot) about: storage, complex system design, scalability of algorithms, visualization techniques, interaction techniques, statistical tests, etc.

Wasn’t this complex before this big data era. Why?



http://spanning.com/blog/choosing-between-storage-based-and-unlimited-storage-for-cloud-data-backup/

What is **big data**? Why care?

Many businesses are based on big data.

Search engines: rank webpages, predict what you're going to type

Advertisement: infer what you like, based on what your friends like; show relevant ads

E-commerce: recommends movies/products (e.g., Netflix, Amazon)

Health IT: patient records (EMR)

Finance

…

Good news! Many jobs!

Most companies are looking for “data scientists”

> *The data scientist role is critical for organizations looking to extract insight from information assets for ‘big data’ initiatives and requires a* ***broad combination*** *of skills that may be fulfilled better as a team*
> - Gartner (http://www.gartner.com/it-glossary/data-scientist)

Breadth of knowledge is important.
This course helps you learn some important skills.

Course Schedule

(Analytics Building Blocks)

Collection

Cleaning

Integration

Analysis

Visualization

Presentation

Dissemination

Building blocks. Not Rigid “Steps”.

Collection

Cleaning

Integration

Analysis

Visualization

Presentation

Dissemination

Can skip some

Can go back (two-way street)

- **Data types** inform **visualization** design
- **Data size** informs choice of **algorithms**
- **Visualization** motivates more **data cleaning**
- **Visualization** challenges algorithm assumptions
  e.g., user finds that results don’t make sense

Course Goals

- Learn **visual** and **computational** techniques and use them in **complementary** ways
- Gain a **breadth** of knowledge
- Learn **practical** know-how by working on **real data & problems**

Grading

- [50%] 4 homework assignments
  - End-to-end analysis
  - Techniques (computation and vis)
  - “Big data” tools, e.g., Hadoop, Spark, etc.
- [50%] Group project — 4 to 6 people
- [**Bonus points**] Quizzes
  - 4 online quizzes in total; ~10min each
  - **1% course grade point** each; lowest score dropped
- **No Exams** 🎉🎉🎉

Policies. Very Important!

(on course website)

Attendance, COVID-19, grading, plagiarism, collaboration, late submission, and the **“warnings”** about the difficulty this course

From Previous Classes…

- Class projects turned into papers at top conferences
- Projects as portfolio pieces on CV
- Increased job and internship opportunities
- Former students sent me “thank you” notes

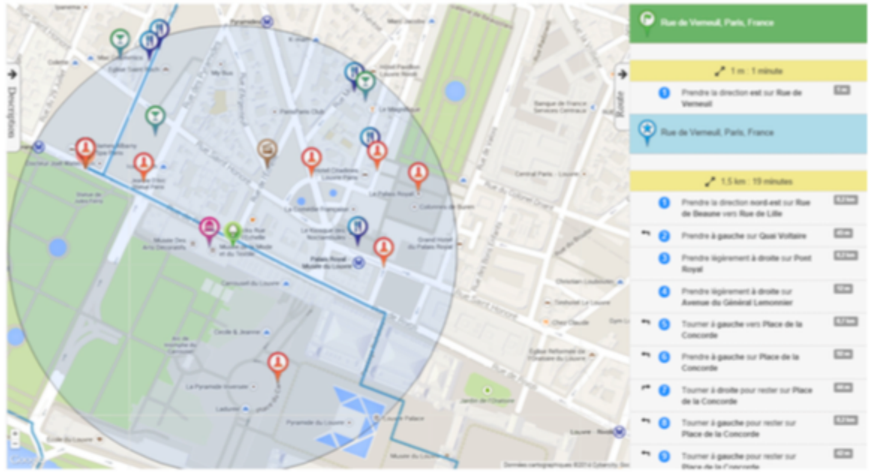
Aurigo: An Interactive Tour Planner for Personalized Itineraries

Alexandre Yahi; Antoine Chassang; Louis Raynaud; Hugo Duthil; Duen Horng (Polo) Chau
Georgia Institute of Technology
{alexandre.yahi, antoine.chassang, l.raynaud, hduthil, polo}@gatech.edu

ABSTRACT
Planning personalized tour itineraries is a complex and challenging task for both humans and computers. Doing it manually is time-consuming; approaching it as an optimization problem is computationally NP hard. We present Aurigo, a tour planning system combining a recommendation algorithm with interactive visualization to create personalized itineraries. This hybrid approach enables Aurigo to take into account both quantitative and qualitative preferences of the user. We conducted a within-subject study with 10 participants, which demonstrated that Aurigo helped them find points of interest quickly. Most participants chose Aurigo over Google Maps as their preferred tools to create personalized itineraries. Aurigo may be integrated into review websites or social networks, to leverage their databases of reviews and ratings and provide better itinerary recommendations.

