Databases and Data-Intensive Systems

Computer Science Day
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Aarhus University

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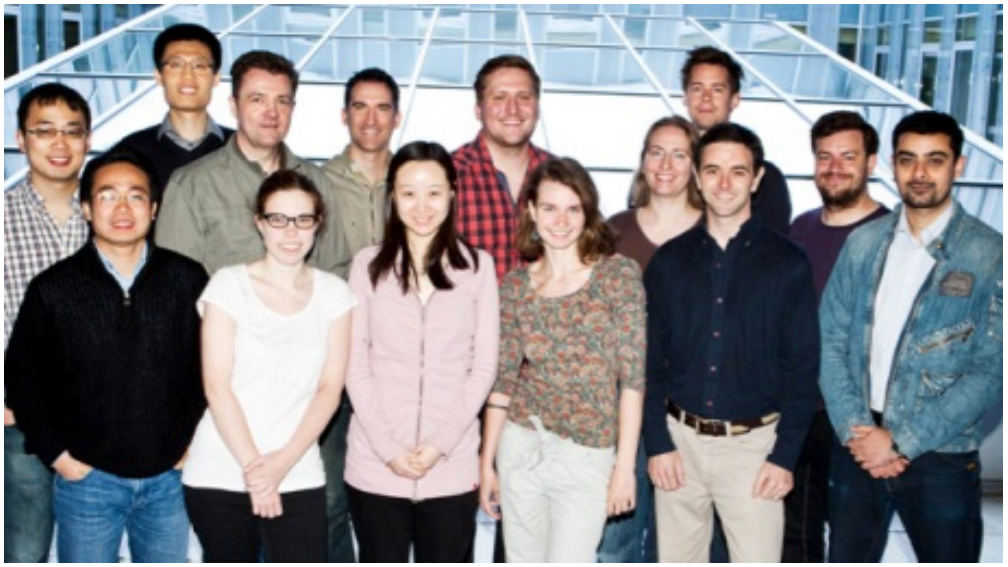


Contact info at
http://cs.au.dk/research/areas/data-intensive-systems/

Data-Intensive Systems

- Focus on solving ”data intensive” tasks
- Query processing for databases
- Mining ”big data” for pattern discovery
- Formalize, implement and test new algorithms
- Inventing new and improving existing types of queries

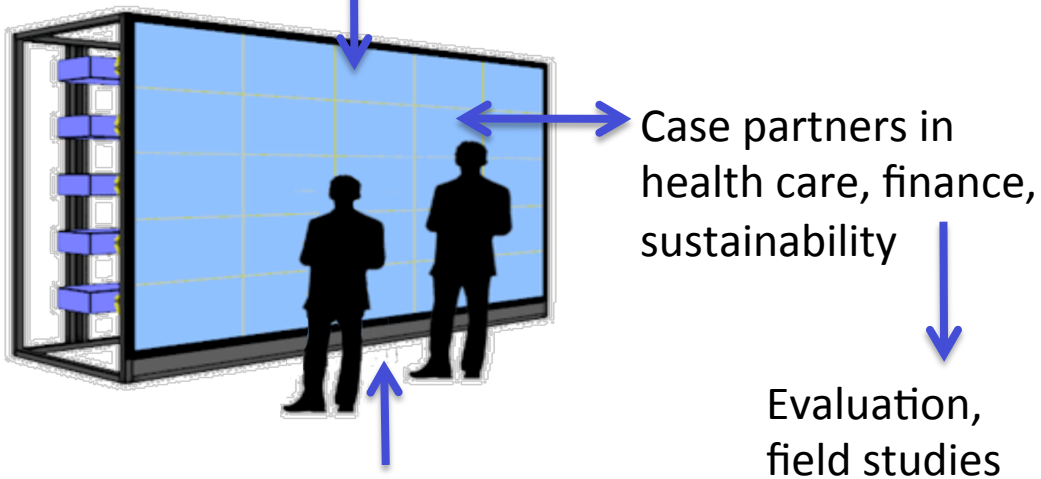
Example: Decision making

WallViz:

Improving decision making from massive data collections using wall-sized, highly interactive visualizations

