CS 784: Foundations of Data Management

Spring 2022

INTRODUCTION

- undergrad in Athens, Greece
- Ph.D. in University of Washington (the other UW)
- at UW-Madison since 2015!

Research Interests

- parallel query processing
- data pricing
- uncertainty in data management

Course Logistics

COURSE FORMAT

- Lectures **Tu+Th** 2:30-3:45 pm
- Office Hours: **Th** 1:30-2:30pm or by appointment
- Webpage: http://pages.cs.wisc.edu/~paris/cs784-s22/

COURSE STRUCTURE

The course will have two parts:

1. Query Languages + Complexity
2. Advanced Topics: provenance, privacy, uncertainty, stream processing, graph databases

For some lectures I will post notes on the webpage, for others we will focus on specific papers

PREREQUISITES

It will be helpful if you have good knowledge of:

- Databases, SQL, Relational Algebra
- Algorithms
- Complexity

GRADING

- Class participation: 10%
- Homework (3): 30%
- Paper reviews (4): 20%
- Research project: 40%

HOMEWORK

- Individual assignments
- Submitted through **Canvas** (use Latex!)
- You can use up to 5 late days for all 3 assignments

PAPER REVIEWS

- Read an assigned paper before the lecture
- Submit a brief review of the paper
- Answer a few questions related to the content of the paper

RESEARCH PROJECT

- In groups of 1 to 3 people
- Independent research on any topic related to the course
- Deliverables:
  - 2/12: email groups + tentative ideas
  - 2/28: project proposal
  - 3/28: milestone
  - Last week: project presentations (10% of grade)
  - 5/8: final report

SAMPLE PROJECTS

- A Lightweight Approach to Approximately Query Big Data
- Efficient Multiway Joins on Heterogeneous Parallel Networks
- Materialized Views In Data Warehousing Environments
- Implementing Datalog on an Asynchronous Distributed Dataflow Framework

What is This Class About?

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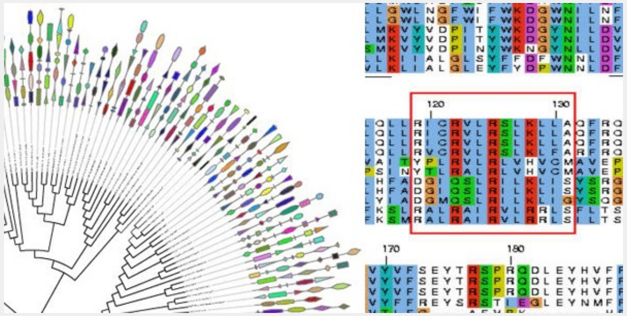
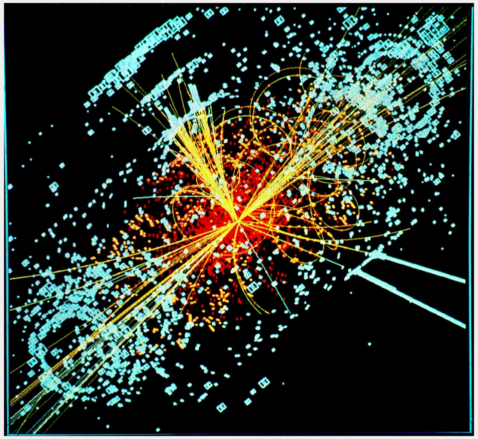


- Data is everywhere!
- Managing data is critical:
  - scientific discoveries
  - online services (social networks, online retailers)
  - decision making



- **Databases** are the core technology
- In this class:
  - Foundations of data management

CLASSIC DATABASE THEORY

- Conjunctive Queries (i.e., join queries)
- Query containment/equivalence
- Query complexity
  - how fast can we evaluate a join?
  - how big can the result of a join be?
  - are some join queries easier to compute than others?

DATALOG

Datalog is a declarative language that allows us to express larger classes of queries!

LogicBlox

bddbddb

OVER ONE QUATTUORDECILLION RELATIONS SERVED

QUERY EVALUATION

- How do we evaluate queries in parallel environments?
  - e.g., Spark
- How do we evaluate queries in streaming environments?

UNCERTAIN DATA

How do we deal with uncertain data?

- probabilistic databases
- query answering over dirty data
- data cleaning / repairs

OTHER TOPICS

- Provenance
- Differential Privacy
- Graph Databases