Author Keywords
User Interfaces; Visualization; Recommendation; Tour itinerary planning

ACM Classification Keywords
(e.g. HCI): User interfaces



Full conference paper

PASSAGE: A Travel Safety Assistant With Safe Path Recommendations For Pedestrians

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Jiaxingsu@gatech.edu

Abstract

Atlanta has consistently ranked as one of the most dangerous cities in America with over 2.5 million crime events recorded within the past six years. People who commute by walking are highly susceptible to crime here. To address this proble… …up has developed a mobile application, PASSAG… …d crime data to find "safe pat… Atlanta. user int…

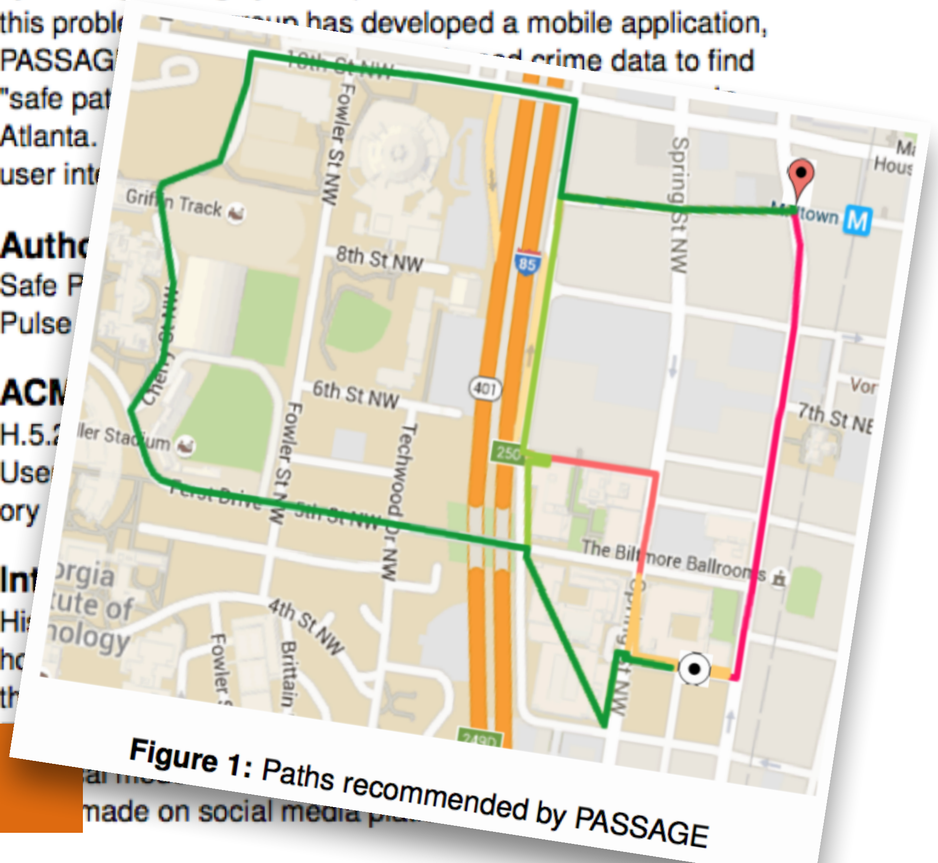

Figure 1: Paths recommended by PASSAGE

…made on social media pl…

Short paper

“As someone with 25 years work experience, I find my self **directly applying what I am learning within days**. The skill set of rapid learning that you are teaching is the main thing I interview for.”

“…thank you for the materials taught in DVA. As it was **perfectly aligned** with the what employers are looking out for. It made less challenging for me to secure this new job [Business Intelligence engineer at Amazon] in this competitive job market.”

“I would like to say thank you for your class! Thanks to the skills I got from the class and the project, **I got the offer**.”

“I feel like the concepts from your class are like a **rite of passage for an aspiring data scientist**. Assignments lead to a feelings of accomplishment and truly progressing in my area of passion.”

“I really get more intuition about how to **deal with data with some powerful tools in HW3** [uses AWS]. That feeling is beyond description for me.”

What we expects from you

- **Actively participate** throughout the course!
- If you need help, **let us know early** — the earlier you let us know, the more help we can offer
- **Help your fellow classmates**, e.g., help answer questions on Ed Discussion
- **Share your ideas!** Ideas for improving learning experiences, let us know