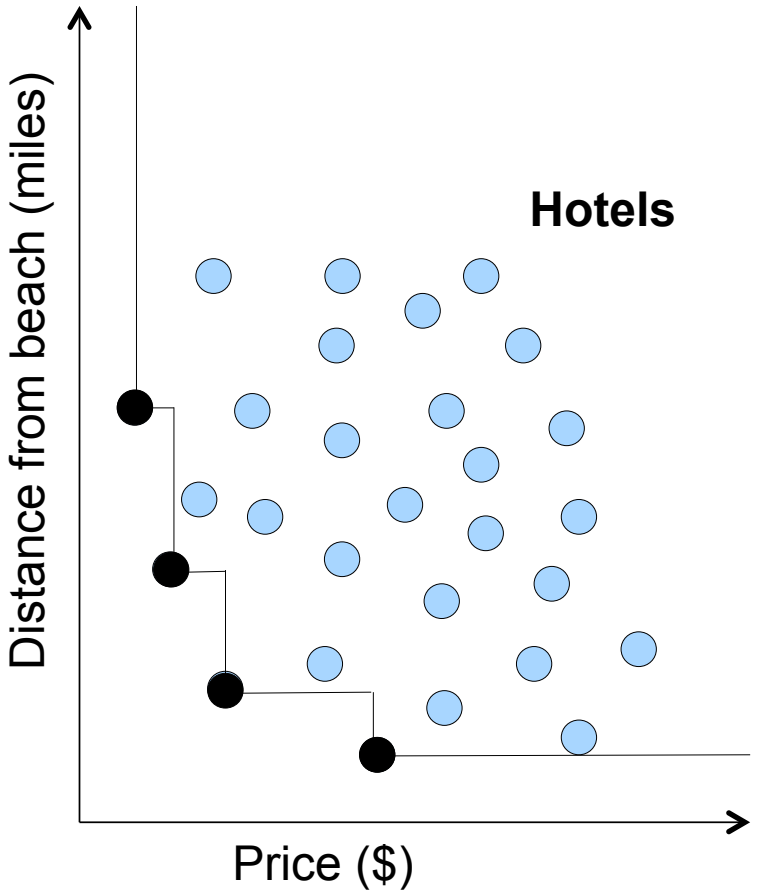
- Decisions are increasingly informed by analysis of massive data collections
- Manual exploration hard; automatic analysis infeasible
- Results in information overload, poor decisions

➢ Visualization helps deal with massive data collections



Entry point generation with the Skyline

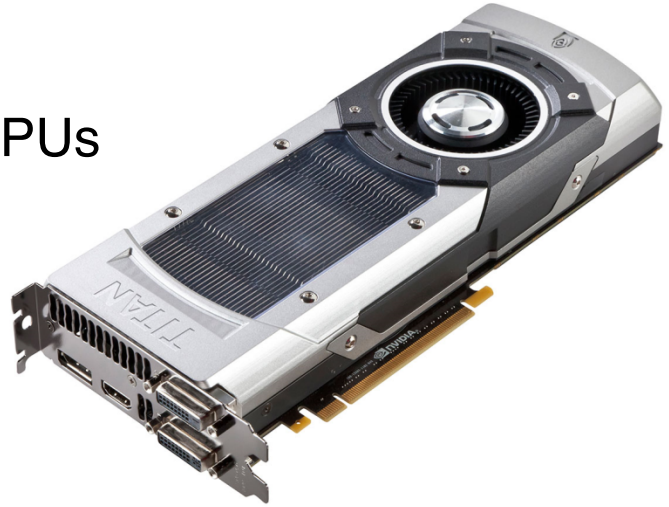
- Given a set of records on n attributes.
  - e.g., hotels, with distance to the beach and price.
- The skyline contains those records for which:
  - The top choice of every user with monotonic preference functions* is in the skyline.
  - Every record in the skyline is the top choice for some user with monotonic preference functions.



* e.g., a hotel 100m from the beach is preferred to a hotel with the same characteristics but 1km from the beach.

Challenges of skylines

- Expensive to compute → Need soultions for scaling
- We are researching approaches to parallelization
  - First to do this on GPUs
  - Currently working on parallelization on CPUs
  - How to appriximate



- Large input → large results
- Selecting a subset of the result
  - Representative skyline
  - Introducing ranking
  - Adding constraints

Data mining

- Automatically identify interesting patterns in data
  (as opposed to queries that specify interesting results)
- Outlier detection:
  - Find “anomalies” that differ from rest of data
    - E.g. credit card fraud detection

  - eData project: outlier detection for eScience

eData

- Subspace clustering:
  - detecting groups in high dimensional data
- Predicting customer shopping
- E.g. Target predicted pregnancy before family knew

Courses

- Specialization Column (with progression)
  - Q1+Q2: Machine Learning - joint course with other research groups
  - Q3: Selfstudy on either data mining or query processing techniques
  - Q4: Multidimensional databases (2014, 2016, etc)
  - Q4: Indexing of disk based data (2015, 2017, etc)
- Related optional courses
  - Q1: Algorithms in bioinformatics – sequences
  - Q3: Algorithm engineering
- PREP: Practical REsearch Project
  - Get a feel for research!

How We Typically Work

- We target some real problem that we find interesting.
- We define the problem precisely.
- We develop a solution that is typically a data structure or an algorithm, i.e., a concrete technique.
- To evaluate, we build prototypes.
  - These are built for the purpose of studying the properties of our solutions.
  - We are often interested in performance, e.g., runtime, space usage, communication cost.
- For some solutions we state formal properties that we then prove, e.g., the correctness of a particular technique

- Brief: isolate and define problem, construct, then evaluate

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Curious?
Come talk to us!

We are looking for
student programmer
Master students
Phds

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